UNIVERSITY OF TARTU
Faculty of Social Sciences
School of Economics and Business Administration

Hlieb Kushlianskyi

PERFORMANCE OF ECONOMICALLY RESILIENT INVESTMENT PORTFOLIOS

Bachelor thesis

Supervisor: Lecturer Mark Kantšukov

Tartu 2025

I have written this Bachelor Thesis independently. Any ideas or data taken from other authors or other sources have been fully referenced.

Table of contents

Introduction

Most investors have heard some variation of a proverb “the best time to invest was yesterday, the second best is today” at some point, however the uncertain financial landscape may leave them searching for a more resilient investment portfolio approach. Whether one is a knowledgeable or a novice investor, both should be enticed by a portfolio that is built with the purpose of minimizing the potential losses at a fraction cost of the returns.

In an ever-changing financial landscape marked by economic uncertainties, market volatility, and shifting macroeconomic factors, investors are increasingly seeking strategies that can provide stability and mitigate risks. A 2017 market research done by strategists at Deutsche Bank states that its unreasonable to think these crises will not become a regular occurrence in the modern financial system (Reid et al., 2017). While wealthier cohorts of society have broader diversification opportunities, the average investor may find economically resilient portfolios, such as those explored in this paper, particularly appealing.

Researchers have established a fundamental understanding that various asset classes — including equities, bonds, REITs, gold, cash, and commodities — exhibit distinct returns and volatility levels across economic cycles. Shahidi (2014) attributes these differences to the unique macroeconomic influences on each asset class, which are shaped by their respective economic sensitivities and biases. Shahidi (2014), however, demonstrates that optimized portfolios can achieve returns comparable to broader markets with significantly lower volatility by reducing exposure to market dynamics.

Building upon these insights, both investors and academics have suggested portfolio strategies that diversify across asset classes to better withstand economic fluctuations. Notable figures in finance, such as Ray Dalio and Harry Browne, have been crucial in laying the foundation for modern investment strategies focused on economic resilience. In this thesis, the author introduces the term "economically resilient investment portfolios" (ERIPs) as an umbrella term to describe such strategies. Dalio’s All-Weather Portfolio and Browne’s Permanent Portfolio, for example, were designed to maintain stability across varying economic conditions and now serve as foundational models in this field (Browne, 1999; Dalio, 2011).

While some academic studies have explored ERIPs (Navas et al., 2020; Simonsen & Hermo, 2021; Anderson et al., 2014; Leow, Nguyen, and Chua, 2021; Li, Wong, and Leung, 2019), along with contributions from Estonian authors (Mähhar, 2015; Kundla, 2013), these works primarily focus on using ERIPs as a basis for developing and evaluating new economically resilient portfolios. However, literature dedicated to comparing the

performance of the foundational portfolios – Permanent Portfolio and All-Weather Portfolio, remains limited. To the best of the author's knowledge, no prior research has systematically compared the performance of the selected ERIPs across varying investment holding periods and rebalancing approaches. This thesis seeks to fill this gap by providing a comprehensive analysis that serves both individual investors interested in ERIPs and researchers, offering an academic foundation for further development in economically resilient portfolio design. Consequently, the aim of this bachelor's thesis is to assess the performance of various ERIPs over varying investment horizons and rebalancing options. The choice for these portfolios is warranted by their exposure to the wider media, availability to investors, relative simplicity and their unique approaches to balancing risks and return across economic conditions. The time frame from 1999 to 2024 was chosen based on data availability. The U.S. market was selected because of its size, maturity, and its frequent use in previous research on ERIPs. The selected investment intervals of 1-, 5-, 10-, and 15-years allow for a comprehensive assessment of the portfolios' performance over time.

To reach the set aim, the author establishes the following research tasks:

- to introduce and discuss the concepts of economic cycles and their influence on the assets' prices;
- to explore the evolution and key principles of economically resilient investment portfolios;
- to provide an overview of previous research on economically resilient investment portfolios performance;
- to introduce the methodology for empirical analysis;
- to calculate and analyze various performance metrics of the portfolios across different investment intervals using data from available financial databases;
- to discuss and summarize the results of the portfolios' performance modelling.

The structure of this bachelor's thesis is divided into two primary sections: the theoretical overview and the empirical analysis. The first chapter examines the theoretical foundations of Economically Resilient Investment Portfolios (ERIPs), emphasizing their relevance in the context of enduring investment strategies. It introduces key concepts such as economic cycles and their impact on various asset classes, offering a foundation for understanding the underlying factors that prompted the development of ERIPs in the first place. Furthermore, this section explores renowned ERIPs, highlighting their different approaches to achieving economic resilience and potential weaknesses. Lastly, the author

presents a review of the prior relevant research, highlighting significant findings and methodologies used.

The latter empirical section introduces the process of data collection, the chosen representative funds and indexes for the asset classes, and the selected methodology for analysing the dataset. The analysis includes historical performance measures, rolling period returns, and a drawdown analysis for the entire period. The section concludes with a detailed evaluation of the portfolios' performance, coupled with identifying patterns in resilience across various investment horizons and rebalancing options.

Keywords: All-Weather Portfolio, Permanent Portfolio, diversification, rebalancing, investment strategies, asset allocation, rolling returns.

1. Theoretical foundations of Economically Resilient Investment Portfolios

1.1. Asset classes' price behavior in different economic cycles

For many decades, extensive research has been conducted on the complex phenomenon of economic cycles, also known as business cycles, with foundational contributions from scholars such as Barna et al. (1948), Plosser (1989), Lucas (1995) and institutions like the National Bureau of Economic Research (NBER). Plosser (1989) defines economic cycles as the fluctuations in economic activity over time, marked by distinct periods of expansion (booms) and contraction (busts). Hence, the business cycle in itself can be described by its cyclical nature, comprising four critical phases: expansion, peak, contraction, and trough (Weinstock, 2024). The duration and intensity of each phase of the economic cycle can vary dramatically, with cycles ranging from just a few months to several years (Economic cycle: Definition…, 2023).

When highlighting the implications of the business cycle, it is essential to delve into the two main phases – the expansion and contraction. A leading institution for research, backdating and predictive forecasting of economic cycles in the U.S. - NBER, defines a recession as "a significant decline in economic activity that is spread across the economy and that lasts more than a few months."(NBER,2024). During the contractionary phase, a range of key economic indicators, such as employment rates, income levels, and production output experience a notable downturn (Economic cycle: Definition…, 2023). Hence, consumer spending and business investment follows suit and increase the risk of creating a negative feedback loop, where lower spending results in decreased production, layoffs, and further declines in income, furthering the economic downturn (Weinstock, 2024). Conversely, the expansionary phase marks the upturn in economic activity. According to the NBER (2024), an expansion is "a period when the economy is not in a recession." It is described as the normal state of the economy. Weinstock (2024) highlights that the rise in economic activity provokes a consequent increase in consumer confidence, stimulating greater consumer spending and investment. Thus, as businesses see rising demand, they often increase production, hire more staff, and invest in new projects, propelling the economy forward (Weinstock, 2024).

Investors have recognized that asset prices respond differently to various phases of economic cycles, driven by their unique characteristics and sensitivities to economic conditions (Shahidi, 2014). This understanding is key in selecting assets that, when combined, can potentially withstand economic fluctuations, and reduce portfolio volatility, while keeping most of the portfolio return (Shahidi, 2014). There are numerous investment

assets, however some share common features and adhere to the same rules and regulations. Thus, a few common asset classes arise: equities, fixed income, cash and cash equivalents, real estate, commodities, and currencies (Ganti, 2024). Large volume of previous research suggest that each of these asset classes' individual returns differ during economic cycles (Moore & Viictor Zarnowitz, 1986; Sa-Aadu et al., 2006; van Vliet & Blitz, 2011; Dzikevičius & Vetrov, 2013). A recent study by Dzikevičius & Vetrov (2013) examined how different asset classes perform across various stages of the business cycle - as defined by the OECD composite leading indicator (CLI). Through their analysis of US stocks, EAFE stocks (proxy for foreign common stock equities), an aggregate of US bonds (investment grade corporate and government bonds), gold, real estate, cash (US dollar index) and commodities, they have reaffirmed that asset classes indeed demonstrate statistically significant varying return/risk characteristics over the business cycle, see table 2.

Table 2

Average monthly returns/standard deviation of assets throughout the business cycles

	S&P 500	EAFE	Bonds	Gold	REIT	Commodities	Cash
Recovery	1.28% / 4.01%	1.88% / 4.36%	0.53% / 1.55%	0.41% / 4.74%	1.82% / 3.53%	0.96% / 4.48%	-0.12% / 2.43%
Expansion	0.70% / 4.24%	0.97% / 4.39%	0.37% / 1.08%	0.49% / 5.18%	0.48% / 4.02%	1.13% / 4.47%	-0.03% / 2.50%
Slowdown	0.72% / 4.06%	0.29% / 4.70%	0.73% / 1.53%	1.34% / 6.56%	1.02% / 4.51%	1.27% / 6.44%	0.02% / 2.44%
Downturn	1.19% / 5.32%	0.69% / 6.37%	1.13% / 2.16%	0.61% / 5.75%	0.97% / 6.78%	-0.54% / 6.40%	0.01% / 3.14%

Source: Compiled by the author based on Dzikevičius and Vetrov (2013)

Dzikevičius and Vetrov (2013) found that equities, such as US and EAFE stocks, and REITs outperform during recovery phases, delivering higher returns compared to other stages of the cycle. Conversely, these assets showed weaker performance in the slowdown and downturn phases. Bonds, in turn, demonstrated stronger performance in these latter phases. Gold and commodities were found to be most profitable during the slowdown phase, outperforming other assets during this period. (Dzikevičius and Vetrov, 2013)

Although asset class returns have been conventionally heavily relied upon when creating a resilient portfolio, Shahidi (2014), a prominent financial advisor and author known for his work on balanced asset allocation strategies, suggests focusing only on the returns when creating a portfolio would not result in a balanced portfolio. Instead, throughout his work he points out that more attention should be paid towards the individual asset classes' "economic biases" - exposures to various economic conditions. (Shahidi, 2014)

Stock prices are significantly influenced by economic conditions, as they reflect the market's expectations of future corporate earnings and broader economic growth. Hence, during periods of economic expansion, factors such as rising GDP, increasing consumer spending, and favourable monetary policies tend to drive stock prices upward. Companies experience higher profitability as demand grows, leading to optimistic investor sentiment and increased valuations. (Levitt, 2022).

Brocato & Steed (1998) found that REITs display cyclical patterns comparable to stocks - outperforming equity in growth periods while underperforming during downturns. This argument was further fortified by recent research, which identified a strong correlation between a REIT index and stock index (Hu, 2022). Hence, REITs are subject to many of the same economic biases as equities. Interest rates hikes and cuts, however, seem to influence REITs bidirectionally – when the interest rate rise, the real estate value tends to fall, and lower risk fixed income securities are seemingly more attractive for an investor (Orzano & Welling, 2017). At the same time, rising interest rate is often a sign of a healthy and growing economy accompanied by rising inflation – which in turn might translate into greater demand for real estate, higher occupancy and rents – all of which would benefit REITs (Orzano & Welling, 2017).

In the latter phases, when the performance of equities and REITs drops, the price of aggregate bonds appreciates. The stronger performance of aggregate bond prices can be explained by the inverse relationship between interest rates and bond prices - since bonds have a fixed interest rate, when the market interest rate drops, bond prices rise, providing investors with a safer investment during economic uncertainty (Shahidi, 2014; Ilmanen et al., 2014). In addition to it, recent research done by Kaczmarek et al. (2022) using an advanced prediction method highlighted that U.S. long-term Treasuries can be considered safe heaven assets, positively contributing to the portfolio performance.

