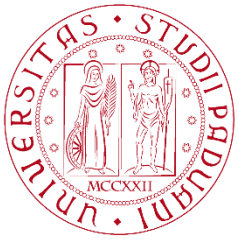

UNIVERSITÀ DEGLI STUDI DI PADOVA

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Dipartimento di Economia

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TESI DI LAUREA MAGISTRALE IN ECONOMICS AND FINANCE

Does Passive Investment Beat Active One?

Relatore: Amedeo Pugliese

Laureando: Andrea Menon

N. matricola: 2073760

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1. INTRODUCTION

Since the formation of the very first stock exchange in Amsterdam back in 1602, financial markets have undergone numerous changes until shaping what is nowadays called finance. Of the many developments made within this discipline, however, one of the most disputed subjects to receive considerable interest from the academic circle and industry participants alike ever since the 1970s had been the arguments between passive and active investment. This has become very important in the investment decision-making process, as investors have a natural desire to maximize returns while minimizing costs and risks, even more considering how these two strategies summarize the main possible approaches available in the financial market nowadays.

1.1 My help to the research

The relevance of this debate to the investment landscape, and its importance to the shaping of perspectives on not only returns but also the risks and costs associated with investor portfolios, has stimulated me to research this subject. The insights given will elucidate current research in an attempt to explain more clearly the effectiveness of passive versus active investment strategies. Though the debate about those two is well-represented within the literature, I strongly believe that certain gaps persist and therefore merit further attention.

Firstly, most of the studies discussed later in Chapter 2 assess performance before and after accounting for costs correctly, but fail to put a relevant focus on any form of risk metrics in their calculations. An example in this case are the works carried out by J. Bogle, which give bigger emphasis on the effect of costs rather than providing a risk-adjusted overview. To cover this omission, I will include three of the main risk metrics in my analysis: standard deviation, Sharpe ratio, and Value at Risk (VaR). Risk-adjusted performance measures, such as the Sharpe ratio, assist in giving a more granular view of just how much return is achieved per unit of risk taken. As a matter of fact, it is an extremely useful measure to look at when making comparisons of investment strategy performance, given that it calculates the excess return per unit of total risk taken, measured by the standard deviation. A higher Sharpe ratio will then denote that more

return is delivered on the strategy for each unit of risk involved, which means a better situation for investors. My expectations in this regard are that due to the low costs and wide diversification, passively managed funds should show competitive ratios compared to actively managed ones. This is because passive funds do not aim at market outperformance, which allows them to avoid extra risks that are part of the active management approach such as market timing or concentrated positions, enabling them to obtain lower volatility.

Secondly, fixed time horizons have also been very common in many professional studies without considering multiple periods. This may indeed be a weakness of the approach, as the choice of the time frame may be self-serving and conveniently support the thesis or conclusion advanced. In this case, the experts that present such bias in their analysis, as we will better be analyzed in Chapter 2, are W.F. Sharpe, M.C. Jensen, D. Nanigian, and many more. A method to reduce this effect, that I've implemented in my study, is to measure performance over different horizons, which in my case will be: 5 years, 10 years, and the maximum period available given the inception date of the various funds. These different times provide a more holistic and complete process for performance appraisal by capturing influences of various market cycles, economic conditions and factors specific to the funds. As a matter of fact, relatively shorter time frames, like 5 and 10-year ones, reflect the most recent trends and may capture high or low volatility periods, economic recessions, or market booms. In contrast, the maximum horizon captures the full lifetime of the fund, thus being indicative of long-term performance and resistance against a variety of influences through time. This analysis, therefore, tries to cover multiple periods with hopes of generating more reliable and generalizable findings about the comparative performance of passive versus active strategies, especially among retail investors with differing investment horizons. I'm expecting that, with the bigger time horizon, passive investments will tend to outperform active ones on account of fewer fees and reduced impact from active management biases. However, over shorter horizons, it is possible to find instances of outperformance by active funds during times of volatility and when markets are generally bearish, given their ability to respond sooner to such changes.

Lastly, the most personal aspect to myself is the generalization of the audience addressed in past studies. While the difference is majorly methodological, most of the

researched papers aim at a wide range of investors, providing this way a broader overview. Other than by the expertise already named, those that preferred to provide a more general overview are B.G. Malkie and K.R. French. Contrariwise, my research will put a focus on retail investors. By this I mean that, as we will see in Chapter 3, I will assume up to a $10.000 minimum investment requirement by active funds, and I will select ETFs to represent the passive investment benchmark. This decision is based on my understanding that small retail investors would often have fewer sophisticated resources, making them the weak part in a relationship between them, the market and advisors, or perhaps operate under different constraints or objectives than larger institutional investors. In this regard, my research, via this focused attention, can better ascertain various investment strategies that pertain to the regular retail investor in a more accurate and realistic manner, as well as trying to provide a minimum level of protection against the possible exploitation of this subject given their unschooled profile.

Given this last point, it is important to underline how although this thesis target is retail investors, the discovery of this study is relevant for many various persons: financial regulators, portfolio managers, and other financial professionals. These may not be identified or quantified but would likely be of interest in the broader implications of general adoption of passive investing. It is through empirical evidence that portfolio managers and financial advisors can recommend the most experienced strategies to their clients by matching investment choices with clients' long-term objectives and risk profiles. The dynamics might also be of interest to banks and financial institutions when designing and offering their investment products to the market segments.

1.2 Work structure

By now the aim of this research should have become clearer: to establish which of the passive and active investment strategies works better, applying an approach focused mainly on retail investors. This would be achieved through answering whether one investment approach outperforms the other one firstly on an absolute basis, but then also after considering its risk- and cost-adjusted performance. The intention of the study is to illustrate the practical implications of choosing either strategy by looking at historical data and applying various metrics for performance.

This work will be initiated with an extensive literature review to place in context, with a definition of the retail investor, passive investment, and active investment, as well as historical comparison studies of these two strategies. Literature will be important in terms of providing the background that should lead to an enhanced understanding of the concepts involved and prevailing expert opinions on the research question. This study would also provide practical insights into historical analyses and methodologies for measuring portfolio performance and risk-adjusted metrics. This part will be accomplished through the review of key studies and seminal papers in the area, to underline the evolution of thought and the current consensus academics and practitioners converge on.

The literature review will be followed by a description of my empirical analysis: I will describe the selection criteria of instruments used, explain the steps for sourcing the data, and detail the measurement methodologies that will be employed in the analysis. The empirical analysis shall be based on data collected for various passive and active funds, looking at their performance over different time periods and comparing their costs and risk-adjusted returns. This study will help illustrate real-life challenges and opportunities for retail investors in their investment decision process, by also considering a diverse range of funds that best represent the various funds in both the passive and active categories. On the passive side, it will includes passive managed ETFs, while on the active side, it will considers actively managed mutual funds, decision based on some aspect of these instruments such as fun size, Morningstar rating, and many more that will be better analyzed in Chapter 3.

The most critical part of this work will be the discussion of the results which were obtained during my analysis. These results will confirm or reject the results that were obtained in previous research by professionals. Returns will not be a performance measure by themselves, but it will be implemented with an analysis of how costs and risks affect the outcomes. The analysis will comprehensively assess each strategy's effectiveness by looking at metrics like the Sharpe ratio and Value at Risk (VaR). The thesis results will add to the debate between passive and active investment, providing a lucid comparison of the two with respect to each other. I expect passive strategies to be more suitable for the majority of retail investors, given their very easy implementation, low fees, and consistent performance. Thus, the thesis looks forward to providing a

detailed examination of the major considerations retail investors need to put into choice between passive and active investment strategies. As a matter of fact, will try, from the analysis of the risk and cost-adjusted performance of both approaches, to infer some evidence-based insights toward retail investors making informed choices.

Finally, conclusion remarks will provide my findings and some recommendations on retail investors' considerations for investment in the long run. The recommendations will be based upon the empirical evidence gathered and the insights that are derived from the analysis. The conclusion will also cover the limitations of the study and indicate areas for future research. I hope that the following pages will have a meaningful impact and assist its readers in making informed investment decisions while contributing to the discourse on the best investment strategy. It will seek to assist retail investors in navigating the complex investment instruments effectively by providing them with clear and detailed comparisons of passive and active strategies.

2. LITERATURE REVIEW

2.1 Literature review of retail investors

Retail investors, otherwise called individual or small investors, are a big player in financial markets undertaking buying and selling of securities, mutual funds, and other various investment products on behalf of their own accounts. Unlike institutional investors who handle huge volumes of money belonging to organizations, these usually have small amounts that they invest for personal benefits. This distinction has profound implications for how retail investors operate, the strategies they employ, and the outcomes they achieve in the financial markets.

Retail investors constitute a diverse group: they possess varying levels of financial literacy, investment goals, risk tolerance, and resources of market accessibility. This is reflected both in the way they make decisions and in the type of investment they prefer. Whereas an institutional investor may use financial models and proprietary research, retail investors typically base investment decisions on market sentiment, trends, or recommendations given by financial advisors. This reliance on readily available information and the advice of others can make individual investors even more susceptible to common cognitive biases and behavioral pitfalls. *B.M. Barber* and *T. Odean* had also said in their *"Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors"* that the retail investors have long been perceived as being less informed than the institutional investor, because they usually depend on publicly available information, which again is less extensive and timely compared to proprietary data to which the professional investors have access.

The increasing online trading platforms and, thus, democratization of financial information have boosted retail investors' participation in the financial markets. As shown by data from different studies, over the last decades, the share of trades executed by retail investors has grown steadily. These changes have democratized access to financial markets and have allowed retail investors to participate more actively in market activities. For example, *Bloomberg Intelligence* estimated that the retail investors' share of the total trading volume rose from just above 10% in 2011 to over 22% in 2021. Moreover, in early

2023, according to a report by *IBISWorld*, the marketplace for individual investors was valued at $7,2 trillion in size. Just in the US instead, *Morgan Stanley* estimated retail investors made up about 10% of daily trading volumes on the Russell 3000, the broadest US stocks index, after peaking in September 2020, when lockdown measures were first enforced, at 15%. Part of this is due to a decrease in transaction costs, increased access to trading platforms, and cultural shifts that increasingly place personal responsibility on finance. As, a matter of fact as reported by *D. Curry* in its two articles for *Business of Apps*, the two most famous trading platforms among retail investors have been seen an exponential increase in users, with Robinhood going from 0,5 million accounts in 2015 to 11,8 in 2024, and eToro moving from 5,6 million in 2016 to 35 in 2024.

One aspect worth of notice when talking about retail investors is the emotional part that come in place when they embrace a journey in the financial markets, a world for most of them so vague and unknow that it is easy to get lost in. This has received plenty of attention of expertise which have conducted many researched on this branch of literature called behavioral finance.

Indeed, behavioral finance has much to contribute toward an understanding of the decision processes of retail investors. This domain, challenging the traditional economic assumption of investor rationality, has identified a host of cognitive biases and emotional factors driving investment behavior. Pioneers in behavioral finance, *D. Kahneman* and *A. Tversky*, were able to show that investors are far from rational, with the greatest susceptibility to these biases being those of retail investors. One of the most common biases among retail investors is overconfidence, a person overestimates his knowledge, abilities, and the preciseness of his predictions. This can lead to too much trading since overconfident investors may feel they can time the market or pick winners, despite an abundance of evidence to the contrary. Behavioral finance researchers *T. Odean* and *B. Barber* provided evidence for the above view by showing that frequent trading by individual investors generates lower market returns, thereby falsifying the belief that active management could surely or consistently outdo the market.

It is *Barber* and *Odean*'s research in their *"Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors",* analyzing the trading behavior of 66.465 households from a large discount brokerage between 1991 and

1996, that provides strong evidence that individual investors pay a substantial performance penalty for active trading. This study finds evidence that the most active traders-those with the highest portfolio turnovers-substantially underperform the market. Where the market returns an annualized mean of 17,9%, the most active traders make only 11,4% after accounting for transaction costs. This drastic underperformance is principally explained by overconfidence, a psychological bias through which investors overestimate their forecasting ability in the market and the value of their private information.

Overconfidence is just one of the cognitive biases affecting retail investors. Loss aversion, an important aspect of prospect theory developed by *Kahneman* and *Tversky*, refers to the fact that individuals suffer more from losses than they enjoy equivalent gains. This could lead the retail investors to hold on to an investment that is running at a loss in anticipation of prices rebounding so that they need not book a loss. This phenomenon is called the disposition effect and is widely observable in retail investor portfolios. The disposition effect has been associated with poorer investment outcomes, as aversion to realizing losses prevents investors from redeploying capital to more promising opportunities at the expense of overall portfolio performance. The pride from gains and regret over losses are considered one of the strong emotional motivators for such investment decisions, since investors sometimes cannot accept mistakes and take the necessary measures to correct their positions. *Malkiel* also cites a study by *Shefrin* showing that *"investors are 1,68 times more likely to sell a stock that has gone up in value than to sell one that has gone down in value. This only causes a pattern of selling the wrong stock".*

One other major phenomenon relating to retail investor way of acting is herding behavior. It occurs when there are a number of individuals acting similarly to other, larger groups, and is usually based on the assumption that this group knows or has acquired better information or even insight. This type of behavior among retail investors who lack confidence in their decisions may be particularly manifested by simply following the trend set by others. While this sometimes results in positive returns, which is what happens when herding occurs along with fundamental market trends, at other times, it may cause asset bubbles and subsequent crashes. Such bubbles burst, leaving the retail investors who usually enter late into the market particularly vulnerable to severe losses.

Retail investors, in particular, may be a source of inefficiencies due to decisions based on biased beliefs and emotional responses rather than fundamental analysis. *"These inefficiencies can be perpetuated since retail investors, influenced by biases, persist in making suboptimal decisions, too frequently buying overpriced assets or selling undervalued ones"* as stated by *H. Shefrin* in its *"Beyond Greed and Fear"*.

In my opinion, retail investors, by their nature, typically have limited access to timely, high-quality financial information, and even when such information is available, they often lack the time or expertise to fully analyze and interpret it. This inherent disadvantage creates an environment where large financial institutions, armed with vast resources, can exploit these gaps in knowledge. Retail investors, many of whom are everyday people seeking to grow their savings or secure their retirement, often find themselves at a significant disadvantage in the investment landscape.

A troubling aspect of this dynamic is the heavy reliance retail investors must place on financial advisors, many of whom work within or are influenced by large financial institutions. The trust placed in these advisors is frequently based on the assumption that they act in the best interest of their clients. However, what is often hidden from view is the potential for conflicts of interest. Advisors may recommend products or investment strategies that benefit themselves or their firm more than the investor. This misalignment of incentives leads to a system where retail investors unknowingly pay for underperformance, saddled with high fees and commissions, all while being sold the promise of "active management" that often fails to deliver superior returns compared to passive investment options.

The active investment industry thrives on the illusion that it holds unique, market-beating insights, but as countless studies as we will see below shows, very few active managers consistently outperform the market after fees. This underperformance, however, does not prevent the industry from marketing itself aggressively to retail investors, many of whom lack the knowledge to scrutinize the results being promised to them. Instead, they are lured by the appeal of professional expertise, believing that a well-spoken advisor or a glossy marketing brochure guarantees results. What is less obvious, but deeply concerning, is the way these institutions exploit the emotional and cognitive

biases of everyday investors—fear of missing out, the illusion of control, and the comfort of professional guidance—all while benefiting from high fees and commissions.

In essence, the system is designed in such a way that retail investors are encouraged to believe that active management is their best path forward, without being fully aware that, statistically speaking, passive investment strategies offer better long-term outcomes. Advisors and institutions profit from this asymmetry of information, leveraging their resources and expertise not necessarily to benefit the investor, but to maintain their profitability. It's a classic case of the power imbalance between the financial elite and the average investor, where the latter is often left in the dark, reliant on advice that may not truly serve their interests.

2.2 Literature review of passive investment

Passive investment strategies are those that do not aim at abnormal returns, instead they try to reproduce a particular market index. This kind of plan of action takes with them different advantages, as well as some disadvantages.

One of the key advantages of passive investing is the low cost. Hereby, passive funds are generally less intervened in and hence keep their management fee and transaction cost much lower than those of active funds. This cost advantage is particularly significant when considering the impact of fees on long-term investment returns. Indeed, over time, even seemingly small differences in expense ratios can compound, leading to substantial differences in overall investment portfolio performance. For instance, as confirmed by *J.C. Bogle* in its book *"The Little Book of Common Sense Investing"*, the 1% discrepancy in the annual fee can make the value reduction of the portfolio over 30 years equal to 20%, underlying how minimizing costs is one of the best way for investors to retain bigger share of returns. Thus, this is a crucial aspect to take in consideration when deciding which investment to pursue, especially for a retail investor who may not have access to much investing in the first place.

Another important advantage of passive investing relates to transparency thanks to their very nature of replicating the composition of a certain index, the contents of which are publicly known. That level of transparency makes investors have a really good view

of what they hold, thereby reducing the uncertainties often associated with active management, whose investment decisions are opaquer and can rapidly change on the judgments from managers. *E.J. Elton*, *M.J. Gruber* and *J.A. Busse* in their article *"Are Investors Rational? Choices Among Index Funds"* for the *Journal of Finance*, underline how this could promote greater investor confidence and predictability in their investment experience, providing finding on how on average investors tend to prefer funds with higher transparency and a better alignment with the public knowledge of index composition.

Finally, one of the main benefits of passive investing is having a wide range of diversification. By its very nature, investments in indexes and passive funds are diversified across securities, sectors, and geographies. As analyzed by *W.F. Sharpe* in its article *"The Arithmetic of Active Management"* for the *Financial Analysts Journal*, this reduces unsystematic risk and ensures the performance of a portfolio stays very close to that of the broader market. Aspect also enhanced by the *Markowitz*'s Portfolio Selection Theory, which underline how passive instruments are useful to retail investors who might not have the necessary resources or wherewithal to create a diversified portfolio on their own. Underlying moreover, how diversification is one of the very key principles for risk management in investing, and it's where passive helps the retail investor get the job done, enabling an enhancement in the risk-return trade-off in an efficient manner without getting into extensive research or active management.

Passive strategies get an additional thumbs-up through evidence provided by behavioral finance. These mental mistakes investors make over and over are because of cognitive biases like overconfidence and chasing after performance on the back of the house, as highlighted in the first part of this Chapter. Passive investing, by its very nature, avoids these biases because it promotes a disciplined way to the process of investment in a long-term manner. As *Thaler* and *Sunstein* indicated, given the automaticity and simplicity of passive investing, it meets those requirements cited in behavioral economics for structures needed to avail better decisions by reducing the opportunity for emotionally driven mistakes.

However, generally simple and cost-effective techniques, passive strategies are not left to be praised in all sorts. Among the key detrimental criticisms laid down against

them are that passive investors bear full exposure to the market's vagaries. Since passive funds simply track the market, they move with the ups and downs of the broader market. Thus, in periods of downturns, passive investors face massive losses since the portfolios cannot be dynamic or flexible enough to respond to new market situations or hedge in risk exposure. This idea is supported in many articles and books of relevant expertise, such the already named *W.F. Sharpe* and *J.C. Bogle*, but also *K.R. French* and *M. Hood*, all acknowledging that passive portfolios in case of downturns are left "unshielded" and so unable to avoid losses and to respond to changing market conditions.

Index Funds and ETFs are the most common instruments that an ordinary investor can use to get access to such strategies, with their relevance increasing years after years. *J. Rekenthaler* in its article *"Index Funds Have Officially Won"* for *Morningstar*, say the inevitable arrived *"Last month, for the first time, passively managed funds controlled more assets than did their actively managed competitors. (This count includes both traditional mutual funds and exchange-traded funds.)"*. This is confirmed directly by Morningstar as we can see by their published Figure 1, below reported.

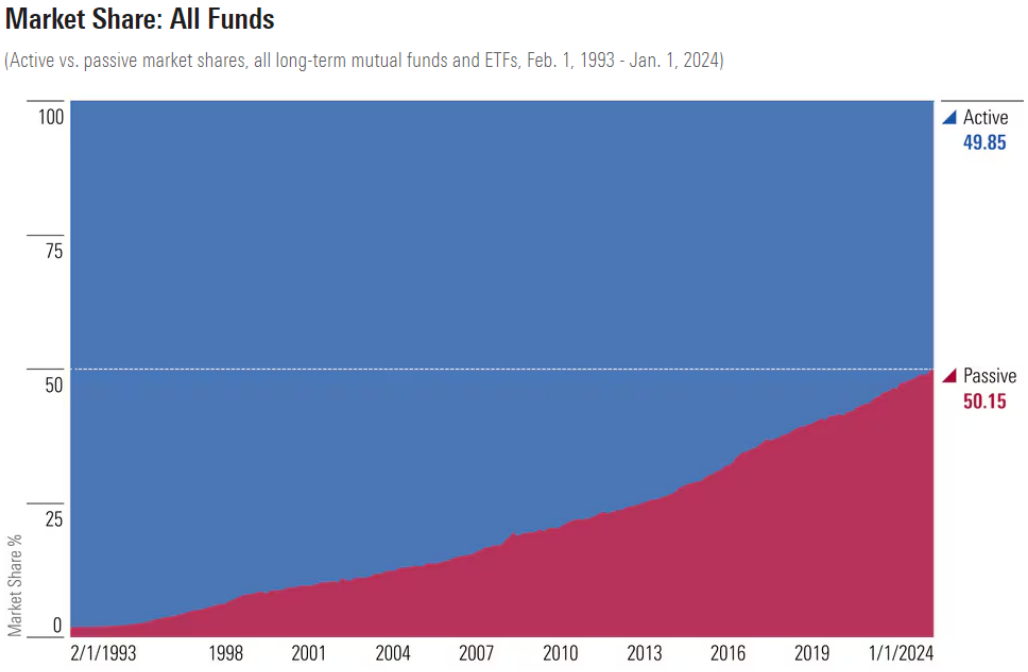

Figure 1

Moreover, according to the *Morningstar* article by *J. McAlpine* entitled *"The Rise of Passive Investing in Today's Market"*, passive investment funds have had huge varying

popularity by region. In the United States, there has been an enormous shift in the market over the last 20 years as also seen in the Figure 1 above, moving from active funds to passive investment vehicles. As stated in the article, this has been in large part because of the infamously low success rate of active managers within the US equity field.

