Lisbon School of Economics & Management
Universidade de Lisboa

MASTER OF SCIENCE IN

FINANCE

MASTER´S FINAL WORK

PROJECT

INVESTMENT POLICY STATEMENT FOR AN INDIVIDUAL INVESTOR:

MR. ANTÓNIO RODRIGUES

GUILHERME RIOS BARBOSA

OCTOBER 2024

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DR. FLORENCE MENDES CORREIA CARP PINTO BASTO

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Abstract:

This Investment Policy Statement (IPS) provides a structure that outlines investment objectives and describes the decision-making process, by ensuring effective communication between the portfolio manager and the client, with the goal of achieving the investment objective.

The client, Mr. António Rodrigues, has a moderately aggressive risk tolerance, with the aim of duplicating his initial investment in a 10-year span. The client did wish to include some constraints in the investment strategy, namely investing the majority of his funds into equities listed in European or North American markets, no use of leverage, no short selling, and a maximum yearly loss of 15%.

For the client's €800,000 investment to be effectively doubled in 10 years, and taking both inflation and capital gains tax into account, an annual real rate of return of 14.31% is required. Over a 10-year period, this rate of return will result in an overall sum of €3,044,754.57 which, after accounting for taxes and inflation, becomes €1,600,000.

The strategy used for this investment is a mixture of small cap equity investing and *GARP* strategies, which combined result in a high growth approach in line with the client's needs.

The final portfolio's expected return and volatility were calculated using Mean-Variance Theory, to maximize expected returns whilst minimizing risk. The end result is a portfolio with an annual expected return of 20.94% and a volatility of 14.84%. The expected return exceeds the client's initial requirement, whilst the annual volatility of the portfolio lies just below the client's threshold of a maximum 15% annual loss.

For risk analysis, the portfolio manager, Mr. Barbosa, used Historical VaR, Monte Carlo VaR and Parametric VaR, along with a risk matrix which outlines the main risks for the following decade.

Keywords: Investment Portfolio; Equities; Hedging; Portfolio Theory; Risk

JEL Codes: G11; G17; G40; C15

Resumo:

O presente IPS procura fornecer uma estrutura que define os objetivos e descreve todo o processo de tomada de decisão na criação do portfólio. Tal é feito com o intuito de assegurar uma comunicação efetiva entre o consultor de investimentos e o cliente, com o objetivo de alcanlar o resultado pretendido pelo cliente.

O cliente, Sr. António Rodrigues, tem uma tolerância ao risco moderadamente agressiva, cujo objetivo é duplicar o investimento inicial em 10 anos. O cliente decidiu incluir algumas restrições na sua estratégia de investimento, nomeadamente ter os fundos investidos somente em ações listadas nos mercados europeus ou norte-americanos, não recorrer à alavancagem, não fazer vendas a descoberto e ter uma perda máxima anual de 15%.

Para que o investimento de €800,000 do cliente seja duplicado em 10 anos, e tendo em conta tanto a inflação esperada como impostos sobre mais-valias, será necessário um retorno real anual de 14.31%. Após o período de 10 anos durante o qual o investimento estará a decorrer, esta taxa de retorno resultará num montante total de €3,044,754.57, que após os impostos e inflação esperada anteriormente referidos, resultará num montante de €1,600,000 para o cliente.

A estratégia utilizada para alcançar este objetivo é uma combinação de investimento em ações com baixo valor de mercado e estratégias *GARP*, que combinadas resultam numa perspetiva de alto rendimento em linha com as necessidades do cliente.

O retorno esperado e volatilidade do portefólio final foram calculados usado *Mean-Variance Theory*, de modo a maximizar retorno e a minimizar risco. O resultado final é um portfólio com retorno esperado anual e volatilidade de 20.94% e 14.84%, respetivamente. O retorno esperado excede o desejo do cliente e o risco é inferior ao valor máximo a que está disposto a perder anualmente (15%).

Em relação à análise do risco, o consultor de investimentos recorreu ao uso do VaR Histórico, VaR de Monte Carlo e VaR Paramétrico juntamente com uma matriz de risco que delineia os prinicpais riscos a ter em atenção durante o período do investimento.

Acknowledgments

As I write this, nostalgia and good times flood my mind. The end of an era is actually here. I can't imagine how proud a little Guilherme would be if I told him that I'm finishing my master's in finance, having already started my career at a prestigious international bank. I would like to extend a special gratitude to the following:

Inês Marques (AKA Mãe), thank you for your help during this period and for always believing in me, even when I didn't believe in myself. I have been stressed and my mood has had its ups and downs, but you were always the best mum I could ask for. Thank you for bearing with me these last few years as I grew up and became an adult. Thank you for accompanying me and Mafalda along this gradual path to independence.

André Barbosa (AKA Pai), thank you for believing in me and convincing me that I could do things when I thought I could not. Thank you for taking me to Bertrand as a child and instilling this love for learning that I may not always show, but that is now a part of me forever. Thank you for the motorbike rides and the incredible trips we've been on – hopefully one day I'll do the same with your grandchildren.

Mafalda, thank you for being the rebellious one, but at the same time incredibly emotional and intelligent. You're one of the brightest people I know and I'm sure that you'll be very successful in the future. I may not show it often, but you inspire me a lot and I can't imagine having anyone else as my sister.

Avó Leonor, thank you for being worried and always concerned about how I'm doing. I know you want the best for me and I hope I'm making you proud. Avó Zita and Avô Judas, thank you for always incentivizing me to do what I want and become my own person, pushing me to make my own decisions and not necessarily follow norms.

To my friends – thank you for all the time we've spent, for the deep talks, and for accompanying me on this journey through life. These memories will last a lifetime.

Finally, thank you to Professor Florence Basto for the guidance.

Guilherme Barbosa, O Próprio.

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Abbreviations

d = Downside deviation

$f(r)$ = Distribution for the annual returns, e.g. the three-parameter lognormal distribution

N = Size of the population

r = Random variable representing the return for the distribution of annual returns $f(r)$

t = Annual Target Return, or MAR

μ = The population mean

x_i = Each value from the population

σ – Population Standard Deviation

σ^2 – Variance

AI – Artificial Intelligence

CAD – Canadian Dollar

CAL – Capital Allocation Line

CFA – Chartered Financial Analyst

CHF – Swiss Franc

CMVM – Comissão do Mercado de Valores Mobiliários

EF – Efficient Frontier

ECB – European Central Bank

EUR – Euro

EU – European Union

ETF – Exchange-traded Fund

FED – Federal Reserve

GARP – Growth at a Reasonable Price

GBP – Great British Pound

GDP – Gross Domestic Product

HICP – Harmonized Index of Consumer Prices

IPS – Investment Policy Statement

IPO – Initial Public Offering

MAR – Minimum Acceptable Return

MPT – Modern Portfolio Theory

MVP – Minimum Variance Portfolio

OTC – Over-the-Counter

P/E – Price-to-Earnings

PEG – Price to Earnings and Growth

PMPT – Post-Modern Portfolio Theory

US – United States

USD – United States Dollar

VBK – Vanguard Small-Cap Growth Index Fund ETF

VaR – Value-at-Risk

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1. Executive Summary

1.1 Scope and Purpose

Mr. Guilherme Barbosa, as the financial advisor for Mr. António Rodrigues, uses the Investment Policy Statement (IPS) as a tool for effective client communication. His responsibilities include regularly updating the IPS in collaboration with Mr. Rodrigues' tax and legal advisors, ensuring transparency in any adjustments or deviations. He seeks Mr. Rodrigues' final approval for all IPS modifications. Committed to his fiduciary duty, Mr. Barbosa offers impartial advice, discloses any conflicts of interest, and adheres to the CFA (Chartered Financial Analyst) Institute's professional conduct standards, aligning Mr. Rodrigues' investments with his personal and financial goals.

1.2 Governance

To guarantee the best outcomes, the IPS defines very distinct roles. The financial advisor, Mr. Guilherme Barbosa, is tasked with creating, executing, and regularly reviewing the investment policy in line with Mr. Rodrigues' goals, including key future financial needs. He provides quarterly reports on investment performance and suggests the necessary adjustments. Asset allocation, shaped by market analysis and Mr. Rodrigues' risk tolerance, is managed by Mr. Barbosa, requiring Mr. Rodrigues' approval for any changes. Risk management, including the continuous monitoring of the portfolio and making the necessary adjustments to ensure it remains within predefined limits, is the responsibility of Mr. Barbosa, ensuring adherence to diversification principles. Ultimately, Mr. Rodrigues maintains final authority over approving any strategic changes.

1.3 Investment Return and Risk

The aim of this IPS is to achieve a yearly investment return of 14.31% over a 10-year period, using mainly equities for asset allocation. With the client having prior knowledge of financial markets, experience investing, and a willingness to explore risk, it can be said that his risk tolerance is somewhat higher than that of a typical risk-averse investor, with a maximum loss limit of 15%. Despite having this information, mean-variance theory will

still be employed to minimize variance, taking full advantage of the positive effects that diversification can have on both expected returns and risk, thus optimizing the portfolio's performance. The final proposed portfolio is expected to offer an expected annual return of 20.94% and a volatility of 14.84%.

1.4 Risk Management

The financial advisor is responsible for measuring both individual and overall portfolio performance in accordance with the CFA Institute's standards. He will also perform regular risk assessments to ensure compliance with predefined metrics. Portfolio rebalancing, subject to Mr. Rodrigues' approval, will occur annually or as needed to align with his investment goals.

2. Investment Policy Statement

2.1 Scope and Purpose

2.1.1 Context and Investor

The main purpose of this document is to provide both the client and the financial advisor with a clear investment plan and methodology. The client entering into this agreement is Mr. António Rodrigues, who spent his 20's building a technology startup and has recently sold his company, of which he owned a majority share, to a large international tech firm.

The client pursued higher education in the United States, where he studied data science. During his studies, Mr. Rodrigues also built upon his existing knowledge of financial markets and economics – topics which have always piqued his interest. This experience allowed him to deepen his understanding of these concepts within a North American context while improving his analytical and technical skills.

Mr. Rodrigues is now 32 years old and has received €1,000,000.00 from the sale of his company. He wants to take at least 1 year off before returning to a job, as he feels he deserves a rest after 5 stressful years building the company. For now, to celebrate the sale of his company, Mr. Rodrigues went on a trip with friends and purchased a new sports

car. As for future expenses, he has promised his sister that he will take care of her medical school debt (due in 10 years). He and his girlfriend also intend to have children soon, as well as buying a home in the future since they have been renting an apartment in the center of the city for the last few years.

2.1.2 Structure

As Mr. António Rodrigues' financial advisor, Mr. Barbosa is tasked with the regular revision and oversight of the IPS. This process entails collaboration with Mr. Rodrigues' tax and legal advisors to ensure a comprehensive approach. Guilherme Barbosa is also responsible for ensuring that the IPS is adhered to and will inform Mr. Rodrigues promptly of any deviations from the written policy. The ultimate authority to approve the IPS and any changes made to it to it rests with Mr. Rodrigues.

