



Lisbon School
of Economics
& Management
Universidade de Lisboa

MASTERS OF SCIENCE IN FINANCE

MASTERS FINAL WORK PROJECT

INVESTMENT POLICY STATEMENT:

MRS. LAURA MENDES

OMAR EL ADIB

JUNE 2025



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PROFESSOR BRUNO GOMES FERNANDES

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Abstract

The investment policy statement (IPS) developed in this Master Final Work (MFW) intends to manage an inheritance of €500,000 for Mrs. Laura Mendes, a Senior Public Health Analyst from Portugal, to support her daughter Sofia's future education and lifestyle costs. The planned investment horizon is 12 years, during which the portfolio aims to achieve a real target value of €1,141,783 which entails a real annual return of 7.13%.

To achieve this objective the IPS uses a strategic equity and bond allocation split of 60/40 and a balanced capital preservation alongside long-term growth. Defensive sectors are mainly used for equities such as consumer staples, healthcare, utilities alongside financials and industrials with Eurozone bias to reduce currency risk. Fixed income securities include sovereign bonds from the Eurozone and U.S. government bonds which enhance stability for portfolio resilience.

The volatility and expected return were obtained using the Modern Portfolio Theory (MPT), based on historical asset-level performance (2010–2025), and validated through an efficient frontier analysis. Risk-adjusted metrics like the Sharpe and Sortino ratios confirm the portfolio's alignment with the client's moderate risk tolerance.

Performance is further evaluated using Monte Carlo simulation and historical back testing under four market stress scenarios, making sure that there is resilience across different macroeconomic conditions. Risk is assessed using Value at Risk (VaR) methodologies and sensitivity analysis. This approach shows the practical application of financial theory in portfolio construction, in line with CFA principles.

JEL Classification: C6; G11

Keywords: Asset Management; Portfolio Theory; IPS; Individual Investors

Resumo

A Declaração de Política de Investimento (IPS) desenvolvida neste Trabalho Final de Mestrado (TFM) tem como objetivo gerir uma herança de €500.000 para a Sra. Laura Mendes, Analista Sénior de Saúde Pública em Portugal, a fim de apoiar os custos futuros de educação e estilo de vida da sua filha, Sofia. O horizonte de investimento planeado é de 12 anos, período durante o qual o portefólio pretende alcançar um valor real alvo de €1.141.783, o que implica uma rentabilidade real anual de 7,13%.

Para atingir esse objetivo, a IPS utiliza uma alocação estratégica entre ações e obrigações na proporção de 60/40, equilibrando a preservação de capital com o crescimento a longo prazo. Os setores defensivos concentram a componente acionista: bens de consumo essenciais, saúde, utilidades, serviços financeiros e industriais, com uma preferência pela Zona Euro para reduzir o risco cambial. Os instrumentos de rendimento fixo incluem obrigações soberanas da Zona Euro e títulos do governo dos EUA, contribuindo para a estabilidade e resiliência do portefólio.

A volatilidade e o retorno esperado foram obtidos com base na Teoria Moderna do Portefólio (MPT), utilizando dados históricos de desempenho ao nível dos ativos (2010–2025), e validados através da análise da fronteira eficiente. Indicadores de risco ajustado, como os rácios de Sharpe e de Sortino, confirmam o alinhamento do portefólio com a tolerância ao risco moderada da cliente.

O desempenho é ainda avaliado por meio de simulação de Monte Carlo e retrospectiva histórica sob quatro cenários de stress de mercado, assegurando a resiliência em diferentes condições macroeconómicas. O risco é analisado com base em metodologias de Value at Risk (VaR) e em análises de sensibilidade. Esta abordagem demonstra a aplicação prática da teoria financeira na construção de portefólios, em linha com os princípios do CFA..

Classificação JEL: C6; G11

Palavras-Chave: Gestão de Ativos; Teoria da Carteira; IPS; Investidores Individuais

Abbreviations

AI	Artificial Intelligence
Beta	Beta Coefficient
BR	Bond-specific Risk
CAL	Capital Allocation Line
CAGR	Compound Annual Growth Rate
CR	Currency Risk
CVaR	Conditional Value at Risk
DR	Diversification Risk
ECB	European Central Bank
ESG	Environmental, Social, and Governance
ETF	Exchange-Traded Fund
EU	European Union
FCF	Free Cash Flow
GDP	Gross Domestic Product
GR	Geopolitical Risk
IMF	International Monetary Fund
IPS	Investment Policy Statement
IR	Interest Rate Risk
MFW	Master Final Work
MR	Macroeconomic Risk
MPT	Modern Portfolio Theory
MVP	Minimum Variance Portfolio
MSCI	Morgan Stanley Capital International
OECD	Organisation for Economic Co-operation and Development
P/B	Price-to-Book Ratio
P/E	Price-to-Earnings Ratio
P/S	Price-to-Sales Ratio
RFR	Risk-Free Rate
SR	Sector-specific Risk
U.S.	United States
VaR	Value at Risk
VIX	Volatility Index
VSTOXX	EURO STOXX 50 Volatility Index

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1 Introduction

This MFW aims to design a comprehensive Investment Policy Statement for Mrs. Laura Mendes, a public health professional residing in Portugal.

Following the tragic loss of her husband to cancer, Laura inherited €500,000, which she intends to invest to secure the future of her 6-year-old daughter, Sofia Mendes. Her primary objective is to grow this inheritance to €1,500,000 over the next 12 years, in time to support her daughter's university education and early adult life.

The IPS begins with an in-depth assessment of the client's financial goals, risk profile, and investment constraints. While Laura is financially independent with a monthly salary of €5,420, she remains cautious and values capital protection. However, she is also open to moderate risk exposure to achieve her ambitious long-term target. The inflation-adjusted portfolio objective is €1,141,783, which requires a minimum nominal return of 9.59% and a real return of 7.13%.

The proposed portfolio is structured around a 60/40 equity-bond allocation, tailored to achieve a portfolio return of 11.81% with an annualized volatility of 8.79%. The majority of equity investments are made in defensive sectors including utilities, healthcare, and consumer staples, however there are also some exposures to financial and industrial sectors. The portfolio maintains a solid European bias to reduce currency risk, though it also includes a diversified allocation to U.S. equities to increase return potential and global diversification. Sovereign bonds from the United States, Germany, and the Netherlands are examples of fixed-income securities, all rated AA+ or higher, indicating excellent credit quality. These selected instruments were chosen for their stability, low default risk, and their role in reducing the overall portfolio volatility.

Monte Carlo simulations, risk-adjusted performance metrics like the Sharpe ratio, correlation and covariance assessment and other techniques are used in the analysis to examine the portfolio's resilience and alignment with the client's objectives. These tools make sure that the diversification and risk management principles are successfully implemented in line with the client's profile and long-term objectives.

2 Executive Summary

2.1 Scope and Purpose

This Investment Policy Statement (IPS) details the financial plan crafted by Mr. Omar El Adib for Mrs. Laura Mendes, to wisely manage her €500,000 inheritance. The objective is to support her daughter's future needs by aiming for long-term growth while ensuring the capital is preserved. With a projected real return of 9.3%, the portfolio's 60/40 equity-bond mix is designed to outperform the 7.13% minimum required to meet her 12-year financial target.

2.2 Governance

The portfolio is managed according to a detailed Investment Policy Statement (IPS), which clearly establishes the client's investment objectives, constraints, and tolerance for risk. The advisor takes charge of selecting assets, distributing them across asset classes, and keeping a vigilant eye on the portfolio's progression. Rebalancing occurs, when necessary, based on regular reviews and shifts in the market.

2.3 Investment Return and Risk

The portfolio is designed for those with a moderate risk profile, targeting an annual return of 11.81%. After considering the expected 2.3% inflation rate, this translates into a real return of 9.3%. With a Sharpe Ratio projected at 1.01, and a volatility of 8.79%, the portfolio demonstrates solid risk-adjusted efficiency. This balance is achieved by following asset allocation models and examining historical performance. Diversification across asset classes ensures a mix that both protects against losses and fosters capital growth.

2.4 Risk Management

The risk framework is designed to support portfolio resilience and ensure long-term alignment with client goals. Volatility, VaR, and SR were used to guide our assessments with sophisticated tools such as Monte Carlo simulation and crisis backtesting. Tactical rebalancing is informed by macroeconomic indicators, while major changes require direct client approval.

3 Investment Policy Statement

3.1 Scope and Purpose

This investment policy statement sets the strategic foundation for managing Mrs. Laura Mendes' investment portfolio. It details the objectives, risk parameters, and asset allocation guidelines that Mrs. Mendes and her advisor, Mr. Omar El Adib, have agreed upon. This document serves as a guide for all investment decisions and ongoing performance reviews, ensuring they are both consistent with Mrs. Mendes' long-term financial goals.

After her husband passed away, Mrs. Mendes, a public health analyst living in Lisbon, Portugal, inherited €500,000. Her husband had specifically asked that this money be used wisely to secure their six years old daughter Sofia's future. With this in mind, the family crafted an investment plan to grow this sum over the next 12 years. This plan is designed to cover both the costs of Sofia's higher education and her early adult life expenses.

Mrs. Mendes enjoys a steady income and values her financial independence. This stability allows her to pursue a moderately adventurous strategy when it comes to investing. Her portfolio is designed to emphasize long-term growth, with a disciplined and risk-conscious approach to asset allocation in both Eurozone and U.S. markets. The focus of the portfolio is on preserving capital, managing volatility, and rebalancing thoughtfully based on economic trends. At the same time, it seizes growth opportunities whenever they arise.

3.2 Structure

Mr. Omar El Adib, the designated advisor, is responsible for overseeing and implementing this Investment Policy Statement (IPS). He is tasked with managing the portfolio strategically, in alignment with the client's long-term goals. Investment decisions will adhere to the guidelines set by the IPS, with a primary focus on sustainable growth and capital preservation.

In fulfilling his fiduciary duty, the advisor will prioritize Mrs. Laura Mendes best interests, while making sure there is transparency, timely communication, and guidance on relevant market developments. Performance, volatility, and alignment with macroeconomic conditions will be reviewed quarterly while considering factors like interest rates, inflation, and recession

risk. Comprehensive reports, including risk metrics and suggestions for rebalancing, will be provided. The advisor has some flexibility in making operational decisions, but any significant strategic shifts will need Mrs. Mendes' prior approval to ensure her continued influence over the portfolio's direction.

3.3 Governance

In line with Mrs. Laura Mendes' long-term objectives, a robust governance framework is put in place to guarantee that the portfolio is both executed and monitored effectively. This framework clearly defines the roles and responsibilities of both the advisor and the client, emphasizing transparency and fiduciary duty.