Also in Europe, the appetite for passive investing is still on the rise. Even more if we look at long-term investment options which, as research from *Morningstar Direct's European Asset Flows Commentary* indicates, have posted inflows of €13,41 billion in April 2024, reaching a market share of 27,96% compared to the 24,79% of April 2023.

Literature on passive investment strategies highlights their increasing adoption by retail investors driven also by the development of the Efficient Market Hypothesis, which says that financial markets are usually efficient, that is, a situation in which all known information is currently reflected in asset prices. Seminal works by *Fama*, among others, have laid a theoretical framework for EMH, postulating that since the markets are efficient, the active managers are unlikely to beat the market on a risk-adjusted basis over the long run. This underpinning has, in large measure, been one of the drivers for the rise of index funds and exchange-traded funds; both are designed to mimic the performance of an underlying index rather than outperform it.

D. Abner's contribution in the book entitled *"The ETF Handbook: How to Value and Trade Exchange-Traded Funds"* gives foundational knowledge of the ETF market, its structure, and its evolution, thus providing fundamentally important insight that is necessary in understanding the wider ramifications of passive investment strategies. *Abner* points out that equity-based products dominate the ETF market, comprising about 70% of the ETF assets in the United States. This is mainly because equity ETFs were the first to hit the market as compared to other asset classes, giving such products a wide lead. According to David, the success of the ETFs does not lie in access to the market early enough but also by design that ensures transparency, liquidity, and importantly ease of trade. These features are particularly important in that they are just the core tenets of passive investing.

2.3 Literature review of active investment

For contrast, I will talk now about active investment approaches, which assume that a skillful manager can utilize the market's inefficiency to attain a better return than that of the market. Active managers use these perceived inefficiencies to their advantage through various techniques, such as stock picking, market timing, and sector rotation, with the final goal of ideally achieve more returns than a general market benchmark, such as the S&P 500, by selecting undervalued securities or timing the market to buy low and sell high. It is an approach essentially characterized by a proactive stance in which fund managers continuously map market conditions, economic indicators, and company specifics to make informed investment decisions. Such inefficiency are presented in many different study like *"The Efficient Market Hypothesis and Its Critics"* by *B.G. Malkiel*, which discuss how despite strong support to EMH anomalies persist in financial markets as highlighted by bubbles, and "*The Adaptive Markets Hypothesis: Market Efficiency from an Evolutionary Perspective"* by *A.W. Lo*, where it states that efficiency is not absolute but varies with market conditions and the behavior of investors. The proponents of managed investment do argue that active management could realize superior returns, especially for markets that are inefficient. Skilled active managers can identify undervalued or overvalued securities and make investment decisions that result in outperformance in such markets where information asymmetry occurs and not all investors possess the same information.

The core attractiveness of active management is then related to its potential for better returns. An active manager, with the power to handle cash at will, can easily adjust an investment style, theoretically allowing him to deliver "alpha," or excess return above the return of a benchmark index, to investors by identifying what the broader market may have missed through better research and analysis in potential investments. Active managers can utilize this flexibility in dynamic management of their portfolio with changes according to the market, thereby potentially reducing the downsides or capitalizing on an uptrend by being effective and industrious in this respect. For example, *Berk* and *Green* provide some empirical evidence in *"Mutual Fund Flows and Performance in Rational Markets"*, underlying how talented fund managers can produce positive alpha.

For this reason, the success of active management is inordinately dependent on the skill and judgment of one individual, the fund manager. The challenge of beating the

market is further compounded by the fact that as time goes by, markets are getting increasingly efficient, whereby more information is readily available to any market participant, increasing the likelihood of human errors by managers. This idea is supported by *B.G. Malkiel* in his book *"A Random Walk Down Wall Street"*, where it states that such increase in efficiency is due to a swift dissemination of information and an increase in the number of participants, all this leading to a diminishing in the opportunities for active managers to exploit market inefficiencies making it unlikely for them to realize superior returns.

Moreover, active management has conventionally been regarded as being of particular benefit during periods of turmoil in the markets, where such ability to rapidly change the portfolio in response to changing conditions protects against losses or enhances gains. This has been underwritten by many experts like *M. Baker*, *B. Bradley* and J. *Wurgler* that in their article, *"Benchmarks as Limits to Arbitrage: Understanding the Low-Volatility Anomaly"* for the *Financial Analysts Journal*, writes how active managers can exploit low-volatility stocks for stability during period of high uncertainty in the market. Thesis also confirmed by *A.W. Lo, C. Cao, Y. Chen* and *B. Liang* that, in their article *"Can Hedge Funds Time Market Liquidity?"* for the *Journal of Financial Economics*, states how active funds adjust their portfolios to account for change in market liquidity, particularly during market turmoil.

However, expertise over the years has also raised several issues and criticism about managed investments. Probably the most important issue is related to the expense of active management. Generally, the management fees and transaction costs of the managed investments are too high. The same *Berk* and *Green* cited before, affirms in their paper how these costs can dramatically eat into returns, especially over the long term. Management fees, for instance, are structured as a percentage of the total assets managed and may lie in the range of 0,5% to 2% or more per annum. Transaction costs related to the frequent buying and selling of securities further deplete returns. This without doubt has contributed to the increased skepticism about whether higher returns justify the higher costs of active management. This underlines one of the key paradoxes presented by *Carhart* in his study *"On Persistence in Mutual Fund Performance"*: while some individual managers may possess talent in picking stocks, management costs often erase the excess returns that otherwise would be turned out as superior performance.

Another critical issue is the fact that the size and liquidity of the assets managed will have a great influence on the results of active management. One piece of evidence, shown in the study done by *Chen, Hong, Huang*, and *Kubik* entitled *"Does Fund Size Erode Mutual Fund Performance? The Role of Liquidity and Organization"*, is that fund size is inversely related to fund performance. As a matter of fact, as it grows, it is more likely to face higher trading costs-especially for larger funds that invest in small-cap stocks-which negatively affect its alpha-generating capability. This relationship is particularly important for small-cap funds, where the cost of trading illiquid stocks grows exponentially as portfolio size increases. The liquidity constraints of larger funds often force them to either spread trades over longer periods or invest in larger, more liquid stocks-thus limiting their manager's ability to exploit smaller market inefficiencies. This evidence by *Edelen, Evans*, and *Kadlec*, in their article titled *"Scale Effects in Mutual Fund Performance: The Role of Trading Costs"* confirms the above finding and shows that the main driver of the performance-size relation is not manager discretion but rather trading costs. In fact, this represents one of the major problems of active investing: how to handle the size of the funds without giving up returns to disproportionately large trading costs. Not to mention the point raised by *A. Shleifer* and *R.W. Vishny* in their *"The Limits of Arbitrage"*, about the possible management problems in case of large inflows or outflows. For example, if a substantial number of investors redeem their shares, the fund manager is compelled to sell some securities, probably at depressed prices, to meet such redemptions. That may jeopardize the overall performance of the fund, particularly if the latter has a considerable portion of its portfolio invested in illiquid assets.

Added to that burden, the constraint imposed by fund regulations and the investment mandate circumscribed the activities of an active manager, as reported by *E.F. Fama* and *K.R. French* in *"The Anatomy of Value and Growth Stocks"*, many mutual funds have strict regulatory requirements with respect to diversification, leverage, and liquidity, and can severely hamper the ability of the manager to fully express the intended investment strategy. These constraints are designed to protect the investor from over-concentration in one asset or sector, and to ensure enough liquidity is available to meet redemptions. However, they can also become overly restrictive for a fund manager in his alpha generation process, since this will limit the degree to which he can exploit some

investment opportunities. A very relevant debate concerning active management, however, is that about economies of scale in mutual funds.

According to *Wermers*, in *"Mutual Fund Performance: An Empirical Decomposition into Stock-Picking Talent, Style, Transactions Costs, and Expenses"* the fund managers might be incentivized to herd, following other managers' strategies of investment performance, without knowing if those will perform above their peers. This, therefore, can result in suboptimal investment decisions since managers may focus on short-term performance rather than long-term value creation.

To conclude, active management carries with it some risks and disadvantages to balance out the hope for higher returns through adept management and alpha generation. The high fees, costs of trading, economies of scale, and behavioral biases are big detriments to overall performance that must be taken into consideration when dealing with actively managed funds. Investors must, therefore, balance these considerations against each other in their decisions between active and passive investment strategies based on their investment objectives, risk tolerance, and after-fee return expectations. The literature identifies the complexity of the attainment of sustainable outperformance in managed investments, indicating that a decision to pursue active management must be made with full awareness of both its possible benefits and naturally occurring risks. As long as the financial markets continue to evolve, active management is likely to remain of considerable interest, especially for its ability to adapt to conditions of change and increasing efficiency in global markets.

2.4 Literature review of passive vs active investment strategies

Historical comparative performances between passive and active strategies have been one of the cornerstones of financial research. This stream of literature tries to analyze and quantify the expertise belief in term of performance differentials between two decidedly different methods of investment, specifically regarding which yields superior returns, especially when considering risk-adjusted metrics of return.

These early formative studies were mostly based on the relative performance of mutual funds to their benchmarks, such as *W.F. Sharpe* and *M.C. Jensen* ones. These

seminal papers laid the foundation for how to think about the intrinsic problems of active managers being hardly able to systematically outperform the market.

W.F. Sharpe introduced in his article *"The Arithmetic of Active Management"* the Sharpe ratio, which became an important device for risk-adjusted returns, tools later used in my own analysis and better explained in my following Chapter. His results showed that most active funds did not perform as well as their benchmarks after fees and expenses were deducted, a result that will be repeated many times in the future.

The other key contribution comes from *M.C. Jensen* when he presented the metric alpha in his paper *"The Performance of Mutual Funds in the Period 1945–1964"*, a measure of the extent to which a fund could generate returns over and above what would have been expected by its benchmark results. This measure further gave support to the factor that active management has great difficulties in trying to beat the market on a constant basis, showing that a small number of managers could achieve positive alpha over a given period consistently.

One of the key relative advantages of passive investing, highlighted in the literature, is the generally lower cost structure compared to active management. Since active funds must continuously engage in research, active trading, and tap into expertise from fund managers, their management fees are usually much higher. These higher fees add up over time and may severely eat into the returns which the investors actually get. For instance, much of the following literatures highlight how the compounding effect of the fees dramatically lowers the long-term return of the active investors as stated by *K.R. French*. On the other hand, passive funds which track only an index work with much lower management costs. According to *J.C. Bogle*, one of the most reliable methods of enhancing long-term investment returns is cost minimization, making passive investing more beneficial for retail investors, who usually have smaller-sized portfolios and are generally more fee-sensitive.

The literature on the topic started to increase at an alarming rate during the 1980s and 1990s when researchers started using broader samples and longer periods to enhance the results' robustness. The most telling argument for the long-term superiority of the passive strategies, particularly index funds, came during this period from *B.G. Malkiel* in his book *"A Random Walk Down Wall Street"*. His analysis showed that a dart-throwing

monkey will always do better than a costly active manager provided, of course, the monkey has the same probability distribution as the universe of active managers. This fact was further corroborated with the empirical evidence that active managers can seldom justify their fees, as any excess return earned by them is usually offset by the costs of active management.

This thesis was then supported by *M. Carhart*'s work in *"On Persistence in Mutual Fund Performance"*, which influence lay on his ability to change the storyline of active management. As a matter of fact, in his four-factor model, he highlights that most of the apparent successes of active managers could be ascribed to their exposure to known risk factors rather than to real skill in stock picking. With this model, including market risk, size, value, and momentum as factors, it furthered a better understanding for mutual fund performance. The implication of *M. Carhart*'s results was that even when active managers do outperform, much of their success is due to systematic risk factors rather than managerial expertise. This certainly reinforced the notion that the consistent generation of alpha is exceedingly rare, and that active management's value proposition may be overstated.

The later rise of exchange-traded funds in the 2000s added a new dimension to the passive versus active debate. With their low costs and efficiency in trading, ETFs became increasingly popular passive investment instruments. The literature during this period started to contrast the performance of the ETFs with those of actively managed funds, further sealing the case in support of passive investing. A major underlying theme in the literature is the increasing efficiency of financial markets, making it even more difficult for active managers to outperform. For example, works like *K.R. French*'s study in *"The Cost of Active Investing"*, underlined the fact that active management is a zero-sum game, where gains from active managers come at someone else's expense. From such a perspective, consistent outperformance was implicitly presented as an unlikely possibility, at least within that landscape where information is available to an important extent and markets gradually turn increasingly competitive.

D. Nanigian's work, *"The Historical Record on Active versus Passive Mutual Fund Performance"*, offers an empirical development of the wide-brush conclusion that passive funds outperform active funds. His vast study on mutual funds for the period 1991

to 2018 makes a case that while, in general, the performance gap between active and passive investment strategies favors passive funds, it is not as wide as one would have thought, at least if consideration is focused on competitively priced active funds. That is where *D. Nanigian*'s findings become highly relevant in the context of cost considerations. His analysis shows that when the expense ratios for active funds are competitive, the differential performance between active and passive strategies can become statistically insignificant. This therefore not only challenges the dominant narrative that passive investing is always better but also suggests that investors who can identify lower-cost active funds might achieve comparable results from those of passive strategies. For instance, his study indicates that the wide universe of equally weighted active and passive fund portfolios generates an annual performance difference of only 0,17%, which is statistically insignificant. This would seem to indicate that the choice between active and passive management can be based more on cost consideration rather than inherent superiority of one strategy over the other.

D. Nanigian's study also looks at the performance of active versus passive funds in different market cycles-something lacking in many of the more superficial comparisons. His findings appear to indicate that when markets are declining, active funds tend to do a better job of protecting against losses, in a manner consistent with the premise that skilled active managers can generate value by adjusting their portfolios as market conditions change. This is an important insight because it says, in effect, that while passive strategies may achieve a certain degree of success in stable or bullish markets, it is in more turbulent times that active management can pay off, providing a degree of downside protection that passive strategies usually are unable to match. For instance, in the equally weighted analysis, the relative underperformance of active funds against passive funds was only 0,59% per year, while in value-weighted portfolios, active funds underperformed their passive peers by a somewhat wider 0,90% per year. The difference in outcome underlines that market conditions and fund characteristics are crucial in comparing the historical performance between active and passive strategies.

On the other hand, the study *"Active versus Passive Investing"* by *Van Loo* and *Molander* in 2020, addresses the issue a little bit differently in focusing on performances of active and passive strategies over several market cycles. Their conclusions highlight that market success is somewhat cyclical because in a bull market, the majority of passive

strategies win out given the move upward in the greater market. However, in bear markets, active strategies are where the value comes in, since an active manager may use his or her discretion to help minimize some of their losses. This is attributed to the better market timing ability of active managers during market downturns since they are better at minimizing their losses compared to passive strategies. Notably, the analysis by *Van Loo* and *Molander* is remarkable for using Sharpe and Sortino ratios in view of risk-adjusted performance and particular consideration of downside risk. The fact that active strategies are better positioned in terms of the risk-return trade-off when markets decline makes them substantial for those investors who do not want to lose their capital and thus avoid risks. Standard deviation, being another important measure of volatility, plays a great role in their analysis, too. According to *Van Loo* and *Molander*, though passive usually stands out in overall volatility, its volatility is less severe during bear markets. This would suggest that some of the merits passive investing has over its active counterpart in terms of simplicity and cost efficiency are balanced out by its greater exposure to market-wide risks, particularly in declining markets. In contrast, active management's ability to significantly better endure these stormy periods indicates that market conditions are relevant when comparing the two approaches. Moreover, through metrics such as the Sharpe and Sortino ratios, the authors prove that active strategies provide a good risk-return trade-off with greater downside protection in market crises. This becomes an important finding because it only implies that the historical performance comparison between active and passive strategies is not that easy but depends on specific risk-return preferences of investors.

These ideas are further developed by *L. Swedroe* in the book *"Mutual Funds Portfolio Structures Analysis Management and Stewardship"* by integrating a perspective based on Modern Portfolio Theory and the Efficient Market Hypothesis (EMH). *Swedroe* postulates that markets are too efficient for active managers to outperform with consistency and create alpha-the return over and above the market benchmark. His critique of the financial industry's promotion of active management is deeply rooted in his observation that, whereas active management has the promise of outperformance, the truth is that very few managers can actually deliver on that promise over time. *Swedroe*'s analysis of the trading costs provides one of the stronger arguments against active management. He points out that high portfolio turnover, typical for the case of actively

managed funds, is in fact associated with high trading costs likely to shrink potential gains.

In this regard, it would seem quite relevant to refer to a study conducted by *Edelen, Evans*, and *Kadlec* in 2007, which documented the impact of trading costs on mutual fund performance. According to their findings, these are one of the major reasons why larger funds fail to maintain consistent outperformance. *L. Swedroe* focuses on the role of costs in supporting the consensus of the literature. In fact, passive strategies, with their lower fees and without the drag of significant trading activity, are better suited to deliver consistent long-term returns.

L. Swedroe's criticism extends even to the underlying financial incentives promoting active management. He believes that the financial industry and media have powerful incentives to support active management since it brings in much higher fees and commissions. This misaligns the interests of the financial industry with those of investors, who would often be better off with lower-cost passive strategies. *L. Swedroe*'s perspective underscores the need for transparency of the active-passive debate and investor education, given that most investors in the face of evidence-based analysis would be swayed by marketing.

Secondly, *L. Swedroe*'s section on behavioral finance gives additional perspective on why active management often fails to deliver above-average returns. He says that such cognitive biases as overconfidence and herd behavior can make active managers make poor decisions. It leads to excessive trading, chasing performances, and other behaviors that detract from the long-run returns.

The cumulative evidence from the works of *Nanigian*, *Van Loo* and *Molander* and *L. Swedroe* is that active-versus-passive choice is no clear-cut affair. While generally passive strategies win out because of their lower costs and market efficiency, there are scenarios where active management can provide value, particularly in managing downside risk during market downturns. However, the high expenses of active management, along with the challenges of identifying consistently successful managers and the impact of behavioral biases, make passive strategies a more reliable choice for most investors. Taken together, this body of work makes the case for a more subtle approach to investing, with the investor's specific circumstances-including his risk

tolerance, investment horizon, and market outlook-dictating whether active or passive is preferable. This is not some kind of general preference for one strategy over another.

Another issue that arises very significantly in the literature pertains to the role of survivorship bias in mutual fund performance studies. Survivorship bias arises because the evaluation only considers the performance of funds currently surviving and excludes any that have died through closure or merger. This can make active performance appear better than it is because poor-performing funds are more likely to be closed or merged out of existence. Moreover, when the studies conducted by *S. Brown*, *W. Goetzmann*, *R. Ibbotson* and *S. Ross* in their *"Survivorship Bias in Performance Studies"*, as well as *M.M. Carhart "On Persistence in Mutual Fund Performance"* controlled for survivorship bias, the evidence to support the passive strategies was even more convincing since the average performance of active funds was usually below that reported once all funds-both those that survived and those that failed-enter the equation.

At the very end, historical performance comparison between active and passive strategies uncovers a complex landscape in constant flux. While the long-term evidence largely supports passive strategies for most investors on cost efficiency and risk management, one cannot completely rule out the potential of active management to add incremental value under certain market conditions. Investors need to consider these factors carefully, weighing not only historical data but also their financial goals and risk appetite. If this subtle nuance is informed by the literature, it presents a better framework of investment decisions that better align with the investor's needs and individual circumstances.

3. DATA AND METHODOLOGY

Finally, we come to the part where I put all theories and literature shown so far to work. My goal will be to create a comparative analysis between a passive investment and a multitude of active ones with the goal of allowing investors to make better informed decision.

I'll now present the data and methodology that I've used in realizing my analyses.

3.1 Passive investment selection

In my analysis of passive investments, the first step has been that of choosing the type of instrument to use. The options were between the two main types of passive funds that dominate the market: index mutual funds and exchange-traded funds (ETFs). Ultimately, I chose to focus on ETFs for different reasons that I will now present.

The first one is their significant growth in assets under management over the past few decades, making them a powerful force in the investment landscape. As a matter of fact, according to *Statista*, a global data and business intelligence platform with an extensive collection of statistics, ETFs have experienced a staggering 7.826% growth in AUM over the past 20 years. This exponential rise can be visually appreciated in the Figure 2 below, which underscores the sheer magnitude of their expansion. Over time, ETFs have gained a more prominent share of the market, positioning themselves as essential tools in the portfolios of retail and institutional investors alike.

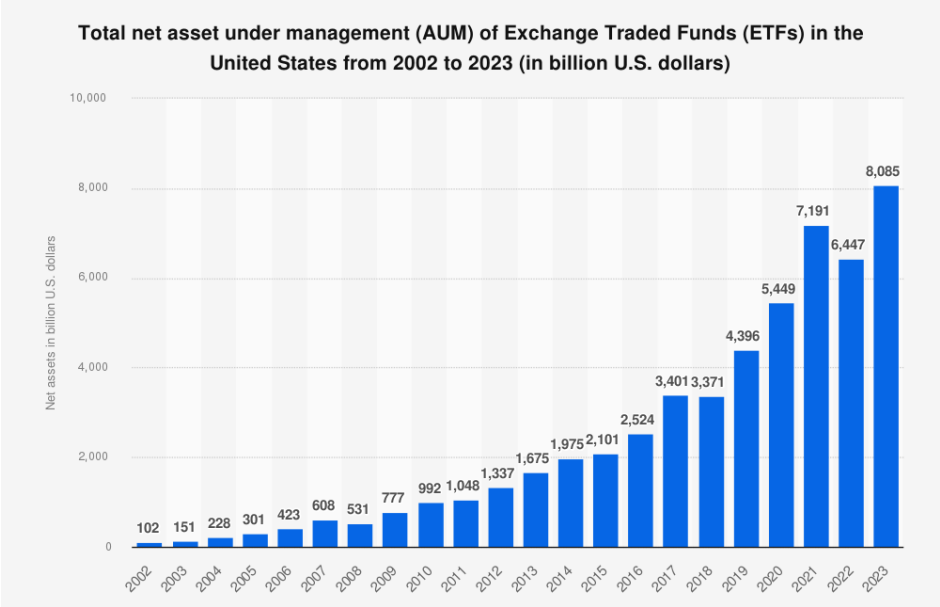

Figure 2

To make it more impactful, *Fidelity* and *ETFGI*, a leading independent research firm specializing in global ETF trends, report that assets in the U.S. ETFs market hit a record high of around $10 trillion by June 2024. *Fidelity* also confirms that ETFs now account for 28% of total U.S. exchange trading volume, with $10 trillion in volume traded in the third quarter alone. This immense volume highlights the liquidity and flexibility of ETFs, which have become the go-to instrument for investors seeking diversified, cost-effective exposure to a wide range of asset classes.