In his role, Guilherme Barbosa's utmost priority is to act within Mr. Rodrigues' best interests in all advisory services. His responsibilities include offering impartial advice, disclosing any potential conflicts of interest, and maintaining complete transparency in reporting. Mr. Barbosa adheres to the CFA Institute Asset Manager Code of Professional Conduct in all its dealings.

As Mr. Rodrigues' designated investment advisor, Mr. Barbosa is charged with identifying and managing all investment-related risks. Mr. Rodrigues has granted Mr. Barbosa authority to invest on his behalf, and so is expected to supply the advisor with regular updates, adhering to a mutually agreed-upon reporting format.

Guilherme Barbosa will compile and present a quarterly financial report to Mr. Rodrigues, which serves as the official documentation of the investment policy and is integral to his risk assessment process.

2.2 Governance

To achieve the best possible outcomes with this IPS, it's crucial that both the advisor and the client establish each other's roles and obligations clearly. This is of utmost importance if we are to ensure a streamlined and effective investment process.

The financial advisor, Guilherme Barbosa, is responsible for the creation, execution, and periodic review of the investment policy, ensuring it's aligned with Mr. Rodrigues' objectives at all times. This is to guarantee that situations that require funds in the future, such as family support, education funding, the purchase of a home, and eventual return to work are all taken into account – from inception to the latter stages of the investments' lifespan. As such, Mr. Barbosa will provide quarterly reports detailing the performance of the investments carried out and recommend adjustments as needed. These reports will serve as a formal record for ongoing risk assessment and investment policy adherence.

Asset allocation will be determined by Guilherme Barbosa, utilizing inputs such as market trends, expected returns, and Mr. Rodrigues' risk tolerance. Rebalancing of the portfolio will be suggested semiannually or periodically (in the case that an event which requires urgent changes to the portfolio occurs), with Mr. Rodrigues' approval required for implementation. Rebalancing can occur in two scenarios. First, if the portfolio manager identifies that an individual asset is underperforming relative to expectations – whether it is a stock or a part of the risk-free asset – it may be sold and replaced with another asset that was pre-selected but not included in the final portfolio, as outlined in section 3.3 of this IPS. Alternatively, the manager may reapply the criteria used in section 3.3 to screen for stocks again, selling the current asset in favor of a more suitable one identified through this process.

The portfolio will be mainly equity-based, however, the proportion of funds allocated to each asset class must be continuously disclosed by the advisor, namely after any rebalancing is performed.

Risk management duties, including monitoring and reporting, are assigned to Guilherme Barbosa. He is expected to inform Mr. Rodrigues of any risk exposure that exceeds the predefined threshold and perform the necessary changes to the portfolio. Diversification of the portfolio and risk mitigation will always be the two main principles by which the advisor is guided, with limitations in place to avoid overconcentration in any one asset class or individual security.

Mr. Rodrigues retains the authority to approve or reject any changes to the investment strategy, ensuring his complete control over the investment process and the funds at play.

2.3 Investment, Return and Risk Objectives

2.3.1 Investment Objective

The goal of this IPS, and the investments to be made, is to generate enough income to cover a few significant expenses in the future as well as providing enough liquidity for the family to be able to fall back on upon the end of the period. Of the €1,000,000 made from the sale of his company, Mr. Rodrigues has just spent €100,000 on a trip and a sports car. Other than this, he considers that another €100,000 should be enough to support his living expenses for the next year. This leaves €800,000 to be invested. Considering the investment timespan and the client's risk tolerance, the goal of this portfolio is to effectively double the client's money in 10 years, netting Mr. Rodrigues around €1,600,000 in today's money. Figure 1 illustrates how the portfolio's final return will be allocated. Of the return, €100,000 would go toward his sister's medical school debt, and €1,200,000 would go towards 2 houses – one in the city and a holiday home by the beach. Of the remaining €300,000, €50,000 would go into discretionary consumption and the remaining €250,000 would serve to pay for future children's education.

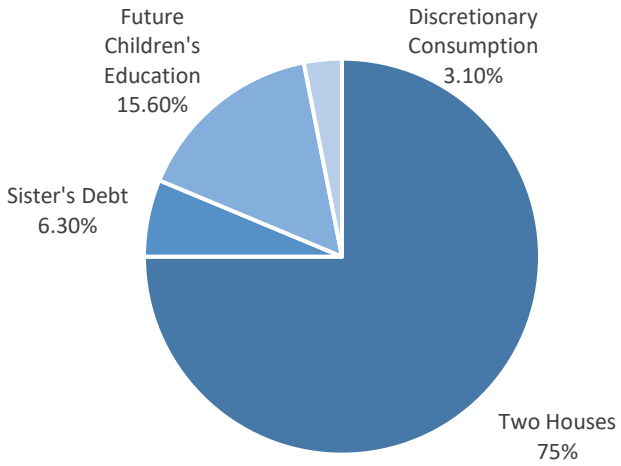


Figure 1 – Allocation of Returns
Source – Author

2.3.2 Return, Distribution and Risk Requirements

In order to meet the investment goal of €1,600,000 by 2034, an annual real rate of return of 14.31% should be the objective. This rate represents the annual return on the investment after adjusting for inflation, which over a 10-year period has a significant impact. This ensures that the portfolio grows in the desired amount whilst keeping up with rising prices. Banco de Portugal's 2023 report projects that the Harmonized Index of Consumer Prices (HICP) in Portugal will drop to 2% by 2026. Considering this projection and recent inflation data (section 3.2.1), the financial advisor will adopt a projection of 2.50% for inflation during the 10 years that this portfolio is being managed. Another important aspect to consider is the 28% capital gains tax in Portugal. This was also considered when elaborating the required real rate of return.

Considering this tax and the average inflation rate of 2.50% for the next decade, the clients' target of €1,600,000 would rise to €3,044,754.57. This is a considerable goal and will require a complex and diversified investment strategy that incorporates various carefully selected asset classes and high precision in managing the funds for the required period.

Considering that Mr. Rodrigues resides in Portugal, and that most of the investments made aren't in Euros, it is important to convert his investment's returns at the end of the period into Euro. Being able to invest in various locations, one also becomes susceptible to currency risk. Any swings in foreign exchange rates can have a significant impact on the client's investments.

To manage this risk, financial derivatives will be employed. These instruments can be used by speculators, looking to secure profits by attempting to predict the price of assets in the future. Beyond speculation, however, derivatives are crucial for hedging purposes. By employing instruments such as currency futures, Mr. Rodrigues can effectively lock in current exchange rates. This strategy ensures that returns from international investments are not undermined by unfavorable currency fluctuations at the time of exchange into Euros.

2.3.3 Portfolio Policy

There should be a strategic asset allocation framework, subject to regular evaluations through collaborative meetings between the advisor and his client. The plan involves setting an ideal allocation for each asset class, guided by the advisor's model. This model should also include predefined upper and lower limits in order to allow for future adjustments in each asset category.

It is crucial that the advisor doesn't deviate from this allocation blueprint, ensuring that the actual distribution of assets stays within the pre-defined parameters. Furthermore, at the close of every quarter, the investment manager is tasked with presenting a comprehensive report to the client. This report should provide explicit details about the prevailing asset allocations and confirm a continued adherence to the established allocation guidelines throughout the quarter.

2.3.4 Investor Risk Tolerance

Considering the IPS' identity as a document that certifies the agreement between client and financial advisor, it's important that it contains the investor's risk profile and a complete and thorough analysis of their risk preferences. A portfolio is subject to many risks, namely liquidity, regulatory, market, political and legal risks. A certain level of risk should be accepted, because without risk there is nothing to gain, but this should all be explicitly laid out and described in the IPS at hand.

Regarding the clients' risk bearing ability, since the investment horizon is relatively long-term, there is plenty of time to both incur losses and recover from them. However, it is important to define a critical threshold – the maximum amount of a loss the client is willing to endure. For Mr. Rodrigues, this threshold is set at 15% and is of the utmost importance regarding the construction of the portfolio, acting as a safeguard to ensure that any possible losses remain within acceptable limits.

Given this critical loss threshold, the client's liquidity needs should also be thoroughly carefully considered. Mr. Rodrigues has decided to keep €100,000 to spend in the coming

year, there are no immediate liquidity needs. The client won't need the invested cash for the foreseeable future either since he has some cash on hand and intends to start working again in around one years' time. Considering these factors, the fact that the clients' wealth is self-made, and the fact that he can rejoin the job market whenever he desires with a high expected salary all contribute to Mr. Rodrigues having a moderately aggressive risk appetite. i.e. Mr. Rodrigues can be described as risk-averse, albeit with some lenience regarding certain factors, such as currency risk or investing in equities (appendix A1).

The client is a professional in the tech industry but has adequate knowledge of financial markets and the risks associated with investing due to personal interest and previous projects conducted. The client has expressed a preference for embracing some degree of uncertainty and the associated risks in investing, driven by his aspiration to double his invested capital. He acknowledges that high returns are difficult to come by without incurring more risks, which reflects his approach to risk management.

The Charles Schwab risk tolerance questionnaire provided in appendix A2 supports these conclusions and offers a rough outline of what type of asset allocation may be appropriate for this client.

In summary, the client can be defined as someone with a relatively high degree of experience with capital markets and an intermediate risk tolerance, albeit with a willingness to embrace certain risks for the potential of higher returns.

2.3.5 Relevant Constraints

The client will be provided with a quarterly report from his financial advisor. This report must include a breakdown of the performance of each asset class, an update on macroeconomic scenarios and how the portfolio might be affected, and a brief overview of the investments as a whole and if the portfolio is on track to achieving the projected returns or not.

Given the fact that the client has decided to keep €100,000 for expenses and doesn't have any outstanding debt, there are no liquidity restrictions, so long as the investments are convertible into fiat money within the defined period.

The main instruments that will be used to carry out the investments at hand are equities, due to this asset class's intrinsic properties and associated risk. Equities have a reputation of being riskier assets to hold than fixed income products, for example. This extra risk brings more uncertainty and, consequently, either greater rewards or greater losses – which is exactly what an investor with Mr. Rodrigues' risk profile is looking for.

An important restriction that derives from Mr. António's risk preferences regarding what is possible within the portfolio is that no leverage, short selling, or financing of any form is allowed in the construction of the investment policy.

Following the client's previous experience in both locations and risk tolerance, another restriction is to invest only in North American and European markets. Although he appreciates the possibility of growth, Mr. Rodrigues considers equities in emerging markets to be too risky for the type of investing he idealizes.

In Portugal, individual investors are subject to a capital gains tax rate of 28%, which is consistent with the tax rate on interest income from bank accounts and the rate applied to dividend payments. Therefore, it's important for investors to consider the impact of taxes, although these are only applicable upon the realization of gains – ideally, at the conclusion of the 10-year investment period.

Since both the client and the portfolio are based in Portugal, the investment as a whole is subject to supervision and monitoring by the Comissão do Mercado de Valores Mobiliários (CMVM) and the Portuguese tax authority.