The role of gold as an inflation hedge and safe haven asset remains a subject of ongoing academic debate. Recent studies have questioned gold's effectiveness in mitigating market volatility. For instance, Kaczmarek et al. (2022) found that gold's hedging capabilities may be limited during certain market conditions, challenging its traditional reputation as a reliable safe haven. Conversely, earlier research by Tanzer and Frick (2010) demonstrated that gold prices do not closely follow equity or bond prices, attributing this divergence to gold's industrial demand. This characteristic enhances gold's potential as a diversifying asset within investment portfolios.

Equities, bonds, gold, REITs, commodities, cash – all the aforementioned asset classes show varying performance in the economic cycles. It, therefore, becomes possible for an investor to hedge their bets against market fluctuations through diversification. In broad terms, diversification is about spreading out the investment across diverse range of assets so the losses in one asset are offset by others (Koumou, 2020). A defining feature of traditional diversification is intuitiveness. It is an easy-to-understand concept which the investors of the past used as means to mitigate an asset's risk and avoid the catastrophic losses, with no thought, however, about the overall portfolio risk or how their approach affected returns.

In contrast, the modern view of diversification is shaped by a mathematical framework of Modern portfolio theory (MPT). Introduced in 1952 by a world-renowned economist Harry Markowitz, the framework changed the way investors approached diversification. To begin with, the contemporary look shifted from individual assets towards portfolio view. The MPT implies that an optimal portfolio should be constructed with correlations between returns of the assets in mind (Baldridge, 2023). Unlike previous conceptions, it emphasizes that the individual assets should be assessed based on their influence on the portfolios' risk and return as a whole ("Modern portfolio theory", 2024). It seeks to combine assets with low or negative correlations to reduce overall portfolio risk and reach the so-called "Efficient Frontier", a state where the portfolio offers the highest expected return for the given risk level ("Modern portfolio theory", 2024).

It has to be noted that MPT has its own limitations and a substantial amount of criticism. Increasingly relevant in a rapidly changing environment of 21st century, one argument is that MPT estimates are based on historic data, which may misrepresent reality. Another potential issue lies in in how MPT handles risk. Using this approach, two portfolios – one with small losses over time and one with a few massive losses are equally valuable, although an investor would most likely choose the former. ("What are the benefits, cons, and limitations…", 2023)

By employing diversification, investors aim to achieve the 'Efficient Frontier,' constructing portfolios that efficiently balance risk and return while remaining resilient to market fluctuations throughout economic cycles. As expressed by Shahidi (2014) - we can construct optimized portfolios with less exposure to the stock market and be quite sure to earn comparable returns with less volatility. Investors can achieve it by balancing their portfolio in an additional dimension – exposure of their asset classes towards various economic conditions. This additional macroeconomic perspective to portfolio diversification

can lead to substantial benefits in terms of risk-adjusted portfolio returns. (Ilmanen et al., 2014)

By integrating an understanding of economic cycles and their influence on the prices of specific asset classes, investors have constructed portfolios designed to deliver more consistent risk-adjusted returns. Such portfolios, despite differences in structure - including asset selection, allocation strategies, and rebalancing frequency - are unified by their focus on achieving economic resilience and mitigating the impact of economic cycles. Therefore, this paper introduces the term "economically resilient investment portfolio" (ERIP) as an umbrella term for this portfolio approach, emphasizing their shared objective of stability across varying market conditions.

1.2. Evolution and Key Principles of Economically Resilient Investment Portfolios

While there are countless variants of economically resilient investment portfolios (ERIPs), their core objective remains consistent: to create a portfolio strategy capable of mitigating the effects of economic cycles while delivering high risk-adjusted returns. The adaptability of ERIPs means that almost anyone can design a portfolio tailored to these principles, incorporating asset classes with varying economic biases to achieve diversification. However, not all portfolios are created equal. For this thesis, three well-established and widely discussed ERIPs were selected for analysis: Harry Browne’s Permanent Portfolio, Ray Dalio’s All-Weather Portfolio, and the Golden Butterfly Portfolio. These portfolios were chosen based on their relevance in academic and financial discourse, their contrasting allocation strategies, and their unique approaches to balancing risks and return across economic conditions.

The foundation of economically resilient portfolios lies in Harry Markowitz's Modern Portfolio Theory, introduced in 1952, which emphasizes balancing risk and return through diversification. Markowitz's seminal paper, *"Portfolio Selection,"* introduced the idea of balancing risk and return through diversification, which is a cornerstone of economically resilient portfolios (Markowitz, 1952). This framework formed the foundation for later creation of portfolios resilient to economic cycles. However, the specific idea of constructing portfolios explicitly designed for resilience across economic cycles was first popularized through work of prominent financial advisor Harry Browne. Conceptualized in the 1980s by Harry Browne, the Permanent Portfolio aimed to safeguard savings and ensure steady growth, regardless of market conditions (Lawson & Rowland, 2012). Because different asset classes perform well in different economic conditions, the Permanent Portfolio diversifies an investor's assets such that if one type of investment sees decreased or negative returns due to

adverse market conditions, one or more other asset classes compensate (Iregbulem, 2023). Aside from the steady performance, Browne advocates for simplicity of use, so that the investor can maintain the portfolio with little to no effort (Browne, 1999). The portfolio is made up of equal parts (25%) of stocks, bonds, gold, and cash, see table 3. Due to this self-imposed minimalism, the portfolio also gained traction in the academic research in the area of optimal asset allocation methods. For instance, a study by DeMiguel, Garlappi, and Uppal (2009) titled "Optimal Versus Naive Diversification: How Inefficient is the 1/N Portfolio Strategy?" examines the performance of equal-weighted (1/N) portfolios relative to more complex optimization-based strategies. The authors found that, despite their simplicity, equal-weighted portfolios often perform comparably to, or even outperform, optimized portfolios, especially when estimation errors are considered (DeMiguel et al., 2009).

The foundation of the Permanent Portfolio strategy rests on the observation that the economy consistently transitions through four fundamental states: 'prosperity,' 'recession,' 'inflation,' and 'deflation,' as identified by Browne (1999). Each of these economic conditions applies unique pressures on financial markets and asset classes, leading to varying performance outcomes. The strategy's core premise is that by holding a balanced allocation of assets—each designed to excel under a specific economic state—the portfolio provides a natural hedge against adverse price movements in any single asset. For instance, equities perform robustly during periods of prosperity, while bonds offer stability and protection in times of deflation. Similarly, gold acts as a safeguard against inflation, and cash provides liquidity and security during recessions. (Browne,1999)

Table 3

Asset allocation of the chosen economically resilient investment portfolios

Portfolio	Stocks	Bonds	Gold	Cash	Other
Permanent	25%	25% Long-term	25%	25%	-
All-Weather	30%	55% (40% Long-term, 15% Intermediate)	7.5%	-	7.5% Diversified Commodities
Golden Butterfly	40% (20% Large cap, 20% Small cap Value)	40% (20% Long-term, 20% Short-term)	20%	-	-

Source: Compiled by author based on Browne (1999), ("The Theory behind the Golden Butterfly…", 2016) and Dalio (2011).

Browne's portfolio, however, has its limitations. Its primary weakness lies in the equal allocation strategy, which may underperform during equity-driven market expansions due to the lower yields of bonds, gold, and cash. While Anderson et al. (2014) found that the

portfolio outperforms an All-Equity portfolio on a risk-adjusted basis, it falls short in terms of raw returns due to the lower yields of the other asset classes compared to equities.

The concept of economic resilience is further advanced by All-Weather strategy, which has also been featured in academic research (Louraoui, 2024; Leow, Nguyen, and Chua, 2021). First suggested by Ray Dalio, the founder of Bridgewater Associates, the All-Weather Portfolio presents itselve as a diversified, risk-balanced investment approach designed to thrive in various economic environments and is superior to a widely used 60/40 portfolio as well as All-Equity investment (Dalio, 2011). While institutional All-Weather approach of Dalio calls for active managing, he did develop an attainable for a common investor, simplified version of it - All-season portfolio. It was popularized in Robbins (2014) book "*Money master the game: 7 simple steps to financial freedom"* and since is synonymized to an All-Weather portfolio (Braun, 2023). Hereafter, for the simplicity, the author uses the terms All-Weather and All-Season interchangeably as they are in the media, with both meaning the latter, accessible and simplified adaptation.

While Browne and Dalio both aim to design portfolios that can withstand various economic conditions, they take fundamentally different approaches to asset allocation. The Permanent Portfolio employs an equal capital allocation model, distributing investments evenly across asset classes such as stocks, bonds, gold, and cash. In contrast, the All-Weather Portfolio adopts a risk parity framework, aiming for equal risk contributions from each asset class rather than equal capital distribution. Dalio (as cited in Robbins, 2014) notes that equities exhibit approximately three times the volatility of bonds. Consequently, a portfolio with a 50-50 capital split between equities and bonds may inadvertently expose the investor to a risk distribution skewed heavily towards equities, potentially as much as 95% equity risk and 5% bond risk. (Robbins, 2014)

To achieve a more balanced risk exposure, Dalio's All-Weather strategy diversifies across five asset classes, see table 3 (Bridgewater Associates, 2012):

- Stocks: To capture growth during economic expansions.
- Long-Term Bonds: To provide stability during deflationary periods.
- Intermediate-Term Bonds: To offer a buffer against interest rate fluctuations.
- Gold: To hedge against inflation and currency devaluation.
- Commodities: To protect against unexpected inflation.

While the All-Weather Portfolio performs well across various economic conditions, it has notable trade-offs. Similarly to Browne's Permanent Portfolio, because of its lower allocation to equities, the overall portfolio performance might lag behind an All-Equity

portfolio in the expansion phase of economy. This means that while the portfolio is great for risk-averse investors, investors with higher risk tolerance seeking high total returns might turn to other portfolio strategies. The other large criticisms is that its heavy allocation in bonds can be problematic in low-interest-rate environments, potentially leading to diminished returns. (Flood, 2024)

Since the creation of Browne's Permanent Portfolio, investors have tried to adjust, append, and reconstruct it to achieve superior risk-adjusted returns while keeping the cornerstone idea of resilience in the face of changing economic cycles intact (Williamson, 2024). Some practitioners refer to them as Modified Permanent Portfolios (MPP) and share their approaches on specialised online forums. Those that gain significant traction and become widely known in the community often receive personalized names, such as the Golden Butterfly portfolio (GBPF). Some of these portfolios have also been examined in academic research. For instance, Keller (2020) used a modified Golden Butterfly portfolio to explore the concept of Resilient Asset Allocation. The study concludes that the constructed portfolio significantly outperforms the benchmark – the 60/40 portfolio – both in annual returns and maximum monthly drawdowns.

While exploring lesser-known Modified Permanent Portfolios could yield valuable insights but lies beyond this paper's scope, representing a potential avenue for future research. Due to the media attention gathered by the Golden Butterfly portfolio, its presence in academic research and structural differences to the Dalio's and Browne's portfolios, it has been selected for comparison in this study.

The Golden Butterfly is a modern investment portfolio introduced by the founder of the Portfolio Charts website. This portfolio builds on the foundation of Harry Browne's Permanent Portfolio by incorporating an additional asset class, U.S. small-cap value stocks, while retaining the original four asset classes of stocks, bonds, gold, and cash - see table 3 ("The Theory behind the Golden Butterfly…"2016). Small-cap value stocks, as defined by Scott (2022), represent a specific subset of equities characterized by two critical traits:

- Market capitalization between a quarter to two billion USD;
- Traded at a lower price relative to their estimated valuation, based on factors such as their earnings, book value.