The investment policy statement (IPS) is planned, executed, and overseen by the designated financial advisor, Mr. Omar El Adib. Among his key responsibilities, Mr. El Adib must ensure compliance with regulations while constructing a portfolio that reflects the client's risk tolerance and investment constraints. Strategic reviews take place at least once a year or are prompted by major changes in market conditions or client circumstances.

Risk exposures and performance are tracked every quarter, with comprehensive reports detailing return attribution, error monitoring, and crucial risk measures. Mrs. Mendes must give her prior consent before any significant changes are made to the portfolio.

To ensure compliance, external legal and tax experts may be consulted as needed. The portfolio explicitly excludes speculative or complex instruments, allowing only blue-chip equities and investment-grade government bonds. It favors liquid assets from the Eurozone and the U.S., supporting transparency, capital preservation, and long-term resilience.

3.4 Investment, Return and Risk Objectives

3.4.1 Investment Objective

The investment objective outlined in this IPS is to preserve and grow the €500,000 inheritance received by Mrs. Laura Mendes, with the main objective of preserving her 6-year-old daughter

Sofia's future. The portfolio targets a nominal value of €1,500,000 by 2037, aligning with the investment horizon of 12 years focused on funding Sofia's early adult needs and education.

The strategy balances capital preservation with long-term growth, reflecting Mrs. Mendes moderate/moderately aggressive risk tolerance and commitment to disciplined, steady performance. It ensures that key future expenses such as tuition, transportation, and housing can be met when Sofia turns 18.

3.4.2 Return, Distribution, and Risk Requirements

The portfolio aims to reach €1,500,000 in 12 years to fund Mrs. Laura Mendes' daughter's future. Adjusting for an average annual inflation rate of 2.3% (According to IMF, inflation rate forecasts for EU and USA between, 2025 and 2030, are in the interval of 2.4%-2.1% and 3%-2.2% respectively, (International Monetary Fund, 2025)) the real target becomes approximately €1,141,783 by 2037.

To meet this goal, a minimum nominal return of 9.59% (7.13% real return) is needed. The portfolio is expected to generate 11.81% annually (9.3% real), providing a safety margin while aligning with the client's moderate to moderately aggressive risk profile. No distributions are planned during the investment period, allowing full reinvestment and compounding.

The risk target is set at 8.79% annual volatility. Speculative assets, high-volatility instruments, and derivatives are excluded. Liquidity is ensured through diversification in high-quality equities and sovereign bonds to cover any unforeseen cash needs.

Risk is assessed using VaR, Monte Carlo simulations, and a risk matrix. Historical stress testing—covering events such as the 2008 Financial Crisis, the European Debt Crisis, COVID-19, and the 2022–2023 inflationary shock evaluates the portfolio's resilience, drawdown recovery, and stability drivers. This disciplined, data-driven approach aims to balance sustainable growth with effective risk control.

3.4.3 Risk Tolerance

Based on Mrs. Laura Mendes' responses to the "Charles Schwab Investment Profile Questionnaire" (Appendix 3) (Charles Schwab & Co, 2021), her risk tolerance is best described as moderate, with a slight lean toward moderately aggressive. Although the capital stems from an inheritance earmarked for her daughter Sofia's future, Laura's stable job, steady income, and long 12-year investment horizon support a balanced approach between preservation and growth.

Her risk-bearing capacity is strong due to her financial stability and absence of short-term liquidity needs. However, her risk willingness is more cautious—she is unwilling to tolerate losses exceeding 5% annually, which would trigger a portfolio reassessment and rebalancing.

Her questionnaire results align with a Balanced Investment Mix: 60% equities and 40% bonds. The portfolio is designed around defensive sectors like healthcare, consumer staples, and utilities, paired with high-grade government bonds from the Eurozone and the U.S., to ensure stability, income, and resilience across market cycles.

3.4.4 Relevant Constraints

The portfolio is constructed with clear constraints aligned to Mrs. Laura Mendes' personal context, investment objectives, and risk profile. As the capital stems from a family inheritance for her daughter's future needs (education, housing, and lifestyle), the strategy prioritizes preservation and disciplined long-term growth.

Liquidity is not a concern over the 12-year horizon due to the client's stable income, but the portfolio maintains flexibility to accommodate unexpected needs. All income dividends and bond interest will be reinvested to enhance compounding.

To limit risk, the portfolio excludes high-volatility assets, leverage, cryptocurrencies, derivatives, and short selling. Geographic exposure is restricted to Europe and the U.S, with a preference for euro-denominated holdings to reduce currency risk, while maintaining limited exposure to USD-denominated U.S. government bonds for diversification and stability.

While taxation under Portuguese law is acknowledged, all return projections and target values in this IPS are presented gross of tax, with a flat 28% capital gains rate assumed for informational purposes only.

3.5 Risk Management

Risk management is a fundamental part of the portfolio strategy, ensuring both resilience and alignment with Mrs. Laura Mendes' long-term goals. The advisor employs a methodical approach to keep an eye on exposures, both at the asset level and across the entire portfolio, every quarter.

Risk-adjusted performance is carefully assessed using essential indicators like volatility, the Sharpe Ratio, and Value at Risk. These metrics are compared with relevant indices to support clarity and informed decision-making.

The portfolio's strength is verified through Monte Carlo simulations, scenario analyses, and historical backtesting. This process includes stress events like the 2008 Financial Crisis and the 2020 COVID-19 pandemic.

Each year, the asset allocation is reviewed and adjusted in response to significant macroeconomic developments. Key influencers for these tactical shifts include inflation, interest rates, GDP forecasts, and recession risks. To maintain a transparent and collaborative governance process, Mrs. Mendes is kept informed about all strategic changes.

3.5.1 Portfolio Rebalancing

To keep in line with Mrs. Laura Mendes goals and moderate risk tolerance, the portfolio is periodically rebalanced. Tactical adjustments are made in response to events affecting specific sectors, market volatility, and macroeconomic signals. Meanwhile, the strategic anchor remains a 60/40 equity-bond allocation.

Rebalancing occurs once a year guided by both quantitative thresholds and qualitative insights. A comprehensive macroeconomic dashboard is employed to track key indicators, such as central bank guidance, yield curves, and sector rotation cues, allowing for timely adjustments

like increasing defensive positions during uncertain times or selectively shifting towards growth opportunities.

The portfolio's risk-return profile is reassessed periodically, and if necessary, a reallocation is triggered by policy changes, such as interest rate adjustments or regulatory updates. Abnormal volatility is flagged for review through a soft stop-loss framework. Macro-driven reallocation rules ensure consistency while upholding the primary strategy, and every rebalancing decision is thoroughly documented. The following table outlines the scenarios and corresponding strategies:

Table 1 – Portfolio rebalancing rules

INDICATOR	THRESHOLD	ACTION TAKEN	RATIONALE
<i>INFLATION RATE</i>	Above 4%	+5% consumer Staples -5% Industrials	-Staples are less affected by inflation -Industrials may face margin pressure
<i>EBC INTEREST RATE OUTLOOK</i>	Share hike expected (\geq 50bps)	+5% Bonds -5% Equities	Bonds become more attractive during tightening cycles
<i>GDP GROWTH PROJECTIONS (EU/US)</i>	Growth > 3% (YoY)	+5% Financials -5% Bonds	Financials benefit from economic expansion
<i>RECESSION PROBABILITY (OECD/IMF)</i>	> 50%	+5% Healthcare -5% Financials	Defensive sectors offer resilience during downturns
<i>VOLATILITY INDEX (VIX)</i>	VIX > 25	+5% Utilities -5% Industrials	Utilities tend to outperform in high-volatility environments

Source: Author

4 Investment Design

4.1 Investment Philosophy

The investment philosophy of this portfolio is grounded in disciplined, long-term value investing with a strong emphasis on capital preservation, resilience across market cycles, and data-driven sector and security selection. In line with the client's preferences, the portfolio favors direct equities and government bond exposures based on fundamental analysis over speculative instruments and ETF-based or ESG-constrained approaches.

Following the principles introduced by Graham (Graham, 1949) and later adopted by Buffett (Buffett, 1984), the portfolio adheres to a value-oriented methodology, focusing on companies with strong fundamentals trading below their intrinsic value. Empirical studies, such as Fama and French (Fama & French, 1992), have documented the existence of a “value premium,” where undervalued stocks consistently outperform their growth counterparts over long investment horizons, particularly during periods of economic recovery or high inflation (Josef Lakonishok & Vishny, 1994).

The strategy prioritizes investments in blue-chip and mid-to-large capitalization stocks, particularly those operating within defensive sectors such as Consumer Staples, Healthcare and Utilities due to the fact that these sectors historically demonstrate greater stability and pricing power in downturns. In alignment with academic findings from Chan and Lakonishok (Louis K. C. Chan, 2004), these sectors provide consistent earnings, high dividend yields, and strong free cash flow, making them ideal for conservative-to-moderate investor profiles.

Security selection within this portfolio was driven by a multi-layered quantitative screening process. Once sectors were determined, companies were evaluated based on six key financial indicators: Price-to-Earnings (P/E), Price-to-Book (P/B), Free Cash Flow Yield (FCF), Beta, Dividend Yield, and Net Debt-to-EBITDA. Using a percentile-based benchmarking methodology, minimum and maximum thresholds were established for each metric, ensuring selection consistency with historical sector norms and valuation expectations. This approach is aligned with the methodology recommended by Damodaran (Damodaran, 2012), who advocates for sector-adjusted financial filtering when building robust equity portfolios.

After passing an initial screening round, companies faced a more detailed, qualitative assessment based on performance. To assess both resilience and consistent performance momentum, the analysis and examination of the stock price movements over the past 1, 3, and 5 years took place. The forecasted price targets were then reviewed to gain insights into market sentiment and potential gains. Only companies with aligned historical and projected data were selected, ensuring they represent quality, stability, and potential value.

In the fixed-income segment of the strategy, only investment-grade sovereign bonds rated AA or higher are included. This ensures low credit risk, aligning with our goal of preserving capital. Selected bonds are matched to the portfolio's 12-year investment horizon, and we avoid those with callable features or options that might reduce return predictability.

Instead of sticking to fixed allocations, the strategy allows for tactical rebalancing based on macroeconomic indicators. These indicators include inflation rates, ECB interest rate forecasts, GDP projections, recession probabilities (according to OECD/IMF data), and measures of market volatility like VIX or VSTOXX. While adhering to the core strategy, these factors enable the portfolio to adeptly adjust whether defensively or opportunistically.