2.3.6 Specific Portfolio Considerations

A strategy centered around equities involves selecting individual stocks to achieve a desired amount of exposure to each individual asset and, more globally, to each sector. An initial phase of the portfolio development includes an evaluation of the investor's needs and preferences. This was carried out previously. Following this, the financial advisor proceeds with identifying and selecting a pool of equities that align with the requirements defined. These assets are then combined into a joint portfolio. If created correctly, the portfolio should be well-balanced and sufficiently diversified enough to avoid major risks.

After the selection has been made and the portfolio is created, the ongoing monitoring and analysis of the investments commences. Individual company performances, market trends and differing sector dynamics all come into play. Regular portfolio reviews and rebalancing can then occur to ensure that the investment strategy is continuously aligned with the current situation and the client's financial circumstances and goals.

2.4 Risk Management

The advisor, Guilherme Barbosa, will calculate both individual asset and overall portfolio performance, ensuring compliance with the Global Investment Performance Standards set by the CFA Institute. The advisor is also tasked with conducting regular risk assessments that monitor potential discrepancies and evaluate potential risks that appear.

Any portfolio rebalancing will be conducted annually or as needed, always subject to Mr. Rodrigues' approval, to maintain the desired asset allocation and control for risk. This comprehensive approach ensures a solid risk management strategy tailored to Mr. Rodrigues' investment goals.

3. Investment Design

3.1 Investment Philosophy

An investment philosophy is best described as a set of principles that shape an investor's decision-making process. How markets work, how investments are affected by risk, the role of a fixed time horizon and the importance of diversification are just a few of the elements that can influence an investment philosophy. The philosophy is what guides an investor in selecting the types of investments they want to focus on, which analytical approach to take, and how to react in all types of market conditions. It often reflects an individual or an institution's risk tolerance, their financial goals, and the investments' time horizon. A well-defined investment philosophy is, therefore, crucial for long-term success in the financial markets, as it helps to maintain a consistent approach in the face of market volatility and changing economic landscapes.

In analyzing one's investment philosophy, there is a field of study that investigates this topic through a compelling lens. Behavioral Finance aims to connect the seemingly distant realms of finance and psychology. Despite their seeming disparities, these two topics are, in fact, deeply intertwined and behavioral finance shines light on an aspect of investing that is often overlooked.

This field studies investor decision processes which in turn shed light on anomalies, i.e., departures from neoclassical finance theory (Sotiris et al. 2003), which argues that markets are efficient and that prices will tend toward equilibrium, assuming rational behavior.

Conventional economic models traditionally depict investor's behavior as that of rational individuals who optimally utilize all available information. There is, however, abundant evidence to suggest that this assumption of rationality is unrealistic. One such example is *Prospect Theory*, developed by Kahneman and Tversky (1979). Here, they suggest that people value gains and losses differently from one another: "… *people underweight outcomes that are merely probable in comparison with outcomes that are obtained with certainty. This tendency, called the certainty effect, contributes to risk aversion in choices involving sure gains and to risk seeking in choices involving sure losses*." (Kahneman & Tversky, 1979, p. 1). The concept of loss-aversion is largely significant in this theory, with the authors stating that from a psychological standpoint, the pain of losing is much more powerful than the pleasure gained from winning.

Therefore, as investors, and more broadly as humans, we aren't entirely impartial and have cognitive and behavioral biases that, to varying degrees, affect our decision-making skills. It is imperative that investors account for this.

As a result, it's safe to assume that an investor must choose an investment philosophy and stick with it, as switching philosophies and strategies while practicing one is a sure-fire way to dwindle any profits one may gain by following a single strategy.

In building a portfolio and dealing with the specific needs of each client, one of either value or growth investing must be chosen. Let's take a look at each one:

Value investing – Buying or selling of stocks on the basis of a perceived gap between their current market price and their fundamental value – commonly defined as the present value of the expected future payoffs to shareholders (Lee, 2014). The main thought behind value investing is that a share represents a fractional claim on a business' future cash flows, and this claim forms the basis of its long-term value. This isn't as straightforward as it may seem, however, as stock prices can significantly deviate from this long-term value over shorter periods. Value investors aim to buy stocks that are priced cheaply relative to their intrinsic value and sell those that seem overpriced. Therefore, this approach can consist in purchasing securities with low price-to-earnings (P/E) ratios, high dividend yields, and low price-to-book ratios. Legendary investors like Warren Buffett have popularized this strategy, emphasizing long-term wealth creation through the acquisition of companies with strong fundamentals at attractive prices.

Growth investing – Investing in companies that exhibit signs of above-average growth, even if some metrics like P/E or price-to-book ratios make the stock appear expensive. Growth investors aren't too concerned with the current price of stocks but rather with their future potential. A key characteristic in growth companies is their above-average potential for experiencing rapid growth in both revenue and earnings. This strategy also can also include investing in emerging markets, technology, and new unexplored industries where there is strong potential for growth.

Bearing in mind the characteristics of the investor at hand, the investment philosophy and strategy present in this IPS and relative to Mr. António Rodrigues is one in which growth investing is preferred to the more traditional value investing.

According to Damodaran (2012), there are a few different types of investing under the growth umbrella. It is important to understand these different sub-strategies before delving any deeper into Mr. António's investments, as one's investment strategy must be robust for there to be above-average returns.

Damodaran lays out 4 main types of growth investing, containing strategies varying from a more passive investment style to so-called Activist investing. The latter won't be looked

into in this IPS as it details strategies for investors looking to engage in Venture Capital and Private Equity investing, which isn't relevant for Mr. António Rodrigues at this stage.

The first strategies we'll explore are Passive Investment Strategies:

Small cap Investing – this strategy basically consists of buying stocks of companies whose market cap is between $250 million and $2 billion. Being companies at the lower end of the market cap spectrum, they are smaller businesses, possibly still in the early stages of their growth cycle, which allows for much more room to grow when comparing these with mid or large-cap stocks. Research has shown that these smaller firms tend to yield higher returns than their larger counterparts. Figure 2 shows annual returns for equities in 10 different value classes, from 1927–2010.

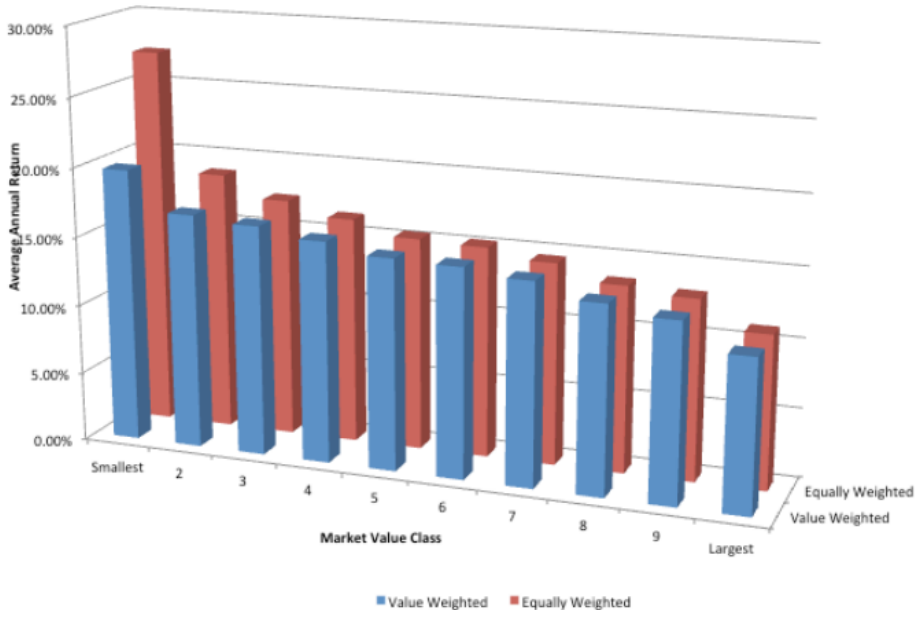


Figure 2 – Annual Returns by Market Value Class – 1927–2010
Source – Damodaran 2012

As we can see, for the smallest market cap class especially, equally weighted returns are much higher than their value weighted counterpart. This indicates that the smaller companies within this class are performing well, and when each stock is given the same weighting, they collectively contribute to a higher average return than when the larger companies in the group are given more significance. In general, most of the advantages of investing in smaller companies can be explained by the *size premium,* which suggests

that there is a market anomaly by which small-cap stocks have substantially higher returns than large ones.

Small-cap investing isn't shielded from issues, however. Extremely high volatility, high transaction costs, a lack of liquidity and insufficient information surrounding these firms are all problems that must be considered when using this strategy.

Initial Public Offerings (IPO)

In IPOs, privately traded companies offer their shares to the public for the first time, allowing outside investors to purchase equity in the company. This process results in a partial loss of control for pre-IPO equity-holders but allows for a large influx of cash to enter the business. This access to fresh capital can be of enormous value for a growing business, allowing for new projects and opportunities to arise, greatly facilitating expansion.

How is this strategy lucrative? The price of a stock that is going public is determined by a group of underwriters from Investment Banks. Historically, however, IPOs have a long history of being underpriced – and generally the smaller the issue, the greater the underpricing. In the 1980s, the average first-day return on IPOs was 7%, doubling in the following decade and reaching an astounding 65% during the dot-com bubble of 1999-2000 (Loughran & Ritter, 2004). Most recently, in 2022, these average first-day gains were around 8% (Statista, 2022).

Growth Screens

Another way to build a portfolio for an investor who's more growth-inclined is to simply screen stocks, selecting them according to predetermined criteria. Damodaran considers 3 screening strategies:

- *High Earnings Growth Strategy* – which consists in buying stocks with high growth rates in earnings. The main problem with this strategy is that historical growth can't be expected to translate into future growth, and analysts' predictions for future growth must be taken with a pinch of salt as their calculations are highly subjective and rely on many assumptions.

- *High P/E Strategy* – this strategy is employed by simply buying stocks that have the highest P/E ratios on the market, assuming that they are growth companies that will deliver above-average returns. This strategy is used by investors who believe that they can take advantage of market cycles, as there have been extended periods of time in which high P/E equities outperform their low P/E counterparts. This strategy can be acknowledged for its simplicity, although in reality one who employs it must have a deep understanding of market dynamics and the value of high-growth companies.
- *Growth at a Reasonable Price (GARP) Strategies* – the objective of an investor who employs this strategy is to buy stocks where growth is undervalued. In order to find stocks that align with this objective, two different strategies have been developed. **The first** consists in buying stocks with a P/E ratio < Expected growth rate of a stock. A stock with a P/E ratio of 10 and an expected growth rate of 20%, for example, would qualify. There are a few problems with this strategy, namely the *Interest Rate Effect*. Given that growth leads to future earnings, the value obtained from a given growth rate becomes more pronounced in a low-interest-rate environment than in a high-interest-rate one. The other problem that arises from using this strategy is relying on others' *Growth Rate Estimates*. It's possible that one penalizes companies that have expected growth for a much longer timeframe than the 5 years used to calculate the Growth Rate. **The second** *GARP* strategy involves buying stocks with a low Price to Earnings and Growth (PEG) Ratio. This ratio is computed by dividing the current P/E ratio by the Expected Growth Rate of a company.

$$PEG\ ratio\ = \frac{PE\ ratio}{Expected\ Growth\ Rate} \quad (1)$$

  An ideal PEG ratio is < 1 (a greater expected growth rate than P/E ratio), as this suggests that the stock may be undervalued relative to its growth potential, presenting an attractive investment opportunity.

