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NAVIGATING SUCCESS: PORTFOLIO MANAGEMENT THROUGH RISK AND PERFORMANCE ANALYSIS

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Abstract. *Purpose* – this study explores the growing interest in Exchange-Traded Funds (ETFs) and public shares during and after the COVID-19 pandemic, aiming to understand the factors driving this investment trend.

Research methodology – an actively managed portfolio of U.S. stocks is constructed and compared to a passively managed S&P 500 index portfolio. Active management is conducted using three approaches: intuition-based selection, the Black-Litterman model, and Modern Portfolio Theory. A quantitative analysis assesses risk, performance, and the impact of reinvestment and transaction costs.

Findings – results show that active investing can outperform passive strategies in the short term but involves higher risk, transaction costs, and ongoing oversight. Passive investing offers stability and lower costs but may yield lower returns during volatile periods.

Research implications – the study deepens understanding of how costs and reinvestment influence investment outcomes and how active and passive strategies perform under varying market conditions, especially post-pandemic.

Practical implications – the findings provide practical guidance for portfolio construction and management, helping investors balance risk and return in a changing financial landscape.

Originality/Value – this paper uniquely compares three active investment approaches against a passive benchmark within a post-COVID context, offering integrated insights on performance, cost, and strategy for both academics and practitioners.

Keywords: stocks, ETFs, bonds, passive investing, active investing, risk management.

JEL Classification: E44, G32, L19.

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1. Introduction

For centuries, investing has been a fundamental aspect of human society, functioning as a method to accumulate wealth and ensure financial stability (Shiller, 2013). The pursuit of augmented financial resources remains a fundamental objective, regardless of whether it is intended to enhance one's quality of life or to prepare for unforeseen circumstances (Bibri, 2019). In ancient Greece, individuals endeavored to increase their income by engaging in activities such as real estate rentals and agriculture, with a particular emphasis on cereal cultivation and cattle breeding (Jeck, 2018).

The foundation for contemporary financial strategies was established by these early investment methods. The range of investment opportunities has been broadened by scientific advancements, technological innovations, and the expansion of the banking sector

(Campanella et al., 2017). This has resulted in the introduction of sophisticated instruments, including equities, bonds, cryptocurrencies, Non-Fungible Tokens (NFTs), and Exchange-Traded Funds (ETFs) (Krause, 2024). Nevertheless, these novel prospects are accompanied by varying degrees of risk, which requires the ability to make well-informed decisions. Investment has garnered a growing amount of attention as the global economy continues to develop, a trend that is partially influenced by demographic shifts, political uncertainties, and economic challenges that generate uncertainty regarding the future (Chen & Wang, 2024). However, individuals who are more prudent may choose low-risk instruments such as term deposits, despite the fact that the returns they produce frequently do not exceed inflation. On the one hand, individuals are incentivized to pursue higher returns through high-risk investments. The increasing dichotomy between active and passive portfolio management approaches is reflected in the divergence in investment strategies (Chowdhury et al., 2025). Although some investors may prefer to actively manage their portfolios, others prefer passive investment strategies, such as investing in ETFs or tracking significant indices, which are intended to replicate the performance of broader market benchmarks (Basilico & Johnsen, 2019; Kardos et al., 2024). The primary objective of this research is to compare the performance of active portfolio management with that of passive investing, as represented by an index portfolio. Passive investing typically adheres to a buy-and-hold strategy, following a market index with minimal intervention, while active investing entails hands-on management, where individual stocks are carefully selected and regularly monitored (Sarpong, 2020). This study evaluates risk-adjusted returns and overall portfolio performance by utilizing established economic models and methodologies to analyze both approaches. The initial segment of the research concentrates on the fundamental principles of portfolio management, incorporating the expertise of international scholars who have specialized in this area. The theoretical framework for the study is established by this literature review, which examines a variety of investment philosophies and their implications for performance optimization and risk management. The second section transitions to the practical aspects of portfolio construction and investment strategies. In this section, authors explore the various asset classes that are accessible to retail investors, including equities, bonds, and more intricate instruments such as ETFs and cryptocurrencies. This chapter not only offers theoretical explanations but also incorporates real-world examples that were derived from past market behavior and contemporary developments that occurred during the research period.