This investment philosophy carefully balances the growth potential of chosen equities with the stability of top-quality, income-generating assets. By merging rigorous bottom-up selection with macro-aware top-down management, the portfolio aims to deliver strong real returns. It also aligns with a client's moderate-to-moderate-aggressive risk tolerance, supported by academic research and enhanced by backtesting and stress testing during past crises.

4.2 Strategic Asset Allocation

The strategic asset allocation of this portfolio is designed to balance the client's objectives of capital preservation and moderate growth over a 12-year investment horizon. By adopting a 60/40 allocation structure, where 60% is allocated to equities and 40% to bonds, the portfolio ensures an optimal balance between growth potential and stability. This structure aligns with Modern Portfolio Theory (MPT), which emphasizes diversification across asset classes to optimize risk-adjusted returns.

4.2.1 Sectors Selection

Figure 1 - Sector Z Scores

Sector Z-Scores for Business Cycles											
	Cons. Disc.	Cons. Staples	Energy	Financials	Health Care	Industrials	Materials	Real Estate	Technology	Utilities	Comm. Services
Recession	-2.0	8.3	4.6	-2.0	8.2	-3.4	-1.3	-8.6	-7.7	6.6	-4.3
Recovery	7.3	-7.5	0.8	-1.5	-4.1	2.2	3.8	7.2	2.3	-9.1	1.1
Expansion	2.8	-4.7	-0.9	8.0	-5.0	2.1	-1.9	3.3	7.6	-10.3	3.9
Slowdown	-5.4	8.1	-0.3	0.5	7.3	3.8	-3.8	-10.8	-0.9	1.4	-1.9

Source: SPDR Americas Research

Through Z-score analysis, we see that sectors like Consumer Staples, Healthcare, and Utilities tend to perform reliably during recessions. This highlights the portfolio's defensive nature. On the other hand, Financials offer moderate growth when economies are expanding, aligning with our long-term goals for appreciation while also emphasizing capital protection.

The approach to security selection brings together key company fundamentals, including stable earnings and revenue growth, along with macroeconomic indicators like inflation, interest rates, and GDP trends. The allocations were adjusted to capitalize on favorable conditions. To safeguard capital and enhance resilience in volatile markets, the portfolio steers clear of speculative assets, opting instead for dividend-paying equities.

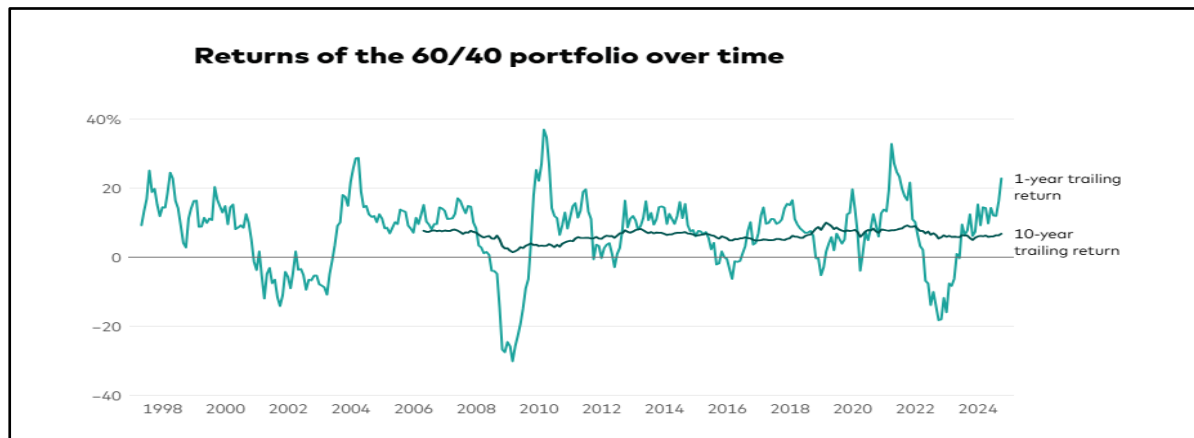
4.2.2 60-40 Portfolio reasoning

Despite evolving market conditions and recent criticisms, Vanguard provides strong evidence that the 60/40 portfolio remains a cornerstone of sound, long-term investment strategy (Schlanger, 2024). Their research demonstrates that combining equities for growth and bonds for stability continues to offer attractive risk-adjusted returns, even during periods of inflation and interest rate volatility.

Vanguard's analysis of historical annualized returns supports the resilience of the 60/40 allocation across economic cycles, validating its relevance for portfolios focused on capital preservation and steady growth. These findings align closely with the objectives of the client,

reinforcing the importance of disciplined, globally diversified asset allocation to maintain long-term portfolio robustness.

Figure 2 - 60/40 Portfolio trailing returns



Source: Vanguard calculations, based on data from Standard & Poor's, MSCI, and Bloomberg.

The claims supporting the effectiveness of the 60/40 portfolio strategy are further supported by Goldman Sachs in their 2023 article, "The 60/40 Portfolio Should Offer a Better Risk-Reward in 2024." Goldman Sachs emphasizes that the traditional allocation of 60% equities and 40% bonds remains a robust approach for achieving balanced risk and return, even in today's evolving market environment (Goldman Sachs, 2023).

According to Goldman Sachs, the 60/40 portfolio is expected to deliver improved risk-adjusted returns in the coming years. This outlook is supported by two main factors:

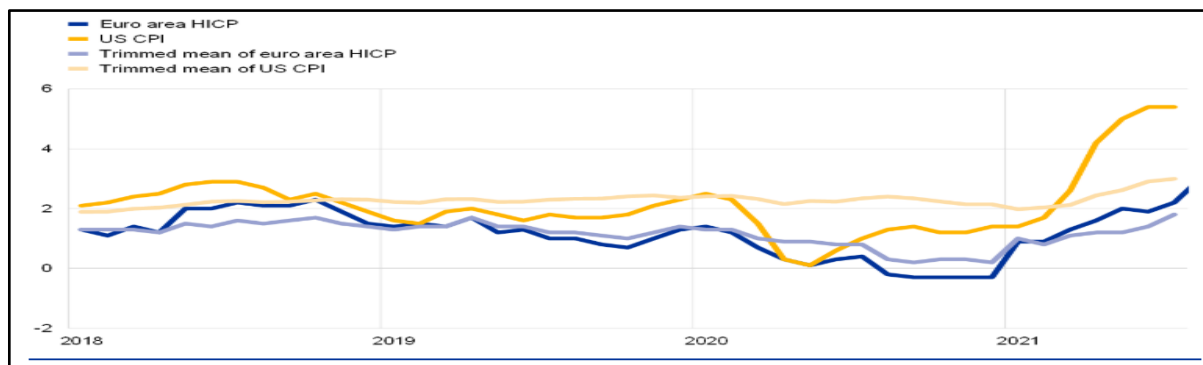
Higher Bond Yields: Although rising yields lead to lower bond prices in the short term, this effect is mitigated when bonds are held to maturity, as is the case in this portfolio. The higher yields enhance long-term income potential and improve reinvestment opportunities for coupon payments.

Equity Exposure: Equities remain a critical component for long-term capital growth, complementing the stability and income generated by the fixed-income allocation.

4.2.3 Macro-economic overview

The global economic outlook remains uncertain, marked by diverging inflation trends, shifting monetary policy, and heightened exchange rate volatility—particularly between the U.S. and the Eurozone. These developments carry significant implications for portfolio risk, asset valuations, and investor positioning.

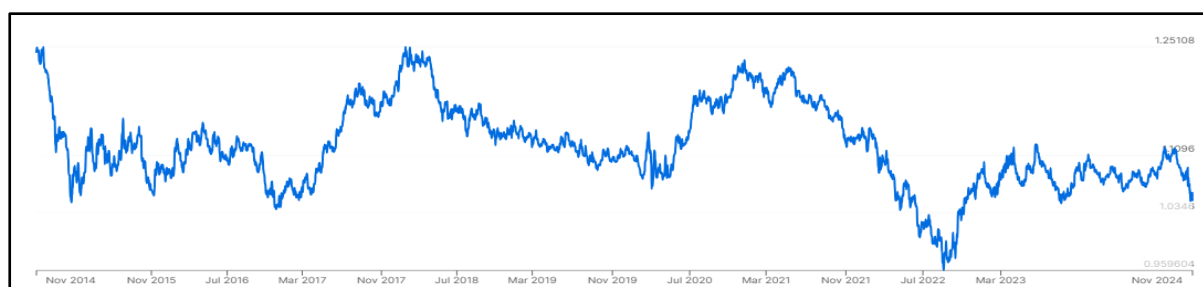
Figure 3 - Inflation Trends and Monetary Policy



Source: Eurostat, Federal Reserve Bank of Cleveland and ECB.

In recent years, inflation in the U.S. rose more sharply than in the Eurozone. By mid-2021, US CPI peaked to 6%, while Euro area HICP stayed below 3%, reflecting milder price pressures. In response, the Federal Reserve raised interest rates rapidly, from near 0% to over 4%, whereas the ECB adopted a slower tightening path. The trimmed mean inflation in the Eurozone remained close to 2–2.5%, supporting a more cautious policy stance. This divergence has influenced growth expectations and capital flows, with Eurozone assets benefiting from greater price stability and lower policy uncertainty (Gerrit Koester, 2021).

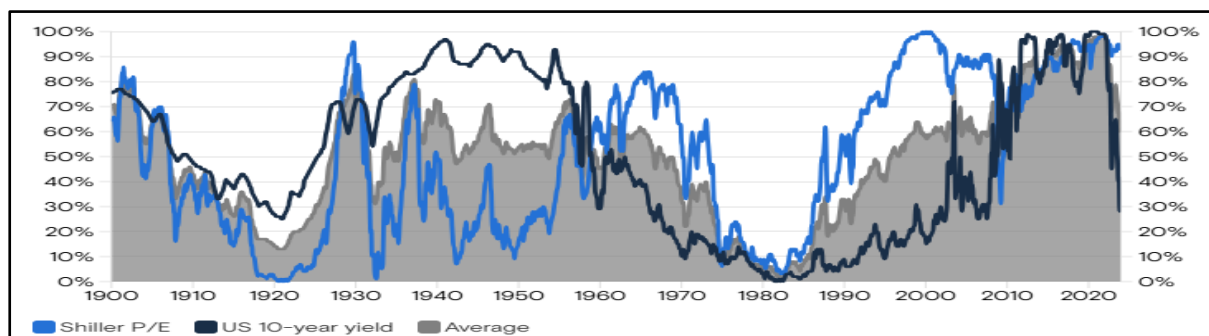
Figure 4 - Exchange Rate Dynamics and Currency Risk



Source: XE.com, Historical Exchange Rates, since 2014

Currency risk has also gained prominence, particularly for Eurozone investors with USD exposure. Over the past decade, EUR/USD exchange rates have shown significant fluctuations driven by interest rate differentials, macroeconomic divergence, and political uncertainty. While a strong dollar may benefit U.S. exporters, it can erode real returns for euro-based investors. To mitigate this risk, many have adopted a more localized allocation strategy, limiting exposure to volatile currency movements while retaining selective access to global growth drivers.