What makes this rise even more compelling is the influx of capital into ETFs, allowing us to better understand of this instrument is becoming more and more relevant for investors. According to *ETFGI* and *Morningstar*, the U.S. ETF industry attracted net inflows of $82,84 billion in June 2024, pushing year-to-date net inflows to $440,41 billion. These figures speak volumes about the growing popularity of ETFs, not just as a passive investment vehicle but also as a preferred choice for a wide spectrum of investors, particularly retail investors. This trend is further evidenced by research from *BlackRock*'s *Samara Cohen*, which shows that retail investors' assets in ETFs increased from under $500 billion in 2019 to nearly $1,4 trillion in the first two months of 2024—an extraordinary 180% growth in just five years.

ETFs as a passive investment vehicle have performed particularly well across Europe. According to research from *Morningstar's European ETF Asset Flows Update Q1 2024*,

while the European exchange-traded fund and exchange-traded commodity market received €44,5 billion of flows in the first quarter of 2024, down slightly from €47,4 billion in the last quarter of 2023, performance was still strong. Assets under management grew to €1,81 trillion, up from €1,64 trillion at the end of 2023, marking a 10% increase in the quarter and setting a record high for the market.

Given that my thesis focuses on retail investors, this shift toward ETFs is highly relevant. Figure 3 below obtained from BlackRock visually demonstrates how ETFs have gained importance in the eyes of individual investors over time.

Figure 10: Individual Investor U.S.-listed ETF AUM and percentage of total U.S.-listed ETF AUM[27]

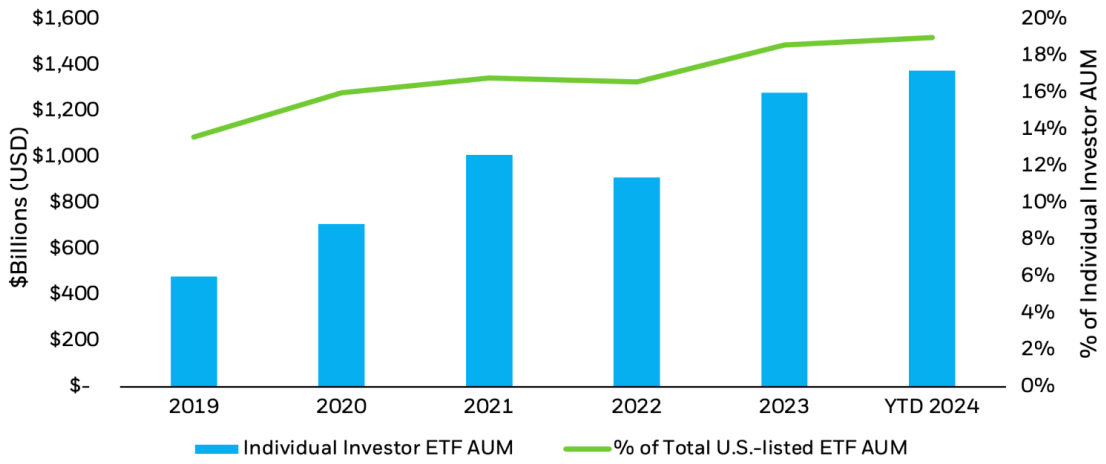

Figure 3

It's important to note that these statistics encompass both active and passive ETFs. However, data from Fidelity indicates that actively managed ETFs accounted for just 29% of 2024 ETF flows, reaffirming the greater significance of passive ETFs in the market. This reinforces my decision to focus on passive ETFs in the context of this thesis.

3.2 Why ETFs over index funds

Having talked about some statistics behind my decision to use ETFs as passive investment instrument, I want now instead provide a reasoning of my decision to select them over index funds.

While both ETFs and index funds adhere to the fundamental principles of passive investing—namely, reducing costs, limiting trading activity, and focusing on long-term

growth—ETFs offer distinct advantages that make them particularly appealing to retail investors. These advantages include liquidity, flexibility, lower costs, accessibility, transparency, and a diverse range of investment options.

One of the most significant advantages of ETFs is their liquidity. Unlike index mutual funds, which can only be traded at the end of the trading day at their net asset value (NAV), ETFs are bought and sold throughout the trading day, just like stocks. This intraday trading capability gives investors greater control over the timing and price of their transactions. While the core philosophy of passive investing emphasizes a "buy and hold" approach, the ability to react swiftly to market conditions, if necessary, is a valuable feature that index funds do not offer. This liquidity can also be beneficial for retail investors looking to rebalance their portfolios periodically or respond to life events that may require selling part of their investments.

J. McAlpine, in *Morningstar*'s June 2024 article *"The Rise of Passive Investing in Today's Market"* emphasizes this point: *"ETFs are similar to index mutual funds, although they are seen as more of an upgrade, offering more trading flexibility like stocks. ETFs can be bought and sold at various prices throughout the trading day."*

Cost is another critical consideration in my decision to prioritize ETFs. Both ETFs and index mutual funds tend to have lower expense ratios than actively managed funds, but ETFs generally offer an even more cost-efficient structure. According to data from *State Street*, the average expense ratio for ETFs is 0,52%, compared to 0,85% for index funds. Over time, these differences in fees—although they may seem small—can significantly impact an investor's returns, especially when compounded over the long term. As a matter of fact, this difference in fees if for example we invest $10.000 for 20 years at a 5% return, will erode our final performance by $1.472,97.

Moreover, with many brokers now offering commission-free ETF trading, the cost of building and maintaining an ETF-based portfolio has never been lower. This is particularly advantageous for retail investors who are often more fee-sensitive than institutional investors. Since retail investors typically have smaller portfolios, higher fees would impact their returns proportionately more than they would for larger institutional portfolios.

Accessibility is another compelling reason to choose ETFs. Unlike index funds, which often come with high minimum investment requirements (typically ranging from $1.000 to $3.000 or more), ETFs can be purchased in any quantity, even as single shares. Some brokers even allow fractional share purchases, further lowering the barrier to entry. This feature makes ETFs a more practical option for retail investors with limited capital who are looking to build a diversified portfolio over time. The absence of a minimum investment requirement also means that ETFs are accessible to a wider audience, including beginners and smaller investors who may not have large sums of money to invest upfront.

Another major advantage of ETFs is the diversity of investment options they offer. The ETF market has grown dramatically in recent years, leading to an extensive range of choices for retail investors. Whether investors are seeking broad market exposure through total stock market ETFs or are more interested in specialized strategies, such as sector-specific or balanced ETFs, there is an option for every investor profile. This diversity allows retail investors to tailor their investments more closely to their individual goals, risk tolerance, and investment horizons, all while adhering to a passive investing strategy. This level of customization is not as easily achievable with index funds, which are often more limited in scope.

Transparency is another critical factor in favor of ETFs. Most ETFs are required to disclose their holdings daily, allowing investors to see exactly what they own at any given moment. This level of transparency is comforting for retail investors who may not be deeply versed in the intricacies of finance but still wish to feel confident about where their money is invested. This real-time transparency offers a high level of visibility and confidence for investors, who can track performance and make informed decisions based on the exact composition of the ETF at any given moment. In contrast, index funds typically only disclose their holdings on a quarterly basis, which means less frequent updates for investors.

3.3 My ETFs dataset

Having explained the rationale behind my choice of ETFs over index funds, I now turn to the methodology used to create the ETFs dataset that I will use for my analysis.

To construct the dataset, I utilized the Morningstar Screening tool, which I accessed through a free trial. My only criterion for selecting ETFs was that they be passively managed. However, I must underline how given the limited scope of my resources, the analysis will focus exclusively on ETFs traded on U.S. stock exchanges.

Once the ETF selection was finalized, I exported the data to an Excel file and included key information for each fund, such as:

- **Ticker**: The unique symbol representing the ETF on the exchange.
- **Fund Name**: The full name of the ETF which a lot of times can give a first idea of type of holdings the fund has.
- **Fund Management Company**: The organization responsible for managing the ETF.
- **Morningstar Rating**: This rating is a purely quantitative, backward-looking tool used to assess a fund's historical performance on a scale from one to five stars. Updated monthly, this rating system evaluates funds within the same Morningstar Category using an enhanced Morningstar Risk-Adjusted Return measure. Only funds with a track record of more than three years qualify for a Morningstar rating, making it a useful starting point for evaluating a fund's track record relative to its peers.

  A high rating, such as four or five stars, signals that an ETF has delivered strong, risk-adjusted returns compared to similar funds, making it potentially more appealing. This rating goes beyond raw returns by accounting for the amount of risk undertaken to achieve those returns. ETFs with higher ratings suggest strong returns with relatively low volatility—a key factor for investors looking to reduce risk in their portfolios. Conversely, a lower-rated ETF may have high returns, but those returns could be associated with significantly higher risk, an important consideration for investors.

For retail investors, who may have less experience or fewer resources for extensive analysis, the Morningstar rating provides a streamlined approach to evaluating fund performance by condensing complex data into an easy-to-understand format. This feature is particularly useful for retail investors, allowing them to quickly filter through available ETFs and focus on those with proven success within specific asset classes or strategies. In essence, the Morningstar rating equips retail investors with a valuable tool for efficient and informed decision-making, particularly when assessing the long-term viability of potential investments, without requiring advanced financial expertise or extensive research resources.

- **Asset Class**: This refers to a category of investments that share similar characteristics and are governed by the same laws and regulations. Investments within an asset class typically behave similarly in the marketplace, making it crucial for investors to understand their preferences when selecting where to allocate their capital—whether in stocks, bonds, or other categories.

  For a meaningful analysis, it's essential to compare only those investments that belong to the same asset class. Comparing different asset classes can lead to misleading conclusions, as they possess intrinsic differences in risk, return expectations, and market behavior.

  By focusing my analysis on specific asset classes, such as comparing stock ETFs to active stock mutual funds or bond ETFs to bond mutual funds, I've ensured that the performance metrics I've evaluate are relevant and directly applicable to retail investors. This targeted approach not only enhances the validity of my findings but also empowers investors to make informed decisions that align with their investment goals and risk tolerances.

- **Fund Size**: This refers to the total assets under management (AUM) of a fund. It needs to be taken in consideration given that a larger fund size typically signals greater stability, as it often reflects a more diverse base of investors. This diversification can mitigate the risk of sudden price fluctuations caused by large withdrawals from a single investor, a risk more prevalent in smaller funds.

Furthermore, larger ETFs usually offer a lower expense ratio for individual investors. A reduced expense ratio translates into lower fees, which can enhance overall returns. This cost efficiency arises from economies of scale; larger funds can distribute operational costs across a broader asset base, enabling them to maintain or even lower their fees. This aspect is particularly vital for passive ETFs, which aim to minimize costs for investors.

Small ETFs, on the other hand, may face closure if they fail to attract sufficient assets to remain profitable for their issuers. A substantial fund size not only indicates a higher likelihood of long-term stability but also protects investors from the inconvenience of having to liquidate or transition to a different fund.

Additionally, larger ETFs tend to exhibit greater liquidity, facilitating easier buying and selling without significantly impacting market prices. This increased liquidity results in tighter bid-ask spreads, thereby lowering trading costs and making the fund more appealing to investors. Overall, a larger AUM is often associated with stability, cost efficiency, and liquidity, making it an important consideration for investors.

- **Net Expense Ratio**: This figure represents the total percentage of a fund's assets allocated to cover its administrative, management, and operational expenses. For instance, if you invest $10.000 in an ETF with an expense ratio of 0,04%, you'll incur a cost of $4 to the fund's manager over the year. This metric is crucial because it directly impacts your overall returns. A higher expense ratio means that a larger portion of your returns is consumed by fees, resulting in a lower net return for you as the investor.

  Over time, even a seemingly small difference in expense ratios can significantly affect your investment outcomes, particularly for long-term investors. For example, a difference of just 0,1% in expense ratios can have a significant impact on your investment over time. As a matter of fact, if you invest $10.000 with an annual return of 5%, the outcomes after 20 years are striking. With an expense ratio of 0,1%, your investment would grow to approximately $33.439. However, with an expense ratio of 0,2%, it would only grow to about $32.247. This means that the difference in the final amounts due to the 0,1% increase in the expense

ratio is around $1.192. This illustrates how even a small difference in fees can result in thousands of dollars in lost returns over the long term. It highlights the importance of considering the expense ratio when selecting investment funds, as minimizing fees can significantly enhance your overall investment performance. Therefore, it's essential to consider the expense ratio when selecting investment funds, as minimizing fees can enhance your overall investment performance.

This dataset will serve as the basis for selecting ETFs to be used as benchmarks in my performance comparison between passive and actively managed funds.

3.4 Active investment selection

After explaining my rationale behind selecting ETFs as the instrument for passive investment analysis, I now turn to the counterpart—active investments. In this case, the choice was more straightforward, as mutual funds are by far the most commonly used vehicle for active investment strategies.

To understand the prominence of mutual funds in the financial landscape, especially in terms of individual investors' preferences, we need only to refer to data from the *Investment Company Institute (ICI)*. A striking observation emerges from Figure 4 below: in 2023, over half of U.S. households included mutual funds in their portfolios. This underscores the widespread appeal and significance of mutual funds for retail investors.

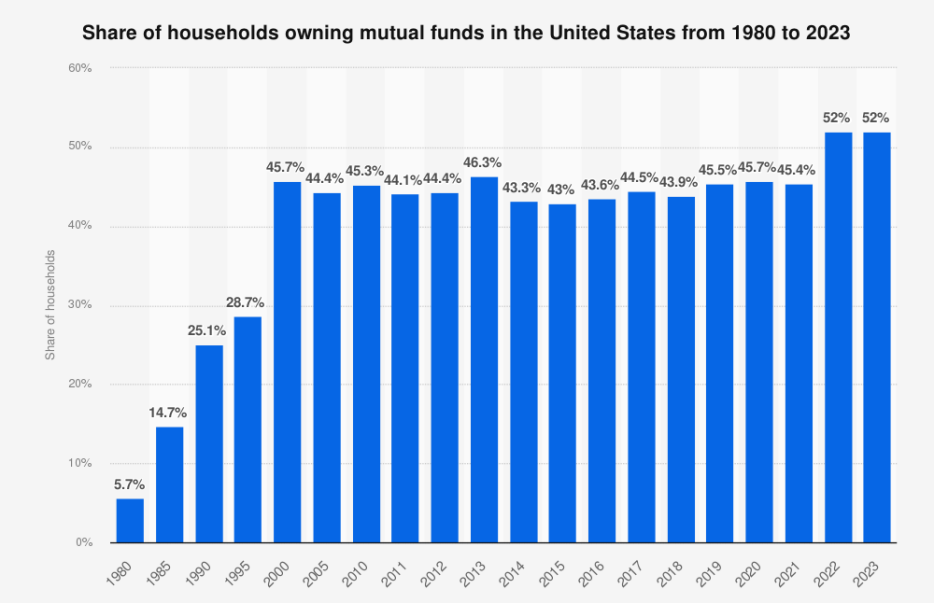

Figure 4

Further emphasizing this point is the staggering amount of assets under management (AUM) held by mutual funds globally. As of 2023, the global AUM for mutual funds stood at approximately $60 trillion, according to the *ICI*. Notably, 63% of this AUM is managed on behalf of retail investors, a statistic confirmed by multiple sources including *Precedence Research* and *Grand View Research*. This high percentage highlights the trust that individual investors place in mutual funds as a key component of their investment strategy.

Moreover, as for ETFs, mutual funds are not only significant in terms of their AUM but also continue to see positive net inflows, signifying ongoing investor interest. For instance, despite the volatile equity markets in 2023, U.S. funds managed to attract $26 billion in inflows as of August, according to a *Morningstar*'s report titled *"US Fund Flows: August Flows Dip Amid Volatile Equity Market"*. This ongoing inflow reflects the resilience of mutual funds as an attractive investment option.

However, it is important to clarify that the statistics cited above encompass both actively managed and passively managed mutual funds. As illustrated in the accompanying Figure 5 from *Morningstar*, passive investment vehicles have driven the bulk of net inflows over the past decade, while actively managed mutual funds have struggled to maintain consistent inflows. In fact, active funds experienced net positive inflows in only two out of the past ten years, in contrast to the steady growth enjoyed by passive funds.

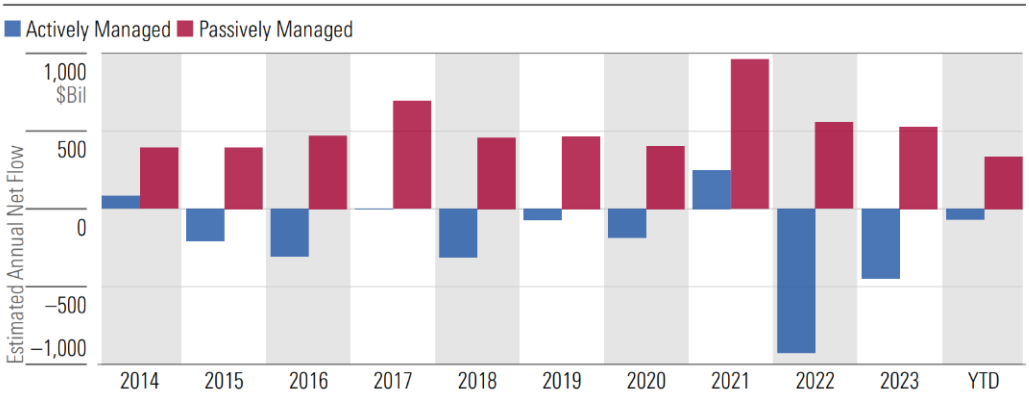

Figure 5

3.5 My Mutual Funds dataset

Having established the rationale behind choosing mutual funds for active investment analysis, I will now outline the criteria used to build the mutual fund dataset that will be compared against ETFs. Similar to the process used for ETFs, I relied on Morningstar's Screening tool, which I accessed through a free trial. The primary screening criterion was straightforward: the selected mutual funds had to be actively managed. Additionally, I included a second criterion: a minimum initial investment of $10.000 or less (the rationale for this will be explained later in this chapter). However, it is important to underline again how due to limited resources, my analysis focuses solely on mutual funds traded on U.S. stock exchanges.

After finalizing the list of funds, I exported the data to an Excel file, including several key pieces of information for each fund. Many of these data points mirror those collected for the ETF analysis, but some additional metrics specific to mutual funds were included:

- **Maximum Deferred Load**: This refers to a sales charge or fee applied to a mutual fund when an investor redeems their shares, rather than at the time of the initial investment. One key advantage of a deferred load is that it allows the entire investment amount to be used for purchasing shares, maximizing the potential for growth as interest accrues on a larger principal over time. The fee is typically calculated as a percentage of the lower of either the investor's original investment or the current value of the investment at the time of redemption. For instance, with

a fee of 2%, if you make an initial investment of $10.000 and the ending value grows to $15.000, you will owe a fee of $200 upon redemption (=$10.000*2%). Conversely, if the final value were to decrease to $8.000, the fee would be $160 ($8.000*2%).

This structure can be beneficial for investors who plan to hold their shares for an extended period, as it enables them to take full advantage of market growth before incurring any charges.

- **Maximum Front Load**: This is a commission or sales charge that is applied at the time of an investment's initial purchase. This fee is deducted from the initial deposit, which means the amount actually invested in the product is reduced. For instance, if an investor places $10.000 into a fund with a 5% front-end load, only $9.500 is actually invested. These charges are typically paid to financial intermediaries as compensation for their role in identifying and selling investments that align with clients' needs, goals, and risk tolerance.

  It's important to note that front-end loads are one-time charges and are not included in the ongoing operating expenses of the investment. While they may reduce the initial capital available for investment, funds with front-end loads often have lower ongoing fees and expense ratios.

- **Minimum Initial Investment**: This term refers to the smallest dollar amount or share quantity required to invest in a specific security, fund, or investment opportunity. Mutual funds, in particular, often impose a minimum investment threshold to ensure they have sufficient assets under management (AUM) to meet their investment objectives and cover operational costs. Consequently, investors cannot freely invest any amount they wish; they must meet this minimum requirement.

  For novice investors, reaching this minimum can be a significant hurdle, often resulting in their entire account balance being allocated to just one fund. This limitation can make mutual funds less accessible for retail investors with limited capital, as these minimums can be prohibitively high. By requiring a minimum

initial investment, funds can inadvertently restrict participation, leading to a lack of diversification for investors who may already be facing financial constraints.

Incorporating these factors into the dataset will allow for a comprehensive comparison between actively managed mutual funds and ETFs, ultimately providing insight into which strategy—active or passive—offers better performance for retail investors.

3.6 Analysis methodology

In this chapter, after explaining my rationale for choosing ETFs as a passive investment option and mutual funds for active management, I'll walk through each step of my analysis and the methods that led to my final results. The outcomes of this study will be detailed in the next chapter.

To start, I imported my datasets of ETFs and mutual funds into Python, the programming language chosen for its versatility in data analysis. Once imported, the data required thorough cleaning to ensure accuracy and consistency. For example, when transferring data from Morningstar to Excel, instances of a 0% Net Expense Ratio were sometimes recorded as "-", which created issues when calculating fund performance. I converted these symbols into usable numeric values, so I could proceed with my analysis without hindrance.

After cleaning the dataset, I developed a code to compare key characteristics between mutual funds and ETFs. This analysis focuses on the following important features: Morningstar Rating for Funds, Maximum Deferred Load, Maximum Front Load, Net Expense Ratio, and Minimum Initial Investment. By comparing these attributes, we can gain a first understanding of the differences between actively managed and passively managed funds.