The study endeavors to offer a comprehensive understanding of the risks and benefits associated with various categories of investments by combining historical data with current market trends. The third segment delves into the fundamental research question: Is it possible for active portfolio management to outperform a passively managed portfolio? In order to address this, authors implemented established investment methodologies, including the Black-Litterman model and Modern Portfolio Theory, to establish an actively managed portfolio of 15 carefully selected American companies. In order to optimize performance, the portfolio was rebalanced and reviewed every six months. Due to its prominence and status as one of the most extensively traded funds in the U.S. market, the SPDR S&P 500 ETF Trust was selected as the benchmark for passive investing. Ultimately, the investigation concludes with an assessment of the findings and provides suggestions for both institutional and individual

investors. This section emphasizes the significance of evaluating the fees and costs associated with active portfolio management, as well as those related to passive investing, such as management fees for mutual funds or ETFs. Furthermore, the reinvestment of dividends, as opposed to receiving them as cash payments, is a critical factor that can have a substantial impact on the long-term growth of a portfolio. Investors can potentially accumulate more wealth over time by reinvesting dividends, which capitalizes on the compounding effect.

In conclusion, this study offers a thorough examination of the advantages and disadvantages of passive and active investing strategies, providing valuable insights into the strengths and weaknesses of each approach. It is designed to assist investors in making informed decisions regarding portfolio management, thereby enabling them to navigate the intricacies of the contemporary financial landscape and achieve their investment objectives.

2. Literature review

2.1. Passive and active investing: conceptual foundations

The origins of portfolio management in the literature are closely linked to the broader concept of investing. Financial literacy represents a fundamental factor in the investment process, as it reflects investors' knowledge, experience, and their capacity to respond to economic developments in a timely and informed manner (Alhouti et al., 2021; Vasenska, 2024). Within this context, passive investing is typically associated with the acquisition of index funds, thereby avoiding detailed analysis of individual financial assets (Cantele & Cassia, 2020). Du et al. (2017) conceptualize passive investing as the construction and long-term maintenance of a diversified portfolio composed of low-cost funds replicating broad market indices, such as the S&P 500. This strategy enables investors to minimize costs and risks while capturing long-term market growth (Carvajal & Nadeem, 2022; Hair et al., 2017).

In contrast, active investing is defined as a process in which investors actively manage and construct portfolios with the objective of optimizing returns through the application of various techniques and models (Belas et al., 2021). According to Dadhich and Kant (2022), successful active investing requires a deep understanding of market challenges. Kliestik et al. (2020) describe active investing as a strategy involving frequent trading with the explicit goal of outperforming index benchmarks. However, this approach has been criticized due to the significant time commitment required and the limited probability of sustained long-term effectiveness (Metzker et al., 2021). Moreover, constructing an optimal portfolio under an active strategy requires forecasting asset prices, which represents a complex and uncertain task (Belas et al., 2020; Raj et al., 2020).

2.2. Risk-return trade-off and investment analysis

The necessity of investment analysis arises from the inherent relationship between risk and return. Investing requires the application of fundamental, technical, and psychological analysis. Malkiel (2012) critically argues that both fundamental and technical analyses are subject to misinterpretation, emphasizing that investors often rely on intrinsic valuation, financial indicators, risk-free rates of return, and anecdotal information that may distort decision-making.

Nevertheless, portfolio construction is widely regarded as a scientific discipline in which data are systematically collected and analyzed to optimize portfolio management, whether through individual instruments or their combinations (Stojanovic et al., 2020).

Vătămănescu et al. (2021) compare portfolio construction to building a house, stressing the importance of clearly defined objectives and the methods employed to achieve them. Similarly, Sexty (2011) highlights the necessity of gathering comprehensive information when forming portfolios and evaluating individual investment decisions. Central to this process is the risk-return trade-off: higher returns are generally attainable only at the cost of increased risk (Schröder et al., 2022). Yield is commonly defined as the income generated by an investment from acquisition to sale (Pereira-Moliner et al., 2021; Valaskova et al., 2021), while expected return refers to the income anticipated in the future (Rozsa et al., 2022). Risk has been described as the potential for deviation from anticipated outcomes (Lashley, 2016), thereby forming a core determinant of investment decisions.