Figure 5 - Bond yields and equity valuations.



Source: Robert Shiller/Yale

Macroeconomic volatility is further reflected in the relationship between equity valuations and interest rates. Historically, elevated Shiller P/E ratios have coincided with periods of low bond yields, suggesting heightened valuation risk particularly in U.S. markets. As yields normalize, especially on the U.S. 10-year Treasury, equity risk premiums are under pressure, reinforcing the need for balanced portfolio structures that incorporate both defensive and income-generating assets.

Forward Outlook

While inflation shows signs of moderating in both the Eurozone and the U.S., the disinflation process remains fragile. According to ECB projections (June 2025), Euro area inflation is expected to be at 2.0% in 2025 and 1.6% in 2026. These figures, combined with the elevated inflation levels observed in previous years, support the portfolio's long-term inflation assumption of 2.3% on average. Growth remains sluggish, with Eurozone GDP expected to expand by just 0.9% (European Central Bank, 2025).

In contrast, the Federal Reserve projects U.S. inflation at 2.6% and GDP growth around 1.8%, with core inflation remaining sticky. This divergence in inflation and growth dynamics may delay rate cuts in the U.S., while allowing for a more dovish stance in the Eurozone. Currency markets are expected to remain sensitive to rate differentials and fiscal developments. Amid continued geopolitical risks, energy volatility, and global trade shifts, a region-specific, data-dependent policy approach will likely dominate, shaping near-term asset pricing and macro uncertainty.

4.2.4 Asset distribution

The portfolio's risky assets, which make up 60% of the total allocation, are fully invested in equities. Within this category, 62.5% of the equity allocation is focused on Eurozone stocks, while the remaining 37.5% is allocated to US stocks. This preference for Eurozone equities is based on a lower inflation environment, which helps preserve real returns. The equity portion of the portfolio prioritizes defensive sectors such as consumer staples, healthcare, and utilities, as these industries tend to be more stable during economic downturns. A smaller allocation is directed toward financials and industrials, offering modest growth potential while maintaining a balanced risk profile.

The remaining 40% of the portfolio is allocated to bonds, ensuring stability and steady income. Euro-denominated investment-grade bonds account for 55% of the bond allocation, while the remaining 45% is invested in US Treasury bonds. This mix helps balance yield generation with risk management. By focusing on intermediate-duration bonds, the portfolio limits interest rate sensitivity while still benefiting from stable returns.

The portfolio has minimum and maximum allocation ranges for every asset class in order to preserve flexibility and adjust to market conditions. For instance, Eurozone equities range from 37.5% to 67.5%, while US equities range from 13.5% to 22.5%. Similarly, Euro-denominated bonds have an allocation range of 18% to 30%, and US Treasury bonds range from 10% to 22%. These ranges allow for dynamic adjustments while staying within the client's low-risk investment parameters. The formula used to calculate them is:

$$\text{Minimum Allocation} = \text{Central Allocation} \times (1 - X\%) \quad (1)$$

$$\text{Maximum Allocation} = \text{Central Allocation} \times (1 + Y\%) \quad (2)$$

Table 2 – Asset Allocation

	<i>Final Allocation</i>	<i>Minimum Allocation</i>	<i>Central Allocation</i>	<i>Maximum Allocation</i>
<i>Eurozone Equities</i>	37.5	37.5	42.5	67.5
<i>US Equities</i>	22.5	13.5	15	22.5
<i>Euro-Denominated Bonds</i>	22	18	22	30
<i>US treasury Bonds</i>	18	10	11.5	22

Source: Author

This allocation strategy ensures that the portfolio remains well-diversified, stable, and aligned with the client's financial objectives, adapting to economic changes while minimizing unnecessary risk.

4.3 Security Selection

The security selection process was thoughtfully crafted to align with the client's risk profile and return objectives, while ensuring diversification across geographies, asset classes, and sectors. By utilizing a structured approach, the portfolio integrates equities and bonds to maintain a disciplined balance between risk and return.

Equity exposure is concentrated on five key sectors: Consumer Staples, Healthcare, Utilities, Financials, and Industrials. These sectors were chosen based on historical performance, economic alignment, and their ability to offer both capital preservation and moderate growth. Defensive sectors form the majority of the allocation: Consumer Staples (21%), Healthcare (18.5%), and Utilities (10%) , given they provide stability, less volatility, and robust performance during downturns. Financials (6.5%) and Industrials (4%) enrich the portfolio with measured exposure to cyclical growth, especially during economic recovery phases. This sector allocation positions 89.5% of the portfolio defensively (including bonds), while the remaining 10.5% is directed towards growth-oriented equities. The allocation strategy reflects

the client's preference for low-risk investments, ensuring the portfolio remains robust and adaptable throughout various economic cycles.

Table 3 – Sectors weights allocation

SECTOR	ALLOCATION (%)	RATIONALE
CONSUMER STAPLES	21	A core defensive sector that performs well during slowdowns and recessions, ensuring stability.
HEALTHCARE	18.5	Combines stability with moderate growth potential, resilient across all economic cycles.
UTILITIES	10	Offers steady dividends and defensive positioning, further stabilizing the portfolio.
FINANCIALS	6.5	Adds moderate growth exposure during recovery/expansion phases while managing risk.
INDUSTRIALS	4	Provides limited growth exposure with manageable volatility, completing diversification

Source: Author

4.3.1 Equities Selection

Equities form the core of the portfolio, accounting for 60% of the total allocation. The selection process started with a comprehensive screening of companies within the MSCI World Index. From an initial universe of approximately 3,000 stocks, the focus was narrowed to large-cap companies with a market capitalization above €2 billion. This criterion ensures that only stable and well-established companies are considered.

The stocks were further analyzed using a set of key financial metrics:

- Price-to-Earnings(P/E), Ratio and Price-to-Book(P/B), Ratio to assess valuation.
- Free Cash Flow Yield (FCF) to evaluate operational efficiency.
- Beta to gauge the volatility relative to the market.
- Dividend Yield for identifying income-generating opportunities.
- Net Debt-to-EBITDA to measure financial stability.

These metrics were weighed differently across sectors to reflect their specific characteristics. For instance, dividend yield and stability were prioritized in Consumer Staples, while innovation and growth potential were preferred for Healthcare. Utilities were selected based on their cash flow stability and low beta, while Financials and Industrials required a balanced evaluation of growth and risk.

4.3.2 Bonds Selection

The bond allocation accounts for 40% of the portfolio, designed to provide stability and mitigate overall portfolio volatility. Bonds were chosen based on the client's preference for high-quality, government-issued securities. The selection process prioritized bonds from highly-rated sovereign issuers, specifically the U.S. Treasury, German Bunds, and Dutch State Loans, with maturities close to the portfolio's 12-year investment horizon.

As can be seen in Appendix 4, the elevated volatility observed in these bonds can be primarily attributed to their long duration. Bonds with longer maturities are significantly more sensitive to interest rate fluctuations, which leads to increased price volatility. This is a well-documented phenomenon in fixed-income markets. According to Fabozzi and Mann, in *The Handbook of Fixed Income Securities*, "the price volatility of a bond increases at an increasing rate as maturity lengthens, due to the compounding effect of discounting future cash flows over longer horizons." As these bonds have maturities beyond 10 years (some nearing or exceeding 30 years), their higher duration amplifies their sensitivity to shifts in yield curves, which explains the relatively elevated volatility despite their high credit quality (Frank J. Fabozzi, 2012).

4.4 Portfolio Composition

The €500,000 portfolio is allocated across €300,000 in equities (60%) and €200,000 in bonds (40%), achieving a balance between growth and stability in line with the client's moderate risk profile and long-term objectives.

Eurozone (59.5%):

- Consumer Staples: Unilever (3.5%), Tesco (3.5%), AAK AB (7.5%)
- Healthcare: Recordati (7.5%), AstraZeneca (4.5%)

- Utilities: SSE Plc (3.5%), Terna (3.5%)
- Industrials: ABB Ltd (4%)
- Bonds: German Bund (12%), Dutch State Loan (10%)

U.S. (40.5%):

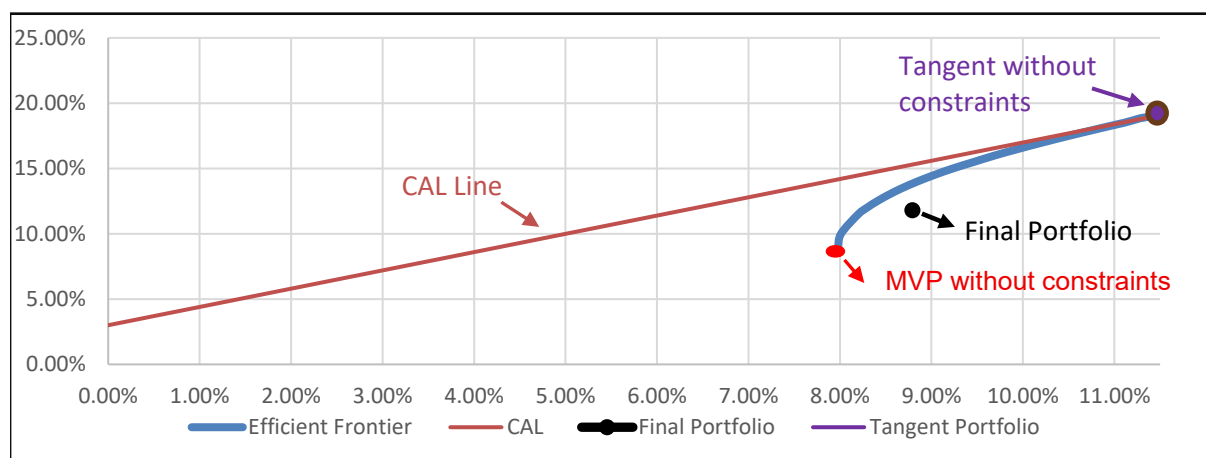
- Consumer Staples: Walmart (6.5%)
- Healthcare: Abbott Laboratories (6.5%)
- Utilities: Southern Co (3%)
- Financials: BlackRock (6.5%)
- Bonds: U.S. Treasury Bond (18%)

Portfolio Optimization

The weights of equities and bonds were optimized to meet the portfolio's return objectives while maintaining manageable volatility. The process included sector analysis, geographic diversification, and the careful selection of low-volatility bonds. To derive the optimal asset allocation, a Sharpe Ratio maximization was conducted using Excel's Solver tool. Constraints were set to respect the 60/40 equity-bond split, sector and regional exposure limits, and client-specific allocation boundaries. This quantitative approach ensured that the portfolio achieved the highest possible risk-adjusted return while remaining aligned with the client's moderate risk profile and investment constraints.

