Lisbon School of Economics & Management
Universidade de Lisboa

MASTER OF SCIENCE IN
FINANCE

MASTERS FINAL WORK
PROJECT

INVESTMENT POLICY STATEMENT:

LOURENÇO FAMILY

ARTUR JOÃO COMPLETO SANTOS SILVA

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PROFESSOR PEDRO RINO VIEIRA

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Abstract

This Investment Policy Statement (IPS) was developed to define a structured strategy for managing the assets of the Lourenço family - a couple in their thirties with two young daughters, professional stability and no debts. The document establishes a long-term investment plan, adapted to their moderately aggressive risk profile, to accumulate capital to support their daughters as they enter adulthood and guarantee a comfortable early retirement.

The investment philosophy adopted is passive and growth-oriented, with global diversification and exclusive use of listed funds (ETFs). The strategic asset allocation was built on Modern Portfolio Theory (MPT), complemented by long-term market assumptions (LTCMAs). The final portfolio, optimised to maximise the Sharpe ratio, predicts an annual return of 9.34%, with a volatility of 12.11% and a Sharpe ratio of 0.55.

The IPS also defines the governance mechanisms: the financial advisor acts under a fiduciary duty and is responsible for managing and monitoring the portfolio, delivering quarterly reports with risk and performance metrics, and proposing annual rebalancing, subject to client approval. Risk management is approached through Value-at-Risk (VaR), Conditional VaR and Monte Carlo simulations, complemented by a qualitative matrix of structural risks.

This work aims to demonstrate how a well-designed IPS can serve as a planning and decision rationalisation tool for private investors, promoting consistency and minimising behavioural biases throughout the investment cycle.

JEL classification: C6; G11

Keywords: Asset Management; Portfolio Theory; IPS; Individual Investors; Risk Tolerance; ETFs; Value-at-Risk; Sharpe Ratio; Mean-Variance Optimisation; Risk Analysis.

Resumo

Este Documento de Política de Investimento (IPS) foi desenvolvido com o objetivo de definir uma estratégia estruturada para a gestão do património da família Lourenço — um casal na faixa etária dos trinta anos, com duas filhas pequenas, estabilidade profissional e ausência de dívidas. O documento estabelece um plano de investimento a longo prazo, adaptado ao seu perfil de risco moderadamente agressivo, com vista à acumulação de capital para apoiar as filhas na entrada na vida adulta e garantir uma reforma antecipada com conforto.

A filosofia de investimento adoptada é passiva e orientada para o crescimento, com diversificação global e utilização exclusiva de fundos cotados (ETFs). A alocação estratégica de ativos foi construída com base na Teoria Moderna do Portefólio (MPT), complementada por pressupostos de mercado de longo prazo (LTCMAs). O portefólio final, optimizado para maximizar o índice de Sharpe, prevê um retorno anual de 9,34%, com uma volatilidade de 12,11% e um Índice de Sharpe de 0,55.

O IPS define igualmente os mecanismos de governance: o consultor financeiro actua sob dever fiduciário, sendo responsável pela gestão e monitorização da carteira, pela entrega de relatórios trimestrais com métricas de risco e performance, e pela proposta de rebalanceamentos anuais, sujeitos à aprovação dos clientes. A gestão do risco é abordada através de Value-at-Risk (VaR), Conditional VaR e simulações de Monte Carlo, complementadas por uma matriz qualitativa de riscos estruturais.

Este trabalho visa demonstrar como um IPS bem delineado pode servir como instrumento de planeamento e racionalização de decisões para investidores privados, promovendo a consistência e minimizando enviesamentos comportamentais ao longo do ciclo de investimento.

Classificação JEL: C6; G11

Palavras-Chave: Gestão de Activos; Teoria da Carteira; IPS; Investidores Individuais; Tolerância ao Risco; ETFs; Value-at-Risk; Índice de Sharpe; Optimização Média-Variância; Análise de Risco.

Acknowledgements

The delivery of this work represents the culmination of a long and demanding journey, marked by interruptions, challenges, and new beginnings. On two occasions its completion had to be postponed, but my commitment to this academic goal remained steadfast.

Throughout this period, I had to balance the demands of my studies with the responsibility of managing a family business and, above all, with the most significant transformation of my life: the birth of my daughters, Maria and Carolina. The preparation of this work required sacrifices of time, energy, and presence with them. These difficult decisions were only possible thanks to the unconditional support of those who were always by my side.

To my wife, my deepest gratitude. You were a constant presence, a silent strength, and daily support in all phases of this journey. To my mother, for replacing me at work whenever necessary and, above all, for offering the comfort and encouragement that only a mother can give. To my sister and my father, for their affection, encouragement, and for reminding me that family unity is a source of strength in the most demanding moments. To my mother-in-law, a sincere thank you for your availability, care, and for so often stepping in when my absence was felt.

To my friend Rafael Nunes, thank you for the timely support you provided at the final stage. To my friend Henrique, a special and heartfelt thanks for your invaluable help in preparing my presentation, which turned out to be something truly innovative and essential to my defence.

To all of you, this achievement also belongs to you.

Finally, I would like to thank Professor Pedro Lino Vieira for his guidance, availability, and fundamental contribution to the successful completion of this work.

I am deeply grateful, and truly happy to have reached this milestone.

Abbreviations

AI – Artificial Intelligence

AUM – Assets Under Management

CVaR – Conditional Value-at-Risk

ECB – European Central Bank

EM – Emerging Markets

ESG – Environmental, Social and Governance

ETF – Exchange-Traded Fund

FED – Federal Reserve System

FRED - Federal Reserve Economic Data

FTSE – Financial Times Stock Exchange

GDP – Gross Domestic Product

HICP – Harmonised Index of Consumer Prices

IMI – Investable Market Index

IPS – Investment Policy Statement

LTCMA – Long-Term Capital Market Assumptions

MFW – Master's Final Work

MSCI – Morgan Stanley Capital International

MVO – Mean-Variance Optimisation

PCE – Personal Consumption Expenditures

REIT – Real Estate Investment Trust

SAA – Strategic Asset Allocation

SR – Sharpe Ratio

TER – Total Expense Ratio

UCITS – Undertakings for Collective Investment in Transferable Securities

VaR – Value-at-Risk

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1 Introduction

This Master´s Final Work (MFW) develops an Investment Policy Statement (IPS) designed specifically for the Lourenço family — a couple in their early thirties, both professionally active, with two young daughters. The IPS sets out a long-term investment plan aligned with their personal goals, financial situation and risk tolerance.

The family's main objectives are twofold: to accumulate capital to support their daughters in beginning their adult lives—particularly by helping them access housing—and to enable both parents to retire early while maintaining their desired standard of living. Taking a long-term view and with no immediate need for liquidity, the family adopted a passive investment strategy built on global diversification and a growth-oriented philosophy. This approach is consistent with their moderately aggressive risk profile, as confirmed by a formal assessment.

The IPS defines the strategic investment approach to be followed and lays out the process through which financial decisions are governed, implemented, and monitored. The investment design includes the construction of a multi-asset portfolio, based on Modern Portfolio Theory (MPT) and long-term capital market assumptions (LTCMAs), with the objective of optimising returns relative to risk. The methodology reflects the structure commonly used in private wealth management and includes strategic asset allocation, ETF selection, and periodic risk evaluation.

This work ultimately aims to demonstrate how a structured IPS can serve as both a planning and decision-making tool for private investors, supporting rational long-term investing, enhancing consistency and reducing the influence of behavioural biases over time.

2 Executive Summary

2.1 Scope and Purpose

This Investment Policy Statement (IPS) sets out the investment approach agreed with the Lourenço family, providing a structured framework for how their capital will be invested over the long term. It reflects their financial profile and risk tolerance, outlining how the portfolio will be constructed, monitored, and reviewed. The IPS also clarifies the advisor's role in overseeing the portfolio and maintaining transparent communication throughout the process.

2.2 Governance

The advisor is responsible for managing the portfolio and providing quarterly performance reports. Asset allocation is reviewed periodically, and any changes to the IPS must be approved by the clients. This framework ensures transparency, consistency, and alignment with the family's long-term financial objectives.

2.3 Investment Return and Risk

The proposed portfolio targets long-term capital growth, consistent with a 20-year investment horizon and a moderately aggressive risk profile. Built using Modern Portfolio Theory and optimised for the Sharpe ratio, the final allocation is expected to generate an annual return of 9.34%, with a volatility of 12.11% and a Sharpe ratio of 0.55. The portfolio is globally diversified and constructed with cost-efficient Exchange-Traded Funds (ETFs), supported by long-term capital market assumptions (LTCMAs).

2.4 Risk Management

Risk is monitored continuously by the advisor, who delivers quarterly reports including performance updates and key metrics such as Value-at-Risk (VaR). Scenario-based analysis supports this process. Rebalancing is proposed annually to ensure the portfolio remains aligned with the defined strategy and approved asset allocation.

3 Investment Policy Statement

3.1 Scope and Purpose

3.1.1 Context and Investor

This Investment Policy Statement (IPS) has been developed to establish a structured strategy for managing the investments of the Lourenço family, comprising Mr João Lourenço, a restaurant entrepreneur, and Mrs Rita Lourenço, a psychiatric nurse. The IPS aims to ensure that the proposed investment strategy aligns with the family's financial goals and risk tolerance.

The couple, in their early thirties, is married, has stable careers, and resides in Peniche, Portugal. They have two daughters, Maria, who is five years old, and Carolina, who is one year old. Their investment objectives are to accumulate sufficient capital to help their daughters purchase a home when they reach adulthood and to build a fund that will enable them to retire early, ensuring a comfortable standard of living after retirement.

The initial investment amount is €500.000 (five hundred thousand euros), sourced from the couple's accumulated savings over the past few years. This is complemented by the proceeds from the sale of a plot of land inherited by Mr João Lourenço. The property, located in a highly sought-after coastal tourist area, was sold at a favourable market value.

3.1.2 Structure

The designated investment advisor is responsible for structuring the investment portfolio, analysing, selecting, and strategically managing the most appropriate asset classes, within the limits and constraints previously defined by the client.