Having described and analyzed each type of investment strategy in the growth category, it's now possible to conclude that the approach most in line with Mr. Rodrigues' risk

tolerance and preferences is a mixture of Small Cap Investing and the second GARP Strategy contained in the Growth Screening subsection. For the equity component of the portfolio, which shall have the highest weight of any asset class, companies located in Europe or North America, with a market capitalization between $250 million and $2 billion, and a PEG ratio < 1 is what we'll be looking for to create an optimal portfolio.

3.2 Strategic Asset Allocation

3.2.1 Macroeconomic briefing

As of early 2024, the macroeconomic state of the European Union (EU) zone and of the world can be characterized by moderate growth and a steady decrease in inflation (European Central Bank, 2024).

Following the pandemic, the European economy experienced a robust expansion in 2021 and 2022, but this momentum has since been lost. Real Gross Domestic Product (GDP) contracted slightly in the final quarter of 2022 and showed minimal growth in 2023 (Figure 3). Following this subdued growth, the EU economy entered 2024 in a less favorable state than what was originally anticipated.

The lack of growth in 2023 can be attributed to a number of factors, namely the decrease of household purchasing power, significant monetary tightening, and falling external demand. After being close to a technical recession (two consecutive quarters of contracting GDP) in the latter part of last year, prospects for the EU economy in the first quarter of 2024 are still dim. The European Union's Winter 2024 Economic Forecast regards GDP growth in 2023 at 0.5% for both the EU and the euro area, which is a downward revision from previous forecasts. For 2024, EU GDP growth is forecasted to improve to 0.9% and 0.8% in the euro area.

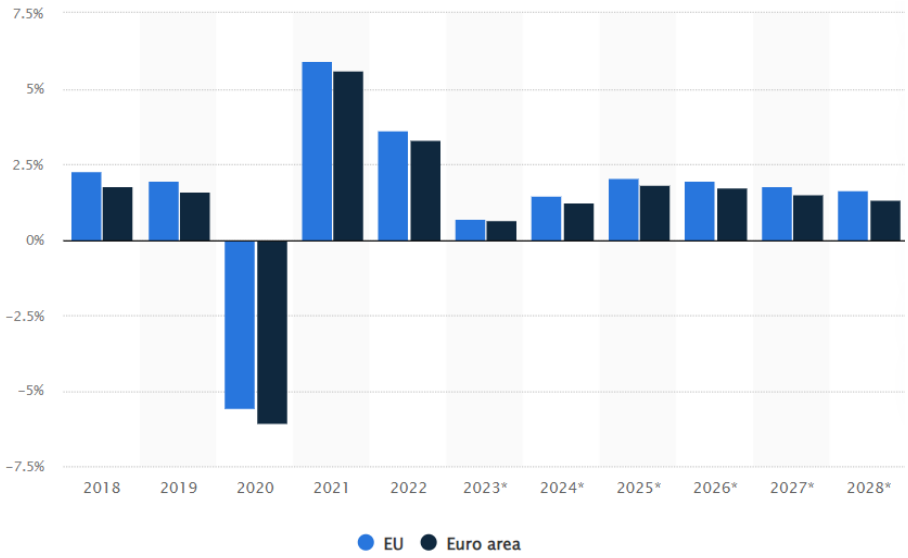


Figure 3 – Growth of real GDP in the European Union and the Euro area
Source – Statista

Not all outlooks are negative, however, with the European Central Bank (ECB) reporting a series of positive developments this year – namely when it comes to inflation – if we compare recent projections with those presented in the 2023 Autumn Forecast. A substantial decline in energy prices led to a widespread and quicker-than-anticipated easing of price pressures, i.e., deviations from the efficient price due to risk-averse intermediaries supplying liquidity to asynchronously arriving investors (Hendershott & Menkveld, 2014). With energy supply consistently surpassing demand, both spot and future prices for oil and gas are now notably lower than initially projected in the Autumn Forecast. Consequently, retail energy prices are poised to decrease further, aiding the EU in regaining some of the competitiveness that was eroded during the energy crisis. Although disruptions in Red Sea trade have been raising shipping costs for what is an essential trade route, this pressure hasn't been able to have significant impact on inflation, which remains firmly rooted in a downward trajectory. In fact, 2023 concluded with an inflation rate just below 3%, approaching values ever closer to the desired inflation target of 2%. This trajectory proves that the measures undertaken by central banks had their desired effect, as Euro area inflation reached peak values above 10% in the end of 2022 and were hovering around 9% at the start of last year. It is important to note that these values are somewhat skewed by the prices of both food and energy (as seen in Figure 4), but this shouldn't detract from the fact that core inflation was on an upward trajectory

until 2023. Inflation in the EU is expected to decrease from 6.3% in 2023 to 3% in 2024, and in the euro area, from 5.4% to 2.7%.

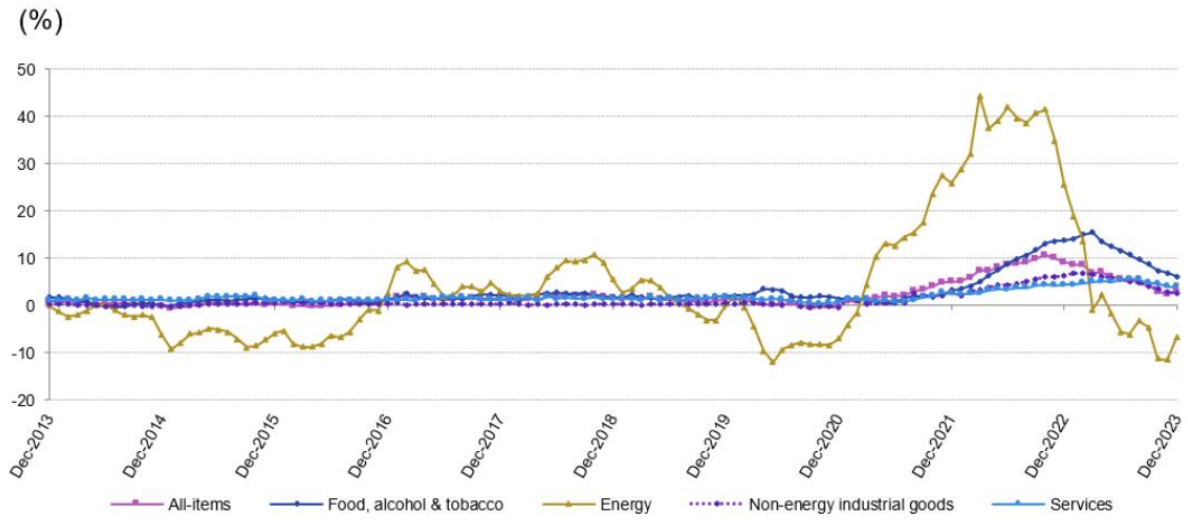


Figure 4 – Euro area annual inflation and its components
Source – Eurostat

Regarding monetary conditions, the ECB's interest rate hikes can be seen as sufficient to control inflation without harming growth, which is what they've accomplished thus far. This strategy can be characterized as a cautious approach, balancing the need to contain inflation whilst avoiding an economic downturn. At the ECB's latest meeting in March, the three main interest rates were kept unaltered at historically high levels. Given the recent downward revision of inflation forecasts and signs of economic recovery, there's an emerging consensus that the ECB might consider reducing interest rates later this year, which is something we'll be keeping an eye on as these decisions can affect our client's portfolio.

Performing a macroeconomic analysis, it's also important to analyze the geopolitical side of things, as these exogenous factors can have a great impact on expected risk and return. Currently, the main risks that could deviate an investment strategy from its objectives are the conflicts in Ukraine and the expansion of the Middle East conflict to the Red Sea. The latter is a more recent issue that has the ability to disrupt a major trade route, therefore affecting supply chains and adding price pressures. One effect of this situation has already been felt in Europe – as around 12% of global maritime oil trade

occurs via the Suez Canal (U.S Naval Institute, 2021), oil prices have risen slightly as a response to this.

The aftermath of COVID-19 was very different in the United States. The largest economy in the world demonstrated a particularly swift recovery as GDP exceeded pre-COVID levels as early as the third quarter of 2021. This can be attributed to a combination of factors, namely a significant fiscal stimulus, a shift in domestic demand towards goods, and a more rapid recovery in domestic spending. In 2023, the US economy continued to show growth, albeit at a more moderate pace after the major development experienced prior.

Looking ahead into 2024 and beyond, the US faces new challenges and uncertainties, including geopolitical tensions and their impact on trade, economic activity, and inflation (Figure 5). According to Deloitte, and despite these challenges, the US economy is projected to grow at an average annual rate of 1.8% from 2024 – 2028 under a baseline scenario in which CPI inflation drops below 3% for the rest of the year, and the Federal Reserve (FED) end up cutting rates twice in 2024. A more optimistic scenario, fueled by technological advancements and population growth, forecasts an average annual GDP growth rate of 2.4% over the same period, highlighting the potential for sustained long-term economic growth.

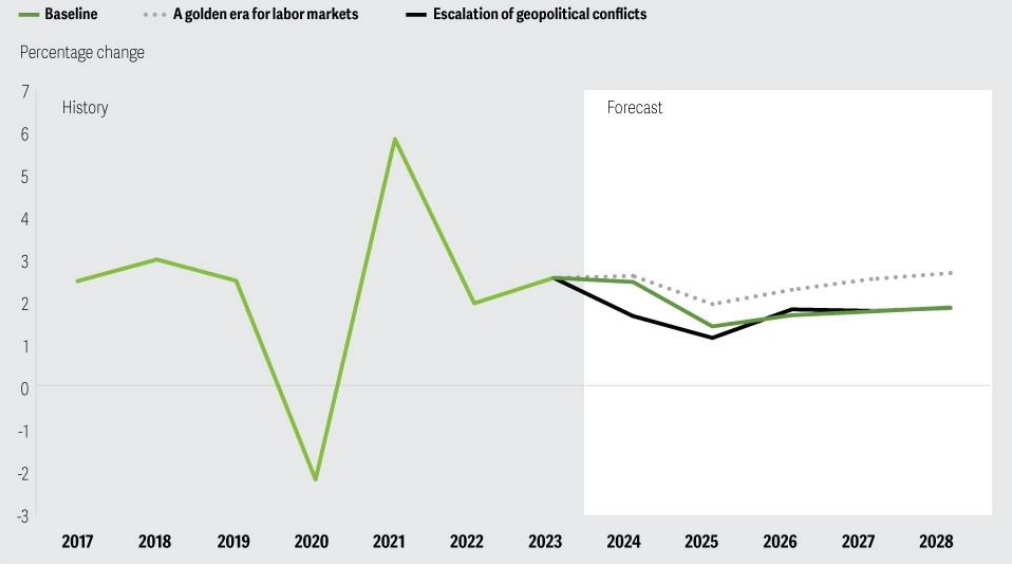


Figure 5 – Real GDP, US$ trillion
Source – Deloitte's United States Economic Forecast (2024)

3.2.2 Hedging currency risk

Currency risk, also known as exchange rate risk, refers to the uncertainty faced by investors that operate with financial amounts denominated in foreign currencies. This risk emerges because the value of a foreign currency fluctuates against the investor's home currency. For an investor like Mr. Rodrigues, that resides in Portugal and who's portfolio consists mainly of non-Euro denominated assets, changes in exchange rates can have a significant impact on the real value of his returns when converted back into Euros.