2.3. Risk, uncertainty, and diversification in portfolio construction

Risk is further conceptualized by Okręglicka and Pichugina (2021) as a phenomenon experienced by individuals or organizations when choosing to operate under uncertainty, whereas uncertainty itself represents a form of deviation that cannot be quantified. Jann (2014) defines risk as the variability of expected returns, with the potential for actual outcomes to diverge from anticipated values in either direction. One of the primary mechanisms for managing risk is diversification. According to Isensee et al. (2020), diversification enables risk mitigation through the combination of assets with differing characteristics. This principle extends beyond asset classes to include diversification across sectors, geographical regions, and industries (Zhang & Browne, 2012).

However, excessive diversification may generate adverse effects, such as increased transaction costs and reduced return potential. Gaio et al. (2022) therefore emphasize that optimal risk diversification represents a critical consideration for both individual and institutional investors. Consequently, the challenge of portfolio construction lies not only in maximizing returns but also in identifying an appropriate balance between diversification and concentration to achieve sustainable performance.

2.4. Quantitative models of portfolio optimization

The use of mathematical and quantitative techniques constitutes a core element of modern portfolio construction. This approach was pioneered by Markowitz, whose Modern Portfolio Theory (MPT) integrates risk and expected return into a systematic optimization framework (Flammer, 2015). The primary objective of MPT is to construct portfolios that either maximize expected return for a given level of risk or minimize risk for a specified return. Despite its foundational significance, Markowitz's model has been subject to criticism, particularly due to its sensitivity to estimation errors and its reliance on historical data (Gajanova et al., 2020).

In response to these limitations, more advanced models have been developed, most notably the Black-Litterman model, which incorporates market views alongside statistical

information. Elkington (1994), for example, extended this framework by introducing a recession factor, referring to the resulting structure as a two-factor Black-Litterman model. Subsequent adaptations have further refined the model through the inclusion of additional market factors. The Black-Litterman approach is widely regarded as a more flexible optimization method, as it measures risk based on asset covariance while integrating uncorrelated market information, thereby enhancing portfolio robustness under conditions of uncertainty.

3. Materials and methods

The study aims to construct a portfolio of American shares, administer it, and, subsequently, compare it to a passively managed S&P 500 index portfolio. First and foremost, authors would like to inform you that the portfolio was established on November 1, 2021, and it was managed until January 13, 2023. The portfolio was composed of the shares of 15 companies. There was a condition related to the simulation of the market portfolio when selecting the portfolio. This indicates that authors structured it in a manner akin to the S&P 500 index. Specifically, there were selected sectors that were either uninteresting to us or did not present significant long-term investment opportunities. Examples of such sectors include the energy sector (CMS Energy) and the sectors that produce basic raw materials and materials (Ball Corporation). This portfolio was developed and managed in three distinct methods. The first method involves the application of Modern Portfolio Theory, the second method involves the Black-Litterman model, and the third method involves the subjective construction of the portfolio without a more thorough analysis. In the theoretical section, authors discussed the Black-Litterman model and modern portfolio theory. Authors aimed to demonstrate the potential outcomes of integrating market information with statistical data and the portfolio's behavior in the absence of a more thorough analysis. The results are subsequently compared to one another and subsequently to passive investing, which results in an index portfolio.

The portfolio analysis comprises stocks of 15 companies that were influenced by the S&P 500 index, as well as subjective opinion (Alphabet, Inc., Netflix, Inc., AMAZON.COM, Inc., Ford Motor Company, Tesla, INC., Mondelez International, Inc., The Coca-Cola Company, JPMorgan Chase & Co, The Goldman Sachs Group Inc., Morgan Stanley, Johnson & Johnson, Pfizer Inc., Apple, Inc., Microsoft Corporation, NVIDIA Corporation). In order to conduct an accurate analysis, it is imperative to establish an optimal portfolio, which was accomplished through three distinct methods: 1. Black-Litterman model; 2. Modern portfolio theory; 3. Intuitive (subjective) modelling. The analysis in all three methodologies is predicated on historical data that spans a decade. Therefore, the portfolio was compiled on November 1, 2021, and the earliest data is from that date. The daily fluctuation in the share price per unit was the most critical data. This allowed us to calculate the average daily yield and, subsequently, the average annual yield of individual company shares. The individual returns and the risks of the shares of the corporations' researchers have selected are presented in the subsequent table (Table 1), which was generated using the arithmetic return calculation algorithm.