Efficient Frontier

Figure 6 – Efficient Frontier



Source: Author

The graph illustrates the Efficient Frontier generated from portfolio simulations across different risk-return profiles. The blue curve shows the set of efficient unconstrained portfolios, while the red Capital Allocation Line (CAL) represents all possible combinations of the risk-free asset and the optimal risky portfolio (the tangency portfolio), illustrating the best achievable risk-return trade-off for an investor.

The purple point shows the mark of the unconstrained tangent portfolio, while the black point represents the constrained portfolio for the client reflecting real world limitations such as the 60/40 equity-bond split and sector caps. The red point identifies the Minimum Variance Portfolio (MVP) without the constraints.

The constrained portfolio lies near the efficient frontier, showing that despite practical constraints, the final allocation remains well-optimized and aligned with the client's risk-return objectives.

4.5 Expected Performance

The expected performance of the portfolio is evaluated through the analysis of its projected return, variance, and volatility, encompassing both equities and bonds. It ensures that the portfolio aligns with the client's goals of achieving stable growth while minimizing risk exposure.

4.5.1 Portfolio Return

An estimation of the performance while relying on historical data was used to calculate monthly returns for each selected equity and bond. These were then annualized to reflect long-term performance. The portfolio's overall return was computed by applying asset weights to each return, combining both equity and bond components.

For the equity portion, historical price data was used to calculate monthly returns for each stock as follows:

$$\text{MonthlyReturn}_t = (\text{Price}_t \div \text{Price}_{t-1}) - 1 \quad (3)$$

The average monthly return was then annualized using the formula:

$$\text{Annual Return} = (1 + \text{Average Monthly Return})^{12} - 1 \quad (4)$$

Similarly, for bonds, the yield-to-maturity data and coupon payments were factored in to estimate expected annual returns. Each security's return was weighted according to its allocation in the portfolio, resulting in the weighted portfolio return:

$$\text{Portfolio Return} = \sum (\text{Weight}_i \times \text{Return}_i) \quad (5)$$

4.5.2 Portfolio Variance and Volatility

Volatility and variance were also analyzed to understand the portfolio's risk profile. Individual volatilities for equities and bonds were computed from historical data using the formula:

$$\text{Volatility} = \sqrt{\text{Variance}} \text{ where } \text{Variance} = \frac{\sum ((\text{Return}_i - \text{Mean Return})^2)}{n} \quad (6)$$

A correlation matrix was constructed to measure relationships between securities, followed by a covariance matrix to quantify the interplay of risks between assets. The portfolio's variance was calculated as:

$$\text{Portfolio Variance} = \mathbf{w}^T \cdot \mathbf{C} \cdot \mathbf{w} \quad (7)$$

Where: \mathbf{w} = Weight vector of the portfolio; \mathbf{C} = Covariance matrix of asset returns

The portfolio volatility was derived as:

$$\text{Portfolio Volatility} = \sqrt{\text{Portfolio Variance}} \quad (8)$$

4.5.3 Final Results

The final portfolio, consisting of 60% equities and 40% bonds, achieves an expected nominal return of 11.81% and an annualized volatility of 8.79% which translates to a nominal return of €1.907,800. This balance shows the importance of diversification, with equities driving performance and bonds effectively mitigating risk.

Table 4 – Performance Summary

<i>Metric</i>	<i>Laura Mendes Portfolio</i>	<i>Benchmark Portfolio</i>
Start Balance	500.000 €	500.000 €
End Balance	2 092,274 €	1 435,212 €
Annualized Return (CAGR)	9.95%	7.24%
Standard Deviation	8.58%	9.51%
Best year	24.27%	18.91%
Worst Year	-15.22%	-15.65%
Maximum Drawdown	-22.36%	-20.75%
Sharpe Ratio	1.01	0.66
Sortino Ratio	1.64	1.00
Benchmark Correlation	0.76	1.00

Source: Portfolio Visualizer/<https://www.portfoliovisualizer.com/>

The performance of the portfolio was compared to the iShares Core 60/40 Balanced Allocation ETF, which is a globally diversified benchmark that represents a moderate-risk, multi-asset strategy. From 2010 to 2025, Laura Mendes’ portfolio consistently surpassed the benchmark in both absolute returns and on a risk-adjusted basis. The portfolio not only achieved a higher annualized return (9.95% compared to 7.24%) but also maintained a lower standard deviation (8.58% as opposed to 9.51%), and boasted a significantly higher Sharpe Ratio (1.01 vs. 0.66).

Figure 7 – Portfolio Growth



Source: Portfolio Visualizer/<https://www.portfoliovisualizer.com/>

The chart above provides a visual representation of the portfolio's cumulative growth when compared to the benchmark, iShares Core 60/40 Balanced Allocation ETF, over the period of January 2010 to January 2025. As depicted, the portfolio has shown remarkable consistency and resilience, especially during times of market volatility. This underscores the effectiveness of its strategy, which includes defensive sector allocation, active risk management, and tactical adjustments. Further, its approach to downside protection, along with its overall robustness, has been crucial in successfully navigating systemic risks.

Table 5 – Risk & Return Metrics

<i>Metric</i>	<i>Laura Mendes Portfolio</i>	<i>Benchmark Portfolio</i>
<i>Arithmetic Mean (monthly)</i>	0.82%	0.62%
<i>Arithmetic Mean (annualized)</i>	10.35%	7.72%
<i>Geometric Mean (monthly)</i>	0.79%	0.58%
<i>Geometric Mean (annualized)</i>	9.95%	7.24%
<i>Standard Deviation (monthly)</i>	2.48%	2.75%
<i>Standard Deviation (annualized)</i>	8.58%	9.51%
<i>Downside Deviation (monthly)</i>	1.47%	1.75%
<i>Maximum Drawdown</i>	-22.36%	-20.75%
<i>Benchmark Correlation</i>	0.76%	1.00
<i>Beta</i>	0.69	1.00
<i>Alpha (annualized)</i>	4.76%	0.00%
<i>R²</i>	58.24%	100%
<i>Sharpe Ratio</i>	1.01	0.66
<i>Sortino Ratio</i>	1.64	1.00
<i>Treynor Ratio (%)</i>	12.62	6.25

Source: Portfolio Visualizer/<https://www.portfoliovisualizer.com/>

This favorable risk-return profile is reflected in its higher Sharpe Ratio (1.01 vs. 0.66), Sortino Ratio (1.64 vs. 1.00), and Treynor Ratio (12.62 vs. 6.25). The portfolio also shows stronger downside protection, with a lower downside deviation of 1.47% compared to 1.75%, and a slightly higher maximum drawdown of -22.36%, in contrast to -20.75%. With an Alpha of 4.76% and a lower Beta of 0.69, compared to 1.00, the portfolio demonstrates effective

diversification and lower sensitivity to overall market movements. This aligns well with the investor's moderate risk tolerance and defensive sector positioning. The analysis of expected performance concludes by confirming that the portfolio is excellently positioned to achieve Mrs. Mendes' goals. The mix of bonds and stocks meets the client's risk tolerance and financial objectives, striking a fine balance between stability and growth. Furthermore, with regular evaluations and rebalancing, the portfolio will continue to align with its strategic goals over time.

4.6 Risk Analysis

The Risk Analysis section assesses the portfolio's exposure to adverse conditions and its ability to achieve long-term objectives under uncertainty. Multiple tools are used to capture different risk dimensions. Value at Risk (VaR) is calculated using Historical, Parametric (Variance-Covariance), and Conditional VaR (CVaR) methods across multiple confidence levels to estimate potential losses under both normal and extreme scenarios. Historical VaR is back tested over 15 years of monthly data to validate its accuracy. Scenario Analysis evaluates performance during key crises, including the 2008 Financial Crisis, the COVID-19 crash, and the 2022 inflationary shock. A Monte Carlo Simulation provides a probabilistic view of future outcomes, helping to assess downside risk and upside potential. Combined, these tools offer a comprehensive framework for managing risk in line with the client's moderately aggressive profile and long-term goals.

4.6.1 Historical VaR

To assess the portfolio's downside exposure under normal market conditions, the Historical Value at Risk method was used. This non-parametric approach relies on the empirical distribution of past returns, avoiding assumptions of normality.

It is calculated as:

$$\text{Historical VaR}(\alpha) = \text{Percentile}_{\alpha}(\text{Portfolio Returns}) \quad (9)$$

Where α represents the left-tail percentile of the return distribution (5% for a 95% confidence level). Monthly portfolio returns were used to compute the VaR at different percentiles,

identifying the maximum expected loss that would not be exceeded with a given confidence level.

Table 6 – Historical VaR

<i>Confidence Level</i>	<i>Percentile</i>	<i>Historical VaR (%)</i>	<i>Historical VaR (€)</i>
99%	0.01	-10.54%	-52 704,11 €
95%	0.05	-5,20%	-26 006,28 €
90%	0.1	-1,86%	-9 319,63 €
75%	0.25	1,71%	8 553,10 €
50%	0.5	6,38%	31 893,81 €
25%	0.75	11,02%	55 109,17 €
5%	0.95	18,30%	91 484,82 €
1%	0.99	25,80%	129 022,36 €

Source: Author

While several percentiles are shown for completeness, risk analysis typically focuses on the 90%, 95%, and 99% confidence levels standard benchmarks in professional risk management. These percentiles illustrate the potential monthly loss not expected to be exceeded under normal conditions.

For instance, at the 99% confidence level, the portfolio would lose no more than €52,704.11 (−10.54%) over a one-month period. Similarly, the 95% and 90% levels correspond to potential losses of €26,006.28 (−5.20%) and €9,319.63 (−1.86%), respectively. These figures help quantify downside risk across increasingly conservative scenarios and support a clearer understanding of the return distribution’s asymmetry.

4.6.2 Back-Testing of the Historical VaR

To assess the accuracy of the Historical VaR model, a backtesting procedure was conducted by comparing monthly portfolio returns against VaR thresholds at 90%, 95%, and 99% confidence levels. For example, a 5% monthly VaR should be breached in roughly 5% of observations about 9 times in a 180-month period. A breach occurs when actual losses exceed the predicted VaR. The observed number of breaches was then compared to theoretical

expectations, offering a practical test of the model's reliability. Excessive breaches suggest underestimation of risk, while too few indicate an overly conservative model.