The inclusion of U.S. small-cap value stocks serves a strategic purpose. By increasing the portfolio's exposure to the 'prosperity' phase of the economic cycle, it aims to capture more growth during periods of economic expansion and rising markets ("The Theory behind

the Golden Butterfly…", 2016). This adjustment introduces a deliberate tilt towards equities with historically strong performance over the long term. Based on the backtesting by Williamson (2020), the portfolio managed to outperform the classic Permanent Portfolio by having a higher risk-adjusted return ratio and CAGR (Compound Annual Growth Rate). A notable weakness of the portfolio stems from the same source—while small-cap stocks have historically delivered stronger performance compared to large-cap stocks, they are also associated with higher volatility and significant underperformance during severe market downturns (Williamson, 2020; Katiyar & Lodh, 2023).

Despite their differences, the presented ERIPs share foundational similarities: they implement comparable asset classes, are accessible to retail investors, and rely on passive management principles. This reliance on passive strategies shifts the focus from individual asset selection to the construction and managing of the portfolio itself. Moreover, at the core of these strategies lies asset allocation - a key determinant of both portfolio resilience and performance. Exploring how allocation choices impacts portfolio performance provides further insights into why these portfolios succeed across economic cycles.

Brinson, Hood, and Beebower (1986) argue that while investment strategy (e.g., security selection, market timing) is important, investment policy (e.g., choice of asset classes and their allocation) predominantly influences almost all variation in performance. Their study of 91 large U.S. pension plans revealed that investment policy accounted for 93.6% of the variation in overall plan returns. Similarly, Ibbotson and Kaplan (2000) found that asset allocation explained 40% of the variation in returns among funds and 90% of the variability in a typical fund's performance over time. Vardharaj and Fabozzi (2007) supported this perspective, reporting that 33% to 75% of the variance in fund returns across funds could be attributed to differences in asset allocation policy. In contrast, Hensel, Ezra, and Ilkiw (1991) argued that most of the variation in a typical fund's returns stems not from investment strategy or policy, but rather from market movements. Building on these foundational studies, Ibbotson (2009) sought to clarify the impact of asset allocation on performance by synthesizing the findings of Brinson, Hood, and Beebower (1986), Ibbotson and Kaplan (2000), and Hensel, Ezra, and Ilkiw (1991). Ibbotson (2009) posited that a fund's total return can be decomposed into three distinct components:

1. The return derived from overall stock market movements.
2. The incremental return attributed to the fund's asset allocation policy.
3. The additional active return (alpha) generated through timing, selection, and fees.

Ibbotson (2009) concluded that while asset allocation policy is critically important, the relative importance of investment policy versus investment strategy depends on the fund's approach. For example, in the case of a market-neutral hedge fund that eliminates beta risk (systematic risk relative to the broader market), performance is primarily driven by active management. Conversely, for a passively managed fund adhering to a long-only index strategy, asset allocation is the predominant determinant of performance.

Brocato and Steed (1998) added another dimension to this discourse by emphasizing the importance of cyclical asset rebalancing to adapt to changes in asset return correlations that occur over the business cycle. They argued that while a buy-and-hold strategy is feasible, it undermines the principles of Markowitz's Modern Portfolio Theory and compromises the premise of economic resilience, resulting in a suboptimal risk-return ratio. Their conclusions are supported by Dichtl et al. (2012), who examined the effects of various rebalancing strategies on portfolio performance under realistic market conditions. Dichtl et al. (2012) observed that while the application of any rebalancing strategy enhances risk-adjusted returns, the specific choice of rebalancing method has only a minor economic impact.

The analysis of economically resilient investment portfolios (ERIPs) highlights the importance of diversification and strategic allocation in driving performance. Comparing Browne's Permanent Portfolio, Dalio's All-Weather Portfolio, and the Golden Butterfly Portfolio reveals the unique approaches taken towards their shared objective - achieving resilience across economic cycles.

1.3. Previous research on Economically Resilient Investment Portfolios' performance

Although a few papers study performance and test the core principles of some ERIPs, most take different time frames or use other variables to compare said portfolios, preventing a fair comparison of the approaches. Thus, an overview of relevant studies are vital in determining the methodology for the empirical analysis of this thesis.

Navas et al. (2020) analyzed six portfolio strategies to identify one capable of weathering financial crises while maintaining strong performance during periods of economic growth. To achieve their goal, they have considered two periods: a decade with two market crashes from 2000 to 2010 and a wealthy period of 2011 to 2018. To model the portfolios, they have used different mixes of equity, bonds, commodities, and VIX (volatility index of SP500). They found that portfolios with diverse asset classes - such as equities, bonds, commodities, and VIX(volatility index of SP500) - exhibited greater resilience during market downturns. For example, portfolios with higher allocations to bonds and commodities

performed exceptionally well during the financial crises of the early 2000s and 2008. (Navas et al., 2020)

Simonsen and Hermo (2021) took a similar approach and compared the All-Weather Portfolio to an All-Equity portfolio and a 60/40 equity-bond strategy, while testing the main principles of Ray Dalio's renowned approach. They constructed the portfolio by determining the optimal percentage allocation for various asset classes, focusing on two time periods: 1970–1993 and 1995–2021. Their findings indicate that the AWP delivers a higher risk-adjusted return and reduced downside risk compared to the 60/40 and All-Equity portfolios. However, their analysis challenged the key assumptions underlying the AWP. For instance, they rejected the hypothesis that all asset classes have similar risk-adjusted returns, discovering significant disparities in Sharpe ratios across asset classes. Similarly, the assumption that asset classes perform consistently in their preferred economic states showed mixed results. Regression analyses revealed inconsistent relationships between asset returns and macroeconomic variables such as inflation and GDP growth, questioning the reliability of these correlations as the basis for risk parity. (Simonsen & Hermo, 2021)

A well-regarded study by Anderson et al. (2014), however, utilised a 39-year time period, from 1972 to 2011, for their research on the Permanent Portfolio. Their research focused on evaluating the Permanent Portfolio's performance in both US and international markets, similar to the approach of Navas et al. (2020). Anderson et al. (2014) have compared the traditional Permanent Portfolio to an All-Equity, 30-70 and 70-30 equity-bond approaches. Their findings revealed that while the Permanent Portfolio underperformed stock-only or stock-and-bond portfolios in raw returns, it consistently delivered superior risk-adjusted performance, as indicated by higher Sharpe ratios and Jensen alphas. The authors further argued that the Permanent Portfolio's ability to reduce volatility and deliver consistent long-term returns makes it particularly appealing to risk-averse investors. Despite its strengths, however, they point out that the asset allocation of the portfolio hinders its potential returns, as the equal weighting of assets ensures that its performance matches the average returns of its components. (Anderson et al., 2014)

Li, Wong, and Leung (2019) extend the foundational work on Harry Browne's Permanent Portfolio (PP) by examining its application in long-term investment and retirement schemes. The study focuses on enhancing the original PP by replacing its cash component with Real Estate Investment Trusts (REITs) and varying the weight of the REIT component to optimise performance. Analyzing data from 1996 to 2016, their research showed that the Enhanced Permanent Portfolio (EPP) significantly outperformed the original

PP in terms of cumulative returns and compound annual growth rates. (Li, Wong, and Leung, 2019)

A notable recent study by Leow, Nguyen, and Chua (2021) involved creating new portfolio models - Sentimental All-Weather (SAW) and Sentimental MPT (SMPT), that combined classical financial theories such as Markowitz's (1952) MPT and Constant Rebalancing with social media sentiments. These models were optimized using a Genetic Algorithm to maximize cumulative returns and minimize volatility. The performance of the models was evaluated using the Sharpe ratio, cumulative returns, and value-at-risk. These measures were compared against benchmarks such as the buy-and-hold SPY index, MPT model, and Constant Rebalancing model for an All-Weather Portfolio. Their findings indicated that the proposed models outperformed both the All-Weather Portfolio and SP500 benchmarks in both cumulative and risk-adjusted measures returns. (Leow, Nguyen, and Chua, 2021)

Estonian scholars have shown academic interest in ERIPs as well. For instance, bachelor theses by Kundla (2013) and Mähhar (2015) both focused on balancing methods for Permanent Portfolio. They have opted for a 20 year time period for their analysis, from 1992 to 2012, and 1995 to 2015 respectively. Kundla (2013) compared the classic Permanent Portfolio, modified Permanent Portfolio and All-Equity approach performance in the context of US and German markets, modelled in different balancing methods. Similarly, Mähhar (2015) analyzed two balancing methods: dynamic rebalancing, which adjusts asset ratios based on historical trends to capitalize on market momentum, and the classic Permanent Portfolio approach, which maintains constant asset ratios. The findings of both theses align with those of Anderson et al. (2014) in demonstrating the Permanent Portfolio's ability to deliver superior risk-adjusted returns compared to more traditional stock-heavy portfolios.

As shown in Table 5, the most frequently used metrics for performance evaluation across the reviewed studies include the Sharpe ratio, cumulative returns, CAGR, standard deviation and various drawdown measures. This thesis adopts these metrics to provide a comprehensive evaluation of risk-adjusted performance, absolute returns, and portfolio volatility.

Table 5
Comparison of relevant studies time frames and metrics of portfolio comparison

Source	Market(s) studied	Time frame(s) used	Metrics used
Navas et al. (2020)	The United States, European markets	2000 to 2010 and 2011 to 2018	Sharpe ratio; excess return (comparing to the SP500); average annual returns; median annually returns; minimum annually returns; maximum annually returns; count of positive years; count of negative years
Simonsen & Hermo (2021)	The United States	1970 to 1993 and 1995 to 2021	Rolling return for holding periods of 1,5,10 and 20 years; average annual returns; standard deviation; VaR (value at risk); conditional value at risk; drawdown measures (average drawdown, maximum drawdown, etc.); excess return (comparing to the SP500); Sharpe ratio
Anderson et al. (2014)	The G7 countries, Australia, Netherlands, Sweden and Switzerland markets	1972 to 2011	Sharpe ratio; Jensen Alpha; VaR; average returns
Leow, Nguyen, and Chua (2021)	The United States	January to April 2020	Sharpe ratio, cumulative returns, and value-at-risk
Li, Wong, and Leung (2019)	Hong Kong, US bonds	1996 to 2016	Cumulative returns; CAGR; Sharpe ratio; Maximum drawdown

Source: Compiled by the author

A review of prior research highlights the importance of analyzing the performance of economically resilient portfolios, particularly given today's volatile market environment. While the All-Weather Portfolio and Permanent Portfolio has been present in academic discourse, much of the existing research is focused on constructing and testing new portfolio strategies and using the fundamental ERIPs as a starting point. Moreover, it is challenging to compare their performance, as studies have utilized varying time frames, metrics, and market contexts. Furthermore, the Golden Butterfly Portfolio, a modern iteration of the Modified Permanent Portfolio, has yet to be explored in academic research. A comprehensive comparative evaluation of the performance of these economically resilient portfolios is thus lacking, presenting a research gap that this thesis seeks to address in the following analysis.

2. Performance of Economically Resilient Investment Portfolios

2.1. Data and methodology

The following subchapter focuses on the methodology selected and data sources for the analysis. The aim of the empirical part is to analyze and compare the performance and risk characteristics of three Economically Resilient Investment Portfolios (ERIPs)—the Permanent Portfolio, All-Weather Portfolio, and Golden Butterfly Portfolio—over varying investment horizons.

The portfolios were selected for their importance in academic and financial discussions, and the relevance of their design to the principles of economically resilient investment portfolios (ERIPs). Each portfolio represents a unique mix of core asset classes, including equities, bonds, gold, cash, and commodities. The SPDR S&P 500 ETF Trust (SPY) has been selected as the equity benchmark for this analysis due to its comprehensive representation of the broader U.S. stock market, capturing both its returns and volatility. SPY's role as a benchmark is well-established in prior research on ERIPs, including studies by Navas et al. (2020), Simonsen & Hermo (2021), Anderson et al. (2014), and Leow, Nguyen, and Chua (2021). Hereafter, this benchmark is referred to as the "All-Equity benchmark" or the “All-Equity portfolio” in the discussion. To evaluate the portfolios' performance relative to U.S. inflation and determine whether they outperform it, the author introduces an additional benchmark: a portfolio modeled on the U.S. 3-Month Treasury Bill Rate (T-Bills).