Table 1. Annual return and risk of companies (source: own elaboration)

Company	Yield	Risk
GOOGL	25.84%	25.26%
NFLX	50.43%	48.13%
AMZN	31.62%	30.41%
F	33.76%	30.90%
TSLA	70.56%	55.56%
MDLZ	9.27%	23.57%
KO	7.58%	17.55%
JPM	19.38%	27.26%
GS	15.76%	28.27%
MS	21.38%	32.96%
JNJ	11.89%	17.22%
PFE	11.65%	20.06%
AAPL	26.98%	28.33%
MSFT	29.45%	25.51%
NVDA	53.69%	40.35%

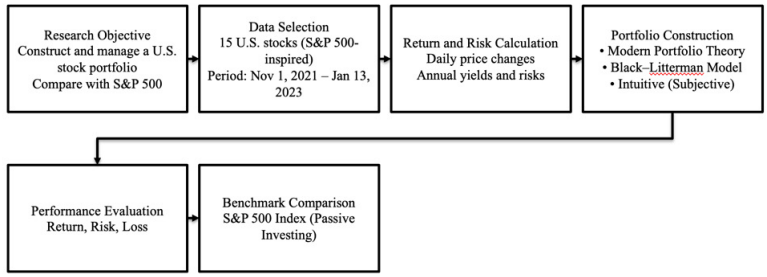

Figure 1. Study framework(source: own elaboration)

Figure 1 representation of the research design, depicting data selection, return-risk computation, portfolio construction through three optimization approaches, performance assessment, and benchmarking against the S&P 500 index.

4. Results

Modern portfolio theory: The correlation matrix can be used to ascertain the intensity of positive dependencies between company shares. Its construction is comparable to that of the covariance-variance matrix; however, the main diagonal contains values of 1, which are present due to the fact that the correlation of the same action is always 1. The covariance-variance matrix is symmetrical for the same reason as the values above and below the primary diagonal. To determine the correlation, authors calculated the difference between the risk and covariance of the selected equities.

$$\rho_{GOOGL,NFLX} = \frac{0.04560}{0.2526 \cdot 0.4813} = 0.375. \quad (1)$$

Alphabet (GOOGL) and Netflix (NFLX) exhibit a correlation coefficient of 0.375. The correlation between the shares of Alphabet (GOOGL) and Netflix (NFLX) is modest to moderate. The yield on the US Treasury bond is the risk-free interest rate that is in effect. The risk-free interest rate was 1.5% per annum at the time the portfolio was assembled. American bonds were selected due to the fact that the majority of the other equities in the portfolio are held by American companies. The risk transfer premium was determined by subtracting the risk-free interest rate from the return on the company's stock.

$$0.2584 - 0.015 = 0.2434 = 24.34\ \%\ . \quad (2)$$

If an investor owns shares of Alphabet (GOOGL), at the beginning of the analyzed period (1 November 2021), he has a risk premium of 24.34%. The optimal weight distribution of all actions is illustrated in the subsequent Table 2.

Table 2. Optimal distribution of portfolio weights (source: own elaboration)

Company	Weights
GOOGL	2.79%
NFLX	17.34%
AMZN	9.23%
F	50.31%
TSLA	23.99%
MDLZ	–22.15%
KO	–27.91%
JPM	35.96%
GS	–61.01 %
MS	–14.50%
JNJ	27.17%
PFE	1.03%
AAPL	3.36%
MSFT	21.77%
NVDA	32.62%

The sum of all weights should give a value of 100%, or 1. This is a redistribution of weights so that the investor's savings are fully utilized. In Table 2, it can be seen that the largest weight was assigned to the stock of Ford (F) 50.31%. Conversely, Pfizer (PFE) had the smallest positive weight in the portfolio at 1.03%. Additionally, in Table 2, there are negative values of the weights, which represents short selling. It actually means that an investor borrows shares from another investor who owns them. However, the short sale does not always take place, as the investor does not provide the shares due to great confidence in the company's shares or possibly because of the bad rating of the investor who wants to borrow the shares. If a short sale takes place, the investor (interested party) immediately sells these shares and pays interest to the other investor (owner).