Mr and Mrs Lourenço retain the authority to approve or reject recommendations regarding any significant changes to the investment strategy, including adjustments to asset allocation or changes in risk exposure.

The designated investment advisor acts under a fiduciary duty, ensuring that all decisions are made in the best interests of the Lourenço family. The advisor is also responsible for continuously monitoring the risks associated with the investment strategy and for ensuring transparent and accurate reporting to the clients.

3.2 Governance

A governance framework supports this Investment Policy Statement (IPS), ensuring that the investment process remains transparent, accountable, and aligned with the Lourenço family's long-term financial goals. Clearly defined roles, responsibilities, and oversight mechanisms guide decision-making, enabling a structured and collaborative relationship between the advisor and the investors.

The designated investment advisor is responsible for designing, implementing, and actively managing the portfolio in line with the family's objectives, risk tolerance, and constraints. Acting under a fiduciary duty, the advisor must uphold the highest standards of ethical conduct and professionalism.

While the advisor provides expert guidance throughout the investment process, strategic decisions are subject to client validation to ensure alignment with their personal and financial objectives.

The advisor is also responsible for developing asset allocation strategies using input assumptions based on expected returns, macroeconomic projections, historical correlations, and selected benchmarks. Asset allocation will be periodically reviewed and adjusted as necessary to ensure continued alignment with the family's investment objectives. Exchange-Traded Funds (ETFs) are the predominant investment vehicle, offering transparent disclosure of allocations across sub-classes, including equities, fixed income, and alternatives. The portfolio excludes speculative or excessively illiquid instruments unless specifically approved by the clients, ensuring all investments align with the family's long-term strategy and risk profile.

To ensure effective oversight, the advisor delivers quarterly performance reports that include risk metrics and portfolio composition. A comprehensive annual review assesses the IPS's continued alignment with the family's goals and evolving circumstances. The review ensures that any adjustments remain consistent with the family's long-term philosophy and disciplined investment approach. Revisions to the IPS are discussed and implemented only upon the client's approval.

3.3 Investment, Return and Risk Objectives

3.3.1 Investment objective

The investment objective of this IPS is to generate sufficient capital over a 20-year horizon to meet the Lourenço family's long-term financial goals. These include supporting their daughters, Maria and Carolina, in purchasing their first homes, with an estimated allocation of €700.000, and accumulating approximately €600.000 to allow João and Rita to retire before the legal retirement age while maintaining their desired standard of living.

3.3.2 Investment, Return and Risk Objectives

To fulfil the capital requirements associated with these objectives, the portfolio must accumulate approximately €1.300.000 in net real terms over a 20-year investment period.

This net target must be considered in the applicable tax framework. Under current Portuguese legislation, capital gains realised within the portfolio are generally subject to a flat tax rate of 28%. However, an exception applies in cases where short-term gains, realised within 365 days, coincide with a taxable income equal to or above €83.696. In such instances, gains are mandatorily included in the taxpayer's overall income and taxed at a marginal rate of 48% (Article 72(14) of the Portuguese Personal Income Tax Code – CIRS). Although this risk is considered highly unlikely in the case of the Lourenço family, due to their long-term investment strategy and income profile, the tax status of the portfolio will be reviewed periodically. Should any changes in income or portfolio structure increase exposure to this risk, appropriate measures—such as extending holding periods or adjusting asset allocation—will be implemented to preserve tax efficiency.

Taking this fiscal context into account, the portfolio must reach an estimated gross nominal value of €1.611.111 to generate the intended net real amount of €1.300.000. This corresponds to a required gross annual return of approximately 6,02% over the 20-year horizon.

According to Banco de Portugal (2025), inflation is projected to stabilise at 1.9% in Portugal and 2.0% across the euro area by 2027. However, a more conservative long-term estimate of 2.5% has been adopted, reflecting prudent financial planning

considering the uncertainty surrounding long-term macroeconomic conditions. After adjusting for both taxation and inflation, the effective real net annual return required is estimated at approximately 8,68%.

These parameters establish the financial foundation of the investment strategy and define the minimum risk-adjusted return necessary to fulfil the Lourenço family's objectives. As both goals are expected to be met upon portfolio maturity, the family intends to reinvest all income generated throughout the investment horizon.

3.3.3 Portfolio Policy

The portfolio will be built with a long-term objective of capital appreciation, relying on a diversified set of instruments and favouring cost-effective implementation. Its structure reflects the strategic asset allocation defined in this IPS, with 75% allocated to equities, 20% to fixed income, and 5% to real estate. ETFs will be employed across all asset classes, as they offer broad market access, low costs, and high liquidity.

The equity portion will be globally diversified, while the fixed-income allocation will prioritise high-quality, euro-denominated bonds. Real estate exposure will be implemented through REIT ETFs, providing indirect access to the property market while preserving both liquidity and diversification.

Asset allocation will be informed by the principles of Mean-Variance Theory (Markowitz, 1952), in alignment with the investors' risk profile, aiming to optimise the balance between expected return and portfolio risk.

Over time, differences in asset performance may cause the portfolio to drift from its original allocation. When appropriate, rebalancing may be carried out to restore the intended structure, subject to prior agreement with the investor. Any substantial changes will be carefully evaluated to ensure they remain aligned with the stated objectives. The monitoring framework is outlined in the next section.

3.3.4 Investor's Risk Tolerance

The Lourenço family's financial situation supports a strong ability to bear investment risk. Their incomes are steady, they have no financial debt, and they do not anticipate needing liquidity before the portfolio matures. Combined with the long-term nature of the investment, these conditions provide a solid foundation for tolerating short-term market fluctuations.

In terms of attitude toward risk, both investors appear comfortable with the idea of temporary losses as part of a long-term investment strategy. The results of the risk profiling questionnaire (Appendix, Table A2) placed them in the moderately aggressive category, which matches their willingness to accept some volatility in pursuit of their goals.

This classification underpins the broader investment strategy developed in this IPS and is consistent with the capital allocation decisions detailed in the next chapter.

These guiding principles are now reflected in the portfolio's design, starting with the investment philosophy and strategic asset allocation model.

3.3.5 Relevant Constraints and Specific Portfolio

The investment strategy adopted for the Lourenço family translates their moderately aggressive risk profile and long-term objectives into a set of defined constraints and portfolio preferences.

In line with the inflation assumption defined in Sections 3.3.2 and 4.2.2, all income will be systematically reinvested. Accumulating share classes will be preferred to support tax-efficient compounding over the investment horizon.

Short selling is not permitted, reflecting the investors' preference for stability and avoidance of speculative instruments. The portfolio is intended to be managed with prudence, avoiding strategies that could expose capital to excessive downside risk.

To limit currency risk, all ETFs will be UCITS-compliant, traded in euros, and, where possible, listed on European exchanges. While some indirect exposure to non-Euro currencies will remain—particularly through global equity instruments—this is accepted given the long-term investment horizon and the diversification benefits associated with international holdings.

To safeguard the lower-risk segment of the portfolio, all fixed-income exposure will be euro-denominated and issued by entities operating primarily within the euro area, eliminating exchange rate volatility in this segment.

While the investors recognise the relevance of ESG considerations, these factors do not take precedence over return expectations, volatility control, and diversification in the current portfolio design. As such, ESG integration is not actively pursued at this

stage, though it may be reconsidered in future reviews should suitable instruments become available.

The investors have expressed targeted preferences regarding portfolio composition. Specifically, they requested that 5% be allocated to real estate via REIT ETFs, primarily to enhance diversification and provide a degree of inflation protection. In parallel, they showed firm conviction in the long-term relevance of artificial intelligence and robotics as structural drivers of economic transformation. As a result, the portfolio is required to maintain a minimum allocation of 10% to thematic strategies focused on these areas, consistent with the broader diversification and risk management principles defined in this IPS. This thematic exposure is further supported by recent academic and industry research (McKinsey, 2023; Fama & French, 2007; Barras et al., 2010).

Finally, while the strategic allocation is clearly defined, diversification at the instrument level will also be actively monitored. To mitigate concentration risk and promote sound portfolio construction practices, a soft cap of approximately 30% of total portfolio value will be considered for each ETF. This threshold is not a binding constraint but serves as a guiding parameter to ensure adequate dispersion and avoid overreliance on any single security. The rationale and implementation of these limits are further explored in Chapter 4.

3.4 Risk Management

The advisor will monitor the portfolio over time to ensure that it remains aligned with the investors' goals and risk tolerance. Every three months, a performance report will be produced, following the standards defined by the CFA Institute (GIPS). These documents will demonstrate the portfolio's performance and whether the asset allocation remains within the original structure.

To understand the level of risk the portfolio carries, several key indicators will be monitored. Among these are volatility, drawdown, tracking error, and Value-at-Risk (VaR), which is calculated at a 99%, 95% and 90% confidence levels. These measures help detect allocation drifts or undue concentrations that may trigger a rebalancing, depending on the materiality of the deviation.

There are two rules for rebalancing. If the share of an asset class deviates more than 5% from its intended level, the advisor will assess whether adjustments are necessary. At the ETF level, if a holding deviates from its target weight by more than one historical standard deviation of its typical allocation, the advisor may also consider rebalancing. These guidelines help avoid excessive trading but keep the portfolio on track (Ilmanen, 2011).

If the portfolio value falls by more than 15%, a detailed reassessment will be initiated. This threshold reflects the investors' tolerance for temporary losses before adjustments are considered.

Stress tests are conducted to assess how the portfolio would perform under adverse conditions. Intervention may be considered if simulated scenarios indicate potential losses exceeding 20% in equity markets, a 200 basis point increase in interest rates, or a depreciation of the euro against the US dollar of 10% or more. These parameters are used to identify material vulnerabilities that could warrant strategic review or rebalancing.

Currency risk is also addressed within the risk management framework. Although the portfolio includes international exposures—particularly to assets denominated in US dollars—no currency hedging is applied. This decision is based on both theoretical and practical grounds. Over long horizons, exchange rate fluctuations tend to revert to the mean, limiting their lasting impact on portfolio returns (Ilmanen, 2011; Dimson, Marsh, & Staunton, 2002; Froot et al., 1993). Furthermore, hedging introduces additional costs and operational complexity, which may erode returns in a passive, long-term strategy. As such, currency risk is explicitly assumed and managed through diversification and time horizon discipline, rather than through tactical overlays.