Based on the theoretical framework presented earlier, I'm expecting significant disparities in fees between the two fund types. Specifically, I expect actively managed funds to exhibit higher fees, averaging around 1%, while passive ETFs, should have fees close to zero. This expectation is rooted in the typical fee structures of these fund types, where

actively managed funds charge higher fees to cover the costs associated with active management strategies.

In terms of minimum initial investments, I predict that ETFs will have a minimum requirement of zero, as they can be traded freely, sometimes even in fractional shares. In contrast, as seen before mutual funds often impose higher minimum investments to ensure sufficient assets under management (AUM), allowing them to meet their investment objectives and cover operational costs.

Regarding the Morningstar ratings, if the literature discussed in Chapter 2 holds true—that passive investments typically outperform their active counterparts—I expect ETFs to achieve higher ratings, reflecting their superior performance while assuming a comparable level of risk. This analysis will provide valuable insights into the cost structures and performance metrics of both fund types, contributing to a deeper understanding of their relative strengths and weaknesses in the investment landscape.

I also analyzed the distribution of funds by asset class, which is crucial because each asset class has unique characteristics, like risk profiles and investment strategies. Conducting the study on an asset-class basis significantly enhances the reliability of the results. By analyzing each asset class separately, I can account for the unique characteristics and behaviors that define each category. This targeted approach allows for a more precise understanding of how funds perform within their specific contexts, leading to insights that are relevant and applicable to investors interested in those particular asset classes.

It is also necessary to underline how the large the pool of funds the better it is. As a matter of fact, when the analysis is based on a substantial number of funds within each asset class, the statistical power of the study increases. This means that the results are more likely to reflect true trends rather than anomalies, providing a stronger foundation for generalizations. With hundreds of funds included in the analysis, the findings can be more confidently applied to a broader population, making the insights gained more valuable for investors and stakeholders.

Now that the introductory steps are outlined, let’s dive into the core part of the analysis: determining the outperformance or underperformance of passive ETFs versus active mutual funds.

Before starting I need to underline how to provide a comprehensive comparison of performance, I've decided to implement my analysis over different horizons. For every study conducted I will provide the results around three distinct time periods: 5 years, 10 years, and the maximum horizon available based on the inception dates of the various ETFs and mutual funds. This approach will offer insights into potential over- or underperformance, catering to investors who may have differing timelines for their investments.

3.7 Data collection for the analysis

The analysis begins with the collection of historical data, which is crucial for calculating returns and evaluating overall performance. Utilizing a Python script, I leveraged the Yahoo Finance library to download historical price data for each ticker in the ETFs and mutual funds datasets. This data will serve as the foundation for my performance metrics and comparative analysis.

During the process of data collection, I had to make some assumption that I will now report:

- **Frequency of Price Data**: I've chosen to download historical prices at a monthly frequency for my analysis. This is because using daily data would exponentially increase the volume of data without offering significant benefits. Given the long-term horizon of my study, daily price fluctuations are unlikely to impact overall performance metrics. Conversely, relying on annual prices could lead to misleading conclusions, particularly regarding standard deviation and risk assessments. Annual data may not accurately reflect the variability in prices, which is essential for measuring risk-adjusted performance effectively.

  Additionally, considering the behavior of retail investors, requiring them to wait until the end of the year to assess performance could misrepresent their investment experience. Monthly data provides a more realistic representation of fund performance while allowing investors the flexibility to withdraw their investments whenever they choose. This approach strikes a balance between capturing relevant

price movements and maintaining a practical perspective for retail investors, ultimately leading to more reliable analysis outcomes.

- **End Date for Analysis**: The end date for my analysis is set to August 31, 2024. By selecting the last day of each month, I can consistently capture the final closing price, ensuring that each data point represents a complete month. This approach prevents discrepancies that might occur if a date mid-month were chosen, as it guarantees alignment with month-end data across all periods in the analysis.

- **Start Dates for Analysis**: For the analysis, selecting the starting date was relatively straightforward for the 5-year and 10-year periods. With the end date set at 31/08/2024, the 5-year period naturally begins on 01/09/2019, and the 10-year period starts on 01/09/2014. However, determining the starting date for the maximum horizon required a more nuanced approach, given the varied inception dates across funds within each asset class.

  To address this, I selected the oldest inception date among the ETFs designated as benchmarks for each asset class. This approach ensures a meaningful comparison with mutual funds over the longest possible period, providing consistency and depth to the performance analysis across different asset classes.

3.8 Type of performances analyzed

After downloading all the historical prices, I calculated the monthly returns for each fund that was traded at the starting date moment. These monthly returns provided the basis for assessing the performance of each fund throughout the analysis period.

The performances are calculated for each holding period and for each asset class in two distinct way:

- **Absolute Performance**: This refers to the measurement of a fund's performance without accounting for any fees or expenses that may affect the final returns. Here, I compared the absolute performance of a selected ETF—chosen based on specific criteria, which will be explained later—against all mutual funds within the same

asset class. This approach ensures a clear comparison of raw performance across similar investment vehicles.

- **Adjusted Performance**: This refers to the measurement of investment performance after accounting for all fees that impact investor returns. In this analysis, I compared the performance of the selected ETF to all mutual funds within the same asset class. Unlike absolute performance, these adjusted returns incorporate the influence of fees, offering a more realistic view of investment outcomes. Specifically, the initial investment is multiplied by (1−maximum front load fee), the final investment value by (1−maximum deferred load fee), and each month's portfolio balance is adjusted by multiplying it for (1−net expense ratio/12).

  This approach ensures that all ongoing and one-time expenses incurred by the investor are accounted for, giving a true measure of net performance. This adjustment is critical given that as highlighted in the literature in Chapter 2, while some active strategies may outperform passive investments on an absolute basis, this is often not the case once fees are considered. Over time, these fees erode capital gradually, often without investors fully realizing the extent of their impact. Consequently, the number of active investments worth considering diminishes significantly when adjusted for fees, underscoring the long-term cost advantage of passive strategies for retail investors.

The only assumption that was made in measuring the performances is:

- **The Initial Investment**: Although the returns and risks of an investment would theoretically remain the same whether the initial amount was $1 or $1.000.000, I chose to set an initial investment of $10.000 to enhance the realism of this analysis. This amount was selected to closely reflect the typical retail investor's experience. According to the Social Security Administration, the average U.S. salary in 2021 was $60.575,07. Additionally, a Personal Capital survey from the same year indicated that individuals earning between $50.000 and $74.999 annually tend to invest 22,2% of their income. Based on these figures, an average retail investor in this income range would invest approximately $13.448 per year. However, to simplify the presentation and better represent a broader segment,

including those with slightly below-average incomes, I rounded this figure down to $10,000. This adjusted starting point enables a clearer depiction of the potential outcomes for a wider range of everyday investors.

3.9 Key metrics for comparison

Calculated the performance it was time to start the most important part, namely the comparison of performances. This will be conducted for each asset class individually, analyzing both absolute and adjusted values, and covering the 5-year, 10-year, and maximum available periods. With this structure in mind, I'll now present the metrics I've chosen for my study, along with the reasons behind each selection:

- **Average Return**: For mutual funds, the average return within each asset class is calculated based on all funds within that class. The return formula used is Return= final value/initial value-1.

  In the absolute comparison, each fund's initial investment amount is set to $10.000. For the adjusted performance calculation, however, the initial value accounts for each fund's front load fee. This adjusted initial value is then calculated as 10.000*(1-froant load of the fund considered), where the front load is the fee percentage applied to the initial investment amount. This adjustment ensures that returns reflect any upfront fees that impact the investment's performance.

  Similarly, the final value differs based on the measurement type. For absolute measurement, the final value is simply the ending balance of each fund. However, for adjusted performance, the final value must also account for each fund's deferred fee. This adjustment ensures that the final amount reflects any back-end charges specific to the fund.

- **Percentage of Overperforming Funds**: The number of mutual funds that outperformed the selected ETF, along with the relative percentage of mutual funds achieving this within each asset class, offers a quick and insightful measure of active strategy efficiency compared to a passive one. For instance, if 90% of

mutual funds are outperformed by the chosen ETF, it’s clear that the passive ETF would likely have been the better choice overall. Of course, this excludes the possibility that you possess the investment skill needed to consistently identify the top 10% of funds that did outperform. This metric serves as a practical guidance for retail investors, highlighting the relative success rate of active funds versus the more predictable results often seen with passive ETFs.

- **Standard Deviation**: While we've primarily focused on performance metrics like returns, it's essential to consider risk factors, such as standard deviation, when evaluating investment options. For instance, imagine an ETF that outperforms all available mutual funds. However, if we examine the risk associated with this ETF and it end up being significantly higher to those of mutual funds, investors should pause to reflect.

  The key question is: does the superior performance of the ETF justify the additional risk taken to achieve it? To address this critical consideration, I've incorporated an additional metric that evaluates performance relative to risk, providing a more comprehensive understanding of the investment's value.

- **Sharpe Ratio**: The Sharpe ratio is arguably the most relevant metric for investors. It directly answers the question of how well an investment compensates for the risk taken. While it’s not readily available on most investment platforms, calculating it is straightforward. The formula is: ((return-risk free rate)/standard deviation). Understanding how to interpret the Sharpe ratio is essential for effective investment comparison. On its own, the ratio may not convey much information; however, when used to compare different investments, its value becomes apparent.

  The Sharpe ratio indicates the amount of excess return (return minus the risk-free rate) an investment generates per unit of risk (measured as standard deviation). For instance, a Sharpe ratio of 1 means that for every unit of risk taken, the investor can expect an equivalent increase of 1 unit in excess return.

  This property makes the Sharpe ratio particularly useful for comparing different investments or funds. Investments with higher Sharpe ratios are more desirable

because they provide better returns for the same level of risk. In essence, when assessing various options, focusing on the Sharpe ratio allows investors to identify those that are likely to perform best relative to their risk exposure.

- **Value at Risk (VaR)**: While it may not be the most intriguing metric for retail investors—partly due to its complexity—it can offer valuable insights.

  To calculate it, the process begins with downloading historical returns for the investment. Once you have this data, you sort the returns from worst to best. The next step is to choose a confidence level; for my analysis, I opted for a 99% confidence level given that it provides a more accurate interval compared to lower percentages. By selecting a 99% confidence level, you're indicating that you will focus on the 1st percentile of the sorted returns.

  Now, let's clarify what this 1st percentile represents: It signifies the worst outcome expected to occur only 1% of the time. For example, if I calculate a VaR of -$1.000 with a 1-month holding period at this confidence level, it means there is a 99% probability that I will not lose more than $1.000 in one month by investing in that fund. I understand that this measurement can be misleading and difficult to grasp, but there are important reasons for including it in my analysis.

  First, VaR gives investors a sense of potential losses, encouraging them to exercise caution. It provides a quantitative estimate of the worst-case scenario, helping them mentally prepare for possible downturns. This awareness can reduce the likelihood of impulsive actions, such as panic selling, when losses occur.

  Second, it emphasizes the need for preparedness in adverse situations. By understanding how bad things can get, investors can implement safeguards, such as maintaining adequate liquidity to cover potential losses. In summary, while VaR is a complex metric, it serves as a crucial tool for investors to assess risk and make informed decisions.

To complement these metrics, I also included distribution graphs to show how mutual fund returns are distributed relative to the ETF, providing a visual representation of performance clustering.

Understood the metrics and graph I will use in my analysis I want to provide a detail of the assumption I had to make in this part:

- The Risk-Free Rate: The one used in this analysis is derived from data provided by the U.S. Department of the Treasury over the past 20 years. Historically, the average risk-free rate is commonly represented by yields on long-term U.S. Recent estimates indicate that the long-term average is approximately 4.36%, based on the 20-year Treasury yield, which serves as a reliable proxy for the risk-free rate. For the sake of consistency and clarity in analysis, I have chosen to round this figure to 5%. This rounding does not impact the overall conclusions of the study, as the same risk-free rate will be uniformly applied across all funds analyzed.

- ETF Selection as Benchmarks: In my analysis, I have selected specific ETFs to serve as benchmarks for comparing the performance of passive investment against active mutual funds. To select it, being a retail investor myself, I considered several key characteristics that investors typically look for when selecting an ETF.

  One crucial factor is the Morningstar rating, which provides a quick summary of a fund's quality. Higher ratings, such as 4 or 5 stars out of 5, indicate superior performance and are likely to attract retail investors seeking confidence in their investment choices.

  Another important consideration is the reputation of the fund company. Larger, well-established firms are generally perceived as more reliable, which instills greater trust among investors.

  Additionally, trading volume plays a significant role in the selection process. ETFs with low trading volumes may not be easily transacted in large quantities, posing risks for investors. If an investor decides to withdraw their investment, low demand could make it difficult to sell their holdings at a fair price. This scenario might force the investor to sell at a bargain price, potentially leading to losses.

By focusing on these criteria, I aim to identify ETFs that not only perform well but also provide retail investors with a reliable and secure investment option against which mutual funds can be compared.

4. RESULTS

4.1 General comparison

We have eventually come to the last part of this thesis before giving the conclusion. In the chapter before I have analyzed the methodology behind my study. It is then now time to show the results I've obtained from my analysis.

As described in Chapter 3, in the first part I'm going to present a universal comparison between passive ETFs and active Mutual Funds. This will allow us to get a first impression of what we should expect from the later, better detailed, analysis. The results are reported in the following Table 1:

Type of Fund	Number of Funds	Average Morningstar Rating	Average Deferred Load	Average Front Load	Average Net Expense Ratio	Average Minimum Initial Investment
Mutual Funds	8065	2,91	0,24%	1,55%	1,21%	$1.424,06
ETFs	1814	2,11	0,00%	0,00%	0,43%	$0,00

Table 1

We can see how I have differentiated the analyses between the type of funds analyzed. These, as explained in Chapter 3, are Mutual Funds and ETFs, with the first one representing active investing and the second one representing passive ones.

It instantly comes to the eyes how the number of passive strategy funds are exponential higher, having 4,5 times the sum of ETFs. The first one reckons 8.065, while for the second one the count is only 1.814. This was extremely easy to prognosticate given that as we have seen in the chapter before the sum of AUM of Mutual Funds is around $60trillion, six times larger than the $10trillion of the ETFs.

On the other hand, the averages of Morningstar Ratings are different than the one I expected. As a matter of fact, as I said, I would have expected a higher rating for ETFs than for Mutual Funds. This is mainly given by the fact that, as analyzed in the literature in Chapter 2, these last ones on average underperformed the corresponding passive strategy.

One possible reason for this discrepancy may be the survival rate: the percentage of funds that survived till today and didn't get closed. This can bring bias into the results given that, if a fund has been shot down it will not be included in the measurement. This will leave out of the calculation those funds that have been closed, including then in the average the best ones that were able to survive until today. For example, as reported by Morningstar only 43% of active US large-cap funds have survived for 10 years.

Another cause may be the limited list of funds available. As a matter of fact, given the more advanced history of ETFs, there is the possibility that many don't have enough years of historical performances to have assigned a Rating. In those cases, the dataset, will by default associated to them a value of 0. This will influence the result of the average, lowering it. To prove this point, if I erase those funds with a Morningstar Rating of 0 from my database, the average of Mutual Funds would keep being 2,91, while the one for ETFs increases to 3,03. This value is more in line with the expectations since it verifies the expectations of better performances of passive investing, represented by a higher rating mean compared to active one.

If we keep looking at Table 1, shifting now our look to the right columns, we can see how the results for both Deferred Load and Front Load are perfectly in line with the expectations. We can see how the ETFs do not accommodate any of these expenses, while alternatively they are allocated for Mutual Funds, respectively 1,56% and 1,21% on average. What ETFs instead present is the Net Expense Ratio which turns out to be on average, 0,43%. This is line with what was reported in Chapter 3, considering how by intrinsic nature active funds must accommodate high fee to cover their cost, thing that passive ones have in lower amount.

Finally, as predicted we can see that ETFs don't require a minimum initial investment, while Mutual Funds on average require $1.424,06. This, as already mentioned, is often imposed to ensure they have sufficient assets under management (AUM) to meet their investment objectives and cover operational costs. It is also important to keep in mind how underlined in Chapter 3, that the Mutual Funds analyzed are subject to a restriction of $10.000 for the minimum investment required. This means that if we get rid of the limitation, the average requirement reported above is likely to

increase, considering that exists some mutual funds that may even come to need millions of dollars to get invested in.

The following two pie charts (Figure 6 and Figure 7) represent instead the distribution of funds for asset class types. We can see how the dispersion changes a lot between Mutual Funds and ETFs.

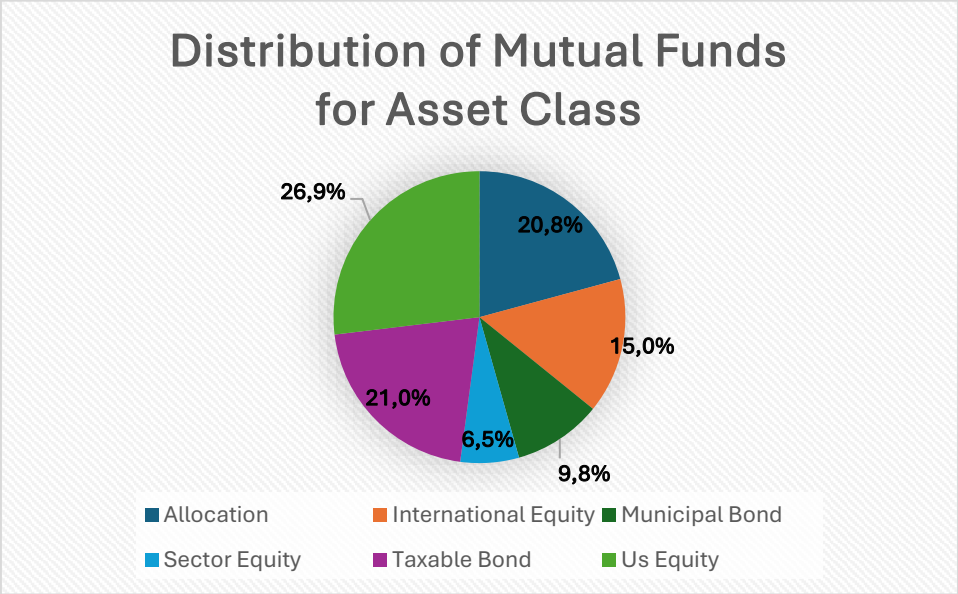

Figure 6

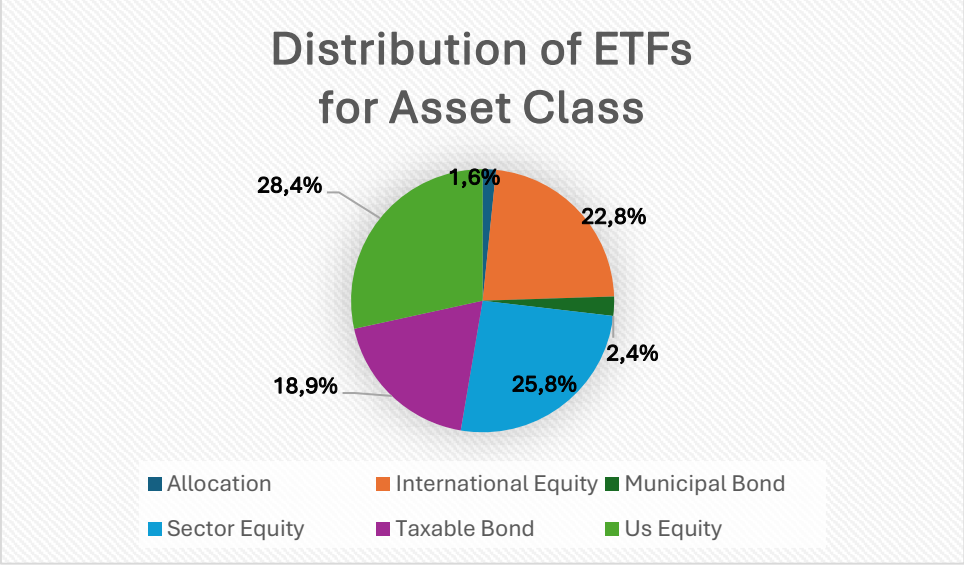

Figure 7

A big residue can be noticed in the asset class Allocation, which has a part of 20,8% in active managed investing (Figure 6), while it has a size of only 1,6% in passive managed one (Figure 7).

It is now time to go more in detail and present the results of the analysis that I've conducted for each of these different asset class.

4.2 Allocation results

In this section, I present the findings from my analysis of the Allocation asset class. In strategic asset allocation, investors set target allocations for different asset classes, eventually adjusting the portfolio periodically to maintain these targets. This explains the predominance of this approach in Mutal Funds (Figure 6), given that it aligns well with the principles of active management.

However, there is a small selection of passive ETFs within this asset class. To represent this few passive investment funds, as we can see on Table 2 below, I selected the iShares Core Aggressive Allocation ETF (AOA), which I then compared to all mutual funds within the Allocation class.

	Fund Management Company	Morningstar Rating for Funds	Asset Class	Fund Size	Net Expense Ratio	Minimum Initial Investment	Management Style
AOA	BlackRock Fund Advisors	5	Allocation	2,04 Bil	0,0015	0	Passive

Table 2

AOA, as a Passive Benchmark, has been selected since it aligns with the criteria outlined in Chapter 3 for an ideal passive investing instrument. As we can see in Table 2, it is managed by BlackRock which is the world's largest asset management company with about $11,48 Trillion AUM in hand. The selected ETF, also boasts a physical fund size of $2,04 billion which ensures liquidity, making it easy to trade. Additionally, AOA holds a 5-star Morningstar rating—the highest possible score—signifying strong past performance. Finally, with a net expense ratio of just 0,15%, which is below the average of the ETFs in my database, AOA is also exceptionally cost effective. Competing

alternatives to AOA lacked these attributes, as they were rated only up to 4 stars, had importantly littler fund sizes, and were managed by less prominent firms.

With AOA selected, I began my analysis by examining absolute performances, omitting costs for both ETF and active funds as well.

I start by analyzing the absolute performances over the maximum period available, which have as starting point the inception date of AOA on December 1, 2008. During this period, I evaluated a total of 683 active funds that are still traded today.