The analysis is based on 25 years of monthly returns data, covering the period from January 1999 to January 2024 in the U.S. This time frame was determined by data availability, as some asset classes lacked sufficient historical data before 1999. The choice of the United States as the primary market is also motivated by its market size, maturity, and availability of data. It is also the most commonly chosen market in previous research on ERIPs. The primary data sources include Yahoo Finance, FRED, Investing.com, and the London Bullion Market Association, ensuring a reliable dataset for analysing asset class performance and portfolio returns. Detailed information about the asset classes, the indices and funds used to represent them, and their respective data sources is presented in Table 6.

Table 6

Asset class representation and data sources

Asset Class	Representing fund/index	Source
US Total stock market/ Large-cap stock	SPDR S&P 500 ETF Trust (SPY)	Yahoo Finance

Long-term US government treasuries (10+ years maturity)	Vanguard Long-Term Treasury Fund Investor Shares (VUSTX)	Yahoo Finance
Intermediate-term US government treasuries (5-10 years maturity)	Vanguard Intermediate-Term Treasury Fund Investor Shares (VFITX)	Yahoo Finance
Short-term US government treasuries (1-4 years maturity)	Vanguard Short-Term Treasury Fund Investor Shares (VFISX)	Yahoo Finance
US Small-cap value stocks	Vanguard Small Capitalization Value Index Fund Investor Shares (VISVX)	Yahoo Finance
Gold	LBMA Gold Price PM USD	London Bullion Market Association (LBMA)
Cash (proxy)	US 3-Month Treasury Bill Rate	US Federal Reserve Economic Data (FRED)
Commodities	S&P GSCI Commodity Total Return (SPGSCITR)	investing.com

Source: compiled by the author

To evaluate portfolio performance, a comprehensive range of measures is utilized. These include cumulative return, compound annual growth rate (CAGR), standard deviation, and Sharpe Ratio, alongside rolling period metrics such as average cumulative return, maximum and minimum rolling returns, and the percentage of negative returns periods. Additionally, drawdown metrics — specifically average drawdown and maximum drawdown -are calculated to assess downside risk during periods of market volatility. As illustrated in Table 5, these metrics are consistent with prior research by Anderson et al. (2014), Li, Wong, and Leung (2019), Navas et al. (2020), Simonsen and Hermo (2021), and Leow, Nguyen, and Chua (2021) to ensure a thorough analysis of the portfolios' performance across varying investment horizons. To facilitate transparency and replicability of results, the author has included the formulas for respective key measures in Appendix A. By adopting metrics established in previous academic studies, this analysis aims to align with recognized methodologies while offering new insights into the evaluation of ERIPs.

While the comparison of historical measures for the portfolios over the entire time frame is crucial, the author acknowledges that the performance and risk are highly dependent on the timing of the investment's start and end dates. To address this potential limitation and provide a more comprehensive comparison, the analysis incorporates 1-, 5-, 10-, and 15-year rolling periods. For example, to calculate returns for a 1-year rolling period, the author computes and average the returns for every possible 1-year interval with a shifting starting

point—such as from 01.01.1999 to 01.01.2000, 01.02.1999 to 01.02.2000, and further, until 01.01.2023 to 01.01.2024.

Hence, the analysis consists of the following:

1. Calculation of performance measures for the entire period and visualization of the theoretical portfolio values based on a set starting balance, for both monthly and annually rebalanced portfolios.
2. Computation of performance measures for rolling holding periods of 1-,5-,10- and 15-years for both monthly and annually rebalanced portfolios.
3. Calculation of drawdown measures for the portfolios for the entire period.

Rebalancing plays a crucial role in maintaining the intended asset allocation of a portfolio, as noted by Brocato and Steed (1998). Hence, the author examines both monthly and annual rebalancing strategies to explore their effects on ERIPs performance and risk measures. Monthly rebalancing, while more frequent, is expected to limit deviations from target allocations, potentially reducing risk and stabilizing returns. However, it may also slightly reduce returns during prolonged market uptrends due to the selling of outperforming assets. Annual rebalancing, in contrast, allows greater shift from target allocations, which may increase returns in bullish markets but also amplify risk during downturns. To ensure comparability, both rebalancing strategies are analyzed using identical performance and risk metrics, providing valuable insights into the trade-offs between rebalancing frequency and portfolio outcomes.

Microsoft Excel is used as the primary tool for data processing, calculations, and visualizations for this analysis. Its flexibility and extensive range of functions make it well-suited for compiling datasets, calculating performance metrics, and generating graphs to support the analysis. While other programming tools, such as Python or R, have been employed in similar studies, Excel provides sufficient functionality for the objectives of this research while remaining accessible and reliable. To facilitate the calculation of monthly returns of portfolios, an online tool is employed – Portfolio Visualizer.

During the chosen time frame, the portfolios experienced several significant market downturns, including the early 2000s recession driven by the Dot-com bubble collapse and the September 11 attacks, the Great Recession of 2007–2009, the 2022 Market decline (driven by the Russian invasion of Ukraine) and the brief recession caused by the COVID-19 pandemic in early 2020. At the same time, this period also captured the longest bull market in US history—the post-2008 financial crisis recovery, spanning from 2009 to 2020 (Butler & Pennarts, 2023). By examining portfolio performance through the lens of historical and

rolling returns, this time frame offers a detailed representation of the financial challenges and growth opportunities that have defined the 21st century.

The author expects that this methodology offers a thorough and well-organized assessment of the ERIPs performance. By utilizing a wide range of performance metrics and building on the groundwork laid by previous empirical studies, the approach aims to deliver a comprehensive evaluation, while contributing valuable insights to the relatively underexplored field of ERIPs.

2.2. Results of the analysis

Figure 1 presents the historical return graph, which visualizes the cumulative return for each portfolio under both annual and monthly rebalancing strategies. The values on the left axis represent the theoretical value of the portfolio at each point in time, with the starting balance of 10,000 USD.

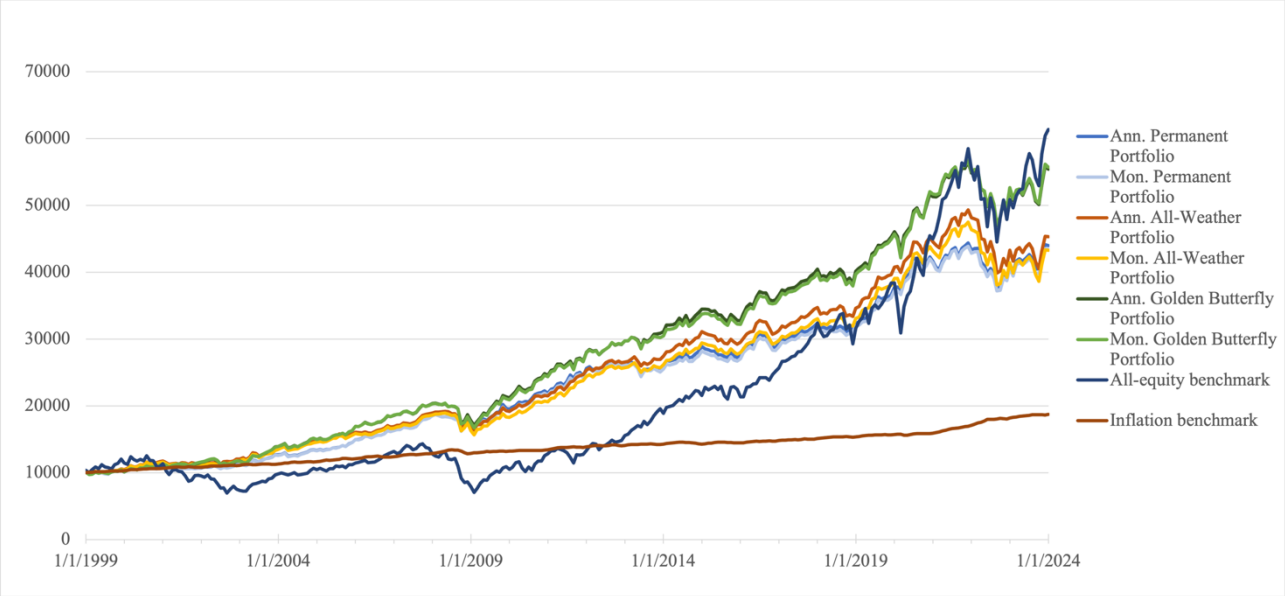


Figure 1. Historical return for monthly and annually rebalanced portfolios and benchmarks from 01.01.1999 to 01.01.2024 (USD)

Source: Compiled by the author

The highest cumulative return of 514% was achieved by the benchmark All-Equity benchmark, while among the ERIPs, the Golden Butterfly Portfolio achieved the highest return of 457% under monthly rebalancing. The All-Weather and Permanent portfolios, both under monthly and annual rebalancing have shown similar, comparatively lower cumulative returns for the period. Over the entire period, the inflation benchmark delivered an 87% cumulative return, highlighting that all the studied portfolios outperformed inflation. Table 7 further highlights the historical measures for both monthly and annually rebalancing

strategies. Note that the All-equity and inflation benchmarks do not benefit from rebalancing, as they are only comprised of one asset class.

Table 7
Historical measures for the portfolios – both for monthly and annual rebalancing

Monthly rebalancing	Permanent portfolio	All-Weather portfolio	Golden butterfly portfolio	All-equity benchmark	Inflation benchmark
Cumulative return	334%	333%	457%	514%	87%
CAGR	6.03%	6.02%	7.09%	7.5%	2.53%
Annualized standard deviation	6.63%	7.24%	7.88%	15.29%	1.32%
Sharpe Ratio	0.64	0.59	0.68	0.43	0.5
Annual rebalancing					
Cumulative return	340%	353%	454%	514%	87%
CAGR	6.08%	6.21%	7.06%	7.5%	2.53%
Annualized Standard deviation	6.6%	7.17%	7.72%	15.29%	1.32%
Sharpe Ratio	0.65	0.59	0.76	0.43	0.5

Source: Compiled by the author

As seen in table 7, the standard deviation uncovers that the All-Equity benchmark, while highly profitable, it has been the riskiest investment for the period – 15.29%. The riskiest ERIP is also the most profitable ERIP from the selection – the Golden Butterfly Portfolio. The portfolio with the least standard deviation has been the Permanent Portfolio – averaging 6.6% between both rebalancing approaches. Expectedly, Inflation benchmark has been the steadiest in the comparison, seeing only 1.32% annualized volatility and 2.53% CAGR.

Furthermore, while the ERIPs cannot match neither the Cumulative return nor CAGR of the All-Equity benchmark, they clearly outperform it in terms of risk-adjusted returns, as pointed out by the Sharpe ratios. The Golden Butterfly Portfolio has demonstrated the highest Sharpe Ratio for both rebalancing strategies – 0.68 when monthly rebalancing is assumed and 0.76 when annual rebalancing is assumed. This also marks the highest difference in Sharpe Ratios between the two rebalancing approaches with the other portfolios showcasing matching risk-adjusted returns. Notably, all ERIPs and the All-Equity benchmark outperformed inflation in the time period.

The analysis is then continued with a rolling return breakdown. Table 8 displays 1-,5-,10- and 15-year rolling return statistics for the portfolios, assuming monthly rebalancing.