Although the family does not expect to withdraw money before the end of the investment period, the advisor will still monitor the liquidity of the investments. If circumstances change, the portfolio should retain sufficient liquidity to allow partial divestment without causing significant disruption.

Together, these mechanisms constitute a robust risk management framework, designed to keep the portfolio aligned with the family's long-term objectives while preserving the flexibility to adapt to evolving conditions.

4 Investment Design

4.1 Investment Philosophy

As Damodaran (2003) defines an investment philosophy as “a coherent way of thinking about markets, how they work (and sometimes do not), and the types of mistakes that you believe consistently underlie investor behaviour.” In essence, it provides a mental framework for making consistent decisions, helping investors avoid reacting impulsively to short-term market noise or volatility.

With this perspective in mind, the IPS defined for the Lourenço family is grounded in a long-term, passive investment approach. The strategy prioritises global diversification, cost efficiency, and behavioural discipline. While the portfolio construction avoids active stock-picking, it incorporates a deliberate factor-based tilt, with particular emphasis on Growth-oriented exposures. These typically capture companies with strong reinvestment potential, high earnings expectations, and premium valuations—frequently present in sectors such as technology, healthcare, and advanced industrials. This orientation reflects the family’s conviction that exposure to sectors at the forefront of innovation—particularly in areas such as artificial intelligence—will be a key driver of long-term value creation over the coming decades. Empirical studies suggest that growth factors tend to outperform during periods of economic expansion and structural transformation. This is evident particularly when technological progress is a key driver (Bender, Briand & Nielsen, 2018; MSCI, 2022).

Acknowledging the cyclical nature of factor returns, the portfolio also incorporates moderate allocations to Value and Minimum Volatility strategies. These elements are included to temper downside risk and provide diversification benefits in market regimes less favourable to high-growth companies. Evidence from MSCI (2018) and academic literature highlights that low correlation between factors—such as Growth and Value—can help smooth performance across different phases of the economic cycle. Investments are made through a combination of broad-market and factor-specific ETFs, selected to reflect the family’s objectives, long-term horizon, and moderately aggressive risk profile.

There is substantial academic support for passive investing: Sharpe (1991) famously argued that, after fees, the average active manager underperforms the

market; Fama and French (1992) reinforced this view by showing that exposure to systematic factors tends to deliver superior results compared to individual stock selection. More recently, the Morningstar US Active/Passive Barometer (2025) continues to demonstrate that most active funds fail to outperform their passive counterparts over longer time horizons.

Beyond cost and performance, a passive strategy offers behavioural advantages. It reduces the temptation to time the market, limits emotional responses to news cycles, and supports disciplined investing, which aligns well with the Lourenço family's preference for a stable, rules-based approach, avoiding speculative bets while focusing on long-term capital growth through globally diversified ETFs.

This strategy is meant to remain stable over time, but it is not fixed. If the family's situation or the broader environment changes significantly, the plan can be reviewed. Even then, changes would only be considered if they still aligned with their long-term goals and comfort level with risk.

4.2 Strategic Asset Allocation

Defining the optimal mix of asset classes is a crucial step in constructing a portfolio that aligns with an investor's long-term objectives. As demonstrated by Brinson, Hood, and Beebower (1986), more than 90% of a portfolio's returns' variability can be attributed to its asset allocation, underscoring the importance of this decision within the overall investment strategy.

For the Lourenço family, strategic asset allocation (SAA) must reflect their specific goals, risk tolerance, and investment horizon, ensuring consistency with the passive investment philosophy outlined in the previous section. The approach presented here is informed by an assessment of conventional models, relevant macroeconomic factors, and the family's unique financial circumstances, resulting in an allocation designed to maximise risk-adjusted returns over a 20-year horizon.

4.2.1 Conventional 60/40 Allocation — And Why It Was Not Adopted

For decades, the 60/40 portfolio, comprising 60% equities and 40% bonds, has been widely adopted by investors seeking a balanced approach. Rooted in modern portfolio theory (Markowitz, 1952), this approach combines capital growth with capital

preservation and has remained prevalent thanks to its simplicity, track record, and ease of implementation.

This allocation model, however, does not adequately reflect the needs of the Lourenço family. With a 20-year investment horizon, no short-term liquidity requirements, and a moderately aggressive risk profile, a conservative tilt such as that of a 60/40 portfolio would likely constrain long-term capital appreciation. In addition, longer investment horizons justify a greater allocation to equities, as investors are better placed to withstand interim volatility in pursuit of higher long-term returns (Bodie, Kane & Marcus, 2021).

Recent shifts in the macroeconomic landscape are also influencing the construction of portfolios. The extended period of ultra-low interest rates, which has shaped fixed-income performance over the past decade, is now coming to an end. As Ilmanen (2011, Chapter 9) observed, such environments resulted in fixed-income assets delivering limited real returns and weaker diversification benefits. Although rates have since normalised, these longer-term effects remain relevant and support the case for maintaining a growth-oriented allocation.

Recent experience, including the 2022 inflationary shock, has demonstrated that traditional equity-bond diversification can underperform in specific market environments (J.P. Morgan, 2025).

Taking these factors into account — including the long-term investment horizon, absence of short-term liquidity needs, and moderately aggressive risk profile — the family opted for a more growth-oriented allocation. This translated into a target structure of 75% equities, 20% fixed income, and 5% real estate, which is better suited to their objectives than a traditional 60/40 allocation.

4.2.2 Macroeconomic Considerations

Asset allocation must reflect the broader economic environment in which capital is deployed. While investor goals remain central, they must be balanced against external forces that influence long-term return dynamics. In recent years, several structural developments — including growing geopolitical fragmentation, breakthroughs in artificial intelligence, and the acceleration of the energy transition — have introduced persistent challenges to conventional investment assumptions (BlackRock, 2025).

The global outlook remains clouded by heightened uncertainty. According to J.P. Morgan (2025), growth is expected to slow in the near term, driven by rising geopolitical tensions and the resurgence of protectionist trade policies. In this context, traditional macroeconomic anchors, including stable inflation expectations and prudent fiscal policy, have become less dependable.

Despite these structural uncertainties, conventional macroeconomic forecasts still serve as a valuable baseline for near-term scenario analysis.

In the euro area, projections published by the European Central Bank in June 2025 point to a gradual economic recovery. Real GDP is expected to grow by 0.9% in 2025 and reach 1.3% by 2027, supported by domestic demand and the easing of financial conditions. Harmonised Index of Consumer Prices (HICP) inflation is projected to stabilise close to the 2.0% medium-term target. In response, the ECB has begun to lower its deposit facility rate, which now stands at 2.0%.

In contrast, the Federal Reserve has maintained a tighter monetary stance. After rates reached 5.50% in 2024, the Fed has recently begun lowering the funds rate, which stands at 4.35% as of mid-2025. According to projections, GDP is expected to expand by 1.4% this year, with limited improvement in subsequent periods. Core Personal Consumption Expenditures (PCE) inflation is projected to decline steadily, reaching 1.5% by 2027, down from 3.0% in 2025. This policy posture appears consistent with the relative strength of the U.S. economy, underpinned in part by leadership in areas such as artificial intelligence and energy infrastructure.

Although the long-term strategic allocation remains anchored in the investors' goals and risk profile, particular attention has been paid to global monetary dispersion, shifting inflation expectations, and regional asymmetries. In light of these dynamics — and despite the ECB and Fed's relatively moderate inflation projections — a conservative inflation rate of 2.5% has been adopted as a baseline planning assumption within this IPS. This reflects both the long investment horizon and the need to preserve purchasing power amid persistent macroeconomic uncertainty.

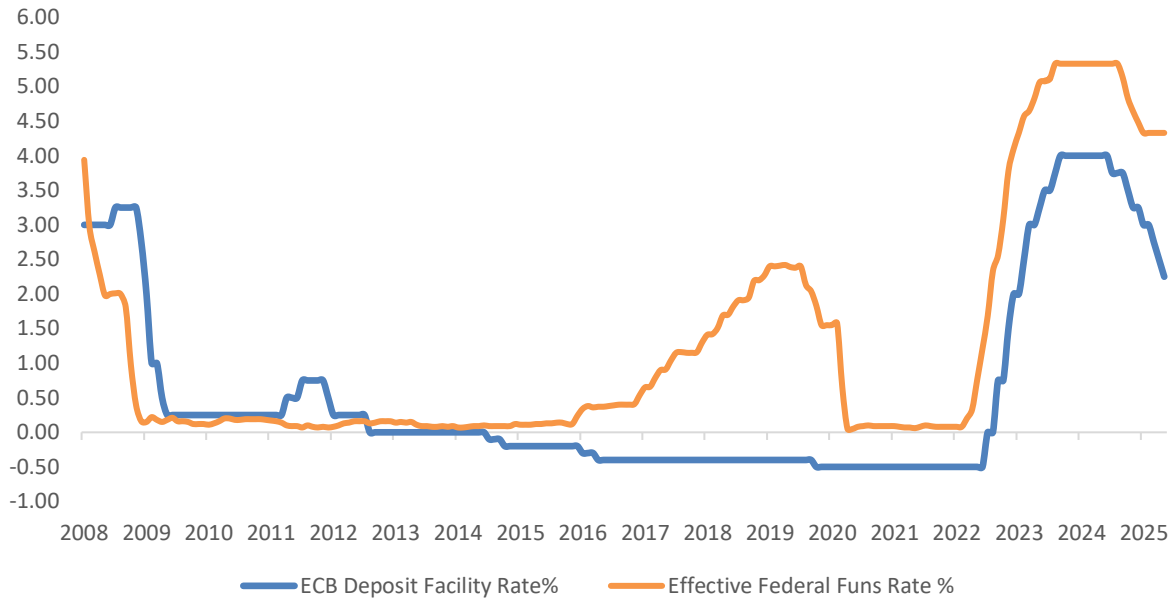


Figure 1 ECB and Federal Reserve Policy Rates (2008–2025)

Source: ECB;FRED

Figure 1 shows the evolution of policy rates set by the ECB and the Federal Reserve between 2008 and 2025. Following the COVID-19 pandemic, both central banks raised rates aggressively to contain inflationary pressures. More recently, their approaches have diverged. The ECB has begun to unwind its restrictive stance, lowering the deposit rate to 2.0%, while the Fed has kept its benchmark rate elevated.