ABSOLUTE (max period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	18	2,64%	83,18%	2416,57	0,000324	-$920,44
AOA	665	97,36%	217,31%	5531,42	0,000384	-$856,38

Table 3

The results convey a striking outperformance by AOA compared to Mutual Funds. As we can see in Table 3 above reported, specifically, AOA outperforms 665 active funds, which represents an astonishing 97,36% overperformance rate.

It is mandatory to note how, as for the cases that will be reported now on, this study did not describe for active funds that closed between the starting date (01/12/2008 in this case) and the end at 31/08/2024. Given that only surviving active funds were included, the overperformance part of AOA could have been even higher if those funds that performed so badly that they needed to be closed were considered.

The extent of AOA's dominance is hike illustrated by the gap in returns. The selected ETF delivers a cumulative return of 217,31%, while the average yield for active funds was importantly lower at 83,18%. This disparity powerfully suggests that, over this long-term horizon, AOA offers a compelling reward for investors seeking high returns.

While total returns highlight the ETF's executing edge, it is also necessary to consider risks undertaken to achieve such overperformances. From this point of view, AOA demonstrates high volatility, with a value of 5531,42 compared to the 2416,57 for active funds. The applicative question, however, is whether this higher risk is justified by corresponding higher returns.

To serve this question, we need to look at the Sharpe ratio,' which for AOA is marginally higher at 0,000384 compared to 0,000324 for Mutual Funds, suggesting that the passive investment additive risk is indeed rewarded with proportionately high returns. Interestingly, contempt AOA's greater volatility, its Value at Risk VAR at the 99% confidence level is lower, standing at $856,38 compared to the average of $920,44 for active funds. This indicates that Mutual Funds pose a greater maximal effectiveness loss, retorting to the expectation that, given their active strategy, they would have been less risky.

To instance AOA's performance against the list of Mutual Funds available, I present below the distribution graph (Figure 8) of overperformance and underperformance against the selected ETF, with the passive fund marked by the red line.

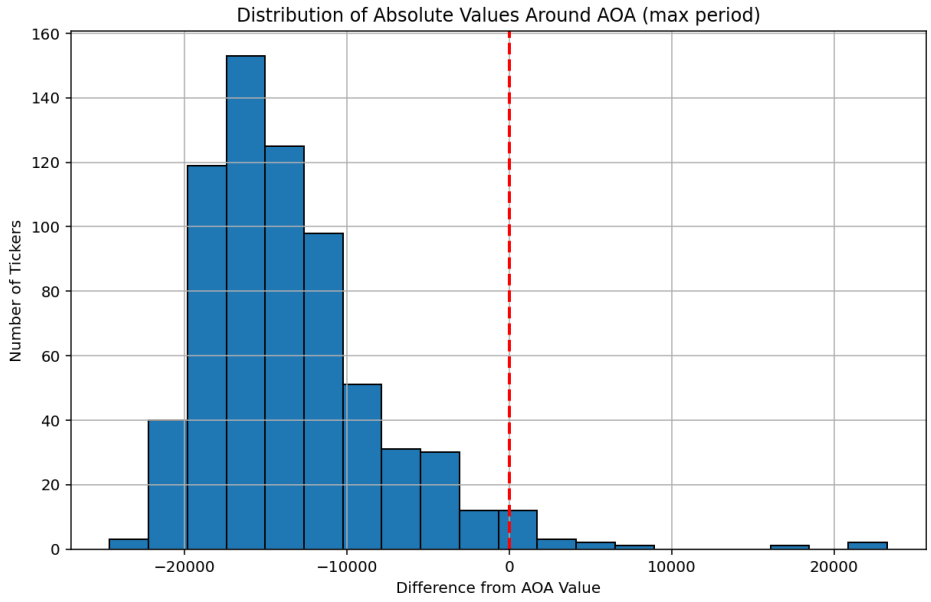

Figure 8

We can see how the bulk of active funds fall below this benchmark, with most clustering inside an underperformance range of $20.000 to $10.000. This helps to have a better visualization of how passive investment in this case would have been the more logical choice an investor could have made.

Next, I evaluated adjusted performance, factoring in the impact of fees and expenses. This will provide a more tangible view for retail investors, considering that by applying costs that they will have to pay I'm presenting a more realistic picture.

As we can see from Table 4 below, after adjusting for expenses, the part of active funds outperforming AOA drops from 2,64% to 0,73%. For a retail investor, this slim adventure of selecting an outperforming active fund equates to less than the chance of rolling four sixes in a row with the same die (0,77%).

ADJUSTED (max period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	5	0,73%	53,45%	1914,97	0,000253	-$902,22
AOA	678	99,27%	209,94%	5336,80	0,000384	-$856,38

Table 4

The adjusted analysis underscores the subtraction touch of fees on investing returns. As a matter of fact, Mutual Funds' average return decrease by around 30%, while AOA's value decline by less than 8%, achieving respectively 53,45% and 209,94%.

The only positive note for active funds is that adjusting for fees results in a lower standard deviation compared to AOA. On this case as well, Table 4 let us see how, while both fund types have a reduction on their value, Mutual Funds have the more severe one reducing its value to 1914,97, while for the ETF it stays closer achieving 5336,80. However, any festivity would be premature, as the Sharpe ratio still favors AOA by an even greater margin. While in the case of absolute performance this is only 0,00006, in the adjusted case it becomes 0,000131, providing an improvement of 118,33%. This finding suggests that contempt reduced volatility, the risk-adjusted return remain unfavorable to Mutual Funds compared to AOA.

Not many considerations had alternatively to be made for the VAR, given that even though Mutual Funds now present a lower value than in the absolute executing case, it remains more negative than the AOA one.

The comprehension of fees also widens the distribution gap, shifting the dispersion of active funds returns even further to the left compared to AOA. In fact, as

we can see on the distribution graph below (Figure 9), it concentrates the losings even more conspicuously below AOA's benchmark.

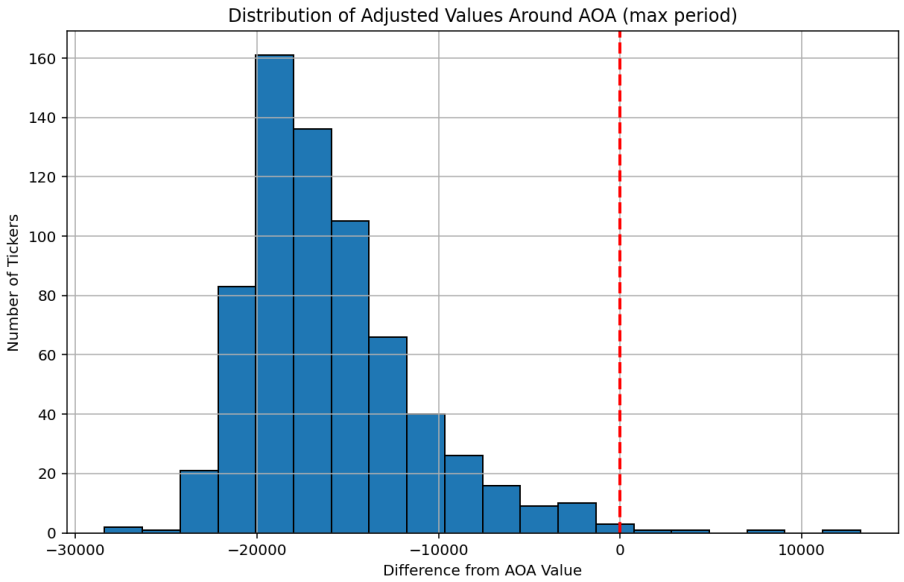

Figure 9

I'll shift now to a different investment holding period, considering in this case the medium-term performance. To allow a view applicative to medium-term investors, I analyzed a 10-year holding period starting the 01/09/2014. A total of 1102 active funds inside the Allocation asset class are compared to AOA over this horizon.

Starting with the results of the absolute performance comparison, this remaines powerfully in favor of AOA, contempt the more medium period. AOA outperforms 1079 of the 1101 active funds analyzed, representing a 97,91% overperformance. This high percentage is illustrious because it underscores the difficulties retail investors face in selecting an active fund able to overperform AOA's even over this timeframe.

As we can see on Table 5 reported below, over this period, AOA generates an absolute return of 73,47%, while the average for Mutual Funds is well lower at 13,34%.

ABSOLUTE (10-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	23	2,09%	13,34%	1014,04	0,000082	-$997,89
AOA	1079	97,91%	73,47%	2033,76	0,000337	-$811,66

Table 5

The gap between AOA and active reaches 60,13%, a striking result. For a retail investor focused on growing their investment over a middle-term horizon, these numbers present how passive investments like AOA may have offered a physical reward in terms of returns.

Examining now risk adjusted returns provides hike brainstorm into whether AOA's executing justifies its risk. The standard deviation for both AOA and Mutual Funds decrease compared to the maximal period, with the ETF having a value of 2033,76, higher than the active fund mean of 1014,04. This suggests that again AOA's returns are correction to greater fluctuations.

However, it is important to bar whether this risk leads to super returns. The Sharpe ratio gives an idea for this, with the one for AOA being 0,000337, importantly higher than the active funds' average of 0,000082. This deliberate indicates that as well as per unit of risk, AOA offers around four times the vantage compared to Mutual Funds. Hence, AOA slimly high volatility is branch by its iron performance, returning it an enthralling choice for retail investors seeking meliorate risk adjusted returns over a medium-term horizon.

The Value at Risk (VaR) at a 99% confidence level also favors AOA. As a matter of fact, its VaR has been calculated at $811,66, while the average of VaRs for active funds is slimly high at $997,89. This again shows that, although AOA have greater volatility, the Mutual Funds in this asset class still present a marginally higher potential for maximum loss at the extreme end of risk scenarios.

We can see below that I've plotted the dispersion of returns crossway active funds (Figure 10), with AOA's return highlighted as a red line on the graph. It is true that the bulk of active funds fold inside an underperformance range of -$9.000 to -$5.000, way meliorate than in the case of the maximal period. However, the clustering of Mutual Funds

returns still proceed largely below AOA's performance, indicating that the vast bulk of active funds fall short of this benchmark.

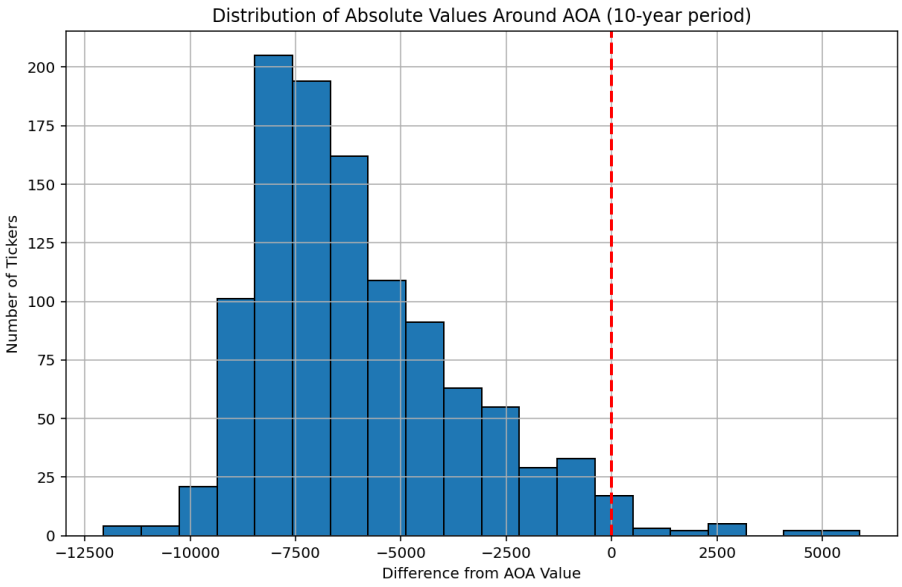

Figure 10

When adjusting returns for fees and expenses,' the medium-term results show an even sharpie tilt toward AOA. As we can see on Table 6, post fee adjustment only 15 active funds manage to beat AOA, translating to a mere 1,36% overperformance rate. With fees accounted for, Mutual Funds' average return drops from 13,34% to a mere 1,64%, with AOA alternatively having a reducing of only 2,58%, achieving 70,89%.

ADJUSTED (10-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	15	1,36%	1,64%	941,61	-0,000036	-$981,49
AOA	1087	98,64%	70,89%	1967,95	0,000335	-$811,66

Table 6

Even though the reducing from absolute to adjusted in this case has been lower than in the maximal period case, it still underscores the touch that fees can have over an even shorter period of 10 years.

Notably, while the standard deviation of active funds drops to 941,61, the risk adjusted Sharpe ratio also fall, dipping exponentially into a value of -0,000036. The same accounts for the selected ETF, which even if it's still showing a higher standard deviation

at 1967,95, shows a lower decrease in Sharpe ratio which got to a value of 0,00035. This difference in Sharpe ratio indicates again how Mutual Funds aren't able to compensate the investor with a higher risk adjusted return for the higher fees they were subject to.

The dispersion graph of adjusted returns shown below (Figure 11), illustrates a pronounced shift to the left as well as returns clustering now in the -10.000, -6.000 area. This shift emphasizes the level to which fees can erode the returns of active funds, which are not able to better position themselves in the underperformance debate.

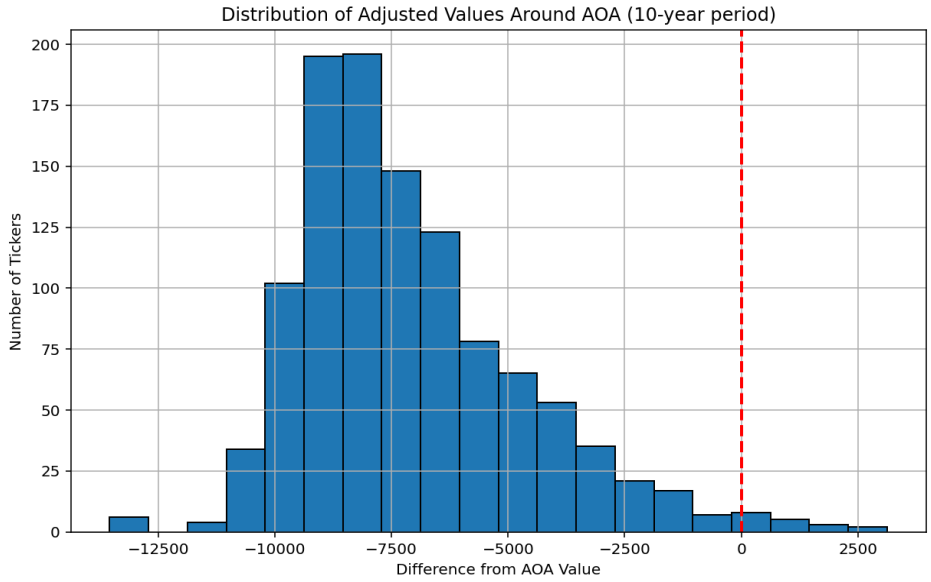

Figure 11

Considering now retail investors with a shorter investing horizon, I conducted an analysis over a 5-year period starting 01/09/2019. This horizon includes 1420 active funds, allowing us to compare performances in a limited timeframe.

As we can see on Table 7 below, in the 5-year period, AOA in absolute terms outperform 1368 of the 1420 active funds, resulting in a 96,34% overperformance rate, high enough to allow an investor to keep his pick even when looking ahead to investing in a shorter period. For investors, this finding implies that the odds of selecting an actively managed fund able to surpass AOA in 5 years are slim, fewer than 4%.

ABSOLUTE (5-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	52	3,66%	12,61%	1014,75	0,000075	-$1.022,18
AOA	1368	96,34%	43,94%	1265,56	0,000308	-$975,48

Table 7

AOA's return over this period is 43,94%, while the mean for active funds is only 12,61%, yielding an executing gap of 31,33%. This gap,' though littler than in the maximal and 10-year horizons, still underscores the executing disparity between AOA and active funds over shorter horizons.

Turning to risk adjusted returns, the 5-year horizon also underscores AOA's tradeoff between risk for returns. The standard deviation as a matter of fact is 1265,56, slimly higher than the active funds mean, of 1014,75. However, as with the 10-year absolute analysis, AOA's Sharpe ratio of 0,000308 is importantly above the Mutual Funds average Sharpe ratio of 0,000075, reflecting AOA's meliorate reward to risk ratio over the short term.

The Value at Risk VAR at 99% confidence level for AOA is calculated at $975,48, slimly lower than the active funds VaR of $1022,18. This finding as for the periods prior analyzed implies that, contempt AOA's high volatility, its effectiveness in terms of possible losings is still better than that of Mutual Funds.

The distribution of performances plot for this 5-year horizon, visible below (Figure 12), again highlights AOA's place well above the Mutual Funds performances. As a matter of fact, we can see how the bulk of active fund returns cluster on the left of the red line, in the -5.000, .2.000 range, illustrating AOA's proportionate reward even in shorter prods.

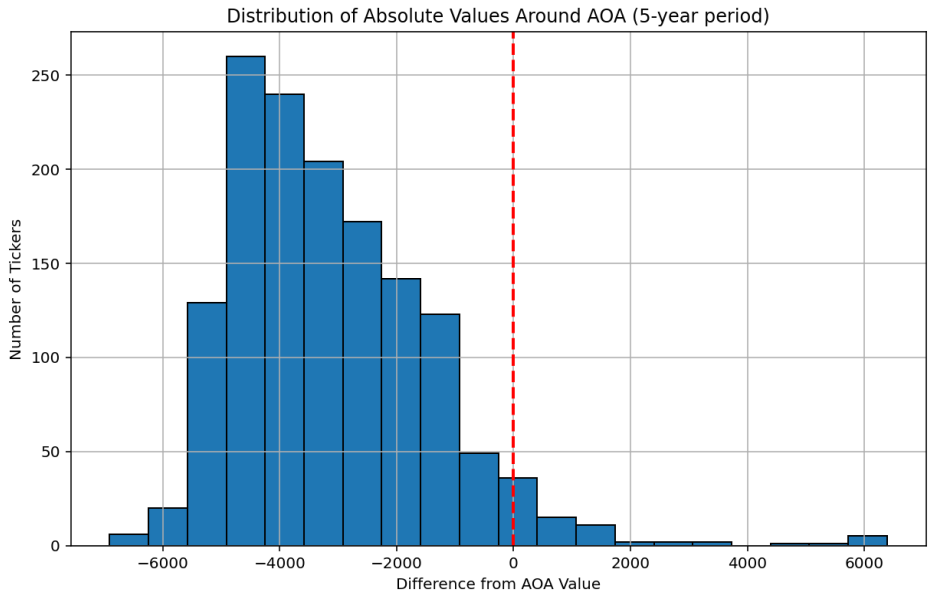

Figure 12

Adjusting the performances for fees and expenses in the 5-year skyline brings an important view for retail investors. As we can see on Table 8 below, after accounting costs, only 32 active funds out of 1420 are able to beat AOA return, resulting in a terrible 2,25% overperformance rate.

ADJUSTED (5-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	32	2,25%	6,47%	1003,58	0,000015	-$1.005,83
AOA	1388	97,75%	42,86%	1244,49	0,000304	-$975,48

Table 8

The average Mutual Funds return, after fees, drops from 12,61% to just 6,47%, whereas AOA remains similar at 42,86%, with a reducing of just above 1%.

Looking at the risk side, standard deviations aren't affected in a big way when considering expenses and fees, underlying the low initiative of price movements in a shorter period. The adjusted Sharpe ratio on the other hand, for active funds decreased to around 0,000015, contrasting with AOA's which stays almost consistent at 0,000304. This reveals the difficulties Mutual Funds face in delivering net returns to offset their costs.

The dispersion graph below (Figure 13) of adjusted returns hike accentuates the touch of fees, with most active fund returns clustering in the- 6.000, -2.000 range. The dispersion shifted as for the past periods to the left, reflecting reduced returns and underscoring the physical reward that a low-priced ETF like AOA offers over actively managed funds even in shorter time horizons.

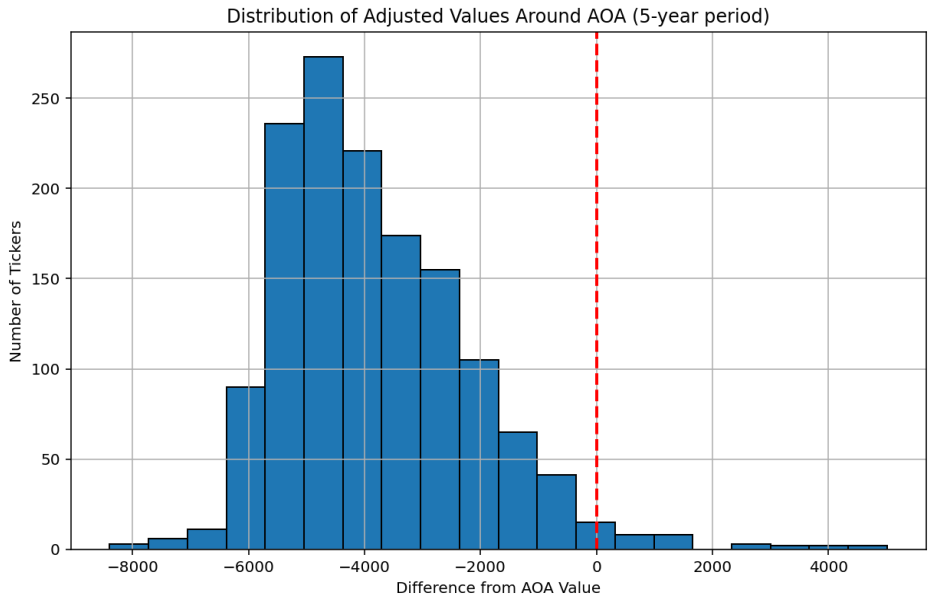

Figure 13

4.3 International Equity results

In this part I present the results of my analysis for the International Equity asset class. This one comprehends publicly traded companies exterior the U.S., allowing the investors to get exposed to crossway both developed and emerging markets.