However, the investor will have to return the borrowed shares at one point, which means that he will have to buy them on the market either at a higher or lower market price than the one for which he sold them. In the case of a higher market price, the investor converted the shares, and in the case of a lower one, he made money. Subsequently, he returns these shares to the investor who lent him these shares. The final matrix was a weighted covariance-variance matrix, whose values were determined by multiplying the values from the covariance-variance matrix and individual weights.

Subsequently, the aggregate of the rows and columns is calculated individually, and the sum is then summed again. This process generated the portfolio's variance, which is 0.11678. The paper reports the annual risk for the selected portfolio, which is 34.17%, after square-rooting the variance. The portfolio's return was calculated by adding the weight multipliers and the individual annual returns of the companies' shares. The optimal portfolio yields 64.57%. The optimal portfolio, which is comprised of shares from 15 companies, has the potential to generate a maximum return of 64.57%, with an annual risk of 34.17%, as per the Modern Theory of the portfolio.

Black-Litterman model: The Black-Litterman model is identical to the previous approach for constructing an optimal portfolio. A covariance-variance matrix and an inverse matrix were generated, which were identical to the procedure employed in contemporary portfolio theory. The subsequent action is to ascertain the Beta coefficient for each share of the organization. The objective of this system is to determine the volatility of the S&P 500 index in relation to the stock market. The Beta coefficient between Alphabet (GOOGL) and the S&P 500 index is 1.06, indicating that the company's shares are more volatile than the S&P 500 index. This was incorporated. The market value of Alphabet (GOOGL) is either increasing or decreasing at a greater pace than that of the S&P 500. Defensive companies are those with a Beta value of less than 1, meaning that the return on their shares fluctuates in a manner similar to that of the market, albeit at a slowing rate. Consequently, the return on Pfizer's shares will increase or decrease by a factor of 0.73 if the market value of the S&P 500 increases or decreases by USD 1. In summary, the Beta coefficients of Morgan Stanley (MS) and NVIDIA (NVDA) indicate that the market's most significant response to the change is 1.53 and 1.45, respectively. Conversely, Coca Cola (KO) will exhibit the least degree of sensitivity to market fluctuations, as evidenced by its Beta coefficient of 0.67.

The CAPM model is intended to represent the anticipated profitability of the investment that investors anticipate in exchange for taking on the risk in the Black-Litterman model. The risk-free interest rate, the market return, and the company's Beta coefficient were employed to determine the expected return for companies.

Table 3 demonstrates that the model does not account for short selling, resulting in all weights being positive. The aggregate of all weights must equal 100%. Please be advised that the deviation may be 0.01 during rounding as a result of the calculation being conducted in Excel. Coca Cola (KO) shares increased by 12.85%, while Johnson & Johnson (JNJ) shares increased by 12.99%. The weight of Microsoft (MSFT) increased by 10.34%. In contrast, the portfolio's lowest weights are Netflix (NFLX) at 1.39% and Tesla (TSLA) at 1.29%. NVIDIA (NVDA), which has a weight of 3.82%, may also be allocated to lesser weight categories.

The Black-Litterman model was used to determine the optimal portfolio, which should have an annual return of 21.47% and a risk of 17.25%. The maximum possible return with the lowest possible risk was also calculated.

Table 3. Optimal distribution of portfolio weights (source: own elaboration)

Company	Weights
GOOGL	6.03%
NFLX	1.39%
AMZN	3.72%
F	5.65%
TSLA	1.29%
MDLZ	5.10%
KO	12.85%
JPM	9.47%
GS	5.35%
MS	5.39%
JNJ	12.99%
PFE	7.70%
AAPL	8.92%
MSFT	10.34%
NVDA	3.82%

Table 4. Comparison of optimal weights of individual methods (source: own elaboration)