As central banks move along increasingly distinct paths, markets have become more reactive to macroeconomic indicators and policy shifts. Inflation surprises, in particular, have driven abrupt moves in equity prices, while bond markets have been unsettled by changing fiscal narratives and episodes of political uncertainty. Against this backdrop, a well-diversified allocation — both geographically and thematically — helps shield portfolios from shocks that tend to impact markets.

According to BlackRock (2025), U.S. equities remain favoured in the current environment, supported by earnings strength and technological leadership, particularly in AI. Europe is approached with greater caution, adopting a neutral outlook and a selective approach in sectors such as infrastructure and defence. Emerging markets remain neutral, though selected local currency debt and equity segments may offer opportunities tied to structural growth trends.

Among the structural forces shaping long-term macroeconomic dynamics, artificial intelligence (AI) is expected to play a central role. Advances in AI are likely to alter productivity trends, sector leadership, and capital allocation across global markets. Within a strategic asset allocation framework, sustained exposure to this theme may support the pursuit of long-term growth, particularly when incorporated through diversified and cost-efficient vehicles.

These macroeconomic considerations underpin the capital market assumptions applied throughout the thesis, with particular reference to BlackRock's long-term market forecasts. The next section outlines how these macroeconomic foundations have guided the portfolio's strategic positioning.

4.2.3 Strategic Asset Allocation Model

The Lourenço family's long-term investment approach is grounded in a strategic asset allocation (SAA) framework that aligns with their financial objectives, risk tolerance, and 20-year investment horizon. Reflecting their moderately aggressive profile, the strategy strikes a balance between pursuing capital growth and prudent risk management.

The portfolio is divided across three asset classes. Equities represent 75% of the total allocation, diversified by region and investment style to support long-term growth and mitigate concentration risk. Fixed income accounts for 20%, providing stability and reducing overall volatility. The remaining 5% is allocated to real estate, offering exposure to inflation-sensitive assets with potential for capital preservation and appreciation.

This allocation is summarised in Table 1 and is consistent with the outcome of the Vanguard risk profiling questionnaire (Appendix, Table A2), which suggested an 80/20 equity-to-bond split. A 5% allocation to real estate was introduced to reflect the family's preference for tangible assets with long-term inflation-hedging characteristics.

Asset Class	Allocation (%)
Equity	75,00%
Fixed Income	20,00%
Real Estate	5,00%

Table 1 Strategic Asset Allocation

Source: Author

These target weights form the foundation for portfolio construction and guide ETF selection, as elaborated in the following sections. While no rigid allocation bands were established, rebalancing thresholds outlined in Section 3.4 provide the flexibility to respond to significant market shifts or changes in the family's financial circumstances.

Although no liquidity needs are foreseen in the short term, the portfolio consists exclusively of highly liquid, listed instruments, allowing for timely and cost-efficient reallocation when required.

The equity component combines core exposure to developed markets with selective allocations to emerging economies. It also includes a minimum volatility segment to enhance defensiveness during market stress and a value-oriented allocation, supported by robust evidence of long-term performance advantages (Fama & French, 1992; MSCI, 2018).

A thematic allocation is dedicated to transformative sectors, particularly Artificial Intelligence and Big Data. These exposures reflect the investors' belief in the structural importance of technology-led growth over the next two decades.

Fixed income exposure is achieved through euro-denominated investment-grade ETFs, encompassing both sovereign and corporate issuers within Europe. This composition seeks to optimise the balance between credit quality, yield, and interest rate risk, in line with a passive and cost-conscious investment approach.

Real estate exposure is implemented via REIT ETFs. These instruments offer liquidity, transparency, and inflation protection, and typically exhibit low correlation with traditional asset classes.

Commodities and alternative assets were intentionally excluded. For retail investors, access to these markets often requires the use of derivatives, which increases complexity, raises transaction costs, and introduces basis risk. Given the family's emphasis on simplicity and long-term efficiency, such exposures were deemed misaligned with their investment philosophy.

The resulting allocation remains consistent with the family's financial capacity, investment beliefs, and long-term goals. ETF-level implementation details are presented in Section 4.4.

4.3 Security Selection

The security selection process is not designed to outperform the market through tactical decisions; instead, it serves to implement the strategic asset allocation in a cost-efficient, transparent, and disciplined manner.

Given the Lourenço family's long-term, passive investment approach, preference is placed on instruments that offer reliable market exposure with low fees and minimal operational complexity, in alignment with their risk profile and financial objectives.

The methodology combined quantitative screening with qualitative assessment. All instruments are ETFs domiciled in the European Union and compliant with UCITS regulation, ensuring a high level of investor protection and tax efficiency for Portuguese private investors.

The main criteria used are:

- Total Expense Ratio (TER): ETFs with lower ongoing costs are prioritised to minimise long-term fee impact (Sharpe, 1991).
- Distribution Policy: ETFs with accumulation structures, where dividends are automatically reinvested. This supports long-term capital compounding, reduces reinvestment risk, and simplifies portfolio maintenance.
- Currency Exposure: Priority is assigned to ETFs traded in euros (EUR), thereby avoiding the need for foreign exchange transactions and the operational burden of managing currency hedging. For fixed income instruments in particular, only euro-denominated bonds are selected to preserve the defensive nature of this allocation and eliminate currency risk from the lower-volatility segment of the portfolio.
- Replication Method: Physical replication—whether full or optimised—is prioritised over synthetic strategies, offering greater transparency and lower tracking deviations (STOXX Research, 2023; MSCI, 2023).
- Assets Under Management (AUM): A minimum of €100 million is required to ensure fund sustainability, liquidity, and operational robustness (Investment Association, 2021).
- Provider Diversification: ETF issuers are diversified across established providers to mitigate concentration risk and ensure operational continuity in the unlikely event of platform-specific disruptions.

The ETF selection will reflect the asset class exposures defined in Section 4.2, while also incorporating the investors' specific preferences. Portfolio construction will aim to achieve broad and balanced exposure across strategic investment segments, including core developed markets, emerging markets, low-volatility strategies, value-based allocations, and long-term structural trends such as artificial intelligence. Additional diversification will be achieved through REITs and the fixed income allocation, focusing exclusively on euro-denominated sovereign and corporate bonds.

The selection within each segment will follow the qualitative and quantitative criteria outlined above, ensuring alignment with the investors' long-term objectives and risk profile. The detailed ETF composition and associated weights will be presented in Section 4.4.

4.4 Portfolio Composition

4.4.1 Theoretical Foundations and Methodology

The portfolio construction process is grounded in the principles of Modern Portfolio Theory (Markowitz, 1952), which highlight the importance of diversification in achieving an optimal balance between risk and return. In line with this framework, a mean-variance optimisation (MVO) approach is applied to determine the asset allocation that maximises the Sharpe Ratio, subject to the investor's constraints and long-term objectives.

While conceptually sound, MVO is highly sensitive to estimation errors in expected returns and covariances (Michaud, 1989; Sharpe, 1991). To mitigate this vulnerability, several safeguards are incorporated. These include using a consistent five-year data window for historical inputs, enforcing uniform periodicity across return series, and applying diversification-aware constraints to reduce the risk of overconcentration. These methodological adjustments are consistent with academic recommendations and help improve allocation stability (DeMiguel et al., 2009; Ilmanen, 2011).

Return and risk assumptions are defined using a dual-source methodology. For core asset classes—such as US, European, and emerging market equities, as well as euro-denominated government and corporate bonds—20-year long-term capital market assumptions (LTCMAs) are sourced from BlackRock (2025), expressed in

euro terms. These projections reflect forward-looking estimates that account for current market valuations, macroeconomic conditions, and structural expectations over a multi-decade horizon. For specific exposures not covered by LTCMAs, such as Factor-based and Thematic exposures (Value, Minimum Volatility, and AI), where no explicit LTCMAs are available, five-year historical data from representative ETFs are used as proxies. This pragmatic approach maintains internal consistency while remaining grounded in documented empirical behaviour (Fama & French, 1992; MSCI, 2018).

The data preparation process is conducted with rigour to ensure consistency and integrity across all inputs. Monthly net return data were retrieved from Bloomberg, covering the period from June 2020 to June 2025. All series are denominated in euros and correspond to total return indices (RT117 - Total Return Index Gross Dividends), which reflect the reinvestment of gross dividends.

Logarithmic returns were computed on a monthly basis for each ETF. These log returns served as the basis for calculating expected annual returns and annualised volatility, but only for those ETFs for which long-term capital market assumptions (LTCMAs) from BlackRock (2025) were not available. When LTCMAs were accessible, the forward-looking expected return and volatility figures were applied directly, consistent with the 20-year investment horizon already defined in the Investment Policy Statement.

For the historically based estimates, expected returns were obtained by annualising the mean of monthly log returns, and volatility was calculated as the square root of the sample variance. The variance–covariance matrix was then constructed using the historical monthly log returns as inputs. To ensure consistency with the LTCMA-based optimisation framework, the diagonal elements — representing the variances of each ETF — were adjusted by applying the squared LTCMA-based volatilities whenever available. For ETFs lacking LTCMA data, the corresponding variance was computed directly from the historical series. The off-diagonal elements, reflecting covariances between asset pairs, were derived exclusively from the historical return data.

To capture the full interaction between asset classes and account for the diversification effects embedded in the covariance matrix, the optimisation was

conducted jointly for all ETFs rather than separately by asset class. This approach allowed for a more accurate and holistic maximisation of the Sharpe Ratio, ensuring that the final portfolio reflected not only the strategic asset allocation targets but also the interdependencies between instruments across equities, fixed income, and real estate.

In line with the IPS, the optimisation incorporated a structured set of constraints to ensure the final portfolio remains diversified, implementable, and consistent with the investors' moderately aggressive risk profile. These general constraints include full investment, prohibition of short-selling, exclusion of leverage and risk-free assets, diversification across ETF providers, and turnover control to enhance operational simplicity and cost efficiency.