For this asset class, I've selected SPDR Global Dow ETF (DGT), managed by State Street Global Advisors which is the fourth biggest asset management firm with more than $4 trillion of assets under management. DGT's characteristics align it with retail investor interests, peculiarly those seeking passive investing strategies. As we can see in Table 9 below, holding a 5-star Morningstar rating which provides a first look on its solid past performances, a net expense ratio of 0,005, a high liquidity with total assets of $221,90 million, makes it the best option compared to all the other ETFs approachable in the selection.

Ticker	Fund Management Company	Morningstar Rating for Funds	Asset Class	Fund Size	Net Expense Ratio	Minimum Initial Investment	Management Style
DGT	State Street Global Advisors (Chicago)	5	International Equity	221,90 Mil	0,005	0	Passive

Table 9

During the maximal period analysis which started the 01/12/2000, results show that DGT maintains a thin lead in performance. As we can see from Table 10 below, on an absolute basis, DGT outperform active funds in 135 instances, accounting for just 52,53% of the total comparisons, which means that active funds achieve 122 instances of outperformance, representing 47,47%.

ABSOLUTE (max period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	122	47,47%	85,03%	4203,21	0,000190	-$1.483,57
DGT	135	52,53%	76,46%	2568,27	0,000278	-$1.139,51

Table 10

Despite Mutual Funds achieving a higher average return of 85,03% compared to DGT's 76,46%, this came with greater volatility. As a matter of fact, active funds report a standard deviation of 4203,21, well higher than the ETF's one of 2568,27. What makes me doubt even more about the reliability of such higher return is the Sharpe ratio. This is because, with active funds posting a lower ratio of 0,000190 compared to DGT's 0,000278, when taking into consideration risks passive investment remains the best option offering a more lasting executing.

Additionally, DGT shows a lower Value at Risk at 99% confidence interval of $1.139,51, suggesting a little effectiveness loss compared to active funds' VaR of $1.483,57.

The even result in overperformances is meliorate visualized in the dispersion graph reported below (Figure 14). As we can see the red line that represents the point where Mutual Funds have the same performance as DGT is found in the middle of the distribution. As a matter of fact, excluded few outliers the main numbers of active funds fold in the range of -10.000 and +10.000 performances.

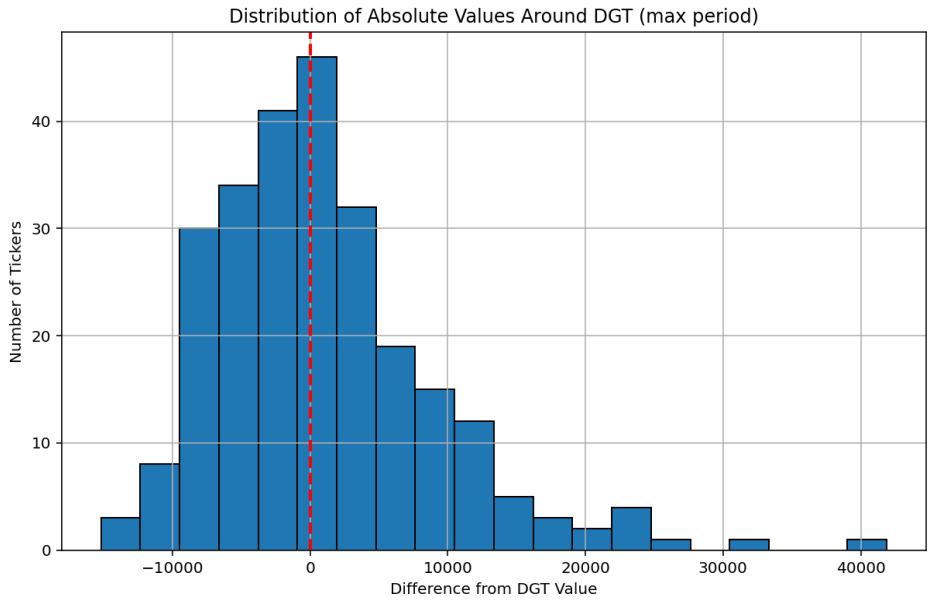

Figure 14

Taking now in condition expenses and fees, the adjusted maximal period results reinforced DGT's advantage. As we can see in Table 11 below, after accounting for expenses, DGT's outperformance increases significantly, with 188 instances of outperformance, covering 73,15% of comparisons, meaning an overperformance on just in 69 cases, or 26,85% for Mutual Funds. This shift indicates that DGT's lower net expense ratio well benefits investors over the long term, giving that including fees increases of more than 20% the reckon of Mutual Funds being overperformed by the ETF.

ADJUSTED (max period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	69	26,85%	35,11%	3138,13	0,000096	-$1.453,98
DGT	188	73,15%	56,76%	2149,04	0,000241	-$1.139,51

Table 11

Adjusted for expenses, DGT achieves a return of 56,76%, surpassing this time active funds' average of 35,11%. This is an idealistic example of the incidence that fees have on performance, with DGT going from underperforming by 9% to overperforming by almost 20%. This is given by the fact that costs impacted more the average return of Mutual Funds rather than that of DGT, lowering them respectively by 50% and 20%.

It is also notable how even though DGT were able to achieve higher return, it was also still able to hold a lower standard deviation of 2149,04, compared to active funds' 3138,13. Also the Sharpe ratio underlines the improvement of DGT compared to Mutual Funds, with the value reaching 0,000241 for the passive instrument, compared to the active funds one of 0,000096. This suggests that, even after adjusting for costs, DGT provided meliorate risk adjusted performance. This is also supported by DGT's lower VaR of $1.139,51, indicating a reduced downside risk compared to Mutual Funds' VaR of $1.453,98.

The high effect that expenses had on active investments compared to the passive one can be better visualized on the distribution graph shown below (Figure 15). As a matter of fact, we can see how the dispersion shifted more left from the red line compared to the absolute case, with the denser area being now in the range of -10.000 and a little bit less than 0.

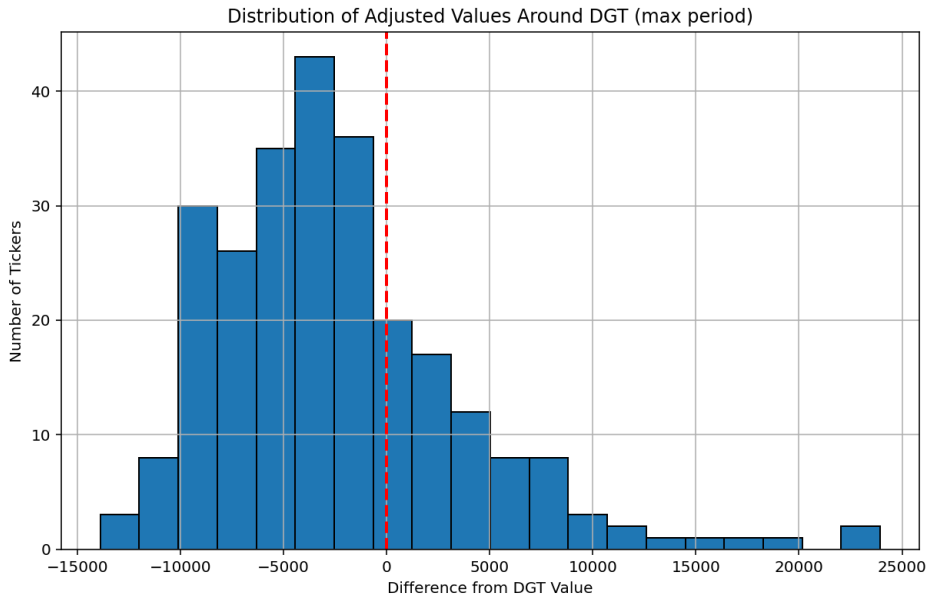

Figure 15

The 10-year period, starting the 01/09/2014, offers additive insights thanks to the comparison of DGT to 257 Mutual Funds. On an absolute basis, the selected ETF exhibits a clear advantage, achieving outperformance in 788 cases, representing 96,21% of comparisons. This is an immoderate shift compared to the maximal period values where the two investing styles were almost even. This makes me believe that 01/09/2014 there

must have been a slot of immoderate overperformance for some active funds that helped them recuperate in the long run.

As we can see from Table 12 below, what has just been reported is also confirmed by DGT's return that reaches 96,77%, which was importantly higher than active funds' 26,13%, that had seen a reduction of around 60% compared to the max period performances.

ABSOLUTE (10-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	31	3,79%	26,13%	1720,89	0,000123	-$1.228,27
DGT	788	96,21%	96,77%	2836,00	0,000324	-$1.115,60

Table 12

This ETF's return was achieved with a standard deviation of 2836,00, compared to 1720,89 for active funds. However, DGT's higher Sharpe ratio of 0,000324 versus active funds' 0,000123 highlights that DGT provides meliorate risk adjusted returns. This higher value for passive instrument reflects a positive tradeoff between increased returns and slimly elevated volatility

In terms of downside risk, DGT again shows a lower VaR of $1.115,60, suggesting reduced effectiveness losings compared to active funds, which record a VaR of $1.228,27. The meaningful exchange in the part of overperformance and in the returns as well as already seen, is immoderate compared to the maximal period analysis.

The meaningful turnaround in the percentage of overperforming funds and in the returns can be seen in the distribution graph reported below (Figure 16), with the red line representing even performances being located on the righter side of the graph. This leaves the denser are in the underperformance range of -12.000 and -3.000.

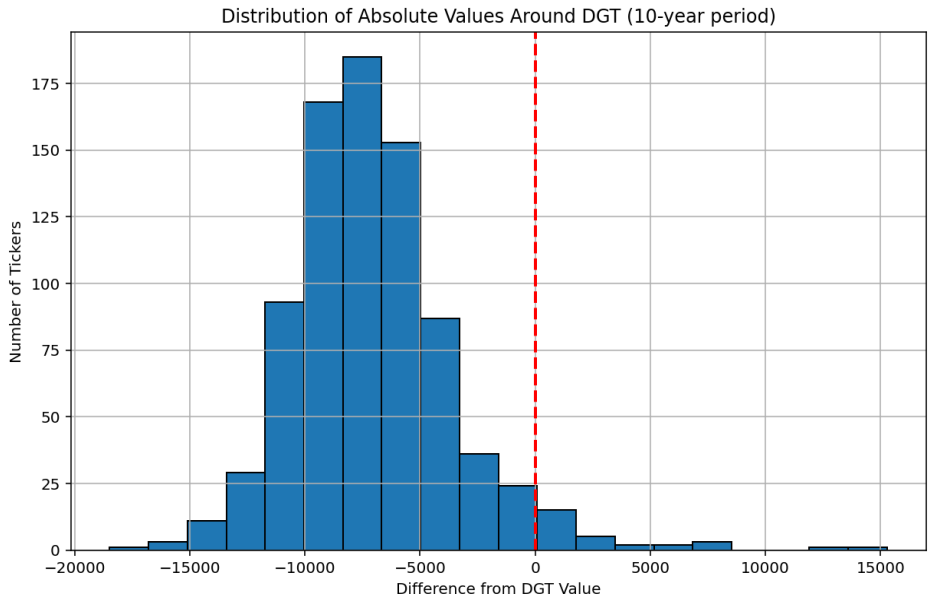

Figure16

When adjusting the 10-year period for expenses, DGT hike extended its lead. As we can see on Table 13 below, the adjusted outperformance for the ETF rose to 807 instances, or 98,53%. Moreover, the passive instrument achieved a return of 87,10%, a stark counterpoint to the 9,71% average of Mutual Funds.

ADJUSTED (10-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	12	1,47%	9,71%	1471,04	0,000032	-$1.206,55
DGT	807	98,53%	87,10%	2584,16	0,000318	-$1.115,60

Table 13

This highlights how fees importantly impacted performances over time. Notably, this case is the best practical example of how these costs affect vary over time. As a matter of fact, by reducing the horizon by 14 years we see that their impact on DGT performance moved from 20%, as seen before, to only 9% for this case. For active funds, while we see a reduction of their impact over this medium period, the touch of fees remains more pronounced due to high disbursement ratios, resulting in a return reduction of 17%, compared to the 50% over the maximal period.

Even with a standard deviation of 2584,16, DGT can compensate it better with its returns, achieving a Sharpe ratio of 0,000318. On the other hand, active funds with a standard deviation of 1471,04, still achieve a lower ratio set at 0,000032, increasing this way the gap compared to the absolute analysis.

Once again, DGT exhibited a lower VaR of $1.115,60 comparative to active funds' $1.206,55, reinforcing the constancy of DGT as a lower risk choice over this period.

The effects of expenses can be seen again in the dispersion graph reported below (Figure 17). As a matter of fact, there is clearly a shift of the graph hike to the left of the red line, with now the denser are clustered in the underperformance range of -12.000 and -5.000.

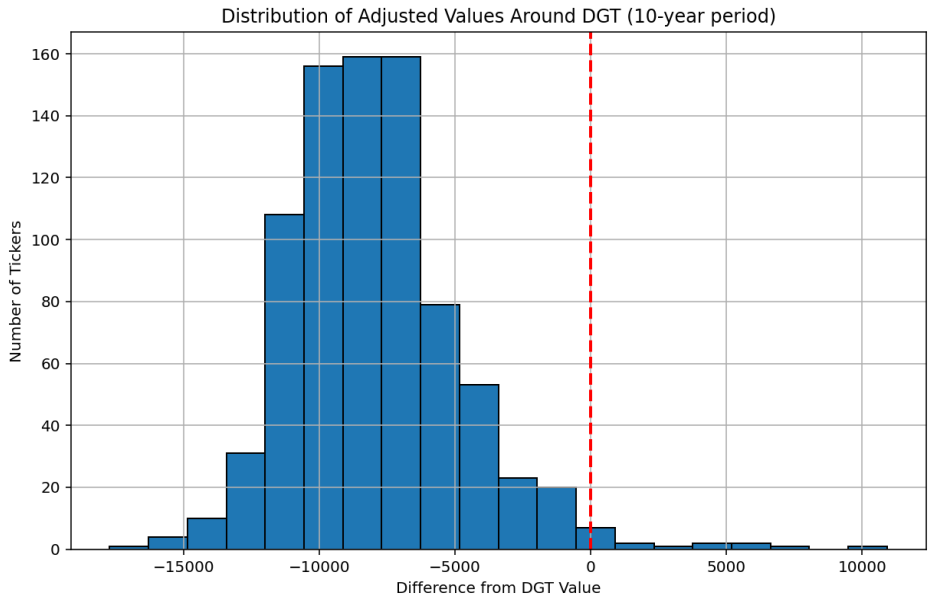

Figure17

In the 5-year period analysis which consider 1047 Mutual Funds, DGT's performance control continued. As we can see from Table 14 below, on an absolute basis the ETF outperforms in 1017 cases, which represents 97.13% of comparisons.

ABSOLUTE (5-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	30	2,87%	21,11%	1595,53	0,000101	-$1.351,16
DGT	1017	97,13%	65,44%	2006,94	0,000301	-$1.286,17

Table 14

DGT's return of 65,44% importantly exceeded active funds' 21,11%, achieving this overperformance with a standard deviation of 2006,94, compared to 1595,53 for active funds. Despite the elevated volatility, DGT's Sharpe ratio of 0,000301 is markedly higher than active funds' 0,000101, suggesting that DGT offers a more gratuitous risk return takeoff even in short term period investment.

Additionally, DGT's VaR 99% is $1.286,17,' reflecting a slimly lower risk of loss compared to active funds' VaR of $1.351,16.

For visualization purposes I'm also reporting below the distribution graph (Figure 18).

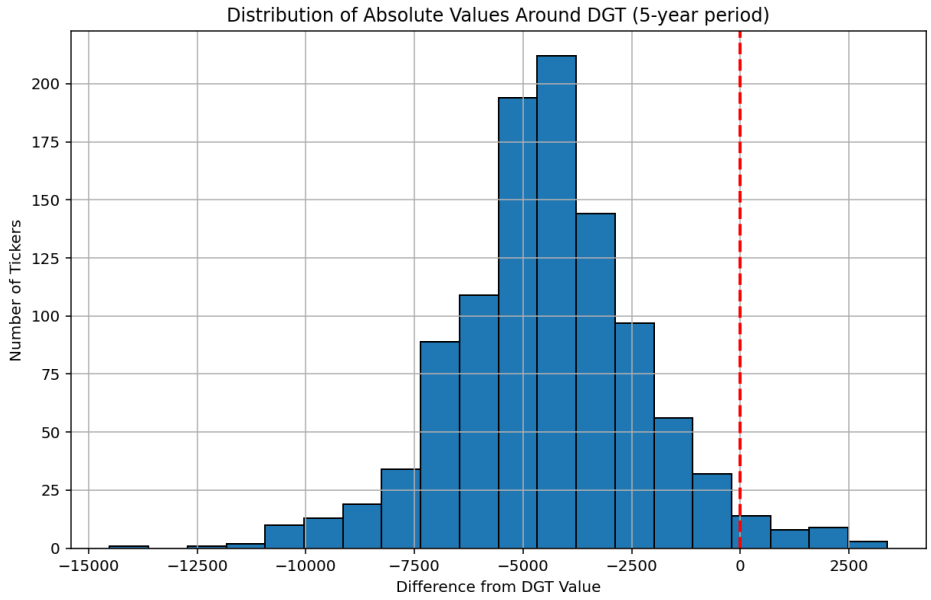

Figure18

This, as we can see, is in line with that seen in the 10-year case. The only thing worth notice is a higher reckon of funds on the higher left side of the graph, signifying a further overperformance of DGT with many Mutual Funds. However, there is the necessity to make the disclaimer that this insight may be also given by the high number of active funds considered in this holding period.

The adjusted 5-year performance results highlight the passive instrument's enduring reward even further. As we can see on Table 15 below, DGT achieves

outperformance in 1030 cases, representing 98,38%. Moreover, after adjusting for expenses, the ETF's return is 61,29%, well higher than active funds' 12,83%.

ADJUSTED (5-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	17	1,62%	12,83%	1523,95	0,000051	-$1.328,77
DGT	1030	98,38%	61,29%	1904,12	0,000296	-$1.286,17

Table 15

DGT also maintains a lower standard deviation of 1904,12 comparative to active funds' 1523,95. The Sharpe ratio results affirmed the passive instrument risk adjusted strength, with its value reaching 0,000296 against active funds one of 0,000051.

Finally, DGT's lower VaR of $1.286,17 reinforced its constancy comparative to active funds, which display a higher VaR of $1.328,77. This keeps higher the reliance on passive investment highlighting how, not only does it achieve higher returns and risk adjusted performance, but in the wort case scenario it has the probability to make an investor lose less than in the Mutual Funds case.

Considering all the measures reported, we can now have a visual representation in the Figure 19 below. The main thing to highlight is that there has been a shift to the left of the distribution from the red line, compared to the absolute case. This is due to the impact of costs, which by being higher for active investments, proportionally reduce their performance more than that of passive investments.

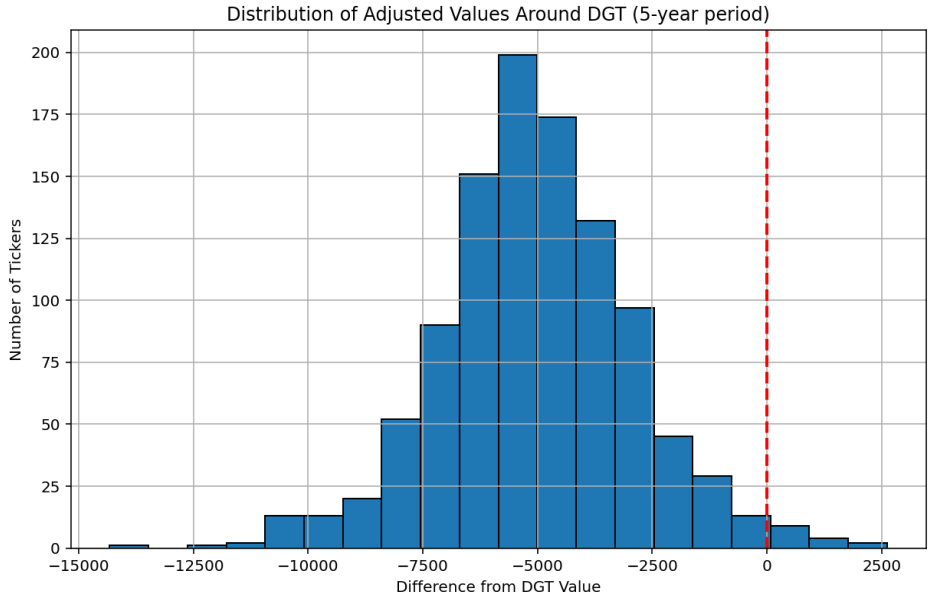

Figure 19

4.4 Municipal Bond results

In the Municipal Bond asset class analysis, I've preferred the iShares National Muni Bond ETF (MUB) to hold passive investing in evaluating the performances versus active funds.

As we can see on Table 16 below reporting its characteristics, MUB was selected based on BlackRock's reputation, high fund size of 38,52 billion which give him immoderate liquidity, low net expense ratio, all this providing approachability for retail investors.

Ticker	Fund Management Company	Morningstar Rating for Funds	Asset Class	Fund Size	Net Expense Ratio	Minimum Initial Investment	Management Style
MUB	BlackRock Fund Advisors	3	Municipal Bond	38,52 Bil	0,0005	0	Passive

Table 16

The fund is categorized under Municipal Bond, holding a Morningstar rating of 3 stars. The low rating compared to that of other asset classes antecedently analyzed, shouldn't warn us too much. As a matter of fact, 3 is the highest level among all ETFs within this asset class.

For the maximum period, starting from 01/12/2007, MUB demonstrate a meaningful reward in absolute performance.

As we can see on Table 17 below, it outperforms active funds in 507 cases, which is 99,22% of all instances. Moreover, MUB achieves a return of 5,60% with a standard deviation of 485,38, resulting in a Sharpe ratio of 0,000012. This ratio, though low indicates a modest return for the risk undertaken. This results, even though moderate, should be compared to the counterparty active funds, which obtain an average negative return of -5,02% and a standard deviation of 481,0, that lead to an even lower Sharpe ratio in the negative range of -0,000208, suggesting an unfitness to covering for volatility, even more if considering a negative return.