Table 7 – Back-Testing of the historical VaR

Confidence Level	Expected Breaches	Actual Breaches	Observation Period	Outcome
99%	$0.01 \times 180 \approx 2$	1	180 months	Model is conservative
95%	$0.05 \times 180 = 9$	9	180 months	Model is accurate
90%	$0.1 \times 180 = 18$	18	180 months	Model is accurate

Source: Author

The table above presents the results of backtesting the Historical VaR model over a 180-month period. For example, at the 99% confidence level, the model predicted approximately 2 breaches, but only 1 occurred indicating a conservative estimate of risk. At the 95% and 90% levels, expected and actual breaches (9 and 18, respectively) matched exactly. While such precision could be partly coincidental, it reinforces the model's consistency and reliability across standard confidence thresholds.

4.6.3 Conditional VaR (CVaR) and Parametric VaR

In addition to Historical VaR, the analysis also includes Parametric VaR (Variance-Covariance method) and Conditional Value at Risk (CVaR) to provide a broader perspective on potential portfolio losses. Parametric VaR assumes normally distributed returns and uses the portfolio's mean (μ), standard deviation (σ), and a Z-score corresponding to each confidence level. The Parametric VaR is calculated using the formula:

$$\text{Parametric VaR}(\alpha) = \mu + Z(1 - \alpha) \cdot \sigma \quad (10)$$

Where $Z(1-\alpha)$ is the critical value from the standard normal distribution corresponding to the confidence level α .

On the other hand, CVaR captures the average loss given that the loss exceeds the VaR threshold. It provides insight into extreme tail risk, making it particularly useful for understanding portfolio behavior during periods of severe market stress. The CVaR is calculated as:

$$\text{CVaR}(\alpha) = E[X | X < \text{VaR}(\alpha)] \quad (11)$$

These two risk metrics complement Historical VaR by incorporating different statistical assumptions and provide a more comprehensive picture of downside and tail risk exposure.

Table 8 – Parametric VaR

<i>Confidence Level</i>	<i>Z-Score</i>	<i>Percentile</i>	<i>Parametric VaR (%)</i>	<i>CVaR (%)</i>
99%	-2,326	0.01	-9.74%	-10.60%
95%	-1,644	0.05	-4.96%	-7.67%
90%	-1,281	0.1	-2.41%	-5.53%
75%	-0,674	0.25	1,85%	-2.30%
50%	0	0.5	6,58%	0.98%
25%	0,674	0.75	11,31%	3.49%
5%	1,644	0.95	18,11%	5.72%
1%	2,326	0.99	22.89%	6.36%

Source: Author

The Parametric Value at Risk estimates potential losses assuming normally distributed returns, based on the portfolio's mean and standard deviation. At a 99% confidence level, the monthly VaR is -9.74%, while the 95% and 90% levels correspond to -4.96% and -2.41%, respectively.

Conditional VaR, by contrast, measures the average loss in the worst-case scenarios beyond the VaR threshold. At 99% confidence, the CVaR is -10.60%, indicating deeper losses when extreme events occur.

As expected, CVaR values are more negative than the corresponding VaRs, reinforcing their usefulness in stress testing and tail-risk assessment where understanding the severity of rare losses is critical for robust risk management.

4.6.4 Historical Crisis-Based Backtesting

To assess the portfolio's robustness under adverse market conditions, a historical crisis-based backtesting analysis was conducted. This methodology evaluates how the portfolio would have performed during four significant financial crises:

- The 2008 Global Financial Crisis,
- The 2011–2012 European Sovereign Debt Crisis
- The COVID-19 Market Crash (2020)
- The 2022–2023 Inflation and Interest Rate Shock

These four historical crises were selected for their macroeconomic significance and relevance to current conditions. Simulating these periods allows assessment of the portfolio's downside protection, volatility control, and recovery capacity against a balanced benchmark (iShares Core 60/40 ETF).

Table 9 – Scenario based Back-test

<i>Scenario</i>	<i>Portfolio Return</i>	<i>Benchmark Return</i>	<i>Portfolio Max Drawdowns</i>	<i>Benchmark Max Drawdowns</i>	<i>Portfolio Sharpe</i>	<i>Benchmark Sharpe</i>
2008 Financial Crisis	7.11%	3.99%	-18.42%	-30.12%	0.62	0.31
2011-2014 Eurozone Crisis	12.98%	8.53%	-3.86%	-10.84%	2.04	1.11
2020-2022 COVID Period	13.29%	11.30%	-5.05%	-13.50%	1.49	0.92
2022-2025 Inflation & Rate Hikes	3.69%	1.40%	-19.70%	-20.75%	0.03	-0.15

Source: Author/Portfolio Visualizer Data

The Laura Mendes Portfolio consistently outperformed the benchmark across all four stress scenarios: the 2008 Global Financial Crisis, the 2011–2014 European Debt Crisis, the COVID-19 and Inflation Shock (2020–2022), and the 2022–2025 Interest Rate Tightening Cycle. In each case, it demonstrated superior downside protection and stronger risk-adjusted returns.

During the 2008 crisis, the portfolio returned 7.11% vs. 3.99% for the benchmark, with a significantly smaller drawdown (-18.42% vs. -30.12%), lower Beta (0.85), and higher Sortino Ratio (0.84 vs. 0.42). In the 2011–2014 debt crisis, it achieved a 12.98% CAGR vs. 8.53%, with lower volatility (6.06% vs. 7.60%) and better Sharpe (2.04) and Sortino (4.34) ratios.

In 2020–2022, the portfolio maintained resilience with a 13.29% return, lower volatility (8.44% vs. 12.06%), a reduced drawdown (-5.05% vs. -13.50%), and elevated Sharpe (1.49) and Sortino (2.73) ratios. Finally, during the 2022–2025 tightening cycle, it returned 3.69% vs. 1.40%, with a smaller drawdown (-19.70% vs. -20.75%) and relative outperformance despite compressed risk-adjusted ratios.

Overall, the portfolio delivered higher returns, lower drawdowns, and stronger risk-adjusted performance across all four crises.

4.6.5 Monte Carlo Simulations

To assess the portfolio's performance under uncertain market conditions, 100,000 Monte Carlo simulations were conducted using real (inflation-adjusted) returns. The simulation was based on the portfolio's annualized real return and volatility, derived from its individual asset components. This approach generates a probabilistic distribution of final portfolio values, allowing for a realistic evaluation of risk and potential outcomes in today's euros.

Table 10 - Monte Carlo Statistics

<i>Forecast Statistics</i>	<i>Values</i>
<i>Base Case (Median) Portfolio Value</i>	€1,452,325.54
<i>Mean Portfolio Value</i>	€1,618,055.29
<i>Standard Deviation</i>	€810,698.99
<i>Variance</i>	€657,232,854,951.44
<i>Skewness</i>	1.45
<i>Kurtosis</i>	6.96
<i>Minimum Portfolio Value</i>	€171,849.80
<i>Maximum Portfolio Value</i>	€10,624,088.19

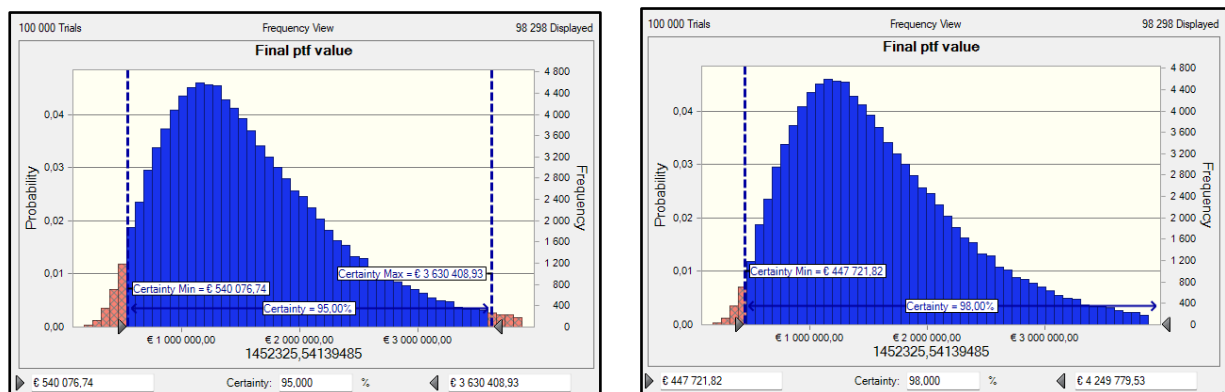
Source: Author/ Crystall Ball Data

The mean forecasted value is €1,618,055.29, with a median of €1,454,121.28 both close to the base case of €1,452,325.54, indicating a fairly balanced distribution slightly skewed to the right (Skewness = 1.45).

The standard deviation of €810,698.99 highlights the variability across simulations, but the coefficient of variation (0.50) suggests an acceptable level of risk relative to return. The worst-case scenario projected a minimum value of €171,849.80, while the maximum exceeded €10.6 million, underlining both downside protection and significant upside potential.

Overall, the simulation supports the portfolio's ability to deliver on its long-term objectives within a realistic range of market conditions.

Figure 8 - Monte Carlo Analysis: 95% & 98% Confidence Level



Source: Crystal Ball software; Author's estimations

The Monte Carlo simulation using 100,000 trials shows that the portfolio's final value lies between €540,077 and €3,630,409 with 95% confidence, and between €447,722 and €4,249,780 with 98% confidence. The distribution is right-skewed, indicating the presence of upside potential beyond the mean.

The base case outcome of €1.45 million (plotted near the center) aligns closely with the median, reinforcing the robustness of expected performance. While a small left-tail risk exists — where outcomes fall below the initial investment of €500,000 — this represents a low-probability scenario (less than 2–2.5%), confirming that capital loss is rare under normal conditions.

These results are presented in real terms, as the simulation inputs have been adjusted for inflation. The median final portfolio value (€1,454,121) exceeds the client's real target of €1,141,783, demonstrating a strong likelihood of meeting long-term financial goals despite market uncertainty.

4.6.6 Certainty Levels

The Monte Carlo simulation also evaluated the certainty levels for reaching specific portfolio values. At the **50th percentile**, the portfolio achieves its median performance, providing further assurance of meeting the client's financial goals.