To ensure that the resulting portfolio is robust, diversified, and aligned with the investors' stated preferences and long-term objectives, the advisor introduced a series of allocation-specific constraints. These limits are intended to prevent overconcentration, promote exposure across key strategic and thematic segments, and reinforce the suitability of the proposed allocation for real-world implementation and long-term portfolio discipline. The constraints are detailed below:

1. Core Developed Equity Allocation:

A minimum of 30% of the total portfolio must be allocated to broad-based developed market equity ETFs. This requirement ensures adequate exposure to the primary drivers of long-term global economic growth, aligning with empirical research that highlights the role of a diversified core equity allocation as the foundation for portfolio stability and long-term compounding (Ilmanen, 2011; BlackRock, 2025).

2. Emerging Markets Equity Exposure:

A minimum of 5% of the total portfolio must be allocated to emerging markets equities. This ensures consistent exposure to economies with high structural growth potential, supporting global diversification and long-term capital appreciation (BlackRock, 2025; Ilmanen, 2011).

3. Factor-Based Exposures – Value and Minimum Volatility:

Exposure to factor-based strategies (Value and Minimum Volatility) is constrained to a combined range of 10% to 25% of the total portfolio. Each individual ETF within this segment must account for at least 5% of the total portfolio.

These constraints allow access to academically validated sources of return (Fama & French, 1992; MSCI, 2023), while preventing excessive concentration in any single investment style. The upper bound helps contain the risk of cyclical underperformance often associated with factor investing (Ilmanen, 2011; Arnott et al., 2020), supporting long-term portfolio resilience and style diversification. Factor exposures are thus positioned as complementary allocations within a broader, diversified equity strategy.

4. Thematic Exposure – Artificial Intelligence & Big Data:

The allocation to Artificial Intelligence and Big Data is constrained to between 10% and 25% of the total portfolio. This ensures a meaningful yet controlled exposure to innovation-driven sectors, in alignment with the investors' long-term convictions.

AI is recognised by BlackRock (2025) as a general-purpose technology with transformative economic potential. However, it is also associated with elevated volatility, sector-specific risks, and market exuberance. Setting clear allocation boundaries helps maintain a prudent balance between capturing growth opportunities and preserving portfolio diversification. As such, these exposures are integrated as satellite positions within a disciplined core-satellite framework (Baker et al., 2022; MSCI, 2023).

5. Real Estate (REITs) Exposure:

The allocation to real estate is fixed at 5% of the total portfolio. This modest exposure contributes to diversification and offers partial protection against inflation, consistent with institutional portfolio construction practices (EPRA, 2024). The allocation is deliberately limited to avoid excessive exposure to a less liquid and more cyclical asset class.

6. Fixed Income Allocation Limits:

Within the 20% strategic allocation to fixed income, no single ETF may represent more than 70% of this segment — i.e., no more than 14% of the total portfolio. This cap ensures internal diversification across fixed income instruments, mitigating concentration risk and promoting exposure to varying credit qualities and durations, in line with institutional best practices (BlackRock, 2025).

Finally, to maintain long-term discipline and strategic alignment, the portfolio is reviewed periodically and rebalanced annually. This rebalancing schedule limits transaction costs while allowing for structural corrections if market dynamics cause significant drift from the strategic asset allocation.

This methodological framework provides the foundation for the practical implementation described in the next section.

4.4.2 Construction of the Efficient Portfolio

The efficient portfolio was derived by applying the methodological framework outlined in the previous section to identify ETF allocations that maximise the Sharpe Ratio while remaining consistent with the investors' long-term goals and the strategic asset mix of 75% equities, 20% fixed income, and 5% real estate. The model was operationalised using Solver with all asset classes considered jointly, to ensure that cross-asset correlations were fully incorporated. This integrated approach enabled a more realistic assessment of diversification effects and avoided distortions that may arise from isolated optimisation processes.

All constraints defined in Section 4.4.1 were operationalised within the model, including minimum and maximum thresholds for key exposures such as thematic sectors, factor-based strategies, emerging markets, and REITs. These boundaries were set not only to reflect investor preferences, but also to mitigate the risk of excessive concentration observed in preliminary optimisation runs—particularly in segments like Artificial Intelligence & Big Data, where the model tended to over-allocate due to attractive recent performance and low correlation with other holdings. By enforcing upper limits in these areas, the portfolio preserves diversification and remains aligned with the intended long-term investment discipline.

The Sharpe Ratio was calculated using a risk-free rate of 2.71%, based on the 10-year German Bund yield as of 28 June 2025. This benchmark is broadly accepted in

euro-denominated portfolios and is considered prudent in the context of a stabilised European monetary policy environment.

Expected return estimates were sourced from BlackRock's 2025 LTCMAs where available. For exposures lacking LTCMA projections—such as thematic and factor-based strategies—five-year historical data (from June 2020 to June 2025) were employed as proxies, consistent with the construction of the variance–covariance matrix.

The final configuration achieved a Sharpe Ratio of 0,55. This result reflects a rigorous optimisation process designed to maximise risk-adjusted returns, while maintaining alignment with the family's moderately aggressive risk profile. Rather than pursuing extreme return scenarios, the optimisation respected forward-looking capital market assumptions and integrated practical constraints to ensure robust diversification and realistic implementability. The outcome is a portfolio positioned to capture long-term growth potential while remaining resilient under a range of market conditions.

$$Max\ Sharpe\ Ratio\ (SR)$$

$$s.t.: \sum_{i=1}^{8} x_i = 1$$

$$x_1 + x_2 + x_3 + x_4 + x_5 = 0{,}75$$

$$x_5 = 0{,}05$$

$$x_6 + x_7 = 0{,}20$$

$$x_1 \geq 0{,}3$$

$$x_i \geq 0{,}05\ , i = 2, 3, 4$$

$$0{,}10 \leq x_5 \leq 0{,}25$$

$$x_3 + x_4 \leq 0{,}25$$

$$x_i \leq 0{,}14\ , i = 7, 8$$

$$\forall X_i > 0$$

$$x_1{:}VGVF, x_2{:}IS3N;\ x_3{:}XDEB;\ x_4{:}IS3S;\ x_5{:}XAIX;\ \ x_6{:}EPRA;\ x_7{:}VGEA; x_8{:}VECA$$

ETF	DESCRIPTION
VGVF GR	Developed Markets Equity
IS3N GR	Emerging Markets Equity
XDEB GY	Value Factor Equity
IS3S GY	Minimum Volatility Factor Equity
XAIX GR	Thematic Equity – AI & Big Data
EPRA IM	Real Estate (REITs)
VGEA GR	Government Bonds
VECA GR	Corporate Bonds

Table 2 ETF Description

Source: Author

This allocation ensures broad exposure across regions, sectors, and investment styles, while avoiding excessive reliance on any single return driver. The structure is grounded in academic theory and designed for practical implementation, supporting the Lourenço family's ambition to accumulate long-term wealth under a moderately aggressive risk profile.

4.5 Expected Performance

The final portfolio is expected to deliver an annual return of 9.34%, with a corresponding annualised volatility of 12.11%, resulting in a Sharpe Ratio of 0.55. These values were derived using the estimation methods outlined in Section 4.4 and reflect the consolidated outcome of the optimisation process. As the return figures are based on total return indices, ongoing ETF-level costs are already embedded in the performance metrics.

Optimal Portfolio	
Expected Annual Return, E(R)	9,34%
Expected Annual Volatility, σ	12,11%
Sharpe Ratio (SR)	0,55

Table 3 Optimal Portfolio

Source: Author

To assess the strategy's ability to meet the investors' objectives, a forward projection was conducted using an initial capital of €500,000, compounded at the expected return of 9.34% per annum. After adjusting for a 2.5% inflation rate and applying a 28% capital gains tax, the projected capital at the end of 20 years amounts to approximately €1,385,733 in real, after-tax terms. This projection is visually illustrated in Figure 2, which presents the year-by-year evolution of capital accumulation over the investment horizon.

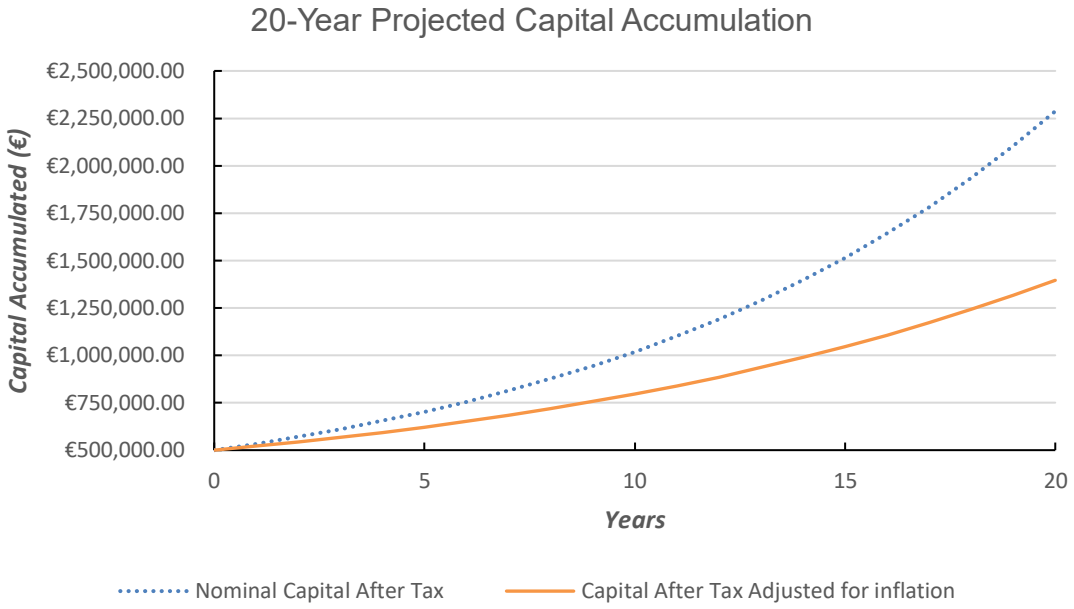


Figure 2 Projected Capital Accumulation after tax and adjusted for inflation

Source: Author

This outcome comfortably exceeds the investment target of €1,300,000 set in Section 3.3.1, providing a prudent margin of safety. Despite being based on long-term projections and assumptions, the result offers a credible indication that the strategy is well-positioned to support the Lourenço family's key financial goals—namely, helping their daughters acquire housing and enabling early retirement. The expected performance is therefore consistent with the strategic intent of the IPS and reinforces the rationale for long-term disciplined implementation.