ABSOLUTE (max period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	4	0,78%	-5,02%	481,02	-0,000208	-$472,13
MUB	507	99,22%	5,60%	485,38	0,000012	-$360,57

Table 17

Additionally, the Value at Risk for MUB is calculated at $360,57, lower than that of active funds $472,13, highlighting again a comparatively smaller downside risk in MUB's returns.

As usual, the lifelike delegate is shown below in the distribution graph (Figure 20). In this case, the 0,78% of overperforming Mutual Funds can be represented by the fact that almost nothing is on the right side of the brakemen point with MUB (the red line).

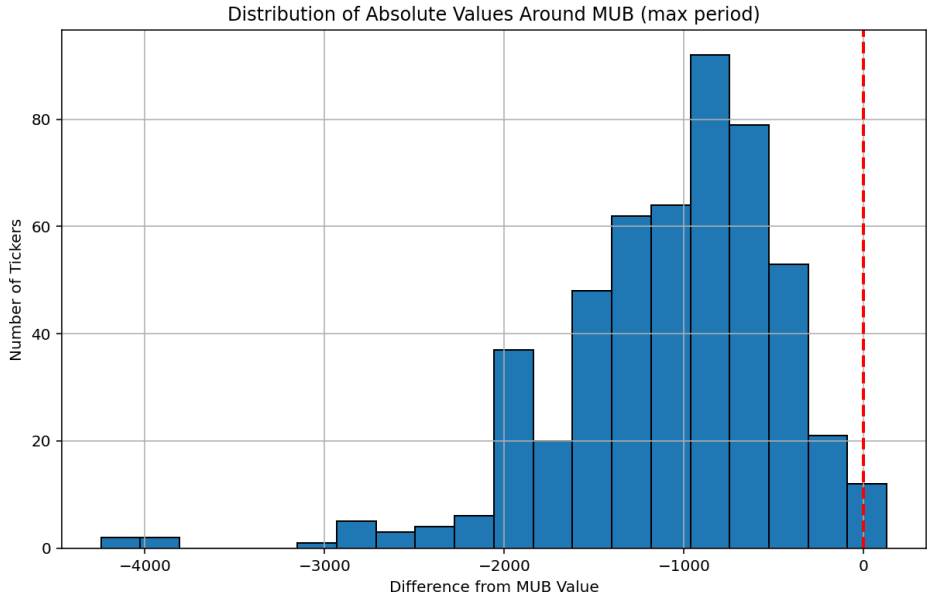

Figure 20

In terms of adjusted maximum period performances, MUB retains its lead, with an overwhelming 99,80% outperformance rate. This can be better analyzed in Table 18 below which shows that after adjusting for expenses, MUB's return reaches a value of 4,72%, slimly decreased by almost 1%, while its standard deviation narrows to 470,10, maintaining a lasting VaR of $360,57. The main negative aspect, however, is that also its Sharpe ratio decreases, reaching the negative area of -0,000006.

ADJUSTED (max period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	1	0,20%	-19,13%	616,62	-0,000391	-$464,18
MUB	510	99,80%	4,72%	470,10	-0,000006	-$360,57

Table 18

By contrast, active funds average returns diminish by almost 14%, reaching a negative yield of -19,13%. And this was not even the worst part, considering that they show an increased standard deviation of 616,62. These two face combined lead to a more negative Sharpe ratio -0,000391 and a VaR of $464,18, indicating high losings and volatility when took in consideration expenses.

As usual, when considering fees and expenses, in Figure 21 below we can see that the dispersion shifted even further left from the red line. Representing a worsening of the results provided by Mutual Funds, against passive investment, when adjusted for costs.

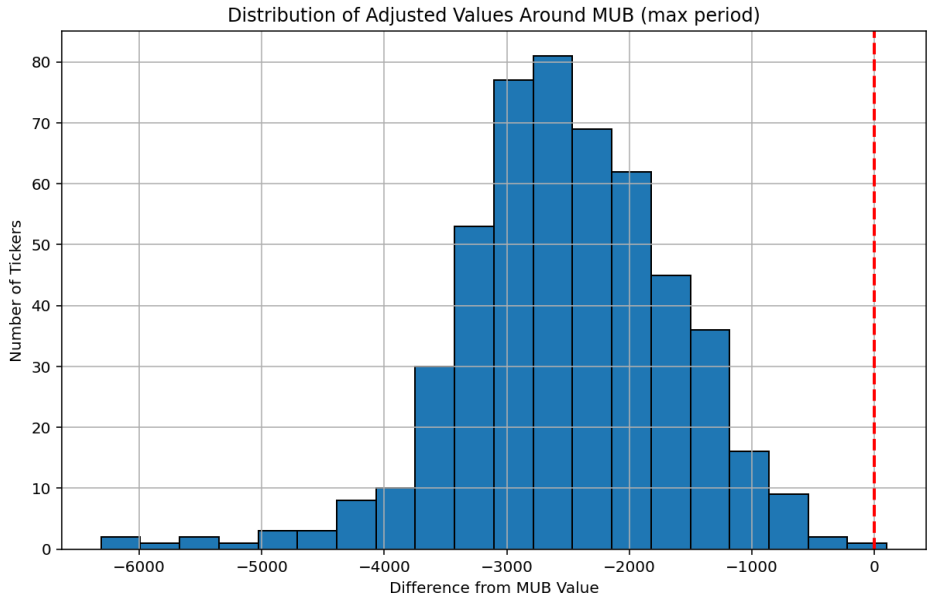

Figure 21

In the 10-year period, in absolute terms, MUB outperforms active funds in 91,10% of instances. As we can see from Table 19 below, although both the passive fund and the active funds report negative returns, MUB's value of -1,71% is less negative than active funds' average of -6,73%.

ABSOLUTE (10-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	58	8,90%	-6,73%	438,41	-0,000268	-$395,55
MUB	594	91,10%	-1,71%	340,84	-0,000197	-$313,21

Table 19

Furthermore, MUB's standard deviation is lower at 340,84, causing a Sharpe ratio of -0,000197. While active funds, considering the higher standard deviation of 438,41, obtain a more negative Sharpe ratio of -0,000268. Finally, VaR figures align with these

findings, with MUB's risk capped at $313,21, contrasting with active funds' higher possible losings at $395,55.

As usual,' I'll account below the dispersion graph (Figure 22). Again, we can see how the bulk of active funds can be found on the left side of the red line, underlying the lower return of active investment. However, as underlined from the percentage of overperformed Mutual Funds, we can see how in this case more Mutual Funds are located on the right side of the breakeven point compared to the maximal period occasion.

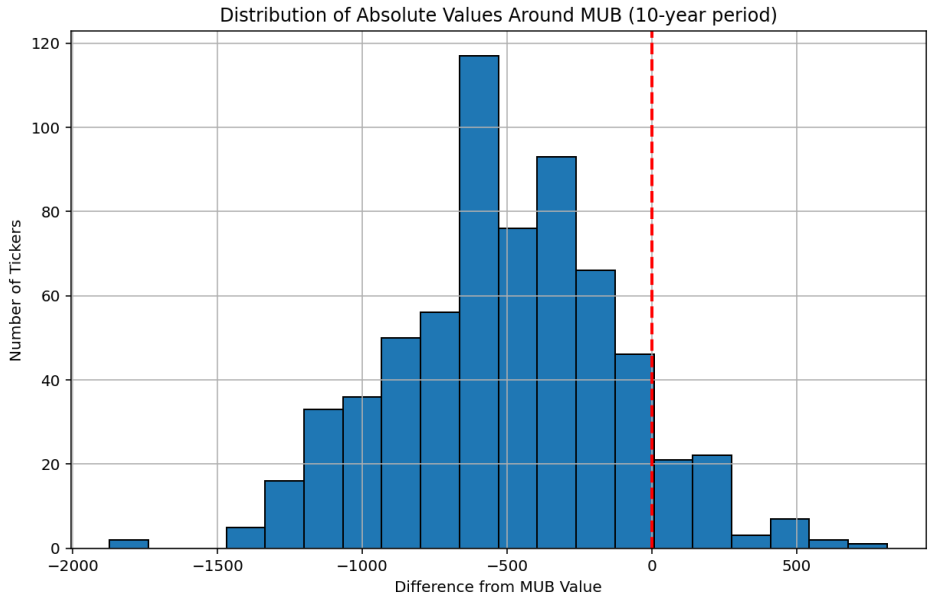

Figure 22

When adjusted for costs, MUB distanced itself from active funds, achieving an adjusted outperformance of 99,39% even though its return declines slimly to -2,21%. As we can see on Table 20 below, this is because it proves again higher constancy than active funds even in short term period, with a standard deviation of 342,76 and a VaR of $313,21. This distancing is moreover thanks to active funds' poor performance. As a matter of fact, their average return got impacted by fees higher than MUB's, achieving a value of -15,73%, with also standard deviation increasing to 597,07 and a VaR staying almost constant at $389,54, emphasizing that adjusted active strategies are markedly less effective.

ADJUSTED (10-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	4	0,61%	-15,73%	597,07	-0,000347	-$389,54
MUB	648	99,39%	-2,21%	342,76	-0,000210	-$313,21

Table 20

This gap is also underlined by the Sharpe ratio that, in the MUB's case achieves a value of -0,00210, while for Mutual Funds it got to even more negative positions at -0,000347.

In this case if we look at the dispersion graph reported below (Figure 23), we can see that compared to the absolute case it achieves a closer look to the maximal period one, with almost no active funds finding themselves on the right side of the red line.

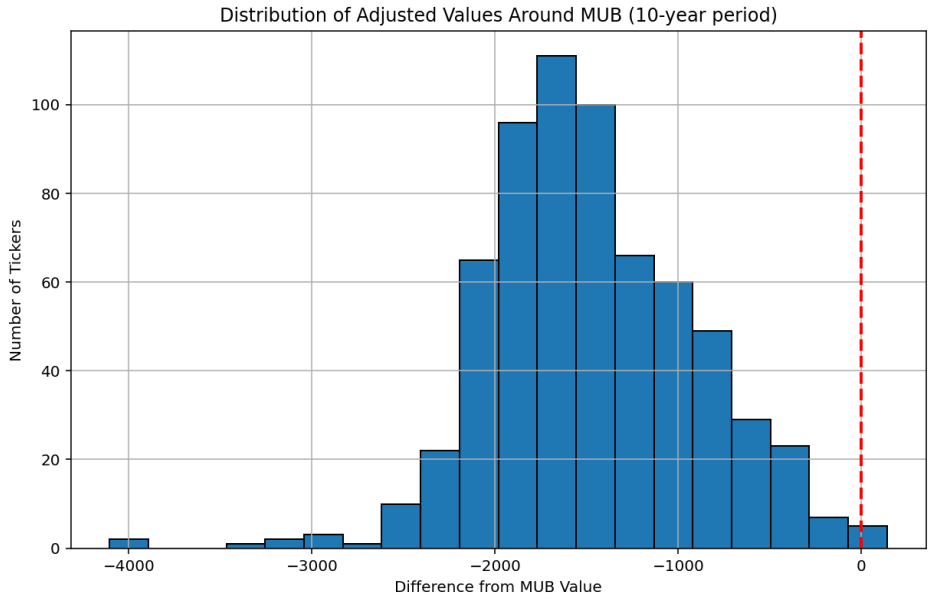

Figure 23

The 5-year period absolute analysis shows that MUB continues to outperform, albeit with slimly lower control at 80,76%. As we can see from Table 21 below, MUB's return of -5,53% is again less negative than the active funds' average of -7,66%.

The selected ETF also exhibited lower volatility, with a standard deviation of 432,84, compared to the 526,41 of Mutual Funds, while the Sharpe ratio narrows to similar value at -0,000243 compared to the -0,000240 for active funds.

ABSOLUTE (5-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	142	19,24%	-7,66%	526,41	-0,000240	-$435,11
MUB	596	80,76%	-5,53%	432,84	-0,000243	-$305,94

Table 21

The VaR analysis for this period reflects MUB's narrow advantage, with a lower possible downside loss of $305,94, compared to the Mutual Funds of $435,11.

The dispersion graph reported below (Figure 24) makes us visualize the results obtained by Mutual Funds and MUB in terms of almost even performances. As a matter of fact, we can see how the red line is around the mean of the distribution. However, given that MUB still overperformed 80,76% of active funds, is undyed to see the breakeven point line shifted a little bit toward the left of the distribution, leaving the bulk of Mutual Funds on his left.

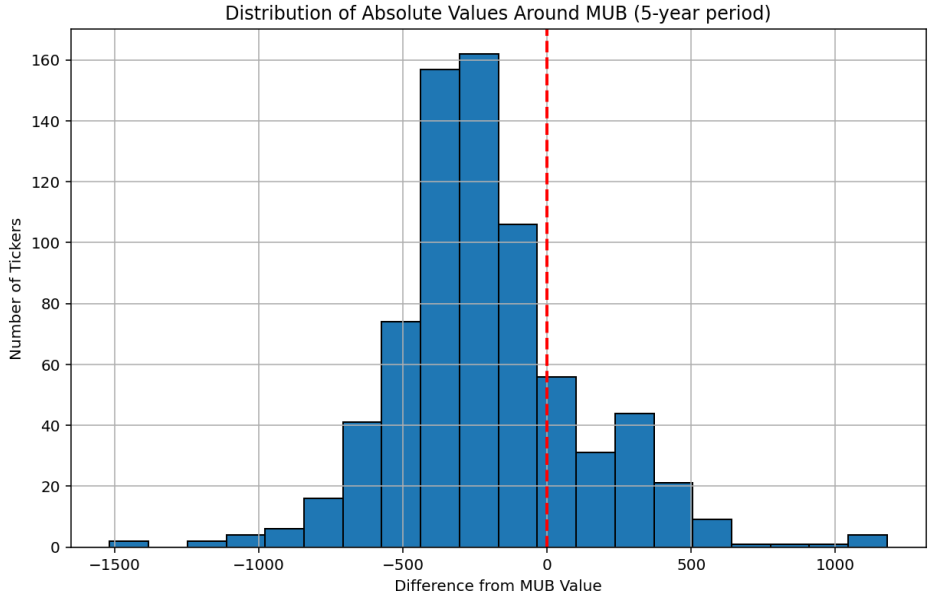

Figure 24

Adjusting now for all costs, MUB's outperformance rate reaches 94,99%. As we can see on Table 22 below, the selected ETF achieved an adjusted return of -5,77%, with a standard deviation that just slimly increases to 437,90 and alternatively a uniform VaR of $305,94.

ADJUSTED (5-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	37	5,01%	-12,35%	614,93	-0,000282	-$428,55
MUB	701	94,99%	-5,77%	437,90	-0,000246	-$305,94

Table 22

Mutual funds' adjusted return, on the other hand, are notably lower at -12,35% with also a higher increase in their standard deviation that reach 614,93, all this matched by an increased VaR of $428,55.

Looking at the risk adjusted measure instead, we can see how after a slighter meliorate value for Mutual Funds in the absolute case, things turn around again with MUB achieving a less negative value. As a matter of fact, for this one the metric stays near the absolute case at -0,000246, while for active funds it has a sharper lessen reaching -0,000282.

As expected, given the results just reported, we can see how in the distribution graph below (Figure 25), there has been a shift of the distribution hike to left of the red line, indicating an improvement in the overperformance of MUB once costs are taken in consideration.

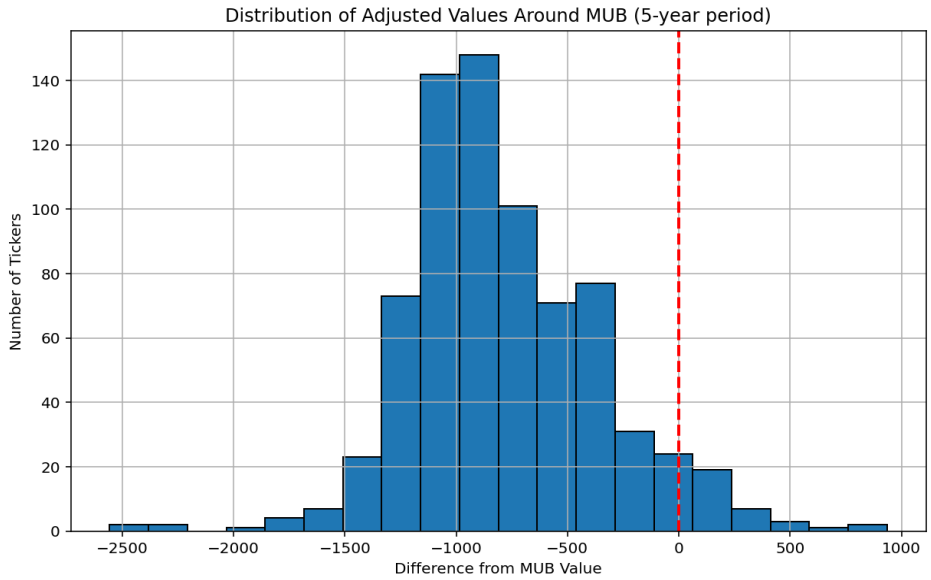

Figure 25

4.5 Sector Equity results

The following analysis examines the performances of the Sector Equity asset class, comparing the passive investing represented by the iShares US Technology ETF IYW against a range of actively managed active funds. This pick is due to its high alliance with retail investor needs.

As we can see on Table 23 below, this fund is also managed by the biggest asset management company, BlackRock, and it holds a 5-star Morningstar rating indicating systematically high performances. Moreover, with a fund size of about $19,08 billion, IYW provides high liquidity, making it approachable and efficient considering its net expense ratio of 0,004.

Ticker	Fund Management Company	Morningstar Rating for Funds	Asset Class	Fund Size	Net Expense Ratio	Minimum Initial Investment	Management Style
IYW	BlackRock Fund Advisors	5	Sector Equity	19,08 Bil	0,004	0	Passive

Table 23

It is now indispensable to underscore how for the past asset class I've been trying to prefer an ETF that was better representing the full category. However, in this case, given the characteristics of this asset class it would have been unthinkable to prefer one

on the same basis. As a matter of fact, by intrinsic characteristic of the category, it focuses on specific segment/sector of the economy, such as technology, healthcare and energy, making it impossible to select a single fund able to represent them all.

I've then decided to select IYW which is in the technological sector, other than for what reported above, because it is the family which had received the highest attention in the last decades. As a matter of fact, as report by *L. Niedend* in its article *"Stock Domination – Before Investors Rotated"* for *Inveperiodedia*, technology funds attracted $4,2 billion in net inflows in the unconventional quarter, wrapping up a first half in which when they gathered $17 billion. Moreover, according to an LPL analysis of *Morningstar*, out of the 10 market sectors composing the benchmark S&P 500 Index, only two others—industrials and financials—had net positive flows, which however were still lower than technology's one.

Starting now by analyzing the actual results, for the maximum approachable period starting on August 1, 2001, IYW demonstrates a total outperformance rate of 100% on an absolute basis compared to the actively managed funds. As we can see from Table 24 below, the select ETF achieves a total return of 1.094,02%, well surpassing the average return of 162,62% for the active funds. However, the standard deviation for IYW is reported at 27.557,34, notably higher than the active funds' 7.319,75, suggesting greater volatility associated with the ETF over this extended period.

ABSOLUTE (max period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	0	0,00%	162,62%	7319,75	0,000215	-$1.732,88
IYW	205	100,00%	1094,02%	27557,34	0,000395	-$1.515,43

Table 24

Despite this, IYW's Sharpe ratio of 0,000395 was able to exceed that of the active funds, which sits at 0,000215, indicating a more gratuitous risk adjusted return. Value at Risk results at the 99% confidence level also highlights a marginally lower risk for IYW, with a VaR of $1.515,43 compared to the active funds' one of $1.732,88.

The absolute overperformance just presented can also be seen graphically in the distribution graph reported below (Figure 26). As a matter of fact, is of clear visualization how all Mutual Funds are located on the left side of the breakeven red line, with most of these funds being located around the -$100.000 underperformance area.

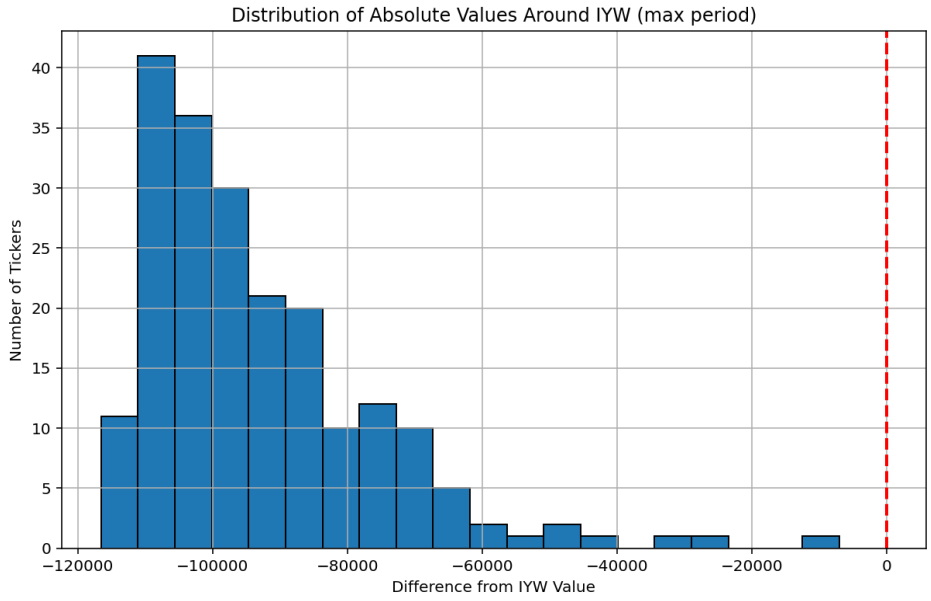

Figure26

When adjusting for expense this outperformance of IYW stiff clear. On Table 25 below, we can see how IYW's average, return is now 989,06%, importantly higher than the active funds' average of 93,93%. Adjusted standard deviation is also lower for both, with the passive investment still reporting a higher value of 25.084,60 with respect to the active funds' 5.607,01.