Table 11 – Monte Carlo Analysis: Forecast Values

<i>Percentile</i>	<i>Forecast Value</i>
0%	€171,849.80
10%	€764,946.16
20%	€959,803.84
30%	€1,125,606.69
40%	€1,284,616.99
50%	€1,454,120.99
60%	€1,643,951.37
70%	€1,874,602.46
80%	€2,176,016.29
90%	€2,673,878.29
100%	€10,624,088.19

Source: Crystal Ball software; Author's estimations

The percentile analysis shows that 50% of portfolio outcomes fall above €1,454,120, which matches closely with the median forecasted value. This reinforces the central tendency of the simulation toward the targeted long-term growth objective.

The 10th percentile outcome (€764,946) suggests that 90% of outcomes exceed this level, which is significantly above the initial capital of €500,000, offering a strong cushion against adverse scenarios. Even at the 1st percentile (approximated by 0%), the portfolio retains

€171,850, representing a worst-case drawdown of ~66% over 12 years—unlikely, but not catastrophic.

On the upside, the 90th percentile reaches €2.67 million, and the maximum value hits €10.62 million, highlighting the right-skewed nature of the distribution and potential for substantial outperformance.

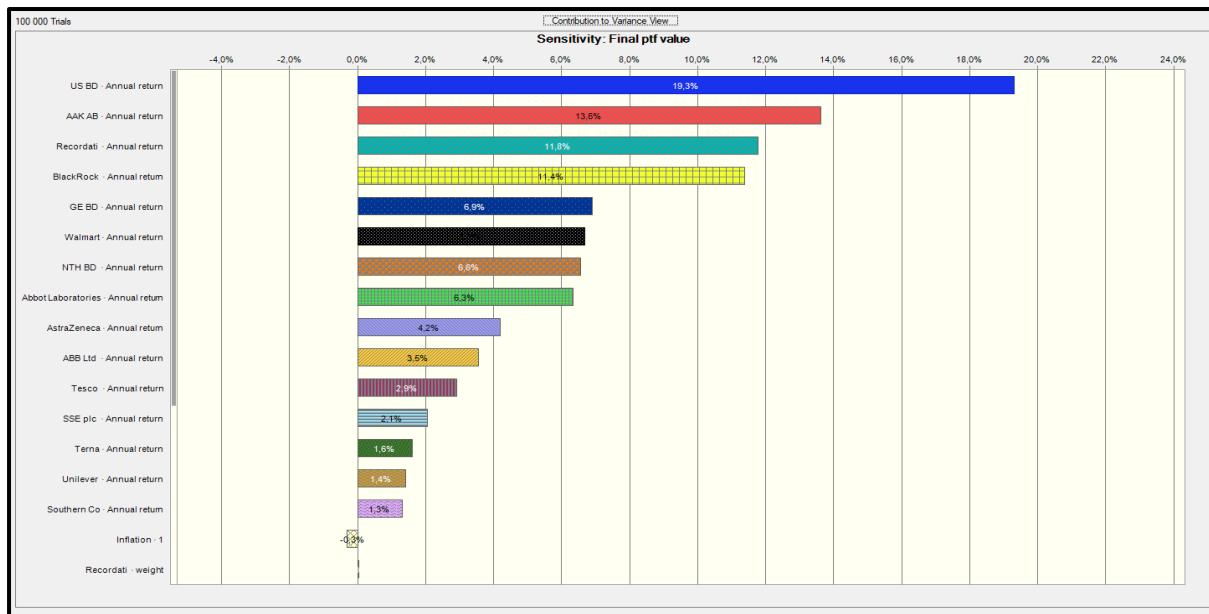
4.6.7 Sensitivity Analysis

The sensitivity analysis highlights the relative contribution of each variable to the variance in the portfolio's final value. The most influential drivers are the annual returns of US Bonds (19.3%), AAK AB (13.6%), Recordati (11.8%), and BlackRock (11.4%). Their significant impact stems from a combination of weight and return volatility, making them key determinants of total portfolio risk.

Inflation, included as a variable in the simulation with a range of 1.8% to 2.8% contributes minimally and negatively to the variance. This outcome is logical, given the moderate fluctuation of inflation compared to equity and bond returns, and the fact that the portfolio was evaluated in real terms. As such, inflation adjustments are consistent across trials and less volatile relative to financial market variables.

Lower-impact contributors, such as Southern Co., Unilever.. indicate that these assets serve more of a stabilizing role, diluting portfolio risk while contributing to diversification.

Figure 9 – Sensitivity Analysis



Source: Crystal Ball software; Author's estimations

The combination of high-quality bonds and defensive equities aligns the portfolio with the client's risk tolerance. Monte Carlo simulations indicate a strong likelihood of meeting long-term financial targets, even in adverse conditions. Regular reviews and rebalancing will maintain alignment with the client's goals, while future simulations will support ongoing risk monitoring and strategic adjustments as market dynamics evolve.

4.6.8 Risk Matrix Assessment:

Table 12 – Risk Horizon

<i>Risks</i>	<i>Implications</i>	<i>Opportunities</i>
<i>Climate Change (SR)(1)</i>	Increased operating costs for utilities and industrials due to regulatory pressure and resource scarcity.	Investment in resilient sectors like consumer staples and utilities as essential services remain in demand.
<i>Geopolitical Tensions (GR)</i>	Supply chain disruptions impacting industrials and increased energy costs affecting operational margins.	Defensive sectors like healthcare and consumer staples may outperform during uncertainty.
<i>Rising Inflation and Interest Rates (IR)</i>	Higher input costs for industrials and reduced consumer spending affecting staples and financials.	Bonds offer stable returns and act as a hedge against equity market volatility.
<i>Exchange Rate Fluctuations (CR)</i>	Reduced returns on US equities due to Euro appreciation; potential erosion of bond yields in foreign currencies.	Euro-denominated bonds mitigate exchange rate risk, ensuring stability for the portfolio.
<i>Global Economic Slowdown (MR)</i>	Decreased corporate profits across sectors and heightened unemployment affecting financial services.	Healthcare and utilities, being essential services, remain robust during downturns.
<i>Demographic Changes in Europe and the US</i>	Aging populations leading to increased demand for healthcare and financial services like retirement plans.	Opportunities for growth in healthcare equities and steady income from bonds.
<i>Regulatory Changes in Europe and the US (SR)(2)</i>	New compliance requirements increasing costs for utilities and financial services.	Consumer staples benefit from regulatory stability due to their essential nature.

Source: Author

To ensure consistency across the portfolio's risk framework, the categories shown in the Risk Matrix are directly derived from the more detailed assessments provided in the Risk Horizon Table. For instance, macro-level threats such as inflation, economic slowdowns, and recessionary pressures are captured under Macroeconomic Risk. Political instability and external conflicts are grouped as Geopolitical Risk. The impact of fluctuating interest rates on the portfolio's bond exposure is reflected in Interest Rate Risk, while exposure to currency fluctuations, particularly from U.S. assets, is summarized as Currency Risk. Risks tied to sector dynamics such as regulatory shifts or demand shocks in defensive industries are represented as

Sector Risk. Potential issues specific to the bond component, including credit or liquidity concerns, fall under Bond Risk. Lastly, the portfolio's geographic concentration in the Eurozone is addressed under Diversification Risk. This structure provides a coherent link between granular risk analysis and the summarized matrix view, facilitating clarity and alignment in risk monitoring.

Figure 10 – Risk Matrix

Risk Matrix		Severity				
		Insignificant	Minor	Moderate	Major	Sever
Likelihood	Almost certain					
	Likely				IR	
	Possible		DR	CR	SR	
	Unlikely			BR	GR	MR
	Rare					

-IR: Interest Rate Risk

-CR: Currency Risk

-SR: Sector-Specific Risk

-MR: Macroeconomic Risk

-BR: Bond-Specific Risk

-DR: Diversification Risk

-GR: Geopolitical Risk

Source: Author

The risk matrix underscores the key vulnerabilities of the portfolio, highlighting Interest Rate Risk as the most critical due to the 40% bond allocation, especially amid ongoing central bank tightening. Currency Risk remains relevant with 12% exposure to U.S. Treasuries, despite the portfolio's Euro-denominated bias. Sector-Specific Risks tied to Consumer Staples, Healthcare, and Utilities are moderate, as these defensive sectors still face regulatory or demand-side threats.

Macroeconomic Risk is severe though less likely, as inflation, recession, or geopolitical shocks can impact both asset classes and reduce diversification benefits. Bond-Specific Risks, while moderate due to the high credit quality of government bonds, may arise from downgrades, liquidity shifts, or fiscal changes. Diversification Risk stems from a 65.5% Eurozone concentration, which mitigates currency exposure but limits global diversification. Finally, Geopolitical Risk is moderate, particularly affecting Eurozone assets in the event of EU instability or global tensions.

References

- Charles Schwab & Co. (2021). Retrieved from Schwab: <https://www.schwab.com/cms/P-778947.3/>
- Buffett, W. E. (1984). The Superinvestors of Graham-and-Doddsville. *Hermes (Columbia Business School Magazine)*.
- Damodaran, A. (2012). *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset (3rd Edition)*. Wiley Finance.
- European Central Bank. (2025, June 05). *Economic, financial and monetary developments* . Retrieved from European Central Bank: <https://www.ecb.europa.eu/press/economic-bulletin/html/eb202504.en.html#:~:text=impact%20on%20inflation.-,Most%20measures%20of%20longer%2Dterm%20inflation%20expectations%20continue%20to%20stand,the%20euro%20area%2C%20June%202025.>
- Fama, E. F., & French, K. R. (1992). The Cross-Section of Expected Stock Returns. *Journal of Finance*, 427–465.
- Frank J. Fabozzi, S. V. (2012). *The Handbook of Fixed Income Securities, 8th edition*. New York: McGraw-Hill Education.
- Gerrit Koester, J. N. (2021, June). *European Central Bank*. Retrieved from European Central Bank - eurosystem: https://www.ecb.europa.eu/press/economic-bulletin/focus/2021/html/ecb.ebbox202106_01~11705a988e.en.html
- Goldman Sachs. (2023, December 8). *The 60/40 portfolio should offer a better risk-reward in 2024* . Retrieved from Goldman Sachs: <https://www.goldmansachs.com/insights/articles/the-60-40-portfolio-should-offer-a-better-risk-reward-in-2024>
- Graham, B. (1949). *The Intelligent Investor*. Harper & Brothers.
- International Monetary Fund. (2025). *Inflation rate, average consumer prices*. Retrieved from International Monetary Fund: <https://www.imf.org/external/datamapper/PCPIPCH@WEO/EUQ/USA/EU>
- Josef Lakonishok, A. S., & Vishny, R. (1994). Contrarian Investment, Extrapolation, and Risk. *Journal of Finance*, 1541–1578.
- Louis K. C. Chan, J. L. (2004). Value and Growth Investing: Review and Update. *Financial Analysts Journal*, 71–86.
- Schlanger, T. (2024, October 22). *The global 60/40 portfolio*. Retrieved from Vanguard: <https://corporate.vanguard.com/content/corporatesite/us/en/corp/articles/global-60-40-portfolio-steady-as-it-goes.html>