Company	Modern portfolio theory	Black-Litterman model	Intuition
GOOGL	2.79%	6.03%	10.00%
NFLX	17.34%	1.39%	5.00%
AMZN	9.23%	3.72%	10.00%
F	50.31%	5.65%	5.00%
TSLA	23.99%	1.29%	3.00%
MDLZ	–22.15%	5.10%	8.00%
KO	–27.91%	12.85%	8.00%
JPM	35.96%	9.47%	5.00%
GS	–61.01%	5.35%	3.00%
MS	–14.50%	5.39%	2.00%
JNJ	27.17%	12.99%	10.00%
PFE	1.03%	7.70%	6.00%
AAPL	3.36%	8.92%	10.00%
MSFT	21.77%	10.34%	10.00%
NVDA	32.62%	3.82%	5.00%

Modern portfolio theory dictates that equities should be acquired through short selling, as illustrated in Table 4. The authors disagree with this assertion due to the fact that they, as investors, would prefer to utilize the savings they have allocated for the purchase of shares, that is, for dispositions at a specific point, rather than to incur an unnecessary risk. Additionally, short selling is challenging in practice due to the fact that other investors verify an investor's creditworthiness or the availability of free funds. This "certainty" ensures that

the investor will be able to repay the interest and possibly request the return of the shares in addition to borrowing them. Another issue is that Modern Portfolio Theory has assigned negative weights to the most dependable companies, such as Coca Cola and Mondelez. Here, authors observe an issue with the monitoring of market values. For instance, NVIDIA experienced substantial stock price fluctuations, whereas Mondelez and Coca Cola experienced minimal price volatility. These two companies are among the most stable in this portfolio, as the risk is minimal from the perspective of the established name among consumers and the market as a whole, regardless of whether it is in the sector or the market. Authors are more inclined to agree with the weights established by the Black-Litterman model, as it does not consider short sales, but rather the investor's savings. A portfolio with an annual return of 21.47% and the lowest annual risk of 17.25% is generated by this weight distribution for the investor. Additionally, a contemporary portfolio approach results in an annual return of 64.57% and an annual risk of 34.17%. The intuitive redistribution of weights was determined by this opinion of the products or the opinions of consumers on the products of individual companies. The sole requirement was that there be no negative weights.

Given that researchers are already aware of the performance of the portfolios through active investing and the S&P 500 index, which represents passive investing, it is feasible to formulate conclusions.

Table 5. Thematic evolution (source: own elaboration)

Investing	Without reconsideration			With reconsideration		
Active	*Max. return*	*Max. loss*	*Value at the end of the analyzed period* (*13 January 2023*)	*Max. return*	*Max. loss*	*Value at the end of the analyzed period* (*13 January 2023*)
Modern portfolio theory	18.09%	72.13%	–63.26%	18.09%	79.41%	–71.23%
Black-Litterman model	7.92%	20.51%	–11.30%	7.91%	21.67%	–12.88%
Intuition	7.02%	24.10%	–17.71%	7.02%	24.82%	–18.07%
Passive	*Max. return*	*Max. loss*	*Value at the end of the analyzed period* (*13 January 2023*)	*Max. return*	*Max. loss*	*Value at the end of the analyzed period* (*13 January 2023*)
Index S&P 500	3.42%	22.81%	–13.73%	3.42%	22.81%	–13.73%

Table 5 displays all of the significant findings of this investigation regarding passive and active investing. Authors concentrated on the portfolios' optimum return and risk during the monitored period, also concentrated on the performance of this research, whether from a passive or active investing perspective, by concluding researchers' surveillance on January 13, 2023. The portfolio without revaluation, which was compiled using the Black-Litterman model, exhibited the lowest loss as of January 13, as indicated by the table.

5. Discussion

5.1. Comparative performance of active and passive strategies

The results indicate that both active and passive investment strategies generated losses over the analyzed period beginning on 1 November 2021, reflecting unfavorable market conditions. However, substantial differences emerged in the magnitude of these losses, underscoring the importance of portfolio construction methodology. Among the examined approaches, the actively managed portfolio based on the Black-Litterman framework exhibited the most favorable outcome in terms of capital preservation, achieving the lowest loss under both rebalanced and non-rebalanced scenarios. The S&P 500 index, representing passive investing, followed closely, while the intuitively constructed portfolio performed moderately. By contrast, the portfolio derived from Modern Portfolio Theory (MPT) recorded the weakest outcomes, particularly under rebalancing.