Table 8

Rolling period metrics for chosen ERIPs and All-Equity benchmark – monthly rebalanced

Rolling period	Metrics	PP	AWP	GBPF	SPY	Inflation
1-year	Average cumulative/annualized return	6.21%	6.26%	7.34%	8.59%	2.55%
	Maximum cumulative return	20.41%	19.09%	27.84%	56.25%	9.05%
	Minimum cumulative return	-13.62%	-18.34%	-17.93%	-43.44%	-2.11%
	Percentage of negative returns periods	15.95%	15.95%	13.29%	23.26%	4.65%
5-year	Average annualized return	6.71%	6.68%	7.72%	8.20%	2.27%
	Average cumulative return	38.81%	39.60%	45.56%	54.12%	11.95%
	Maximum cumulative return	67.85%	71.19%	88.35%	179.90%	22.04%
	Minimum cumulative return	13.73%	14.13%	18.72%	-29.21%	6.04%
	Percentage of negative returns periods	0.00%	0.00%	0.00%	16.12%	0%
10-year	Average annualized return	6.64%	6.58%	7.64%	8.12%	2.12%
	Average cumulative return	91.32%	90.05%	109.70%	139.55%	23.48%
	Maximum cumulative return	147.86%	130.57%	164.25%	362.46%	31.12%
	Minimum cumulative return	40.11%	46.94%	59.75%	-29.63%	14.23%
	Percentage of negative returns periods	0.00%	0.00%	0.00%	12.64%	0.00%
15-year	Average annualized return	6.64%	6.59%	7.65%	8.08%	2.12%
	Average cumulative return	162.94%	161.26%	202.94%	237.41%	37.10%
	Maximum cumulative return	202.87%	190.30%	240.32%	676.57%	45.14%
	Minimum cumulative return	107.84%	108.99%	139.19%	71.75%	30.27%
	Percentage of negative returns periods	0.00%	0.00%	0.00%	0.00%	0.00%

Source: Compiled by the author

Over the 1-year rolling period, the All-Equity Benchmark showed the highest average cumulative/annualized return at 8.59%, followed by the Golden Butterfly Portfolio at 7.34%. The Permanent Portfolio and All-Weather Portfolio perform similarly, with average returns of 6.21% and 6.26%, respectively. However, the All-Equity Benchmark also has the largest downside risk, with a minimum return of -43.44% and the highest percentage of negative returns (23.26%). In contrast, the Golden Butterfly Portfolio has the lowest percentage of negative return periods at 13.29%.

For the 5-year rolling period, the All-Equity Benchmark continued to lead in performance with an average cumulative return of 54.12%, followed by the Golden Butterfly Portfolio at 45.48%. The Permanent and All-Weather Portfolios again show similar cumulative returns of 38.81% and 38.57%, respectively. Importantly, none of the ERIPs experience negative returns over this time frame, while the stock market benchmark still shows 16.12% negative return periods.

Over the 10- and 15-year rolling periods, the trade-offs between the portfolios become clear. The All-Equity benchmark achieved the highest average cumulative returns - 139.55% for the 10-year period and 237.41% for the 15-year period - but it also continued to show greater variability in performance. The Golden Butterfly Portfolio performs best among the ERIPs, with 109.7% and 202.94% average cumulative returns for the 10- and 15-year periods, respectively. All portfolios, except the All-Equity Benchmark, experience 0% negative return periods over these longer investment horizons, highlighting their stability over time. Moreover, the All-Equity Benchmark has a minimum return of 71.75% over the 15-year period, much lower than the diversified portfolios, which maintain minimum cumulative returns above 107%.

Comparing the annualized returns offers a complete perspective: the All-Equity benchmark consistently outperforms the chosen ERIPs (PP, AWP, and GBPF) across all rolling periods. Out of the ERIPs, however, GBPF is the one with a marginally higher annualized return. Meanwhile, the inflation benchmark significantly lags, with annualized returns as low as 2.12% for longer horizons, emphasizing that all the analyzed ERIPs and All-Equity portfolio effectively outperformed inflation over the studied periods.

To complement and draw comparisons, the author compiled a rolling return table for annually rebalanced portfolios. Table 9 shows the rolling returns for the portfolios, assuming annual rebalancing. It highlights that the long-term performance of the portfolios remains largely consistent with their monthly rebalanced counterparts. Average cumulative and annualized returns across all rolling periods (1-, 5-, 10-, and 15-year) are nearly identical for

both rebalancing strategies. The largest differences between the approaches are seen for the All-Weather Portfolio, which performs moderately better under annual rebalancing.

Table 9

Rolling period metrics for chosen ERIPs and All-Equity benchmark – annually rebalanced

Rolling period	Metrics	PP	AWP	GBPF	SPY	Inflation
1-year	Average cumulative/annualized return	6.26%	6.40%	7.30%	8.59%	2.55%
	Maximum cumulative return	20.49%	18.75%	26.77%	56.25%	9.05%
	Minimum cumulative return	-13.14%	-17.58%	-16.37%	-43.44%	-2.11%
	Percentage of negative returns periods	15.95%	14.95%	12.96%	23.26%	4.65%
5-year	Average annualized return	6.77%	6.85%	7.73%	8.2%	2.27%
	Average cumulative return	39.19%	39.60%	45.56%	54.12%	11.95%
	Maximum cumulative return	67.65%	71.41%	88.01%	179.90%	22.04%
	Minimum cumulative return	14.58%	17.12%	21.07%	-29.21%	6.04%
	Percentage of negative returns periods	0.00%	0.00%	0.00%	16.12%	0%
10-year	Average annualized return	6.74%	6.81%	7.70%	8.12%	2.12%
	Average cumulative return	93.14%	94.1%	110.98%	139.55%	23.48%
	Maximum cumulative return	146.89%	134.15%	164.43%	362.46%	31.12%
	Minimum cumulative return	41.38%	48.73%	59.52%	-29.63%	14.23%
	Percentage of negative returns periods	0.00%	0.00%	0.00%	12.64%	0.00%
15-year	Average annualized return	6.74%	6.82%	7.71%	8.08%	2.12%
	Average cumulative return	166.66%	169.83%	205.77%	237.41%	37.10%
	Maximum cumulative return	206.39%	198.22%	245.21%	676.57%	45.14%
	Minimum cumulative return	110.71%	116.22%	139.14%	71.75%	30.27%
	Percentage of negative return periods	0.00%	0.00%	0.00%	0.00%	0.00%

Source: Compiled by the author

To further research the resiliency of the portfolios, portfolio drawdown measures are analysed. Table 10 completes the picture with drawdown measures comparison. Appendix B and Appendix C plot the drawdowns for the portfolios on a graph for a visual representation, both for monthly and annual rebalancing.

As presented in the table 10, average drawdowns are nearly identical, with annually rebalanced portfolios showing slightly smaller values in most cases. Maximum drawdowns also show improvements with annual rebalancing, particularly for the Golden Butterfly Portfolio (-18.1% compared to -16.81%) and the All-Weather Portfolio (-19.8% compared to -19.27%). The All-Equity portfolio experiences the largest drawdowns under both rebalancing approaches (-50.8%), reflecting its higher risk profile. Overall, the frequency of rebalancing has minimal impact on portfolio drawdown performance.

Table 10

Drawdown measures of the portfolios

Metrics	PP	AWP	GBPF	SPY
Monthly rebalancing				
Average drawdown	*-1.96%*	*-2.43%*	*-1.97%*	*-10.54%*
Maximum drawdown	*-15.23%*	*-19.8%*	*-18.1%*	*-50.8%*
Annual rebalancing				
Average drawdown	-1.90%	-2.26%	-1.94%	-10.54%
Maximum drawdown	*-14.82%*	*-19.27%*	*-16.81%*	*-50.8%*

Source: Compiled by the author

2.3.Discussion of results

The findings of the analysis support previous scholars' findings. Researchers such as Anderson et al. (2014), Li, Wong, and Leung (2019), Navas et al. (2020), Simonsen and Hermo (2021), and Leow, Nguyen, and Chua (2021) have concluded that while various ERIPs provide superior risk-adjusted returns, due to their diversified nature, they cannot match the long-term returns of stock-heavy portfolios.

For the entire period and the rolling holding periods, the ERIPs showed higher risk-adjusted returns, as highlighted by their Sharpe Ratios for the full period and the spread between maximum and minimum for rolling returns. The absolute returns, however, were lower compared to the All-Equity benchmark in both analyses. The findings have also

showcased that the Portfolios have effectively outperformed inflation in all of the studied investment periods.

The Golden Butterfly Portfolio emerged as the top-performing ERIP over the entire analyzed period, achieving cumulative returns of 457% (7.09% annualized) with monthly rebalancing and 454% (7.06% annualized) with annual rebalancing. Its performance was second only to the All-Equity benchmark, which delivered a 514% cumulative return (7.5% annualized) but with much higher volatility. Under both rebalancing strategies, it consistently achieved the highest returns and Sharpe Ratios, with a notable improvement when annual rebalancing was assumed, improving its Sharpe Ratio by 8 basis points. The GBPF's success can be attributed to its inclusion of low-cap value stocks, which captured upside during the record-long bull market (2009–2020), while its diversification into long- and short-term bonds and gold mitigated losses during downturns. This reflects findings by Navas et al. (2020), who emphasized the effectiveness of diversified portfolios during financial crises.

Consistent with the findings of Anderson et al. (2014), the Permanent Portfolio showed superior risk-adjusted returns compared to the All-Equity benchmark but underperformed in raw returns due to its equal asset allocation approach. Our findings support this, with the PP achieving the lowest annualized standard deviation (6.6% average across both rebalancing strategies) and the smallest maximum drawdowns (-15.23% under monthly rebalancing, -14.82% under annual rebalancing), making it the least risky portfolio among those studied for the entire period. Furthermore, with a Sharpe Ratio of 0.64 for the full period, the Permanent Portfolio outperformed the All-Weather Portfolio on a risk-adjusted basis in both monthly and annually rebalanced scenarios.

The All-Weather Portfolio showed balanced results over the entire period. It achieved moderate returns and risk metrics compared to the other ERIPs analyzed. While it did not match the superior risk-adjusted performance of the other two ERIPs, its annualized standard deviation remained relatively low (7.2% average across both rebalancing strategies). Similarly to the Permanent Portfolio, its return was substantially lower than for the more equity-heavy Golden Butterfly Portfolio. These findings align with Simonsen and Hermo (2021) and Leow, Nguyen, and Chua (2021), who highlighted the All-Weather Portfolio's risk-adjusted performance but noted that its returns tend to lag behind equity-heavy strategies.

The rolling return analysis further emphasizes the stability and risk mitigation characteristics of the ERIPs over different holding periods. The All-Equity benchmark leads in average returns across 1-, 5-, 10-, and 15-year horizons but experiences substantial

variability, with negative returns in 23.26% of 1-year periods and 16.12% of 5-year periods. In contrast, the ERIPs exhibit 0% negative returns in 5-, 10-, and 15-year rolling periods, showcasing their resilience and reliability over the time frames. They also experience significantly lower percentages of negative returns periods in 1-year periods while providing only 2-3% lower yearly returns on average. The Golden Butterfly Portfolio particularly stands out for its ability to achieve the highest average returns among the ERIPs while maintaining consistent positive performance over all rolling horizons. Another notable insight is that the difference between the ERIPs' and All-Equity benchmark's returns shrinks as the time interval increases. The benchmark's annualized returns decrease as the investment horizon increases, and the annualized return of the ERIPs remains mostly unchanged. In terms of absolute returns, however, the All-Equity benchmark remains the preferred choice. Paired with the significant decrease in percentage of negative returns periods, from 23.26% for 1-year intervals to 16.12% for 5-year and 0% for 15-year investment periods – as the investment horizon grows, one might place more consideration on riskier, equity-heavy portfolios.

Another critical takeaway from both the entire-period and rolling-period analyses is the minimal impact of rebalancing frequency on ERIP performance, albeit, excluding transaction costs and other external factors. The finding, however, is supported by Dichtl et al. (2012), who concluded that rebalancing frequency has limited long-term economic significance for diversified portfolios and have included realistic transaction costs in their analysis. However, annual rebalancing slightly improves return and drawdown metrics, particularly for the All-Weather Portfolio. This suggests that less frequent rebalancing may better accommodate market momentum during periods of sustained growth while still offering downside protection.