Appendix

Table 13 – A1: Client's Profile (detailed)

Name	Mrs Laura Mendes
Children	Sofia Mendes – 6 years old
Average Monthly spending	€ 2,250
Monthly Salary	€ 5,420
Additional information	Mrs Laura Mendes recently lost her husband to a stage IV cancer. Her late husband left her an inheritance of € 500,000 , to take care of their daughter's future. Mrs Laura Mendes has an annual salary of € 65,000 and work as a Senior Public Health Analyst in a governmental agency.
Investment Constraints	-No investing in high volatility securities; No Cryptocurrency; No annual losses over 5%; Aim for defensive sectors; EU/US markets only
Risk Acceptance	Moderate/Moderate Aggressive
Investment	€ 500,000
Target	€ 1.141,783,216 (€ 1,500,000 in 12 years with a 2.3% forecasted inflation)
Time Horizon	12 years (144 months)
Minimum Real Return & Nominal Return required	7.13% & 9.59%
Real and Nominal rate of Return	9.3% & 11.81%
Volatility of the Portfolio	8.79%

Table 14 – A2: Portfolio Computations information

Securities Selected	weight	monthly return	Annual return	Weighted Return	Annual Volatility
Unilever	3.50%	0.887%	11.174%	0.391%	15.18%
Tesco	3.50%	0.423%	5.192%	0.182%	22.34%
AAK AB	7.50%	1.596%	20.922%	1.569%	21.92%
Recordati	7.50%	1.755%	23.223%	1.742%	20.79%
AstraZeneca	4.50%	1.315%	16.978%	0.764%	19.98%
SSE plc	3.50%	0.808%	10.134%	0.355%	18.02%
Terna	3.50%	1.090%	13.898%	0.486%	16.11%
ABB Ltd	4.00%	1.226%	15.748%	0.630%	20.78%
Walmart	6.50%	1.432%	18.601%	1.209%	18.38%
Abbot Laboratories	6.50%	1.415%	18.372%	1.194%	17.68%
Southern Co	3.00%	1.222%	15.692%	0.471%	17.04%
BlackRock	6.50%	1.444%	18.769%	1.220%	23.15%
NTH BD	10.00%	0.327%	4.000%	0.400%	11.75%
US BD	18.00%	0.353%	4.318%	0.777%	11.03%
GE BD	12.00%	0.285%	3.471%	0.417%	10.19%

Table 15 – A2: Profiling Questionnaire

TIME HORIZON
 Circle the number of points for each of your answers and note the total for each section.

1. I plan to begin withdrawing money from my investments in:		2. Once I begin withdrawing funds from my investments, I plan to spend all of the funds in:	
Less than 3 years	1	Less than 2 years	0
3–5 years	3	2–5 years	1
6–10 years	7	6–10 years	4
11 years or more	10	11 years or more	8

Enter the total points from questions 1 and 2. **Time Horizon Score: 18**

<p>5. I would describe my knowledge of investments as:</p> <p>None 1</p> <p>Limited 3</p> <p>Good 7</p> <p>Extensive 10</p> <p>6. What amount of financial risk are you willing to take when you invest?</p> <p>Take lower than average risks expecting to earn lower than average returns 0</p> <p>Take average risks expecting to earn average returns 4</p> <p>Take above average risks expecting to earn above average returns 8</p> <p>7. Select the investments you currently own or have owned:</p> <p>Bonds and/or bond funds 3</p> <p>Stocks and/or stock funds 6</p> <p>International securities and/or international funds 8</p> <p>Example: You now own stock funds. In the past, you've purchased international securities. Your point score would be 8.</p>	<p>3. Consider this scenario:</p> <p>Imagine that in the past three months, the overall stock market lost 25% of its value. An individual stock investment you own also lost 25% of its value. What would you do?</p> <p>Sell all of my shares 0</p> <p>Sell some of my shares 2</p> <p>Do nothing 5</p> <p>Buy more shares 8</p> <p>4. Review the chart below.</p> <p>We've outlined the most likely best-case and worst-case annual returns of five hypothetical investment plans.</p> <p>Which range of possible outcomes is most acceptable to you?</p> <table border="1"> <thead> <tr> <th>Plan</th> <th>Average annual return</th> <th>Best-case</th> <th>Worst-case</th> <th>Points</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>2.6%</td> <td>10.8%</td> <td>-5.1%</td> <td>0</td> </tr> <tr> <td>B</td> <td>4.1%</td> <td>19.2%</td> <td>-10.6%</td> <td>3</td> </tr> <tr> <td>C</td> <td>5.6%</td> <td>27.6%</td> <td>-16.4%</td> <td>6</td> </tr> <tr> <td>D</td> <td>6.1%</td> <td>36.0%</td> <td>-21.7%</td> <td>8</td> </tr> </tbody> </table>	Plan	Average annual return	Best-case	Worst-case	Points	A	2.6%	10.8%	-5.1%	0	B	4.1%	19.2%	-10.6%	3	C	5.6%	27.6%	-16.4%	6	D	6.1%	36.0%	-21.7%	8
Plan	Average annual return	Best-case	Worst-case	Points																						
A	2.6%	10.8%	-5.1%	0																						
B	4.1%	19.2%	-10.6%	3																						
C	5.6%	27.6%	-16.4%	6																						
D	6.1%	36.0%	-21.7%	8																						

Enter the total points from questions 3 through 7. **Risk Tolerance Score 22**

Source: Charles Schwab Questionnaire

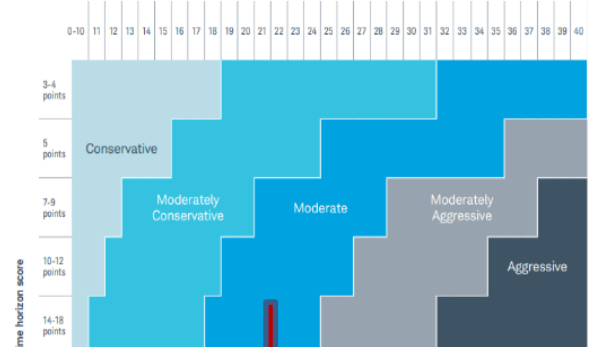


Table 16 – A4: Portfolio Selection Screen

Chosen Security	Indices/CUSIP &ISIN	Sector	Market Cap/Coupon Rate	Asset	Region	Annual Return	Annual Volatility
Unilever	STOXX Euro600	Consumer Staples	Large Cap	Equity	Europe	11.17%	15.18%
Tesco	STOXX Euro600	Consumer Staples	Large Cap	Equity	Europe	5.192%	22.34%
AAK AB	STOXX Euro600	Consumer Staples	Mid Cap	Equity	Europe	20.92%	21.92%
Recordati	STOXX Euro600	Healthcare	Mid Cap	Equity	Europe	23.22%	20.79%
AstraZeneca	STOXX Euro600	Healthcare	Large Cap	Equity	Europe	16.97%	19.98%
SSE PLC	STOXX Euro600	Utilities	Large Cap	Equity	Europe	10.13%	18.02%
Terna	STOXX Euro600	Utilities	Mid Cap	Equity	Europe	13.89%	16.11%
ABB Ltd	STOXX Euro600	Industrials	Large Cap	Equity	Europe	15.75%	20.78%
Walmart	S&P500	Consumer Staples	Large Cap	Equity	U.S	18.60%	18.38%
Abbot Laboratories	S&P500	Healthcare	Large Cap	Equity	U.S	18.37%	17.68%
Southern Co	S&P500	Utilities	Large Cap	Equity	U.S	15.69%	17.04%
BlackRock	S&P500	Financials	Large Cap	Equity	U.S	18.76%	13.15%
US TB	912810PT9	Fixed Income	4.75%	Bond	US	4.32%	11.03%
German Bond	DE000NRW1030	Fixed Income	4.95%	Bond	Europe	3.47%	10.19%
Dutch Bond	NL0000102234	Fixed Income	4%	Bond	Europe	4.00%	11.75%

Figure 12 – A5: Portfolio Composition

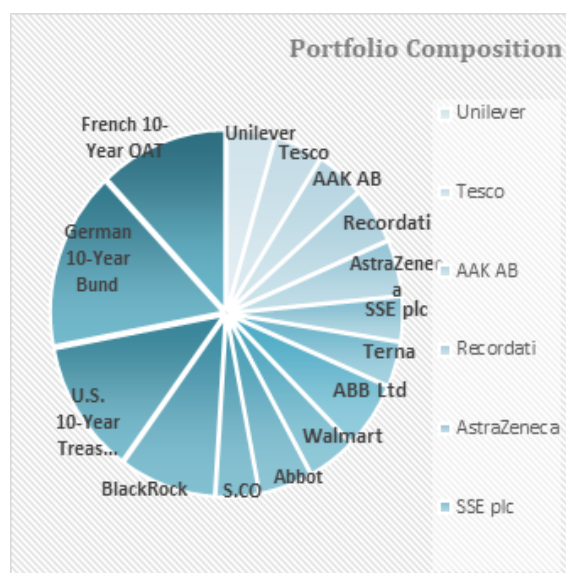


Figure 11 – A6: Monte Carlo Set-up

Stock Selected	weight	Annual return	Annual Volatility
Unilever	9.50%	11.17%	15.18%
Tesco	9.50%	5.19%	22.34%
AAK AB	7.50%	20.92%	21.92%
Recordati	7.50%	23.22%	20.79%
AstraZeneca	4.50%	16.98%	19.98%
SSE plc	9.50%	10.13%	18.02%
Terna	9.50%	13.89%	16.11%
ABB Ltd	4.00%	15.75%	20.78%
Walmart	6.50%	18.60%	18.38%
Abbot Laboratories	6.50%	18.37%	17.68%
Southern Co	9.00%	15.69%	17.04%
BlackRock	6.50%	18.77%	23.15%
NTH BD	10.00%	4.00%	11.75%
US BD	18.00%	4.32%	11.03%
GE BD	17.00%	3.47%	10.19%

Final ptf's Nominal Return	11.81%		
Inflation	2.30%	1.80%	2.80%
Final ptf's Real Return	9.29%		
The initial investment	€ 500 000,00		
Final ptf value	€ 1 452 325,54		

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06/28/2025

Omar El Adib