There are many types of derivatives such as futures, forwards, options, and swaps. Forwards are over-the-counter (OTC) contracts to buy or sell a specified asset at a specified price, at a future time (Witzany, J. 2020). The main difference between this type of derivative and Futures, is that the latter have standardized terms and are traded on an exchange. This implies greater liquidity, which is useful in any situation in which rebalancing may be necessary. If rebalancing implies reducing the weight in an asset to buy more of another asset in different currency, the Futures contracts held will need to be adjusted, so being able to buy/sell them from the market is a great advantage.

In the context of Mr. Rodrigues' investment portfolio, which predominantly holds assets denominated in United States Dollar (USD), along with significant positions in Canadian Dollar (CAD), Great British Pound (GBP), Swiss Franc (CHF), and Euro (EUR), the strategic application of Futures contracts is crucial for dealing with currency risk. As we briefly explained in the beginning of this IPS, Futures enable an investor to lock in an exchange rate for the purchase or sale of a currency on a future date, without the exchange of the underlying currency until maturity. This feature is particularly advantageous in this case, as it allows for hedging against unwanted movements in exchange rates across different currencies. For instance, if USD strengthens against EUR towards the end of the investment period, the post-exchange returns could be significantly less when converted into EUR. By entering into a Futures contract, Mr. Rodrigues could lock in the current favorable exchange rate for USD/EUR, thereby neutralizing this risk.

The exact amount held in each currency is only going to be known closer to the investment's maturity. The decision has been made to purchase these contracts 5 years

from the present (in the middle of the portfolio's lifespan). At this point, we will have a better idea of what assets are working in our favor or not, and possibly will have conducted some rebalancing already. It is then that future contracts will be bought, locking in values for the rates we're exposed to.

3.2.3 Asset Allocation

Following the client's requirements and restrictions, the final portfolio consists of mainly equities (67.76% allocation), with the remaining 32.24% being allocated to a fixed income product, which in this case is a 10-year US Note – a bond offered by the US government (Figure 6). The portfolio is close to a 70/30 portfolio – recommended for investors with slightly more lenient risk appetites. The balance between these two assets allows for an expected return higher than what the client required, with variance close to the critical threshold chosen by the client.

The final asset weights were determined by Excel Solver – which was instructed to maximize returns and minimize risk whilst maintaining asset weights between 3% and 15% to ensure the presence of all assets.

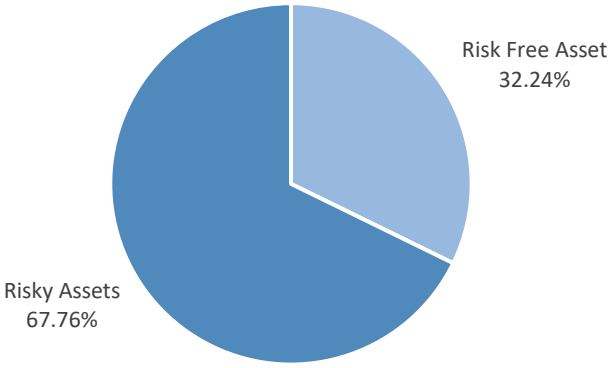


Figure 6 – Allocation by Asset Class
Source – Author

3.3 Security Selection

Regarding the selection of assets that the client's portfolio will be comprised of, Mr. Guilherme Barbosa used Refinitiv Eikon, a software platform used in Finance to provide comprehensive data, analytics, and trading capabilities. As Refinitiv offers extensive and

real-time market data across a variety of asset classes, this is an ideal platform to select assets with. The first step was to apply some restrictions, to be able to filter out some of the tens of thousands of possible equities to choose from.

Bearing the clients' risk profile and preferred restrictions in mind, the first filter applied to Refinitiv's stock screener was "Country of Headquarters: Europe and North America". The next filter applied has more to do with the client's individual strategy. As the investment strategy employed is a mix of Small Cap Investing and GARP Strategies, the next filters applied were "Market Cap > $300 Million and Market Cap < $2 Billion". This ensures that we are only looking for very small firms, possibly in the early stages of their growth cycle, that have plenty of room to grow. The last filters added were "PEG Ratio (Forward) < 1", which is a core part of Mr. António's strategy, and as we saw previously, reflects a firms' potential for growth. Finally, the last filter added to conclude the stock screening process was "Sharpe Ratio > 0". By excluding companies that exhibit a negative Sharpe Ratio, we're ruling out any investment in firms that display lower expected returns than a risk-free/benchmark rate.

Having added all these filters to the world of stocks we started off with, the screening results in 26 individual stocks that comply with every restriction, from a variety of different locations and industries. As Mr. António doesn't have any particular restrictions regarding what industries to invest in, the decision was made to diversify as much as possible within the parameters that were already set.

We must also consider that the COVID-19 pandemic introduced significant market distortions, such as heightened volatility, government interventions, and shifts in consumer behavior. Some stocks may have temporarily benefited from pandemic-driven trends, while others faced setbacks unrelated to their long-term potential. These factors highlight the importance of being cautious whilst interpreting past performance during this period.

As for the final selection of equities, the screening process helped in narrowing down the choices to 26 stocks. However, while the screening helped ensure compliance with all criteria, it isn't perfect, and there may still be less optimal options among them.

Additionally, it is widely regarded that selecting between 15 and 20 stocks is enough to guarantee diversification without compromising potential gains.

Bearing in mind the number of stocks necessary, and the desire to include equities from various industries, the final list of stocks was chosen by analyzing the pre-selected 26 stocks and selecting the ones with the best blend of high Sharpe Ratio and low PEG Ratio, whilst trying to include something from each industry to ensure diversification as well.

3.4 Portfolio Composition

3.4.1 Modern Portfolio Theory & Post-Modern Portfolio Theory

In 1952, Harry Markowitz developed the basis of what is now known as *Modern Portfolio Theory* (MPT). In his work, Markowitz follows an analytical approach to building an adequate portfolio, namely emphasizing the importance of considering both risk and return in investment decision-making. Markowitz's theory is based on a few key principles – the first being that an investor seeks to maximize discounted expected returns, and the second being that an investor mitigates variance (a mathematical definition for risk) in favor of discounted expected returns.

Beyhagi et al. (2012) outlined five assumptions inherent to Modern Portfolio Theory (MPT):

1. **The investor is rational.** That we are all utility-maximizing *Homo Economicus'*. As we detailed in the "Investment Philosophy" section of this IPS, this isn't necessarily the case.
2. **Investors are risk averse** i.e. when presented with two portfolios offering equal expected returns but differing levels of risk, investors opt for the one with lower risk.
3. **An investor will always prefer a portfolio with a higher expected return over a different portfolio with a lower expected return**, as any rational investor should.

4. **Investors are price takers who cannot affect a security price**, reflecting the idea that in competitive markets, individual investors lack the influence to impact security prices, which aligns with the principles of market efficiency.
5. **The investor knows the expected return of each asset in his/her portfolio**, enabling informed decision-making in accordance with MPT.

In addition to these assumptions, MPT introduced concepts that revolutionized portfolio management. MPT emphasizes the benefits of diversification and the trade-off between risk and return in portfolio construction. According to MPT, investors can achieve optimal portfolios by allocating assets in a manner that either maximizes expected returns for a given level of risk or minimizes risk for a given level of expected return.

Despite its strengths, and all that it has added to the worlds of academia and finance, MPT has faced criticism and challenges over the years. Markowitz himself has acknowledged there are important limitations to the original MPT formulation, in part due to computational problems faced at the time MPT was developed. Critics argue that some assumptions, such as market efficiency and investor rationality, are not always applicable in real-world scenarios. More importantly though, critics questioned how MPT measures and interprets risk.

Rom & Ferguson (1994) challenge MPT, and assert that the most unsatisfactory aspects of MPT are that “the investment returns of all securities and assets can be adequately represented by the normal distribution”, and that “variance of portfolio returns is the correct measure of investment risk” (Rom & Ferguson, 1994, p. 1) Essentially, they argue that MPT is constrained by risk and return metrics that don't always reflect the actual dynamics of investment markets.

Post-Modern Portfolio Theory (PMPT) builds upon the foundation laid by MPT, whilst questioning and attempting to improve some of its fundamental aspects. PMPT questions MPT’s usage of variance as a measure of risk, arguing that it treats all uncertainty equally when it is not. In MPT, investment outcomes that exceed expectations are treated equally as those that fall short, highlighting the counter-intuitive nature of using a symmetrical risk measure in real-world applications. Rom & Ferguson’s work defends the opposite – that one should seek as much volatility as possible in a bull market, whilst searching to

minimize it in a bear market. In the words of the authors, and as we have seen previously, "it is well known that individuals are more concerned with avoiding loss than with seeking gain" (Rom & Ferguson, 1994, p. 3) – highlighting once again that risk is not only non-symmetrical, but in fact severely positively skewed.

PMPT labels an investor's required rate of return as one's Minimum Acceptable Return (MAR), defining it as the rate of return that must be achieved to accomplish the investor's financial goal. This theory defends that outcomes above the MAR don't represent financial risk. It therefore distinguishes between downside and upside volatility:

> *"… only volatility below the investor's target return incurs risk; all returns above this target cause "uncertainty", which is nothing more than riskless opportunity for unexpectedly high returns."*
> *(Rom & Ferguson, 1994, p. 3)*

$$\sigma = \sqrt{\frac{\sum(x_i - \mu)^2}{N}} \quad (2)$$

Calculation of risk in MPT

- σ = population standard deviation
- N = the size of the population
- x_i = each value from the population
- μ = the population mean

$$d = \sqrt{\int_{-\infty}^{t} (t - r)^2 f(r)\, dr} \quad (3)$$

Calculation of downside risk in PMPT

- d = downside deviation
- t = annual target return, or MAR
- r = random variable representing the return for the distribution of annual returns $f(r)$
- $f(r)$ = distribution for the annual returns, e.g. the three-parameter lognormal distribution

3.4.2 Methodology

Now that the model to create the Efficient Frontier (EF) has been determined, the next step is to extract the data to be used in our model. The data selected was extracted from the YahooFinance! (2024) online platform, as it provides easily accessible and accurate financial data. The returns selected to be used in our model are the most recent 5-year

end-of-month security prices (from May 2019 to May 2024). These returns are then used to calculate each equity's Average Annual Return ($\bar{R}$), Standard Deviation (σ) and Variance (σ^2). Subsequently, these variables are used to construct a Variance-Covariance matrix, which in turn is used to calculate the portfolio's expected return and variance. All this data is obtained to create a Portfolio Opportunity Set.