The drawdown analysis underscores the conservative nature of the ERIPs, with maximum drawdowns significantly lower than those of the All-Equity benchmark. The Golden Butterfly Portfolio, once again, strikes a balance between higher returns and lower drawdowns, reinforcing its position as the most balanced ERIP in the analysis. The Permanent Portfolio, while demonstrating the lowest standard deviation and drawdowns, sacrifices return potential, making it suitable for extremely risk-averse investors.

The results affirm the effectiveness of ERIPs in providing stable, risk-adjusted returns across various investment horizons, in line with previous research. The results of this analysis provide valuable insights for investors and researchers. Risk-averse investors might find value in ERIPs like the Permanent and All-Weather Portfolios, which offer consistent returns

with minimal downside risk. These portfolios are particularly well-suited for short- to medium-term horizons, where stability and preservation of capital are prioritized. On the other hand, the Golden Butterfly Portfolio stands out as a balanced option, delivering competitive returns with relatively low volatility, making it appealing to investors seeking moderate growth with controlled risk. For risk-tolerant, long-term investors, the All-Equity portfolio remains the most attractive choice, offering the highest cumulative and annualized returns. However, its significant volatility and susceptibility to drawdowns highlight the importance of aligning investment strategies with individual risk tolerance. As investment horizons grow, the benefits of equity-heavy portfolios become more pronounced, but ERIPs remain compelling options for those seeking diversification and stability.

Conclusion

This thesis set out to analyze and compare the performance of Economically Resilient Investment Portfolios across varying investment horizons, addressing gaps in existing literature. By integrating rolling period analysis with rebalancing strategy comparisons, it offers unique insights into the behavior and performance of ERIPs during diverse economic conditions, offering actionable insights for both investors and researchers.

The theoretical foundations of ERIPs, rooted in Modern Portfolio Theory and enriched by financial theorists such as Harry Browne and Ray Dalio, emphasize the importance of diversification and resilience. ERIPs leverage the distinct behaviors of asset classes during economic cycles to mitigate risk, with equities thriving during expansions and bonds and gold offering stability during contractions. Previous research, including Anderson et al. (2014) and Simonsen and Hermo (2021), highlighted their consistent ability to deliver superior risk-adjusted returns compared to equity-heavy portfolios, albeit with lower absolute returns. This study builds on this foundation, focusing on the Permanent Portfolio, All-Weather Portfolio, and Golden Butterfly Portfolio to assess their performance across multiple metrics and investment horizons.

The empirical findings confirmed and extended many observations from prior studies. The Golden Butterfly Portfolio emerged as the most balanced ERIP, delivering highest returns out of the studied ERIPs, with significantly lower volatility than the All-Equity benchmark. This aligns with Navas et al. (2020), who emphasized the role of diversified portfolios in weathering financial crises. The GBPF's inclusion of small-cap value stocks enabled it to capture upside during equity-driven growth periods, particularly the record-long bull market from 2009 to 2020, while its diversification into bonds and gold mitigated losses during downturns. The portfolio's higher Sharpe Ratio across both rebalancing strategies

underscores its effectiveness in balancing risk and return. Furthermore, the GBPF's performance demonstrates the potential for further research into modified ERIPs that incorporate alternative asset allocations.

The Permanent Portfolio displayed the lowest risk profile, consistent with its equal allocation to assets designed to perform well in distinct economic conditions. This was evidenced by its minimal drawdowns and the lowest standard deviation (6.6% on average) among the portfolios, confirming findings by Anderson et al. (2014). However, its conservative asset allocation limited its absolute returns, making it a suitable choice for extremely risk-averse investors seeking stability. On a risk-adjusted basis, the Permanent Portfolio outperformed the All-Weather Portfolio, achieving a higher Sharpe Ratio (0.64) under both rebalancing strategies.

The All-Weather Portfolio (AWP) achieved balanced results, showing moderate returns and risk metrics. While it lagged behind the GBPF and All-Equity benchmark in cumulative and annualized returns, it provided superior risk-adjusted returns compared to the All-Equity benchmark, in line with findings by Simonsen and Hermo (2021) and Leow, Nguyen, and Chua (2021). Its emphasis on bonds offered stability during market downturns but limited its upside during equity-driven growth periods. The AWP's performance illustrates its suitability for conservative investors prioritizing stability over maximizing returns.

Notably, rebalancing frequency had minimal impact on ERIP performance, echoing conclusions by Dichtl et al. (2012). Annual rebalancing slightly improved cumulative returns and drawdowns, particularly for the AWP, but overall risk and return differences were negligible. This suggests that ERIPs are adaptable to different investor preferences and constraints, offering flexibility without compromising performance.

The rolling return analysis further underscored the resilience of ERIPs across various investment horizons. While the All-Equity benchmark delivered the highest cumulative returns, its significant variability and high percentage of negative returns periods highlight its unsuitability for risk-averse or medium-term investors. In contrast, ERIPs demonstrated consistent positive returns across 5-, 10-, and 15-year horizons, showcasing their stability and appeal for conservative and medium-term investors. The GBPF particularly excelled among the ERIPs, achieving the highest average returns across all rolling horizons while maintaining consistent positive performance. The findings also revealed that as the investment horizon grows, the relative advantages of equity-heavy portfolios become more pronounced, making them more appealing for long-term investors.

The inflation benchmark's performance underscores the consistent ability of ERIPs to exceed inflation across all investment horizons. This finding is particularly important for risk-averse investors searching for an investment portfolio to protect their savings against the inflation.

The drawdown analysis reinforced the conservative nature of ERIPs. Both the PP and AWP exhibited significantly lower drawdowns compared to the All-Equity benchmark, demonstrating their effectiveness in preserving capital during market downturns. The GBPF balanced higher returns with moderate drawdowns, making it an appealing option for investors seeking a middle ground between risk and reward. These findings align with prior studies emphasizing the stability and risk-adjusted returns of ERIPs, even in volatile market conditions.

This study is not without limitations. Factors such as transaction costs and taxes were excluded, which could influence real-world investment outcomes. Additionally, operational costs associated with higher-frequency rebalancing were not modeled. Future research could address these gaps by incorporating cost adjustments and exploring alternative asset allocations or inflation-protected securities. Examining ERIP performance across different global markets would also provide valuable comparative insights.

In conclusion, this thesis contributes to the academic discourse on ERIPs by systematically evaluating their performance under varying investment horizons and rebalancing strategies. Results confirm ERIPs' ability to deliver stable, risk-adjusted returns, while highlighting trade-offs in absolute performance compared to equity-heavy portfolios. For risk-averse and medium-term investors, the Permanent and All-Weather Portfolios offer stability and resilience, while the Golden Butterfly Portfolio balances growth and risk effectively. Long-term, risk-tolerant investors may still prefer equity-heavy portfolios for superior cumulative returns, but ERIPs remain compelling options for those seeking diversification and stability. The findings provide valuable insights for both investors and researchers, paving the way for further exploration and refinement of economically resilient investment strategies.

List of references

1. Anderson, H., Marshall, B., & Miao, J. (2014). The Permanent Portfolio. *Applied Financial Economics*, *24*(16), 1083–1089. doi:10.1080/09603107.2014.924290
2. Baldridge, R. (2023). Understanding modern portfolio theory. Retrieved from https://www.forbes.com/advisor/investing/modern-portfolio-theory/
3. Barna, T., Burns, A. F., & Mitchell, W. C. (1948). Measuring Business Cycles. *Economica*, *15*(60), 305. https://doi.org/10.2307/2549570
4. Braun, K. (2023). Retrieved from https://www.clevergirlfinance.com/what-is-an-All-Weather-portfolio/#:~:text=An%20All-Weather%20portfolio%20is,economic%20storm%20comes%20your%20way.
5. Bridgewater Associates. (2012). *The All Weather Story*. Bridgewater. https://www.bridgewater.com/research-and-insights/the-All-Weather-story
6. Brinson, G. P., Hood, L. R., & Beebower, G. L. (1986). Determinants of portfolio performance. *Financial Analysts Journal*, *42*(4), 39–44. doi:10.2469/faj.v42.n4.39
7. Brocato, J., & Steed, S. (1998). Optimal Asset Allocation over the business cycle. *Financial Review*, *33*(3), 129–148. doi:10.1111/j.1540-6288.1998.tb01387.x
8. Browne, H. (1999). *Fail-safe investing: Lifelong financial safety in 30 minutes*. New York: St. Martin's Press.
9. Butler, D., & Pennarts, M. (2023). *The biggest bull markets in history: Comparison chart*. Finder UK; finder. https://www.finder.com/uk/share-trading/share-trading-research/biggest-bull-markets-in-history
10. Dalio, R. (2011). Engineering targeted returns and risks - bridgewater.brightspotcdn.com. Retrieved from https://bridgewater.brightspotcdn.com/fa/e3/d09e72bd401a8414c5c0bdaf88bb/bridgewater-associates-engineering-targeted-returns-and-risks-aug-2011.pdf
11. Danthine, J.-P., & Girardin, M. (1989). Business cycles in Switzerland. *European Economic Review*, *33*(1), 31–50. doi:10.1016/0014-2921(89)90035-4
12. 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
13. Dichtl, H., Drobetz, W., & Wambach, M. (2012). Testing Rebalancing Strategies for Stock-Bond Portfolios: What is the Optimal Rebalancing Strategy? SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2139915

14. Dzikevičius, A., & Vetrov, J. (2013). Investment Portfolio Management Using the Business Cycle Approach. *Verslas: Teorija Ir Praktika*, *14*(1), 57–63. https://doi.org/10.3846/btp.2013.07

15. Economic Cycle: Definition and 4 Stages of the Business Cycle (2023). Retrieved from https://www.investopedia.com/terms/e/economic-cycle.asp#:~:text=An%20economic%20cycle%20is%20the,stage%20of%20the%20economic%20cycle.

16. Flood, P. (2024). *Ray Dalio All Weather Portfolio Review, ETF's, & Leverage*. Https://Www.optimizedportfolio.com/. https://www.optimizedportfolio.com/all-weather-portfolio/

17. Ganti, A. (2024). *What Are Asset Classes? More Than Just Stocks and Bonds*. Investopedia. https://www.investopedia.com/terms/a/assetclasses.asp#toc-what-is-an-asset-class

18. Hensel, C. R., Ezra, D. D., & Ilkiw, J. H. (1991). The importance of the Asset Allocation Decision. *Financial Analysts Journal*, *47*(4), 65–72. doi:10.2469/faj.v47.n4.65

19. Hu, X. (2022). Exploring How Macroeconomic Factors Affect REITs and Evaluating Its Downside Risk – Empirical Evidence From China and the US. *Junior Management Science*, *7*(4), 874–898. https://doi.org/10.5282/jums/v7i4pp874-898

20. Ibbotson, R. G., & Kaplan, P. D. (2000). Does asset allocation policy explain 40, 90, or 100 percent of performance? *Financial Analysts Journal*, *56*(1), 26–33. doi:10.2469/faj.v56.n1.2327

21. Ibbotson, R.. (2009). The Importance of Asset Allocation. Financial Analysts Journal. 66. doi:10.2307/27809175.

22. Ilmanen, A., Maloney, T., & Ross, A. (2014). Exploring Macroeconomic Sensitivities: How Investments Respond to Different Economic Environments. *The Journal of Portfolio Management*, *40*(3), 87–99. https://doi.org/10.3905/jpm.2014.40.3.087

23. Iregbulem, N. (2023). Retrieved from https://www.composer.trade/learn/permanent-portfolio-the-ultimate-guide

24. Kaczmarek, T., Będowska-Sójka, B., Grobelny, P., & Perez, K. (2022). False Safe Haven Assets: Evidence From the Target Volatility Strategy Based on Recurrent Neural Network. *Research in International Business and Finance*, *60*, 101610. https://doi.org/10.1016/j.ribaf.2021.101610