This pattern reinforces the argument that, although market downturns affect all strategies, model-based active management can mitigate downside risk when appropriately designed. The superior performance of the Black-Litterman portfolio in terms of loss containment suggests that the integration of market equilibrium information with investor views enhances portfolio robustness. This finding is consistent with prior research emphasizing that informed strategic decision-making and the incorporation of forward-looking information can improve risk management outcomes (Du et al., 2017; Flammer, 2015). At the same time, the relatively strong performance of the S&P 500 index confirms the resilience of passive investing as a benchmark strategy for investors seeking transparency, low costs, and reduced managerial intervention (Belas et al., 2020; Kliestik et al., 2020). In efficient markets, where persistent alpha generation is increasingly difficult, passive strategies therefore continue to represent a stable and cost-effective investment alternative.

5.2. Portfolio optimization models, risk structure, and practical implications

A more detailed examination of the optimization models reveals significant heterogeneity in risk exposure and performance. Although MPT delivered the highest theoretical return potential, it also entailed the greatest risk. This outcome reflects a core limitation of mean-variance optimization: the tendency to generate extreme allocations, including short positions and overexposure to volatile assets. Such characteristics amplify sensitivity to estimation errors and market turbulence, thereby increasing the likelihood of severe drawdowns in practice. These findings are consistent with critiques of MPT that question its applicability under real-world constraints, including transaction costs, borrowing restrictions, and liquidity limitations (Zhang, 2024). The assignment of negative weights to traditionally stable firms further highlights the disjunction between mathematically optimal portfolios and investor preferences for low-volatility, high-stability assets during periods of uncertainty (Polyviou, 2020).

In contrast, the Black-Litterman model produced a more balanced risk-return profile. By combining equilibrium market returns with subjective investor views, the framework generates realistic weight distributions without relying on extensive short selling. This feature not only reduces exposure to extreme outcomes but also enhances practical feasibility for

investors operating under regulatory and risk constraints (Tripathi & Panwar, 2024). The observed performance supports the argument that optimization approaches incorporating both statistical data and market expectations are better suited to environments characterized by heightened volatility and structural uncertainty (Isensee et al., 2020; Schroder et al., 2022).

The intuitively constructed portfolio, based primarily on subjective assessments of firm reputation and perceived market positioning, achieved intermediate results. While it outperformed the MPT-based portfolio in risk-adjusted terms, its lack of formal optimization renders it vulnerable to behavioral biases and inconsistent decision-making. Consequently, such an approach may be unsuitable for institutional settings that require transparency, replicability, and rigorous risk controls (Samuels, 2024). Passive investing, as proxied by the S&P 500 index, exhibited comparatively low volatility and ranked second in terms of capital preservation, which is consistent with evidence that passive strategies tend to perform favorably over the long term in efficient markets (Dorsey, 2012).

Beyond model structure, the analysis highlights the material impact of transaction costs and dividend reinvestment on realized performance. Dividend reinvestment contributes positively to long-term returns through compounding effects, corroborating prior findings on the significance of reinvestment strategies for portfolio growth (Gonçalves, 2021). Conversely, transaction costs, particularly those associated with short selling, erode net returns and diminish the practical viability of portfolios heavily reliant on leverage and frequent rebalancing. Short positions introduce borrowing costs, margin requirements, and execution risks, all of which may undermine performance and add operational complexity (Glantz, 2003). These factors underscore a fundamental gap between the theoretical assumptions underlying MPT and the operational realities faced by investors in actual financial markets.