4.6 Risk Analysis

The final chapter of this IPS presents a comprehensive risk assessment of the proposed portfolio. The objective is to quantify potential losses under different methodologies, offering greater clarity on the portfolio's downside exposure. The analysis includes Historical Value-at-Risk (VaR), Conditional VaR (CVaR), Parametric VaR, and Monte Carlo VaR. A Monte Carlo simulation was also performed to project the range of expected annual returns over the investment horizon.

4.6.1 Historical Value-at-Risk (VaR)

To compute the Historical Value-at-Risk (VaR), the portfolio's monthly returns were sorted in ascending order, allowing the identification of the worst observations for each selected confidence level. The 1st, 5th, and 10th percentiles were extracted to estimate losses under the 99%, 95%, and 90% confidence levels, respectively. For each of these thresholds, both the Historical VaR and the Conditional Historical VaR (CVaR) were calculated.

While the VaR reflects the minimum loss that could be expected at a given confidence level, the CVaR provides the average loss that would be incurred if this threshold is breached. This distinction enables a more comprehensive assessment of potential downside risk, particularly in tail events.

The results are summarised in Table 4.

Confidence Level	VaR (%)	VaR (€)	CVaR (%)	CVaR (€)
99%	23,21%	116 068 €	23,21%	116 068 €
95%	20,04%	100 192 €	22,33%	111 640 €
90%	12,11%	60 534 €	18,94%	94 710 €

Table 4 Historical VaR and CVaR (Annualised)

Source: Author

At the 99% confidence level, both the Historical VaR and CVaR amount to 23,21%, corresponding to a potential loss of €116 068.

At the 95% confidence level, the Historical VaR is 20,04% (€100.192), while the CVaR increases to 22,33% (€111.640). At the 90% level, the figures are 12,11% (€60.534) and 18,94% (€94.710), respectively.

These results suggest that the portfolio presents a moderate level of downside risk, with more substantial losses becoming relevant primarily in extreme scenarios. All values are shown as negative to reflect their interpretation as potential losses.

4.6.2 Parametric VaR

The Parametric Value at Risk (VaR), also referred to as the Variance-Covariance approach, relies on the assumption that portfolio returns are normally distributed. This method is particularly suited to stable market conditions, offering a closed-form analytical solution based on the portfolio's historical mean (μ) and standard deviation (σ).

The monthly return distribution of the optimised portfolio was modelled as a Gaussian process. Based on the same historical data used in the previous simulation, the estimated annualised mean return is 14,03%, with a corresponding standard deviation of 11,58%. The analysis was conducted using the 99%, 95%, and 90% confidence levels, consistent with standard market risk conventions. The corresponding Z-scores were drawn from the standard normal distribution and applied using the following formula:

$$VaR_{\alpha} = \mu + Z(\alpha) \cdot \sigma$$

In addition, the Conditional Value at Risk (CVaR) was computed for each level. While the VaR identifies the minimum loss expected in adverse market conditions, the CVaR quantifies the average loss should the VaR threshold be exceeded. The CVaR was calculated as follows:

$$CVaR_{\alpha} = \mu - \left(\frac{\phi(Z\sigma)}{1-\alpha}\right) \cdot \sigma$$

The results are summarised in Table 5:

Confidence Level	Z-Score	φ(z)	Parametric VaR (%)	Parametric VaR (€)	Parametric CVaR (%)	Parametric CVaR (€)
99%	-2,326	0,02667372	12,90%	64 522 €	16,86%	84 285 €
95%	-1,645	0,10311081	5,02%	25 099 €	9,85%	49 252 €
90%	-1,282	0,17539749	0,82%	4 084 €	6,28%	31 407 €

Table 5 Parametric VaR and CVaR (Annualised)

Source: Author

At the 99% confidence level, annual portfolio losses are not expected to exceed 12,90% (€64.522) under normal market conditions. If this threshold is breached, the expected shortfall, as measured by the CVaR, rises to 16,86% (€84.285).

At the 95% level, the VaR indicates a loss of 5,02% (€25.099), with the CVaR increasing to 9,85% (€49.252). For the 90% confidence level, the VaR is 0,82% (€4.084), while the CVaR reaches 6,28% (€31.407).

While the parametric approach offers a computationally efficient framework, its reliance on normally distributed returns may understate tail risk—particularly in periods of high volatility or when returns deviate from symmetry. Nonetheless, the magnitude of estimated losses remains consistent with the investor's moderately aggressive profile and their stated ability to tolerate short-term fluctuations.

4.6.3 Historical vs. Parametric VaR: A Comparative Overview

A comparison between the two methods shows that Historical VaR consistently yields higher loss estimates than the Parametric approach across all confidence levels. At 99%, the Historical VaR reaches –23,21%, while the Parametric VaR is –12,90%. Similar differences are observed at the 95% and 90% thresholds.

This discrepancy reflects the models' assumptions: The Parametric approach presumes a normal distribution of returns and performs reasonably well in stable market conditions — although such environments are not always guaranteed; The Historical method, by relying directly on observed past returns, incorporates extreme market events and tends to produce more pronounced loss estimates, particularly in the tails of the distribution.

In the context of this IPS, where the investor has a moderately aggressive profile and no foreseeable short-term liquidity needs, the Historical VaR provides a more prudent and potentially more accurate reflection of downside risk, especially under adverse market conditions.

4.6.4 Monte Carlo VaR

To assess the tail risk of the optimised portfolio over time, a Monte Carlo simulation was conducted using a normally distributed model of annual returns. For the first year, the simulation was calibrated with an annualised mean return of 14.03% and a standard deviation of 11.58%, derived from monthly historical log returns of the portfolio over the past five years. These parameters served as the initial inputs to generate 10,000 random paths of annual returns. From the second year onward, the return and risk parameters were updated iteratively using the mean and standard deviation of the previous year's simulated values, ensuring a more path-dependent and dynamic estimation.

The simulation aimed to quantify the Value at Risk (VaR) and Conditional Value at Risk (CVaR) at various confidence levels, offering a forward-looking view of downside risk. The following table presents the estimated VaR and CVaR figures for the 1st and 20th year of investment, corresponding to percentiles commonly used in risk management:

Confidence Level	Z-Score	ϕ(z)	1st Year		20th Year	
			VaR	CVaR	VaR	CVaR
99%	-2,326	0,026673718	12,91%	16,87%	13,07%	17,11%
95%	-1,645	0,103110811	5,02%	9,86%	5,02%	9,95%
90%	-1,282	0,175397486	0,81%	6,28%	0,73%	6,31%

Table 6 Monte Carlo VaR and CVaR for year 1 and year 20

Source: Author

These figures reveal a remarkably stable risk profile throughout the investment horizon. Unlike the previous simulation where the tail risk decreased over time, the updated figures now show that the downside risk in the 20th year remains at levels

similar to those in the first year. For example, the 5% VaR remains at 5.02% in both years, while the CVaR deteriorates marginally from 9.86% in the 1st year to 9.95% in the 20th.

Such stability suggests that while the portfolio has a strong potential for long-term returns, it is still exposed to substantial tail events even at maturity. The 0.10% percentile, representing extreme but rare scenarios, estimates a potential loss of 25.4% in the final year—virtually identical to the worst-case scenario in the initial period. This implies that market shocks or rare events could impact portfolio value even after two decades, reinforcing the importance of prudent risk controls and periodic rebalancing.

4.6.5 Risk Matrix

Despite the insights provided by the preceding quantitative analysis — particularly through VaR and CVaR metrics — a comprehensive understanding of portfolio risk requires attention to broader qualitative factors. These risks often fall outside the scope of statistical models, yet they can materially affect asset returns, delay capital accumulation, or compromise long-term objectives. In the case of the Lourenço family, whose investment strategy is guided by a 20-year horizon and a moderately aggressive risk profile, it is essential to consider structural and market-based risks that may emerge over time and affect the portfolio's performance.

Risks	Implications	Impacts	Probability
Market Risk	The portfolio's 75% equity exposure, makes it highly sensitive to systemic events. Global recessions, financial crises, or geopolitical tensions may trigger widespread market declines, regardless of individual asset quality.	High — Market downturns could substantially reduce short- to medium-term portfolio value and delay capital accumulation.	Moderate to high — Over a 20-year period, several market corrections or crises are likely.

Interest Rate	The fixed income allocation (20%) is exposed to rate fluctuations. Rising interest rates reduce bond prices, particularly for instruments with longer duration. Current monetary policy uncertainty heightens this risk.	Moderate — Exposure is limited to investment-grade euro-denominated bonds, providing some cushion.	High — Rate volatility remains a key concern amid changing central bank strategies.
Inflation	A long-term inflation rate above the assumed 2.5% would erode the real value of returns and endanger the portfolio's ability to meet future real purchasing power objectives.	High — Persistent inflation could compromise the real wealth generation expected from the strategy.	Moderate — While central banks aim for inflation stability, structural and geopolitical uncertainties remain.
Thematic Concentration	The targeted exposure to AI and Big Data may introduce concentration in high-growth, volatile sectors. If market sentiment shifts or sector-specific bubbles burst, this could magnify portfolio losses.	Moderate to high — While thematic allocations are capped, their relative volatility could affect total returns.	Moderate — Technological trends are robust, but susceptible to cyclical corrections.
Correlation Breakdown	In periods of market stress, asset class correlations often rise, reducing the effectiveness of diversification and increasing portfolio drawdowns.	Moderate — The optimisation model considers cross-asset correlations, but these may change in crises.	Moderate — More likely during systemic shocks or global crises.
Tracking Error	ETFs may not precisely replicate their benchmarks due to sampling methods, fees, or replication strategies, leading to deviations in performance.	Low to moderate — The selected ETFs have strong track records, high AUM, and physical replication.	Low — The risk is small given ETF quality and strategy.
Regulatory and Tax	Changes in tax laws or EU financial regulation may impact ETF treatment, alter net returns, or restrict access to current investment vehicles.	Moderate — Current UCITS structure is favourable, but future legislative shifts may pose challenges.	Low to moderate — The regulatory environment is relatively stable, but long-term changes are plausible.