25. Katiyar, S., & Lodh, A. (2023). *Small Caps Have Been a Big Story After Recessions*. Www.msci.com. https://www.msci.com/www/blog-posts/small-caps-have-been-a-big/03951176075

26. Keller, W. J. (2020). Lazy Momentum with Growth-Trend timing: Resilient Asset Allocation (RAA). *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3752294

27. Kundla, T. (2013). *"'Püsikestva portfelli'" investeerimisstrateegia kasutamise tulemuslikkus USA ja Saksamaa väärtpaberiturgudel* (thesis). Retrieved from http://hdl.handle.net/10062/32013

28. Lawson, J. M., & Rowland, C. (2012). The permanent portfolio: Using allocation to build and protect wealth. Retrieved from https://www.aaii.com/journal/article/the-permanent-portfolio-using-allocation-to-build-and-protect-wealth?via=emailsignup-readmore#fig1

29. Leow, E. K., Nguyen, B. P., & Chua, M. C. (2021). Robo-advisor using genetic algorithm and Bert sentiments from tweets for hybrid portfolio optimisation. *Expert Systems with Applications*, *179*, 115060. doi:10.1016/j.eswa.2021.115060

30. Levitt, A. (2022). *Economic Indicators That Affect The U.S. Stock Market*. Investopedia. https://www.investopedia.com/articles/investing/031413/economic-indicatiors-affect-us-stock-market.asp

31. Louraoui, Y. (2024). The All-Weather Portfolio Approach: The Holy Grail of Portfolio Management. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4649247

32. Lucas, R. E. (1995). Understanding Business Cycles. In *Essential Readings in Economics* (pp. 306–327). https://doi.org/10.1007/978-1-349-24002-9_17

33. Mähhar, M. (2015). *Dünaamilise rebalansseerimise mõju investeerimisportfelli tootlusele püsikestva investeerimisportfelli näitel* (thesis). Retrieved from http://hdl.handle.net/10062/48087

34. Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, *7*(1), 77–91. https://doi.org/10.1111/j.1540-6261.1952.tb01525.x

35. Modern portfolio theory (2024). Retrieved from https://en.wikipedia.org/wiki/Modern_portfolio_theory

36. Moore, G. (1983). *Business cycles, inflation, and forecasting* (2nd ed.). Cambridge, MA: Ballinger Publishing Co.

37. Moore, G. H., & Viictor Zarnowitz. (1986). Appendix A: The Development and Role of the National Bureau of Economic Research's Business Cycle Chronologies. *NBER Chapters*, *25*, 735–780.

38. National Bureau of Economic Research (NBER). (2023). *US Business Cycle Expansions and Contractions*. National Bureau of Economic Research. https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions

39. National Bureau of Economic Research (NBER). (2024). *Business Cycle Dating Procedure: Frequently Asked Questions*. NBER. https://www.nber.org/research/business-cycle-dating/business-cycle-dating-procedure-frequently-asked-questions

40. Navas, R. D., Bentes, S. R., & Navas, H. V. G. (2020). Optimized Portfolios: All Seasons Strategy. *IntechOpen EBooks*. https://doi.org/10.5772/intechopen.95122

41. Orzano, M., & Welling, J. (2017). *RESEARCH Real Estate CONTRIBUTORS The Impact of Rising Interest Rates on REITs*. https://www.spglobal.com/spdji/en/documents/research/the-impact-of-rising-interest-rates-on-reits.pdf

42. Plosser, C. I. (1989). Understanding Real Business Cycles. *Journal of Economic Perspectives*, *3*(3), 51–77. https://doi.org/10.1257/jep.3.3.51

43. Reid, J., Burns, N., Chanda, S., & Nicol, C. (2017). Deutsche Bank Markets Research The Next Financial Crisis Long-Term Asset Return Study. Retrieved from https://www.tramuntalegria.com/wp-content/uploads/2017/09/Long-Term-Asset-Return-Study-The-Next-Financial-Crisis-db.pdf

44. Robbins, T. (2014). *Money master the game: 7 simple steps to financial freedom*. Simon and Schuster.

45. Sa-Aadu, J., Shilling, J. D., & Tiwari, A. (2006). Portfolio Performance and Strategic Asset Allocation Across Different Economic Conditions. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.890816

46. Scott, G. (2022). Small-Value Stock Definition. Retrieved from: https://www.investopedia.com/terms/s/small_value_stock.asp

47. Shahidi, A. (2014). *Balanced Asset Allocation How to Profit in Any Economic Climate*. Hoboken, Nj, Usa John Wiley & Sons, Inc.

48. Simonsen, L. A. F., & Hermo, M. (2021). *A review of Bridgewater Associates investment strategy: The All-Weather portfolio* (thesis). Retrieved from https://ntnuopen.ntnu.no/ntnu-xmlui/bitstream/handle/11250/2780519/no.ntnu%3ainspera%3a82752696%3a84743303.pdf?sequence=1&isAllowed=y

49. Tanzer, A., & Frick, B. (2010). Gold: Long-Term Hedge or Bubble About to Burst? Retrieved from: https://www.kiplinger.com/article/business/t019-c000-s002-gold-long-term-hedge-or-bubble-about-to-burst.html

50. *The Theory Behind the Golden Butterfly – Portfolio Charts*. (2016). Portfolio Charts. https://portfoliocharts.com/2016/04/18/the-theory-behind-the-golden-butterfly/

51. Vardharaj, R., & Fabozzi, F. J. (2007). Sector, style, region: Explaining stock allocation performance. *Financial Analysts Journal*, *63*(3), 59–70. doi:10.2469/faj.v63.n3.4691

52. Vliet, P., & Blitz, D. (2011). Dynamic strategic asset allocation: Risk and return across the business cycle. *Journal of Asset Management*, *12*(5), 360–375. https://doi.org/10.1057/jam.2011.12

53. Weinstock, L. (2024). *Introduction to U.S. Economy: The Business Cycle and Growth*. Crsreports.congress.gov. https://crsreports.congress.gov/product/pdf/IF/IF10411

54. What Are the Benefits, Cons, and Limitations of Modern Portfolio Theory? (2023). Retrieved from https://www.realized1031.com/blog/what-are-the-benefits-cons-and-limitations-of-modern-portfolio-theory

55. Williamson, J. (2020). Golden Butterfly Portfolio Review and M1 Finance ETF Pie. Retrieved from: https://www.optimizedportfolio.com/golden-butterfly-portfolio/

56. Williamson, J. (2024). *Harry Browne Permanent Portfolio Review, ETFs, & Leverage (2024)*. Optimizedportfolio.com. https://www.optimizedportfolio.com/permanent-portfolio/

Appendix A

Measures and formulas utilized in the analysis

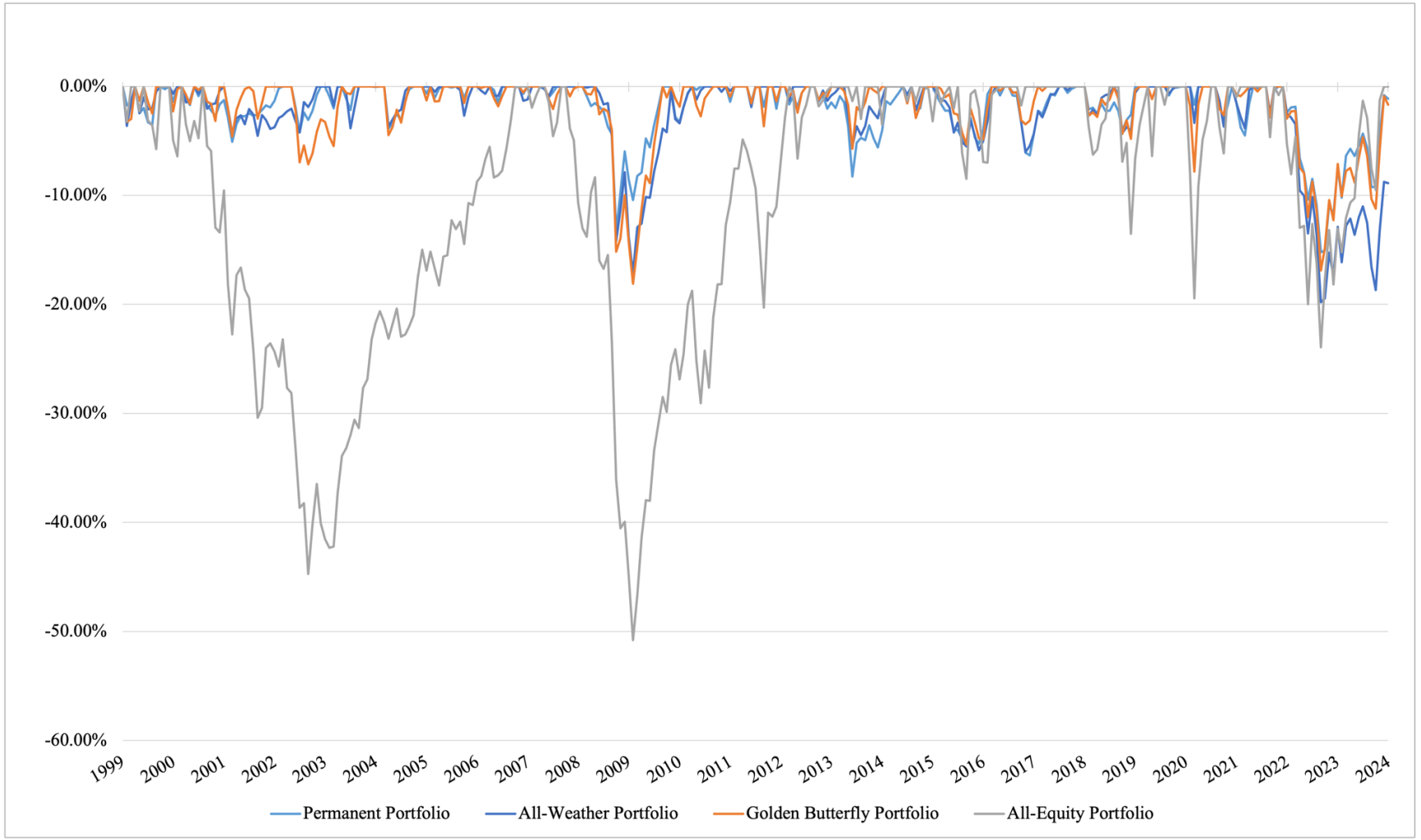
Measure	Formula	Notes
Cumulative return	$\left(\frac{\text{End Value} - \text{Start Value}}{\text{Start Value}}\right) \times 100$	
Monthly Standard deviation	$\sqrt{\frac{\sum_{i=1}^{n}(R_i - \bar{R})^2}{n\ -\ 1}}$	R_p- individual portfolio returns $\bar{R}$ - mean portfolio return n - total number of periods (months)
Annualized Standard deviation	$\sigma_{\text{annual}} = \sigma_{\text{monthly}} \times \sqrt{12}$	σ_{annual} - annualized standard deviation σ_{monthly} - monthly standard deviation
CAGR – Compound Annualized Growth Rate	$\left(\frac{\text{End Value}}{\text{Start Value}}\right)^{\frac{1}{n}} - 1$	n – number of periods (years)
Sharpe Ratio	$\frac{R_p - R_{RF}}{\sigma_p}$	R_p- individual portfolio returns R_{RF} - risk free rate σ_p- standard deviation of portfolio returns 3-Month T-Bills returns are used a proxy for risk-free rate.
Percentage of negative returns periods	$\frac{\text{Number of Negative Returns}}{\text{Total Number of Returns}} \times 100$	
Maximum Drawdown	$\frac{\text{LP}\ -\ \text{ATH}}{ATH}$	LP - lowest point after the portfolios latest ATH value ATH - all time high value of the portfolio
Average drawdown	$\frac{\sum_{i=1}^{n} \frac{LLP_t - LATH_t}{LATH_t}}{n}$	LLP - the lowest after the portfolios latest ATH (LATH) LATH - latest all time high value of the portfolio n - number of drawdowns

Notes. Standard Deviation and Average Drawdown can be calculated with built-in Excel functions, yielding the same results.