Overall, the evidence suggests that while all examined strategies were adversely affected by market conditions, the choice of optimization methodology plays a decisive role in determining the extent of losses. Among the evaluated approaches, the Black-Litterman framework

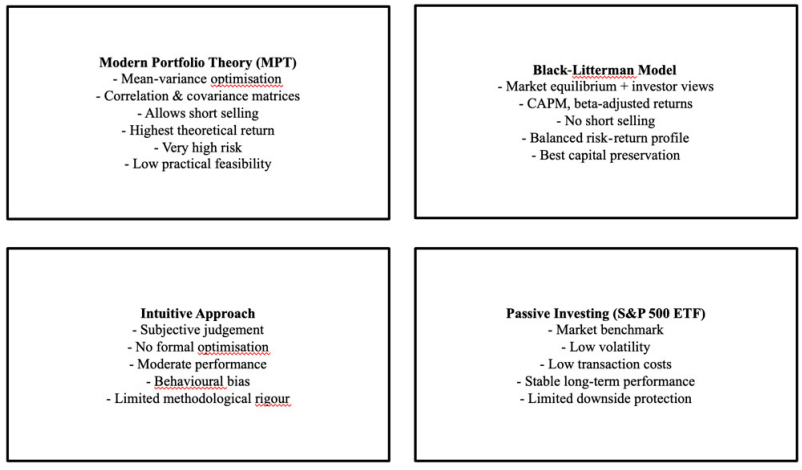

Figure 2. Comparative performance of portfolio strategies (source: own elaboration)

offers the most effective balance between return potential and risk control. By integrating market equilibrium with investor insights, it generates stable and implementable portfolios without relying on unrealistic assumptions such as frictionless markets or unrestricted leverage (Umadevi & Sundar, 2023). The findings therefore support a hybrid investment approach that combines rigorous quantitative modelling with informed market perspectives, enabling investors to enhance adaptability, manage volatility more effectively, and achieve more resilient long-term outcomes (Figure 2).

6. Conclusions

This study is subject to several limitations that should be acknowledged when interpreting the findings. First, the analysis is confined to a relatively short and turbulent time horizon (November 2021–January 2023), which may not adequately capture longer-term investment cycles or structural economic shifts. Consequently, the results cannot be readily generalized to periods of sustained market growth or alternative macroeconomic regimes. Had the analysis been conducted in earlier periods, particularly during more stable market phases prior to 2021, the relative performance of the portfolio optimization models might have differed, with Modern Portfolio Theory potentially benefiting from lower volatility and more predictable return distributions. Conversely, extending the forecasting horizon beyond January 2023 into phases of market recovery or stabilization could yield different outcomes, especially for active strategies, as model-based rebalancing may better capture emerging trends in less turbulent environments.

Second, the portfolio construction relies on historical data and a predefined set of assets, thereby limiting its ability to reflect dynamic market changes, regime shifts, and unexpected exogenous shocks. Moreover, the relatively small universe of only 15 firms constrains the degree of diversification that can be achieved. Expanding the asset base to include a larger number of companies across additional sectors and geographical regions would likely enhance diversification benefits, reduce idiosyncratic risk, and improve the robustness of forecasting outcomes. In such a setting, optimization models, particularly the Black-Litterman framework, could exploit a broader covariance structure and incorporate a wider range of market views, potentially yielding more stable and generalizable portfolio allocations.

Several methodological challenges also remain. While quantitative optimization frameworks provide analytical rigor, their practical implementation is affected by transaction costs, liquidity constraints, regulatory restrictions, and the operational complexities associated with rebalancing and short selling. In addition, intuitive portfolio construction, although informative from a behavioral perspective, remains vulnerable to cognitive biases and lacks replicability. These factors underscore the persistent gap between theoretical portfolio optimization and real-world investment practice, particularly under conditions of market stress and heightened uncertainty.

Future research should therefore extend the present analysis to longer time horizons and alternative market phases in order to test the robustness of portfolio strategies across different economic conditions. Further studies may explore dynamic rebalancing schemes, stochastic optimization techniques, and machine-learning-based predictive models to enhance

adaptability and risk management. Integrating Environmental, Social, and Governance (ESG) criteria into portfolio construction frameworks, particularly within the Black-Litterman model, represents another promising avenue. Finally, deeper investigation into behavioral and psychological determinants of investor decision-making would provide valuable insights into portfolio performance under uncertainty and market stress.

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Author contributions

MN and KV conceived the study and were responsible for the design and development of the data analysis. MN was responsible for data collection and analysis. KV was responsible for data interpretation. MN and KV wrote the first draft of the article.

Disclosure statement

The authors declare that they have no relevant or material financial interests, no financial, professional or personal interests from other parties that relate to the research described in this paper.

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