Rebalancing	Rebalancing may trigger transaction costs, tax events, or unfavourable timing. In volatile periods, execution may be suboptimal.	Low — The passive approach with annual rebalancing limits exposure.	Moderate — Rebalancing will be required as market values drift.
Liquidity	Market liquidity can deteriorate during stress periods, leading to wider bid-ask spreads and price execution risks, particularly in REITs and fixed income.	Low to moderate — Most ETFs are highly liquid, but REITs and corporate bonds may be vulnerable.	Low — The risk is limited under normal conditions.
Sustainability and ESG	Although some ETFs apply ESG filters, the portfolio lacks a dedicated sustainability mandate. Exposure to assets not aligned with ESG standards could face regulatory or reputational pressures.	Low to moderate — Exposure is partly mitigated through the exclusion of commodities and the inclusion of ESG-integrated funds.	Moderate — ESG risks are rising in regulatory and investment agendas.

Table 7 Key Risks and their relevance to the portfolio

Source: Developed by the author, drawing on long-term risk management principles and selected insights from BlackRock (2025), J.P. Morgan (2025), and Morningstar (2025).

To complement the textual assessment, a visual risk matrix is presented below. This graphical representation classifies the identified risks according to their expected impact and probability, supporting prioritisation in future risk management and governance decisions.

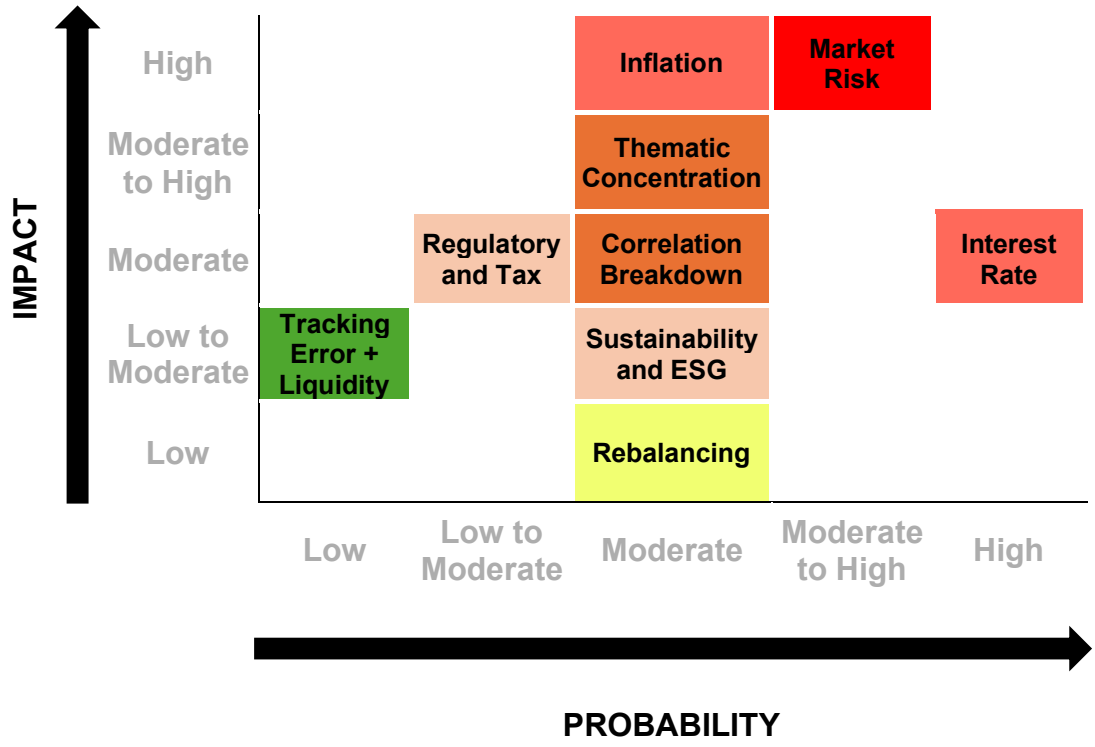


Figure 3 Risk Matrix

Source: Author

The risk categories identified in the table above were defined based on a combination of academic principles and practical market considerations. The assessment of impact and probability was grounded in the investor's strategic profile and exposure structure, and supported by insights from long-term capital market publications, including BlackRock (2025) and J.P. Morgan (2025).

Particular emphasis was placed on scenarios affecting asset classes with greater portfolio weight, such as equities and thematic exposures. Risks directly linked to core allocations were classified as having a high impact, even if their probability was moderate. Conversely, risks with potentially slower transmission to financial markets — such as regulatory or ESG-related developments — were considered to have a lower immediate impact.

While this IPS adopts a passive and long-term investment philosophy, active risk monitoring remains essential. Any material change in the underlying risk factors may warrant a strategic reassessment or a tactical rebalancing of the portfolio. Periodic reviews — conducted at least annually — will ensure that the portfolio remains aligned with the stated objectives, and that emerging risks are adequately addressed.

References

Arnott, R. D., Beck, N., Kalesnik, V., & West, J. (2020). The short-run pain of long-term stock returns. Research Affiliates

Baker, M., Bradley, B., & Wurgler, J. (2022). Evaluating the role of thematic investing in portfolio construction. Harvard Business School Working Paper

Banco de Portugal. (2025). Boletim Económico – Projeções Macroeconómicas. Retrieved from https://www.bportugal.pt

Barras, L., Scaillet, O., & Wermers, R. (2010). False discoveries in mutual fund performance: Measuring luck in estimated alphas. Journal of Finance, 65(1), 179–216. https://doi.org/10.1111/j.1540-6261.2009.01527.x

Bender, J., Briand, R., & Nielsen, F. S. (2018). Harvesting factor returns in the long run. MSCI Research Insights.

BlackRock. (2025). Capital Market Assumptions – Long-Term Outlook. Internal report.

Bloomberg L.P. (2025). Bloomberg Terminal Data Services. Retrieved June 2025.

Bodie, Z., Kane, A., & Marcus, A. J. (2021). Investments (12th ed.). McGraw-Hill Education.

Brinson, G. P., Hood, L. R., & Beebower, G. L. (1986). Determinants of portfolio performance. Financial Analysts Journal, 42(4), 39–44. https://doi.org/10.2469/faj.v42.n4.39

CFA Institute. (2018). Managing Investment Portfolios: A Dynamic Process (3rd ed.). Wiley.

CFA Institute. (2020). Global Investment Performance Standards (GIPS®) for Firms. CFA Institute. https://www.cfainstitute.org

Damodaran, A. (2003). Investment Philosophies: Successful Strategies and the Investors Who Made Them Work. John Wiley & Sons.

DeMiguel, V., Garlappi, L., & Uppal, R. (2009). Optimal versus naive diversification: How inefficient is the 1/N portfolio strategy? Review of Financial Studies, 22(5), 1915–1953. https://doi.org/10.1093/rfs/hhm075

Dimson, E., Marsh, P., & Staunton, M. (2002). Triumph of the Optimists: 101 Years of Global Investment Returns. Princeton University Press.

EPRA. (2024). The role of listed real estate in a diversified portfolio. European Public Real Estate Association. https://www.epra.com

European Central Bank. (2023). Euro area yield curves and zero-coupon yields. Retrieved from https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_area_yield_curves/html/index.en.html

European Central Bank. (2025). Macroeconomic projections – June 2025. Retrieved from https://www.ecb.europa.eu

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. The Journal of Finance, 47(2), 427–465. https://doi.org/10.1111/j.1540-6261.1992.tb04398.x

Fama, E. F., & French, K. R. (2007). Disagreements, tastes, and asset prices. Journal of Financial Economics, 83(3), 667–689. https://doi.org/10.1016/j.jfineco.2006.01.003

Froot, K. A., Scharfstein, D. S., & Stein, J. C. (1993). Risk management: Coordinating corporate investment and financing policies. The Journal of Finance, 48(5), 1629–1658. https://scholar.harvard.edu/files/stein/files/risk-management-jf-dec-93.pdf

Ilmanen, A. (2011). Expected returns: An investor’s guide to market forecasts and risk premiums. Wiley.

Investment Association. (2021). Fund Charges and Costs: IA Research and Analysis. Retrieved from https://www.theia.org

J.P. Morgan. (2025). Guide to the Markets – Europe, Q2 2025. Retrieved from https://am.jpmorgan.com

MSCI. (2018). Foundations of Factor Investing.

MSCI. (2022). Growth investing: Resilient factor for the long term? MSCI Research.

MSCI. (2023). Megatrends and the Rise of Thematic Investing. Retrieved from

Markowitz, H. (1952). Portfolio selection. The Journal of Finance, 7(1), 77–91. https://doi.org/10.2307/2975974

McKinsey & Company. (2023). The Economic Potential of Generative AI: The Next Productivity Frontier. Retrieved from https://www.mckinsey.com

Michaud, R. O. (1989). The Markowitz optimization enigma: Is “optimized” optimal? Financial Analysts Journal, 45(1), 31–42. https://doi.org/10.2469/faj.v45.n1.31

Morningstar. (2025). Morningstar US Active/Passive Barometer: Year-End 2024. Morningstar Research Report.

Portuguese Tax and Customs Authority. (2025). Personal Income Tax Code – Category G: Capital Gains (Article 72, paragraph 14). Retrieved from https://info.portaldasfinancas.gov.pt

Sharpe, W. F. (1966). Mutual fund performance. The Journal of Business, 39(1), 119–138. https://doi.org/10.1086/294846

Sharpe, W. F. (1991). The arithmetic of active management. Financial Analysts Journal, 47(1), 7–9. https://doi.org/10.2469/faj.v47.n1.7

STOXX Research. (2023). Understanding ETF Replication: Full vs. Optimised vs. Synthetic. STOXX Insights.