Source: Compiled by author based on Navas et al. (2020), Simonsen & Hermo (2021)

Appendix B

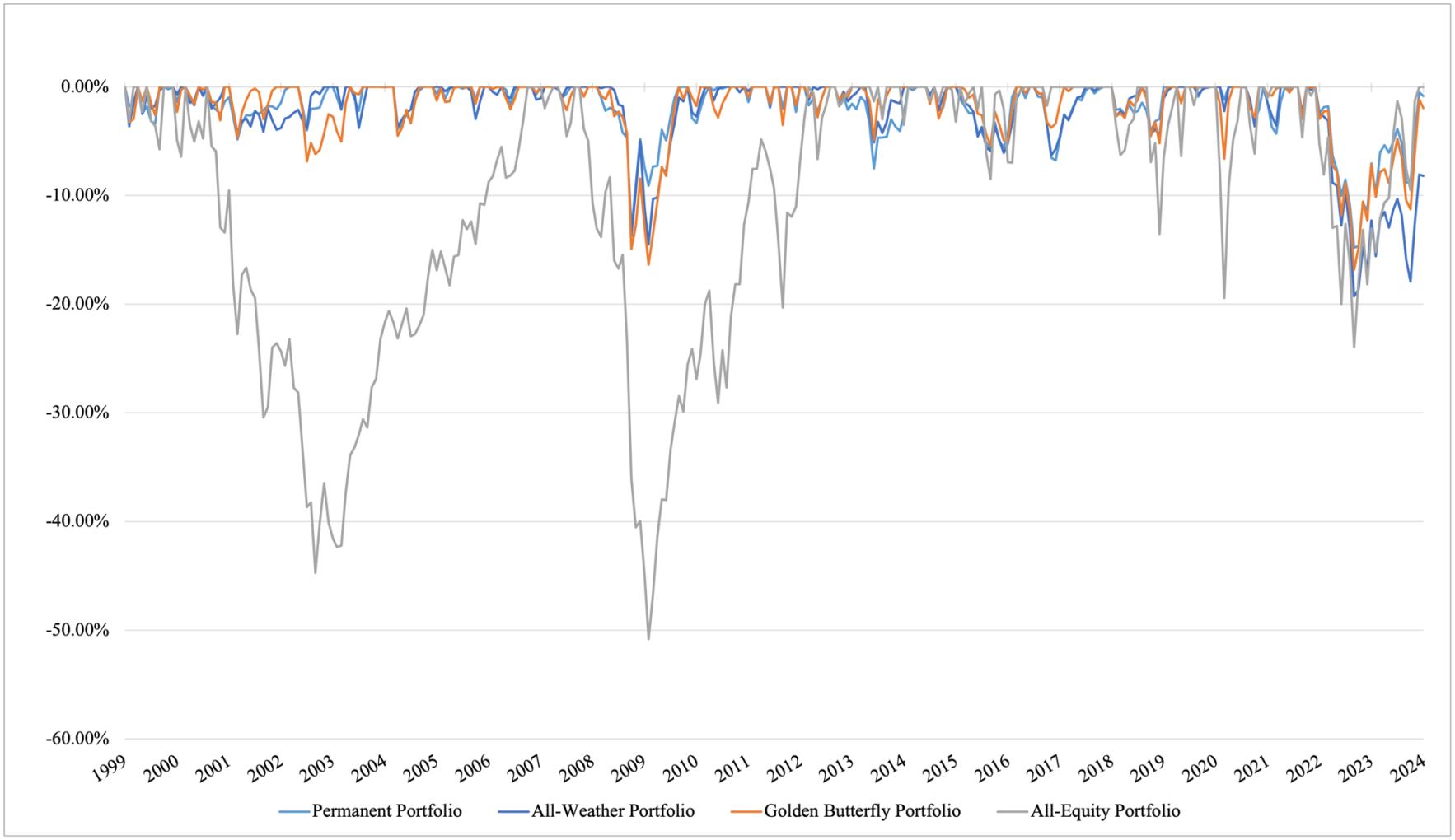
Drawdowns for the portfolios, assuming monthly rebalancing



Source: compiled by the author

Appendix C

Drawdowns for the portfolios, assuming annual rebalancing



Source: compiled by the author

Resümee

MAJANDUSLIKULT VASTUPIDAVATE INVESTEERINGUTE INVESTEERIMISPORTFELLIDE TULEMUSTE VÕRDLUS

Hlieb Kushlianskyi

Pidevalt areneval finantsmaastikul, mida iseloomustab majanduslik ebakindlus ja turu volatiilsus, otsivad investorid strateegiaid riskide maandamiseks, saavutades samal ajal püsivat tulu. Teoreetilised raamistikud, nagu Modern Portfolio Theory, on pannud aluse portfelli hajutamise mõistmiseks, rõhutades, et erineva riski- ja tuluprofiiliga varade kombineerimine võib tootlust optimeerida. Siiski on tekkinud nüansirikkamad strateegiad, mis käsitlevad stabiilsuse vajadust erinevates majandustsüklites. Majanduslikult vastupidavad investeerimisportfellid (ERIP-d) põhinevad sellel alusel, võimendades erinevat varaklassi käitumist laienemise, kahanemise ja majandussõkkide ajal, et luua tasakaalustatud, riskikartlikke portfelle.

ERIP-de keskne eeldus seisneb nende võimes vähendada kokkupuudet konkreetse turu dünaamikaga, hõlmates erinevaid varaklasse, millest igaüks reageerib makromajanduslikele tingimustele ainulaadselt. Näiteks aktsiad õitsevad majanduskasvu perioodidel, samas kui võlakirjad ja kuld tagavad stabiilsuse kahanemise ajal. Selline majandustsüklite mõistmine on olnud keskse tähtsusega selliste portfellide nagu Harry Browne'i Permanent Portfolio ja Ray Dalio All-Weather portfell, mis on pälvinud tunnustust oma suutlikkuse eest tormilistele turgudele vastu seista. Mitmed uuringud on näidanud, et optimeeritud ja mitut vara hõlmavate portfellidega on võimalik saavutada turuga võrreldavat tulu, minimeerides samal ajal volatiilsust, pakkudes kaalukaid põhjusi portfelli kujundamisel majandusliku vastupidavuse tagamiseks.

Hoolimata nende teoreetilisest veetlusest, on ERIP-de akadeemilised uuringud keskendunud peamiselt uute portfellimudelite loomisele ja testimisele, jättes lünga kirjandusse, mis hindab nende strateegiate aluspõhimõtteid ja tegelikku toimimist. Varasemad uuringud on uurinud ERIP-de toimivust, tõstes esile nende parema stabiilsuse võrreldes aktsiaportfellidega. Need uuringud erinevad aga sageli ajakavade, turutingimuste ja hindamismeetodite poolest, mis muudab otsese võrdlemise keeruliseks. Selle väitekirja eesmärk on kõrvaldada see lünk, analüüsides süstemaatiliselt kolme tuntud ERIP-i – Permanent Portfolio, All-Weather portfelli ja Golden Butterfly portfelli – toimivust erinevate investeerimishorisontide ja tasakaalustamisstrateegiate lõikes, kasutades võrdlusalusena USA turgu.

Empiiriline analüüs keskendub USA turule tänu selle ulatuslikule andmete kättesaadavusele, ülemaailmsele majanduslikule mõjule ja selle kasutamisele varasemates ERIP-uuringutes. Analüüsiperiood, mis kestab 1999–2024, kajastab olulisi turusündmusi, sealhulgas Dot-comi mulli, 2008. aasta finantskriisi ja COVID-19 krahhi, aga ka USA ajaloo pikima pulliturgu. SPDR S&P 500 ETF Trust (SPY) toimib võrdlusalusena esindades kõigi aktsiate portfelli ja pakkudes aluse ERIP-de suhtelise tootluse hindamiseks.Samuti võetakse kasutusele inflatsiooni võrdlusalus, et hinnata portfellide tootlust võrreldes USA inflatsiooniga ja teha kindlaks, kas need ületavad seda.Kasutades tugevat metoodikat, hinnatakse lõputöös portfelli tootlust selliste mõõdikute kaudu nagu kumulatiivne tootlus, Sharpe'i suhtarvud, väljavõtmise mõõdud ja jooksev tootlus 1-, 5-, 10- ja 15-aastaste intervallidega. Kaasatud on nii igakuised kui ka aastased tasakaalustusstrateegiad, mis võimaldavad igakülgselt võrrelda nende mõju riskidele ja tuludele. Tulemuste eesmärk on anda nii investoritele kui ka teadlastele praktilisi teadmisi, käsitledes samal ajal laiemat küsimust selle kohta, kuidas ERIPd toimivad võrreldes aktsiamahukate strateegiatega erinevates investeerimisperioodides.

Kuigi analüüs seisis silmitsi piirangutega, nagu tehingukulude ja maksude korrigeerimiste väljajätmine, andis see väärtuslikku teavet aegumiskuupäevade toimivuse kohta. Tulemused näitasid, et Golden Butterfly portfell saavutas ERIP-de seas kõrgeima tootluse, lähenedes aktsiate võrdlusindeksi tootlusele, kuid oluliselt väiksema riskiga. Selle põhjuseks oli väikese kapitalisatsiooniga aktsiate kaasamine, mis aktsiaturu kasvu ajal tõusid, ning selle hajutamine võlakirjadeks ja kullaks, mis leevendas languste ajal kahjusid. Permanent Portfolio näitas madalaimat volatiilsust ja laenude väljavõtmist, kuid kinnitas selle madalamat absoluutset tootlust konservatiivsete jaotuste tõttu. All-Weather portfell andis tasakaalustatud tulemusi, säilitades suurepärase riskiga korrigeeritud tootluse, kuid mõõduka kogutootluse.

See väitekiri aitab kaasa akadeemilisele diskursusele, kinnitades ERIP-de vastupidavust erinevates majandustingimustes ja ajahorisontides. See tõstab esile nende kasulikkust riskikartlike investorite jaoks ja rõhutab nende võimet riski ja tulu tõhusalt tasakaalustada. Tulevased uuringud võiksid uurida reaalsete tegurite, nagu tegevuskulud, või alternatiivsed varade jaotused, praktilisi tagajärgi, et veelgi optimeerida majanduslikult vastupidavate portfellide toimivust.

Non-exclusive licence to reproduce thesis and make thesis public

I, Hlieb Kushlianskyi,

1. herewith grant the University of Tartu a free permit (non-exclusive licence) to

reproduce, for the purpose of preservation, including for adding to the DSpace digital archives until the expiry of the term of copyright,

“Performance Of Economically Resilient Investment Portfolios”,

supervised by

lecturer Mark Kantšukov.

2. I grant the University of Tartu a permit to make the work specified in p. 1 available to the public via the web environment of the University of Tartu, including via the DSpace digital archives, under the Creative Commons licence CC BY NC ND 3.0, which allows, by giving appropriate credit to the author, to reproduce, distribute the work and communicate it to the public, and prohibits the creation of derivative works and any commercial use of the work until the expiry of the term of copyright.

3. I am aware of the fact that the author retains the rights specified in p. 1 and 2.

4. I certify that granting the non-exclusive licence does not infringe other persons’ intellectual property rights or rights arising from the personal data protection legislation.

Hlieb Kushlianskyi
15/01/2025