The Portfolio Opportunity Set shows all potential portfolios that can be constructed from our set of risky assets. This graph is divided into two parts, separated at the Minimum Variance Portfolio (MVP) – the portfolio with the lowest standard deviation out of all efficient combinations of risky assets. The section of the graph below the MVP is the "Inefficient" or "Minimum Variance" frontier, where the upper part is the Efficient Frontier. The latter has this name because for any given expected return, there is no efficient combination of stocks with a lower standard deviation, and vice versa. Therefore, the EF offers investors the best possible return for a given level of risk. By selecting a portfolio that lies directly on the EF, investors are optimizing their investment choices, balancing risk and return in the most advantageous manner.

The Efficient Frontier can be defined by the following equations:

$$\sigma_P^2 = \frac{A\bar{R}_P^2 - 2B\bar{R}_P + C}{AC - B^2} \tag{4}$$

$$A = 1'V^{-1}1 \tag{5}$$

$$B = 1'V^{-1}\bar{R} \tag{6}$$

$$C = \bar{R}'V^{-1}\bar{R} \tag{7}$$

And, finally, to exclude short selling and ensure all assets have a relevant weight in the portfolio:

$$\sum_{i=1}^{n} w_i = 1 \tag{8}$$

$$w_i > 0 \; \forall \; i \tag{9}$$

$$3\% \leq w_i \leq 15\% \tag{10}$$

The MVP discussed above was calculated using the Excel Solver Add-in, with which variance was minimized whilst keeping all security weights > 0.

Once the MVP is defined, the next step is to define the Capital Allocation Line (CAL). The CAL is a line that stems from the y-axis and is tangent to the EF, representing all possible combinations of risky and risk-free assets. Using Solver once again, it was possible to find the coordinates of the tangent point between the EF and the CAL – which is the point in which the Sharpe Ratio is maximized. In order to find this point, some restrictions were put into place, such as allocating maximum and minimum weights for each individual asset and not allowing assets to have negative weights (no short selling).

In constructing the optimal portfolio, Roy's Safety-First Criteria was also employed. This criterion was first introduced by A.D Roy in 1952, where he suggests a strategy that minimizes the risk of a catastrophic loss in the portfolio from occurring. In essence, Roy's Criteria is based on identifying a critical threshold, below which the portfolio's returns are classed as disastrous. His criteria argues that the optimal portfolio is the one which minimizes the probability of the expected return of the portfolio falling below the threshold.

The threshold defined in section 2.3.4 of this IPS specifies a catastrophic loss as any drop exceeding 15% of the portfolio's value. By setting this threshold, the portfolio is structured to prioritize protection against any risk that presents a threat to this limit, following Roy's principle.

3.4.3. Portfolio Composition

The portfolio composition is outlined in appendix A3, and a description of the securities is provided in appendix A4. The portfolio is made up of equities from Europe and North America, with the latter leading the total number of equities held by the portfolio.

While the final portfolio appears concentrated in sectors such as Industrials and Financials, this outcome aligns with the overall growth objective and reflects the

prioritization of sectors with favorable risk-reward profiles during the selection process. As described previously, diversification was emphasized across asset classes and geographies. Sectoral concentration, however, emerged as a result of allocating resources to areas with strong historical performance, projected growth potential, and resilience under current economic conditions.

When it came to choosing a risk-free rate to incorporate into the portfolio due to the fact that the majority of equities in the portfolio are US-based, the consensus was that it should be a US Treasury Bond. These bonds are among the safest investments in the world, backed by the strong creditworthiness of the U.S government, which make them a reliable benchmark for the risk-free rate. Additionally, since a significant portion of the portfolio is composed of North American equities, primarily denominated in USD, using a US Treasury Bond aligns the risk-free rate with the currency that the portfolio's primary holdings are held in, providing consistency in the evaluation of expected returns.

Given the portfolio's 10-year investment horizon, the US 10-year Treasury note was selected as the portfolio's risk-free component. As of 20th August 2024, the time of the portfolio's creation, this product offered a yield of 3.88%.

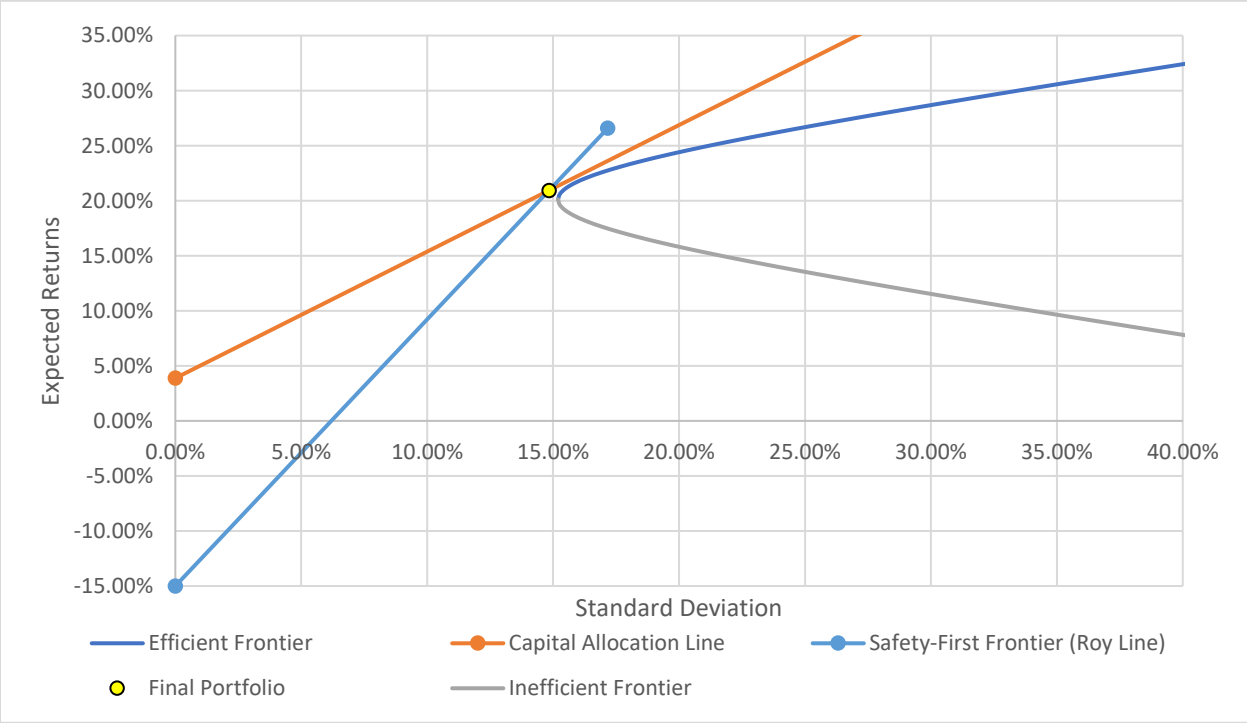


Figure 7 – Risk/Reward Portfolios
Source – Author

The final portfolio (identified in Figure 7 by a green dot) achieves an Annual Expected Return ($\bar{R}$) of 20.94%, and an Annual Volatility (σ) of 14.84%.

3.5 Expected Performance

The Final Portfolio, following all restrictions and investment requirements has the characteristics displayed in Table 1:

Table 1 – Final Portfolio Data

	Final Portfolio
Expected Annual Return	20.94%
Expected Annual Variance	14.84%
Sharpe Ratio	1.15
Risky Assets (%)	67.76%
Risk-Free Assets (%)	32.24%

Source – Author

The portfolio adheres to all constraints, with an Expected Annual Return that exceeds the client's requirements by a few percentage points. While the portfolio is notably risky, as indicated by its relatively high variance, this level of risk was necessary to meet the client's desired returns. The allocation in the risk-free asset is also quite substantial, although it doesn't follow the classic 60% stocks and 40% bonds portfolio. This allocation plays a crucial role, as it significantly reduces risk and contributes to a more balanced overall portfolio, helping to stabilize returns while still meeting the client's objectives. The Sharpe Ratio isn't otherworldly, but still manages to be greater than 1, which means the portfolio offers excess returns in relation to the volatility it provides.

In isolation, a portfolio's returns will always look attractive. Its true value, however, can only be truly comprehended when comparing it to other investments. For that reason, we must decide on a benchmark to compare our results with. The benchmark chosen is the Vanguard Small-Cap Growth Index Fund ETF (VBK). This seeks to track the performance of a benchmark index that measures the investment return of small-capitalization growth stocks (Vanguard, 2024). This Exchange Traded Fund (ETF) is a great comparison to Mr. Rodrigues' portfolio because it targets the exact same type of equities – small cap growth

stocks. The main difference is that Mr. Rodrigues' portfolio has stocks from the US, Canada and Europe, where VBK includes only US equities.

Figure 8 shows the evolution and a comparison between VBK and Mr. Rodrigues' portfolio over the last 5 years.