U.S. Federal Reserve (FRED). (2025). Federal Funds Rate Data. Retrieved from https://fred.stlouisfed.org

Appendix

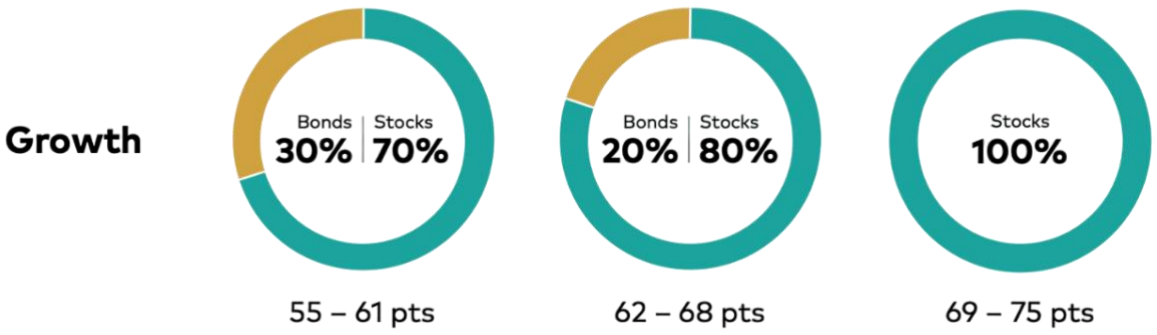
Table A 1 Client's Profile

Names	Mr. and Mrs. Lourenço
Age	Mr. Lourenço 31years old and Mrs. Lourenço 32 years old
Children	A five-year-old and a one-year-old girls
Net Anual Wage	Mr. Lourenço - Restaurant entrepeneur (60.000€) Mrs. Lourenço - Psychiatric nurse (28.000€)
Investment Constraints	1. Accumulating ETFs only (UCITS-compliant) 2. No use of leverage or short-selling 3. No currency hedging 4. No liquidity requirements during the investment period 5. Portfolio Currency in euros (€)
Ability to Bear Risks / Willingness to Take on Risks	High capacity / Moderate to high willingness
Risk Profile	Moderately Aggressive (Investor Profile in Appendix – Table A2)
Amount to Invest	€500.000
Investment Objective	€1.300.000 (€1.611.111 in 20 years assuming 2.5% average inflation and 28% capital gains tax)
Time Horizon	20 years (240 months)
Minimum Real Annual Return (Portfolio)	8,68%
Expected Annual Portfolio Return	9,34%
Expected Annual Portfolio Volatility	12,11%

Source: Author

Table A 2 Profiling Questionnaire

Question	Answer	Points
1. I plan to begin taking money from my investments in . . .	More than 15 years	17
2. As I withdraw money from these investments, I plan to spend it over a period of . . .	More than 15 years	8
3. When making a long-term investment, I plan to keep my money invested for . . .	More than 8 years	7
4. From September 2008 through November 2008, stocks lost over 31%. If I owned a stock investment that lost about 31% in three months, I would . . .	Hold on to the investment and sell nothing	5
5. Generally, I prefer an investment with little or no ups or downs in value, and I am willing to accept the lower returns these investments may generate.	I somewhat agree	3
6. When the market goes down, I tend to sell some of my riskier investments and put money in safer investments.	I agree	2
7. Based only on a brief conversation with a friend, coworker, or relative, I would invest in a mutual fund.	I strongly disagree	5
8. From September 2008 through October 2008, bonds lost nearly 4%. If I owned a bond investment that lost almost 4% in two months, I would . . .	Hold onto the investment and sell nothing	5
9. The chart below shows the highest one-year loss and the highest one-year gain on three hypothetical investments of $10,000.* Given the potential gain or loss in any one year, I would invest my money in . . .	Investment B (gain $1,921; loss $1,020)	3
10. My current and future income sources (such as salary, Social Security, pension) are . . .	Stable	4
11. When it comes to investing in stock or bond mutual funds (or individual stocks or bonds), I would describe myself as . . .	Somewhat experienced	3
TOTAL		**62**



Source: Vanguard Investor questionnaire

Table A 3 ETF's Selection Criteria

ETFs	Fund Size	Index	Replication Method	Distribution Policy	Traded Currency	ETF Provider	Asset	Investment Focus / Region
Vanguard FTSE Developed World UCITS	> € 100M	FTSE Developed Index	Physical Replication	Accumulating	€	Vanguard	Equity	Core Developed Markets / World
iShares Core MSCI EM IMI UCITS	> € 100M	MSCI Emerging Markets IMI Index	Physical Replication	Accumulating	€	Blackrock	Equity	Emerging Markets / World
Xtrackers MSCI World Minimum Volatility UCITS	> € 100M	MSCI World Minimum Volatility Net Total Return Index	Physical Replication	Accumulating	€	Xtrackers	Equity	Minimum Volatility / World
iShares Edge MSCI World Value Factor UCITS	> € 100M	MSCI World Enhanced Value Index	Optimised Sampling	Accumulating	€	Blackrock	Equity	Value / World
Xtrackers Artificial Intelligence & Big Data UCITS	> € 100M	Nasdaq Global AI and Big Data Index	Physical Replication	Accumulating	€	Xtrackers	Equity	AI & Big Data / World
Amundi Index FTSE EPRA NAREIT Global UCITS	> € 100M	FTSE EPRA/NAREIT Developed Net Total Return Index	Physical Replication	Accumulating	€	Amundi	Real Estate	Real Estate / World
Vanguard EUR Eurozone Government Bond UCITS	> € 100M	Bloomberg Euro-Aggregate: Treasury Index	Physical Replication	Accumulating	€	Vanguard	Fixed Income	Government Bond / Europe
Vanguard EUR Corporate Bond UCITS	> € 100M	Bloomberg Euro-Aggregate: Corporates Index	Physical Replication	Accumulating	€	Vanguard	Fixed Income	Corporate Bond / Europe

Source: Author; JustETF

Table A 4 ETF's Detailed Information

Chosen ETFs	ISIN / Bloomberg Ticker	INFO
Vanguard FTSE Developed World UCITS	IE00BK5BQV03 / VGVF GY	The ETF tracks the FTSE Developed index, which includes the largest stocks in developed markets globally. TER: 0.12% p.a. Largest and cheapest ETF for this index. Utilises sampling technique. Dividends reinvested. AUM: €4,040 million. Launched: 24 Sep 2019. Domiciled in Ireland.
iShares Core MSCI EM IMI UCITS	IE00BKM4GZ66 / IS3N GY	The ETF tracks the MSCI Emerging Markets Investable Market (IMI) index, covering stocks from emerging markets worldwide. TER: 0.18% p.a. Cheapest and largest ETF for this index. Utilises full replication. Dividends reinvested. AUM: €23,054 million. Launched: 30 May 2014. Domiciled in Ireland.
Xtrackers MSCI World Minimum Volatility UCITS	IE00BL25JN58 / XDEB GY	The ETF tracks the MSCI World Minimum Volatility index, which includes MSCI World stocks optimised for lowest absolute risk. TER: 0.25% p.a. Cheapest ETF for this index. Utilises full replication. Dividends reinvested. AUM: €661 million. Launched: 5 Sep 2014. Domiciled in Ireland.
iShares Edge MSCI World Value Factor UCITS	IE00BP3QZB59 / IS3S GY	The ETF tracks the MSCI World Enhanced Value index, selecting value stocks from developed countries based on price-to-book, price-to-forward earnings, and enterprise value-to-cash flow from operations. Sector weights mirror the MSCI World index. TER: 0.25% p.a. Cheapest and largest ETF for this index. Utilises sampling technique. Dividends reinvested. AUM: €3,169 million. Launched: 3 Oct 2014. Domiciled in Ireland.
Xtrackers Artificial Intelligence & Big Data UCITS	IE00BGV5VN51 / XAIX IM	The ETF tracks the Nasdaq Global Artificial Intelligence and Big Data index, which includes international companies in AI, big data, and cybersecurity, filtered using ESG criteria. TER: 0.35% p.a. Only ETF tracking this index. Full replication. Dividends reinvested. AUM: €4,857 million. Launched: 29 Jan 2019. Domiciled in Ireland.
Amundi Index FTSE EPRA NAREIT Global UCITS	LU1437018838 / EPRA IM	The ETF tracks the FTSE EPRA/NAREIT Developed index, which includes the largest real estate companies in developed markets. TER: 0.24% p.a. Cheapest ETF tracking this index. Full replication. Dividends reinvested. AUM: €294 million. Launched: 17 Nov 2016. Domiciled in Luxembourg.
Vanguard EUR Eurozone Government Bond UCITS	IE00BH04GL39 / VGEA GY	The ETF tracks the Bloomberg Euro Aggregate Treasury index, which includes investment-grade euro-denominated government bonds issued by eurozone countries across all maturities. TER: 0.07% p.a. Cheapest and largest ETF tracking this index. Replication: sampling. Coupons reinvested. AUM: €2,508 million. Launched: 19 Feb 2019. Domiciled in Ireland.
Vanguard EUR Corporate Bond UCITS	IE00BGYWT403 / VECA GY	The ETF tracks the Bloomberg Euro Corporate Bond index, which includes investment-grade euro-denominated corporate bonds from industrial, utility, and financial issuers in Eurobond and eurozone domestic markets. TER: 0.07% p.a. Cheapest ETF tracking this index. Replication: sampling. Coupons reinvested. AUM: €2,813 million. Launched: 19 Feb 2019. Domiciled in Ireland.

Source: Author; JustETF

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I disclose that AI tools were employed during the development of this thesis as follows: (i) AI-based research tools were used to assist in the literature review; and (ii) Generative AI tools were consulted for brainstorming and outlining purposes. However, all final writing, synthesis, and critical analysis are my own work. Instances where AI contributions were significant are clearly cited and acknowledged.

Nonetheless, I have ensured that the use of AI tools did not compromise the originality and integrity of my work. All sources of information, whether traditional or AI-assisted, have been appropriately cited in accordance with academic standards. The ethical use of AI in research and writing has been a guiding principle throughout the preparation of this thesis.

I understand the importance of maintaining academic integrity and take full responsibility for the content and originality of this work.

Artur João Completo Santos Silva, 31/07/2025