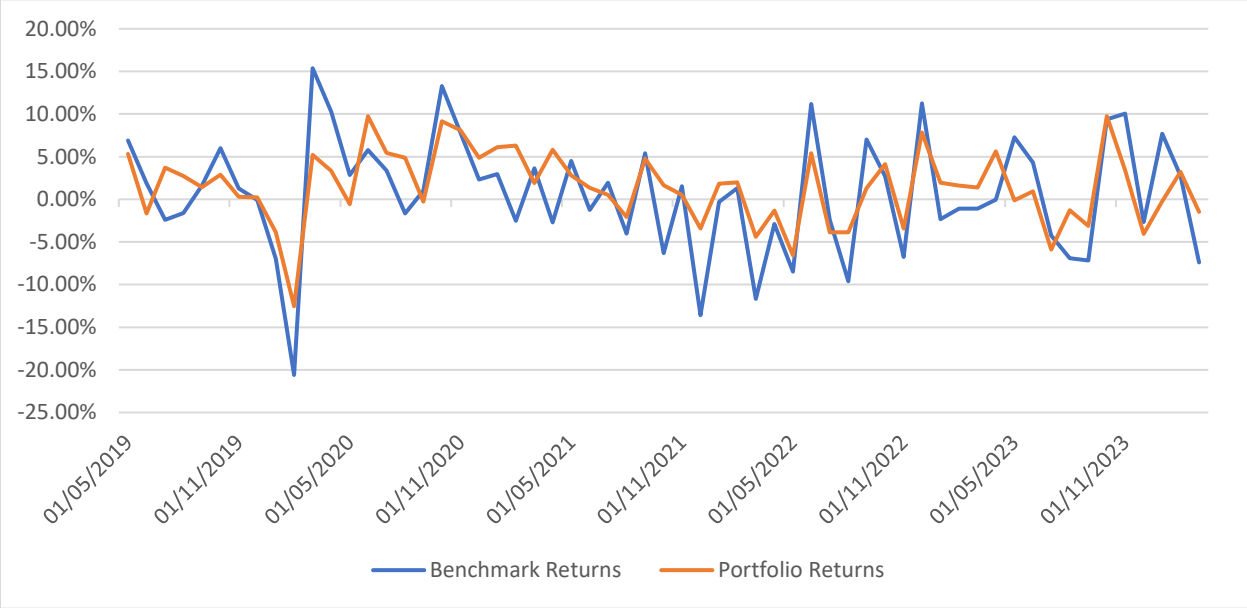


Figure 8 – Returns from 2019 – 2024 of our portfolio and VBK (Benchmark)
Source – Author

Looking at the graph above, both investments exhibit similar patterns of ups and downs, indicating that they are both influenced by market conditions in the same manner, as we would expect. The main difference is that our portfolio seems to experience some lower volatility, as it has more moderate highs and lows. The sharp pandemic-related decline in 2020 and subsequent rally are perfect examples of this as our portfolio behaved more conservatively than its 100% equity counterpart. The bond component of our portfolio is what makes the difference here, as it provides significant cushioning in times of market downturns. This extra cushioning really makes a difference if we look at both investments' compound returns, presented in Figure 9.

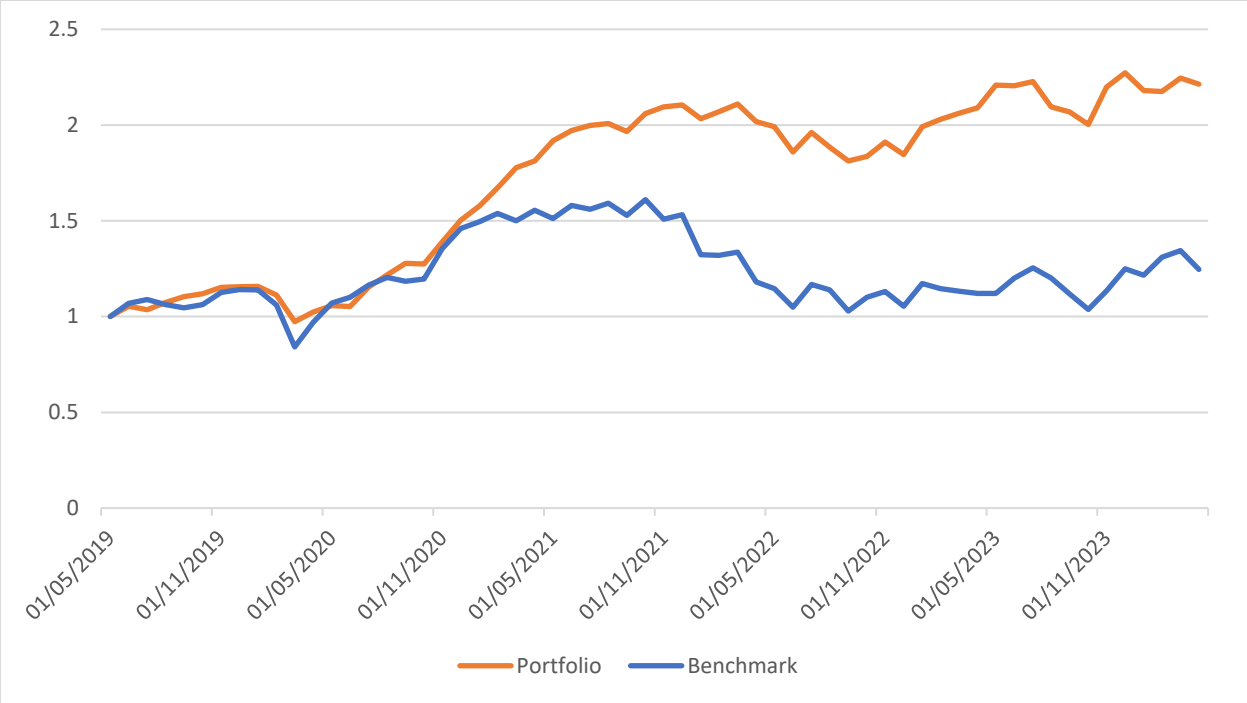


Figure 9 – Cumulative Returns of our portfolio and VBK (Benchmark)
Source – Author

Figure 9 shows that €1 invested in our portfolio 5 years ago would yield €2.21. Comparatively, the benchmark would only return €1.24 over the same period. Although the benchmark experienced higher peaks of percentual growth, it is the lack of downside protection that this ETF has that made the difference. Cumulatively, the lower lows that the benchmark experienced and had to bounce back from are what ultimately made the difference.

3.6 Risk Analysis

For the risk analysis section of this IPS, an assessment of the underlying risk of these investments was performed using various Value-at-Risk (VaR) methodologies. VaR is a statistical measure commonly used in risk management to estimate the maximum loss an investment (in this case a portfolio) might incur over a specified period. The basis of VaR are three main variables – time frame, confidence level, and potential loss incurred.

The types of VaR chosen to quantify the potential risk exposure of the portfolio were Historical VaR, Monte Carlo VaR, and Parametric VaR. These risk measures were chosen since they provide a comprehensive understanding of the portfolio's risk profile, with each

method allowing us to view risk from a different perspective. Using these methods collectively rather than individually allows us to gain insights from historical data, simulation-based scenarios, and a statistical model-driven approach. This multi-faceted analysis enables us to develop a more nuanced and effective risk management strategy, ensuring that both client and portfolio manager can address potential risks with a solid understanding of the portfolio's weaknesses.

The results from this analysis will serve as a foundation for implementing strategies to lessen risks and optimize the portfolio's performance.

3.6.1 Comparative analysis of VaR models

Historical VaR, as its name suggests, is a method that uses past information to predict future outcomes. This method allows us to analyze how an investment or portfolio has performed in previous market conditions and apply that data to estimate potential future losses. It captures data from real-world events and reflects real historical risks, making it a practical approach for evaluating scenarios that may deviate from normal market behavior. This doesn't come without limitations, however. One of the main issues of this model is that it can be particularly sensitive to outliers (like the pandemic, for instance), as rare events can disproportionately affect risk estimates.

To broaden our analysis, we also employed a Monte Carlo simulation. This method allows a wide range of potential outcomes to be generated by simulating thousands of market scenarios through random sampling. For this study, we used 10 years of monthly returns and assumed a Gaussian distribution based on the portfolio's mean return of 20.94% and standard deviation of 14.84%. Running 10,000 simulations, we were able to gain insights into the range of possible future risks.

Finally, the Parametric VaR approach was applied, which estimates potential losses under the assumption that returns follow a normal distribution. Using the same mean and standard deviation as in the Monte Carlo simulation, this model provides a more straightforward estimation of risk but relies on the assumption of normality in the distribution of returns.

Table 2 – Annualized VaR methods

Confidence Interval	Z-Score	Historical	Monte-Carlo	Parametric
90%	-1.282	€ 106,967.09	€ 102,758.78	€ 200,484.84
95%	-1.645	€ 126,381.38	€ 144,503.91	€ 243,612.86
97.5%	-1.960	€ 173,818.73	€ 181,794.59	€ 281,019.99
99%	-2.326	€ 251,475.51	€ 222,089.35	€ 324,513.86

Source – Author

Table 2 illustrates the portfolio's potential losses at various confidence intervals using three VaR methodologies mentioned previously. The confidence intervals – 90%, 95%, 97.5%, and 99% – reflect the level of significance, which indicates the willingness to accept the chance of being wrong. For example, a 95% confidence interval corresponds to a 5% level of significance, meaning there is a 5% chance that losses could exceed the estimated values. Similarly, a 90% confidence interval implies a 10% chance of exceeding the calculated losses under normal market conditions. At the 90% confidence level, the Parametric VaR method reports the highest potential loss (€200,484.84), while the Monte-Carlo method yields the lowest (€102,758.78). This suggests that the Parametric method anticipates larger tail risks under its assumption of normally distributed returns. Conversely, the Historical VaR reflects past market behavior, which potentially underestimate risks in volatile conditions.

As the confidence intervals increase, the 95% and 97.5% levels show a similar pattern, with Parametric VaR consistently estimating the largest losses (€243,612.86 and €281,019.99, respectively). Monte Carlo VaR offers intermediate loss estimates, with values falling between the Historical and Parametric methods, which could suggest that it captures some of the tail risks present in the portfolio's return distribution.

At the 99% confidence level, the divergence among the methods becomes most apparent. The Parametric VaR again predicts the largest loss (€324,513.86), followed by Monte Carlo (€222,089.35) and Historical (€251,475.51). Historical VaR is more in line with observed historical data, whereas the Monte Carlo and Parametric approaches

consider more extreme hypothetical market scenarios, with Parametric being the most sensitive to such tail events.

Given the client's maximum loss limit of 15%, or €120,000 from the initial €800,000 investment, it is evident that (excluding parametric VaR), only the 5% worst possible outcomes exceed this boundary. Although all three models exceed the threshold, they all represent statistically unlikely scenarios. The 90% confidence interval results from two of the three models are well within the client's acceptable loss boundary. This indicates that under more probable circumstances, the portfolio's risk remains manageable. Therefore, the portfolio largely aligns with the client's risk tolerance, with only the most extreme events presenting a risk.

Overall, the results match the expectation we had from the data and we can conclude that the historical method may be more appropriate when based on past data and stable market conditions, but for scenarios involving higher volatility or stress testing for infrequent events, the Monte Carlo and Parametric models provide a broader range of outcomes.

3.6.2 10 Year Risks

A risk matrix allows us to assess and visualize the potential risks that could affect the investment strategy detailed in this IPS. By combining the likelihood of a risk materializing with its potential impact on the portfolio, a risk matrix is a useful tool in identifying risk exposure. Table 4 outlines medium-term risks, as identified by Schroders (2023), highlighting key challenges within a ten-year horizon.

Table 3 – Risks for the next decade

Risks	***Implications***	***Impact***
Mass adoption of Artificial Intelligence (AI) (A)	Labor market shifts and a workforce redesign. Improved decision-making through predictive analytics.	Companies that adapt AI to improve operational efficiency will benefit in the long run. This positions technology stocks for a strong performance.

An escalation in geopolitical conflict (B)	Energy and commodity price shocks. Supply chain disturbance.	Increased volatility. Safe-haven assets like USD and gold.
Failure to mitigate climate change (C)	Global food/water shortage. Widespread migration, social instability.	Increased operational costs, increase in inflation.
Interest rate Hiking (D)	Slower economic growth. Shift in preferences towards fixed-income products.	Decline in value of bonds as newer issues offer higher yields.
Inflation risk (E)	Reduced real returns. Higher interest rates, higher cost of living and a tighter monetary policy.	Less spending implies lower corporate revenues. Bonds and cash lose value.
Global Recession (F)	Contraction in global demand, rise in unemployment, rate cuts by central banks.	Fixed income and defensive sector stocks become solid options.

Figure 10 displays a risk matrix, created with the intent of classifying the different risks in terms of both probability and impact, for the period in which our portfolio is considered.

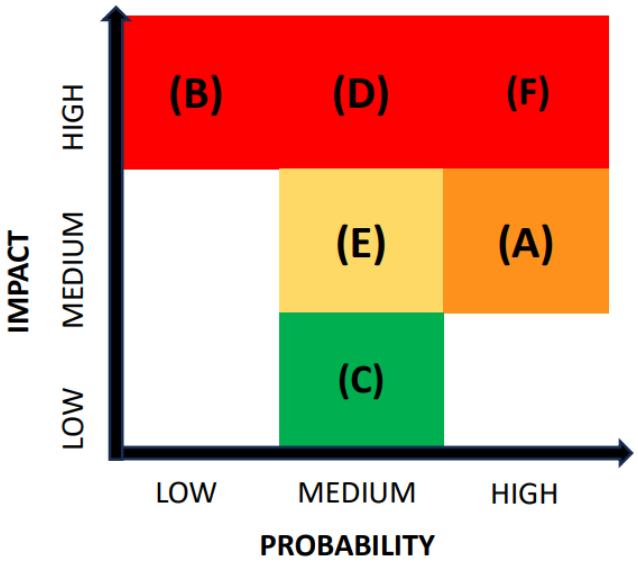


Figure 10 – Risk Matrix
Source – Author

It has therefore been determined that, out of the risks outlined previously, a failure to mitigate climate change (C) is the risk least capable of causing damage or any potential harm to the portfolio. On the other hand, an escalation in geopolitical conflict (B), interest rate hikes (D), and a global recession (F) would be the most impactful out of all the risks listed, with the latter having a relatively high likelihood of happening in the next decade.

These risks will all be closely monitored, and each report sent to the client will have a clear outline of the strategy going forward, potential upcoming rebalancing and how to proceed in mitigating these risks.

Looking at this IPS, we can say that the client's investment goal was not only met but exceeded, with risk being managed accordingly, using the objective and risk profile to determine appropriate levels of risk. Only the future will tell how these investments will fare – but the portfolio itself has been constructed and strategically designed to maximize potential outcomes.

Appendix

Table A1 – Client Profile

Name	**Mr. António Rodrigues**
Age	32
Occupation/Annual Wage	Sabbatical leave/ Ex-Entrepreneur Current plan is to live off the sale of his company for a year. No yearly wage.
Academic Background	Master's Degree in Data Science
Additional Information	Lived very frugally whilst building his company, now wants to invest and be able to enjoy the fruits of his labor before returning to the workforce. Has some experience investing by himself previously.
Investment Constraints	• Mainly stocks • No short selling • Companies with a high capacity for future growth • Investing only in North American or European markets • Only small companies • Maximum annual loss of 15%
Risk Profile	Moderate Aggressive
Investable Amount	€800,000 (from the sale of his company)
Investment Objective	€1,600,000 (€3,044,754,57 considering 2.50% annual inflation and 28% capital gains tax)
Investment Horizon	10 years
Minimum Rate of Return	14.31% annually
Final proposed portfolio	20.94% annual return, 14.84% annual volatility

Source – Author

Figure A2 – Charles Schwab Questionnaire

I plan to start withdrawing money from my investments for major needs in: **6-10 years** Select the investments you currently own or have owned: **Bonds, Stocks.**	Once I begin withdrawing funds from my investments, I plan to spend all of the funds in: **11 years or more**	My knowledge of investments is: **Good**	What amount of financial risk are you willing to take when you invest? **Take above average risks expecting to earn above average returns.**	We've outlined the most likely best-case and worst-case annual returns of five hypothetical investment plans. Which range of possible outcomes is most acceptable to you? **Plan E: Average annualized - 7.2%; Best case scenario - 42.5%; Worst case scenario: - 25.8%**	Imagine that the stock market has dropped by 25% in value over the past three months. A stock that you own has also dropped by 25% in value. What would you do with your shares? **Sell some.**

Investor Profile Questionnaire Results

Moderate Aggressive Plan

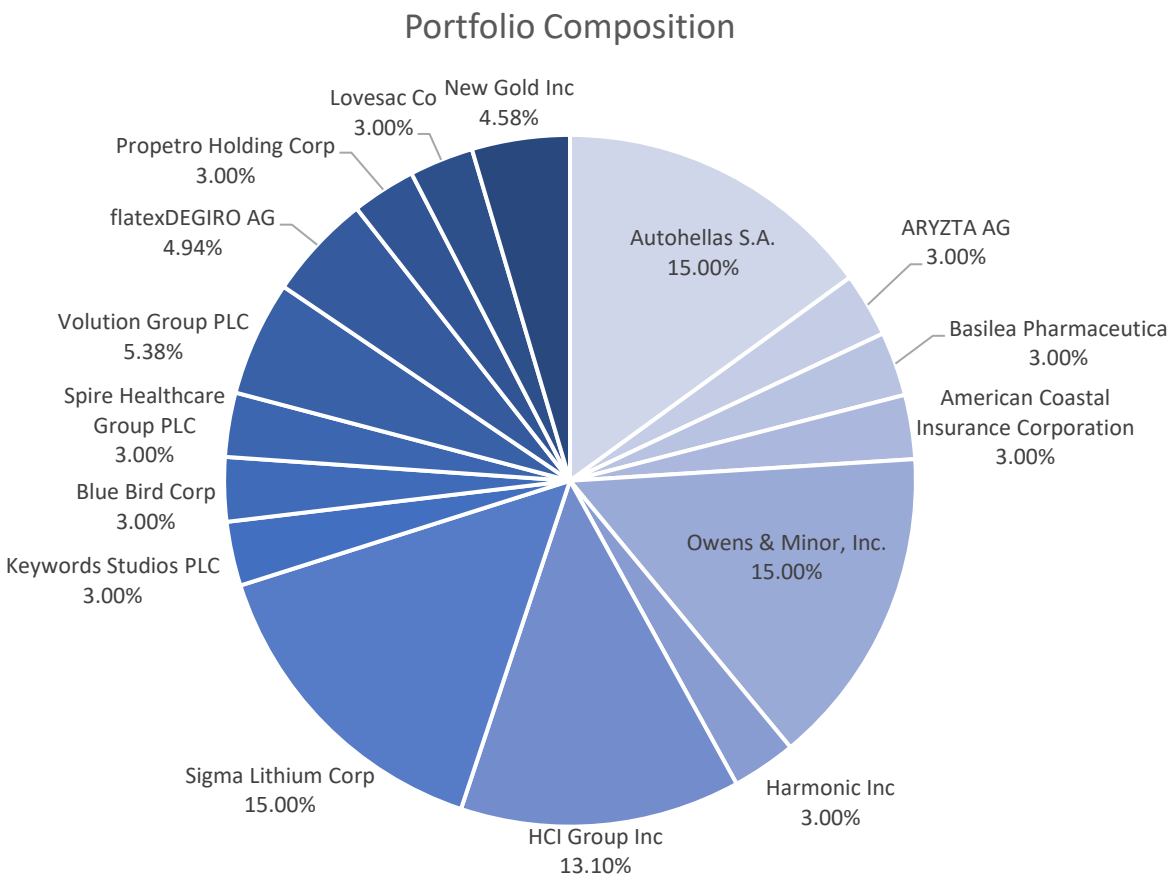
The information you have provided indicates that your target asset allocation is **Moderate Aggressive**. Please review the information below to make sure you are comfortable with the asset allocation reflected for this target asset allocation.

Moderate Aggressive	Asset Class	Allocation
	Large Cap Equity	45%
	Small Cap Equity	15%
	International Equity	20%
	Fixed Income	15%
	Cash Investments	5%
	Other	0%

1971 - 10/2023*						
Target Portfolio	Goal	Average Annual Return	Best Year	Worst Year	Investment Time Horizon	Risk Level
Moderate Aggressive	Growth	9.8%	34.7%	-30.5%	SHORT LONG	LO HI RISK

Source – https://hgtoolsweb.schwab.com/pcu/mp/riskProfileQuestionnaire.action

Figure A3 – Portfolio Composition



Source – Author

Table A4 – Description of Securities

Company	Description
Autohellas SA	Autohellas S.A. offers occasional and small duration rental services to individuals and companies; and fleet management services. The company also trades in new and used cars of various brands.In addition, it imports and distributes aftermarket car parts; and provides consulting services and administrative support.
ARYTZA.AG	ARYZTA AG provides products and services for in-store bakery solutions in Europe and internationally.
Basilea Pharmaceutica	Basilea Pharmaceutica AG, a commercial-stage biopharmaceutical company, focuses on the development of products that address the medical needs in the therapeutic areas of oncology and anti-infectives.
American Coastal Corporation	American Coastal Insurance Corporation primarily engages in the commercial and personal property, and casualty insurance business in the United States.
Owens & Minor, Inc.	Owens & Minor, Inc., together with its subsidiaries, operates as a healthcare solutions company worldwide. It offers a portfolio of products and services to healthcare providers and manufacturers.
Harmonic, Inc.	Harmonic Inc., together with its subsidiaries, provides broadband solutions worldwide. The company operates through Broadband and Video segments.
HCI Group, Inc.	HCI Group, Inc., together with its subsidiaries, engages in the property and casualty insurance, insurance management, reinsurance, real estate, and information technology businesses in Florida.
Sigma Lithium Corporation	Sigma Lithium Corporation engages in the exploration and development of lithium deposits in Brazil. It serves lithium-ion battery supply chain for electric vehicle industries worldwide.
Keywords Studios PLC	Keywords Studios plc provides creative and technical services to the video game industry worldwide.
Blue Bird Corp	Blue Bird Corporation designs, engineers, manufactures, and sells school buses internationally.
Spire Healthcare Group PLC	Spire Healthcare Group PLC owns and operates private hospitals and clinics.
Volution Group PLC	Volution Group PLC manufactures and supplies ventilation products to residential and commercial constructions in the United Kingdom, Continental Europe, and Australasia.
FlatexDEGIRO AG	FlatexDEGIRO AG provides online brokerage and IT solutions in the areas of finance and financial technology services in Europe.
Propetro Holding Corp	ProPetro Holding Corp. operates as an integrated oilfield services company.
Lovesac Co	The Lovesac Company designs, manufactures, and sells furniture.
New Gold Inc.	New Gold Inc., a gold mining company, develops and operates of mineral properties in Canada. It primarily explores for gold, silver, and copper deposits.

Source – YahooFinance!

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Guilherme Barbosa, 09/10/2024