ADJUSTED (max period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	0	0,00%	93,93%	5607,01	0,000159	-$1.704,09
IYW	205	100,00%	989,06%	25084,60	0,000392	-$1.515,43

Table 25

The Sharpe ratio, however, confirms IYW's advantage in risk adjusted performances, given its value of 0,000392 compared to the active funds' 0,000159. The

VaR at 99% also indicates a slimly lower risk for IYW, given its value of $1.515,43 versus $1.704,09 for the active funds.

The fitting for expenses did not alter the absolute outperformance, with IYW maintaining a 100% rate. This is again well visible in the dispersion graph below (Figure 27), showing how there hasn't been meaningful change in terms of performance when costs were introduced.

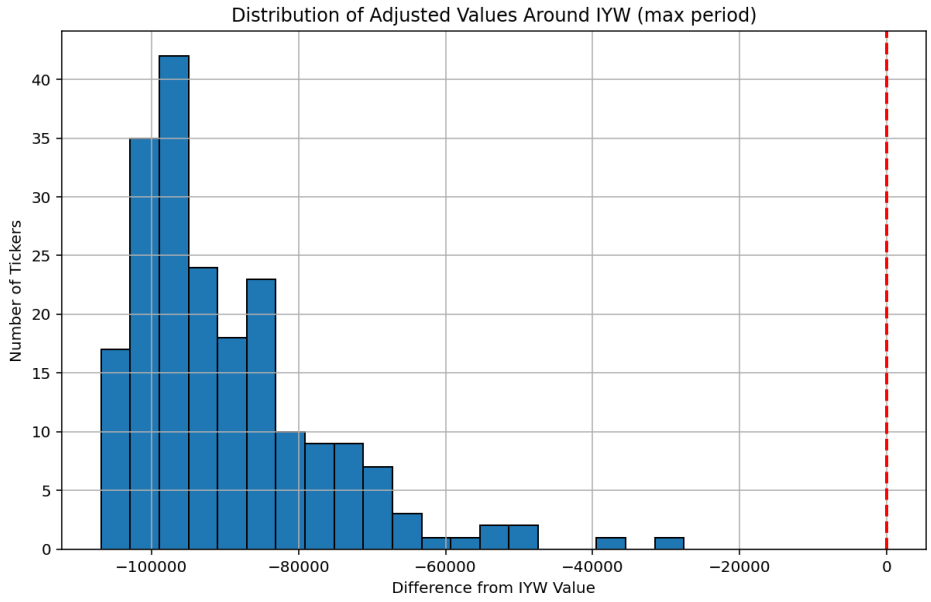

Figure 27

Moving to the 10-year period, as we can see on Table 26 below, IYW continues to lead on an absolute basis, reaching again a percentage of overperformance of 100%. The ETF's average, return of 515,32% stands out against the active funds' average of just 30,55% marking a meaningful outperformance by IYW. Standard deviation for this one is however higher, recorded at 14.487,55, compared to the active funds' 2.233,44, indicating a higher but more rewarded volatility inside the domain of this timeframe.

ABSOLUTE (10-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	0	0,00%	30,55%	2233,44	0,000114	-$1.558,92
IYW	423	100,00%	515,32%	14487,55	0,000352	-$1.183,51

Table 26

The high vantage is confirmed by the Sharpe ratio which follows a likely pattern, with IYW value at 0,000352 while active funds one stands at 0,000114, signaling a meliorate risk adjusted return for the ETF. VaR also conveys reduced risk for IYW given its value of $1.183,51 versus the $1.558,92 for Mutual Funds.

As for the case of the maximal period, we can see on the graph below (Figure 28) how the distribution is located on the left side of the red line. This again represents the total overperformance of IYM, with just a small number of Mutual Funds being able to get close to it.

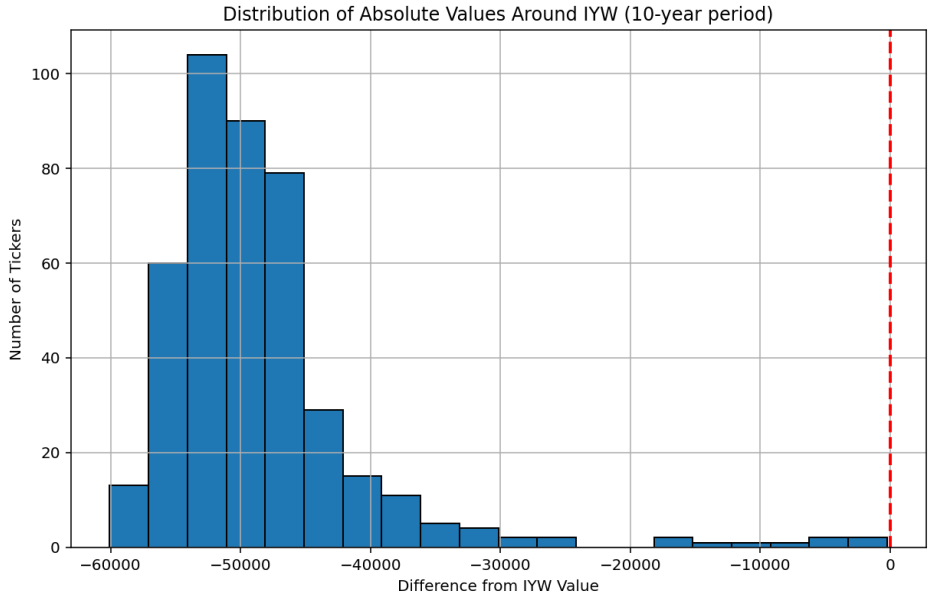

Figure 28

The adjusted performances results for the 10-year period once again underscored IYW's superiority, showing a percentage of overperformance still at 100%. As we can see from Table 27 below, the ETF also presents a return of 491,00% in counterpoint to the active funds average of 12,03%. Standard deviation on the other hand, is slimly reduced in both cases with IYW's at 13.850,13 and the active funds at 1.974,57.

ADJUSTED (10-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	0	0,00%	12,03%	1974,57	0,000036	-$1.528,65
IYW	423	100,00%	491,00%	13850,13	0,000351	-$1.183,51

Table 27

Sharpe ratios for this period, is again unidirectional with IYW reporting 0,000351, well above the active funds' 0,000036, indicating a more efficacious risk adjusted return for the ETF. The VaR results for this adjusted analysis also demonstrate a lower risk profile for IYW, showing a value of $1.183,51 compared to $1.528,65 for the active funds.

Overall, the data for this period reinforces IYW's super overperformance even after evaluating expenses. This can be shown in the graph below (Figure 29) to have a clear example of the effect of fees. As a matter of fact, it is clear how those funds that before were performing close to IYW, when introducing costs got shifted further left, indicating a poorer performance than calculated in the absolute case.

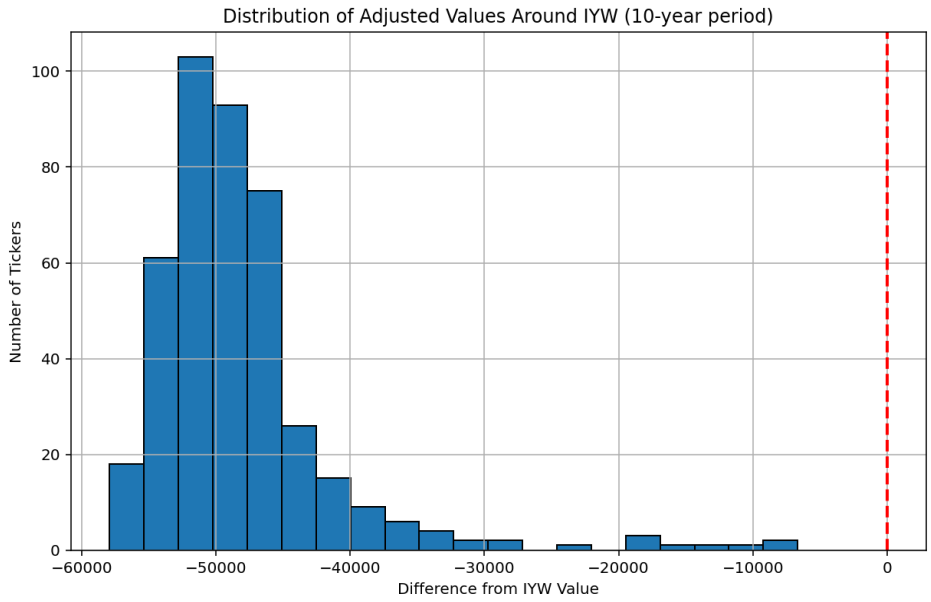

Figure 29

Finally, also for the shortest 5-year period, IYW achieves illustrious results. We can see on Table 28 below how, for the first period above all those considered, the ETF

didn’t overpermed all the Mutual Funds considered but 98,54% of those. On an absolute basis, the passive investment achieves a return of 203,61%, while the active funds show a much lower average of 23,44%.

ABSOLUTE (5-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	7	1,46%	23,44%	1894,50	0,000097	-$1.706,95
IYW	474	98,54%	203,61%	5303,71	0,000374	-$1.266,39

Table 28

Standard deviation for IYW is again higher at 5.303,71 compared to the active funds’ 1.894,50, not compromising however its Sharpe ratio that again is well meliorate at 0,000374 compared to 0,000097 for active funds, affirming the ETF efficacious risk adjusted performance. The VaR value also demonstrates that IYW’s risk level stiff slimly lower, this is due to a value of $1.266,39 which is lower than the active funds’ $1.706,95, suggesting a comparatively safer option contempt its higher volatility.

In the graph below (Figure 30) we can finally see the first 7 Mutual Funds that were able to overperform IYW. As a matter of fact, we could eventually visualize some values on the right side of the red line,' still few but better than nothing.

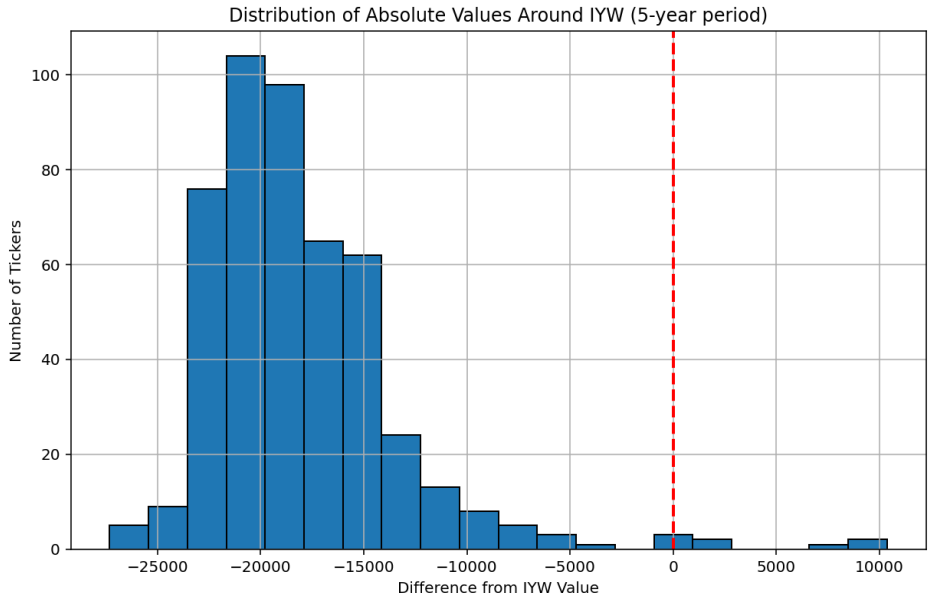

Figure 30

In the adjusted 5-year period the results and findings are consistent. IYW's increases by a little the percentage of overperformance reaching 99,17%, while its return, adjusted for expenses, is 197,50%, which far exceeds the active funds' average of 13,62%.

As we can see on Table 29 below, standard deviation figures for IYW and Mutual Funds are 5.148,44 and 1.774,88 respectively, once again indicating higher volatility for the ETF.

However, the Sharpe ratio for IYW stayed constant at 0,000374, importantly outperforming the active funds' 0,00049.

ADJUSTED (5-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	4	0,83%	13,62%	1774,88	0,000049	-$1.675,54
IYW	477	99,17%	197,50%	5148,44	0,000374	-$1.266,39

Table 29

Furthermore,' the VaR column shows the ETF's potential loss at $1.266,39 compared to the active funds' $1.675,54, confirms IYW control inside the Sector Equity asset class over this timeframe even after considering expenses and risks.

In the distribution graph below (Figure 31) we can see how of those few active funds that were able to overperform IYW in the absolute case, just a few resist after considering the costs. As a matter of fact, it's clear how the bulk of the distribution have undergone a shift toward left with respect to the red line.

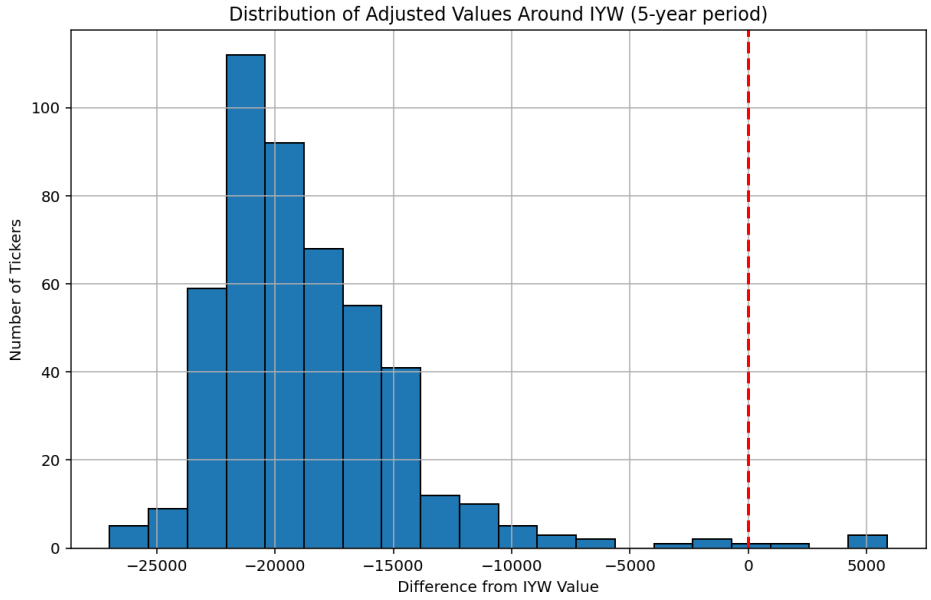

Figure 31

4.6 Taxable Bond results

In the analysis of the 'Taxable Bond' asset class, the selected ETF for passive investing is the iShares 3-7 Year Treasury Bond ETF IEI, this one too managed by BlackRock Fund Advisors. As we can see on Table 30 below, this passive fund stands out with a five-star Morningstar rating, meaningful fund size $14,98 billion, and an ultra-low net expense ratio of 0,15%, a lineament well suited for passive investors aiming to maximize returns.

Ticker	Fund Management Company	Morningstar Rating for Funds	Asset Class	Fund Size	Net Expense Ratio	Minimum Initial Investment	Management Style
IEI	BlackRock Fund Advisors	5	Taxable Bond	14,98 Bil	0,0015	0	Passive

Table 30

The absolute performance over the maximum approachable period, beginning from February 1, 2007, already reveals physical outperformance by IEI compared to almost all active funds.

As we can see on Table 31 below, IEI outperformes active funds 636 times, achieving a 99,69% overperformance rate with a return of 17,52% and a standard

deviation of 730,00. In contrast, active funds underperform with an average return of 11,94%, showing however a lower standard deviation of 681,56.

ABSOLUTE (max period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	2	0,31%	-11,94%	681,56	-0,000249	-$539,75
IEI	636	99,69%	17,52%	730,00	0,000172	-$303,39

Table 31

Looking at the risk adjusted metrics, IEI accentuate its overperformance and a batter risk adjusted profile thanks to a value of 0,000172, compared to the active funds one recorded at negative value of -0,000249. The Value at Risk for IEI at a 99% confidence level is $303,39, well less grievous than the active funds' VaR of $539,75, underlying even more the greater downside risk faced by active strategies during this period.

In the distribution graph below (Figure 32) we can clearly see how all Mutual Funds are located on the left side of the red line, indicating their underperformance. The only exception are the two active funds that overperformed IEI, which given their immoderate location looks more like two outliers rather than 2 rational solutions for a retail investor.

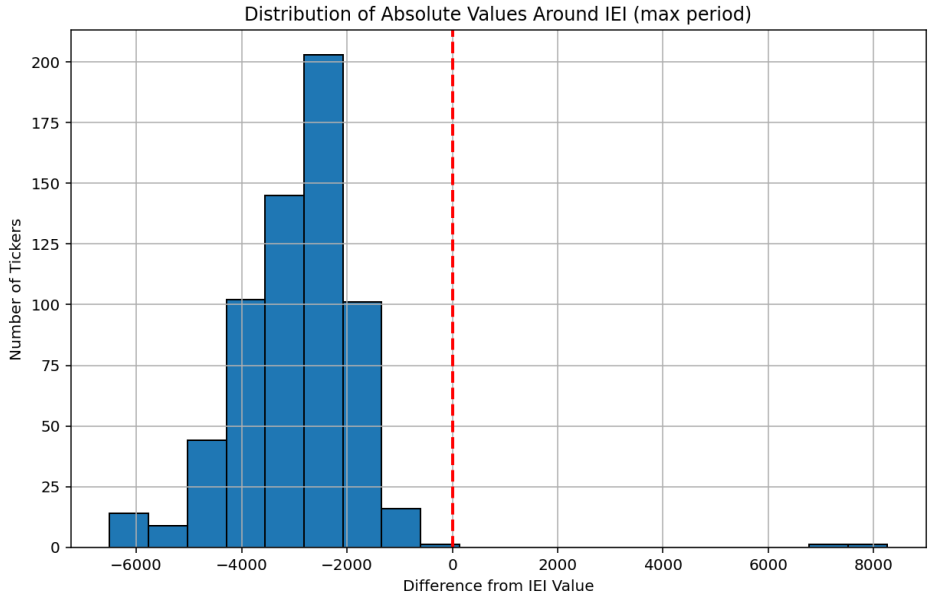

Figure 32

When adjusted for fees and other expenses, IEI's outperformance remaines systematically strong. As Table 32 below shows, in the adjusted maximum period, IEI withhold a 99,69% outperformance rate, with a slimly reduced return of 14,48% but also a lower standard deviation of 677,00.

ADJUSTED (max period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	2	0,31%	-26,61%	869,66	-0,000364	-$531,80
IEI	636	99,69%	14,48%	677,00	0,000140	-$303,39

Table 32

Despite these adjustments, IEI's Sharpe ratio stays convinced at 0,000140, while active funds continue to post a negative Sharpe ratio of -0,000364. This is due to their reduction in average returns that lead to an even more negative value of -26,61%, with also a standard deviation that became higher than that of the ETF at 869,66.

The adjusted VaR for active funds is $531,80, importantly higher than IEI's $303,39, reinforcing IEI's pull as a safer option with fewer downside risks when expenses are factored in.

On the graph below (Figure 33), we can see how the only thing that changed is a shift toward the left of the red line, indicating the negative influence of fees on the active funds' performances. As a matter of fact, we can still see how the only active funds located on the right side of the breakeven line are the two outliers already seen in the absolute case, which however got closer by reducing their overperformance from +$8.000 to +$6.000.

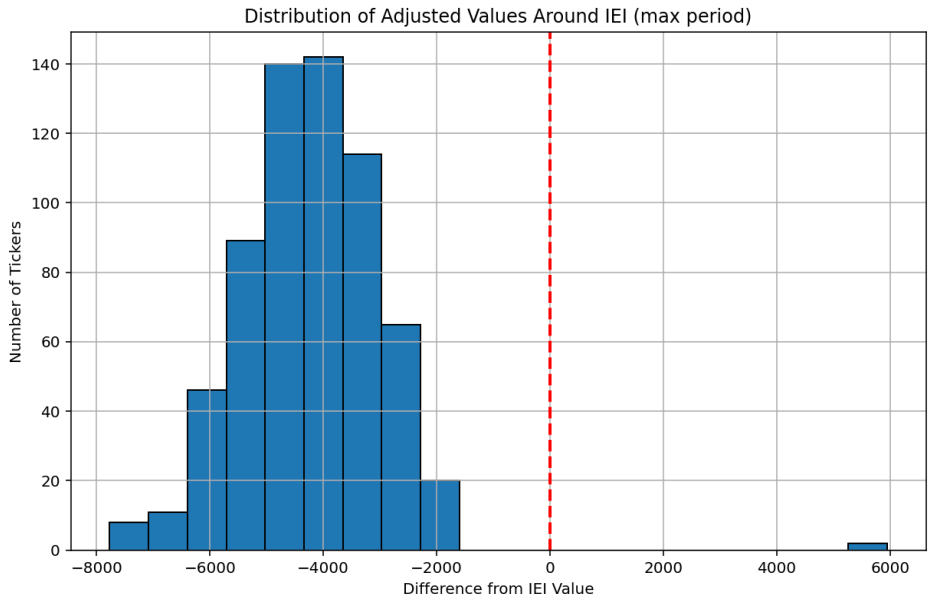

Figure 33

Over the 10-year period, IEI maintains its control with a 90,39% overperformance rate on an absolute basis. Even though it was able to achieve such measures, on Table 33 below we can note how the return is slimly negative at -2,87%, with a standard deviation of 453,60. Mutual funds, on the other side, still show a lower average return of 12,34% and a higher standard deviation of 584,48.

ABSOLUTE (10-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	113	9,61%	-12,34%	584,48	-0,000297	-$439,14
IEI	1063	90,39%	-2,87%	453,60	-0,000173	-$300,27

Table 33

For those reasons, IEI's Sharpe ratio is again less negative at -0,000173, compared to active funds' 0,000297. The VaR analysis hike supported IEI's resilience, which with a lower 99% VaR of $300,27 versus the active funds' $439,14,' indicates reduced risk when selecting the ETF over the Mutual Funds.

In the graph below (Figure 34) we see how things changed by reducing the holding period. As a matter of fact, is easy to learn how more Mutual Funds are now located nigher

to the red line, indicating an improved in the reckon of funds that are close to the performance of IEI.

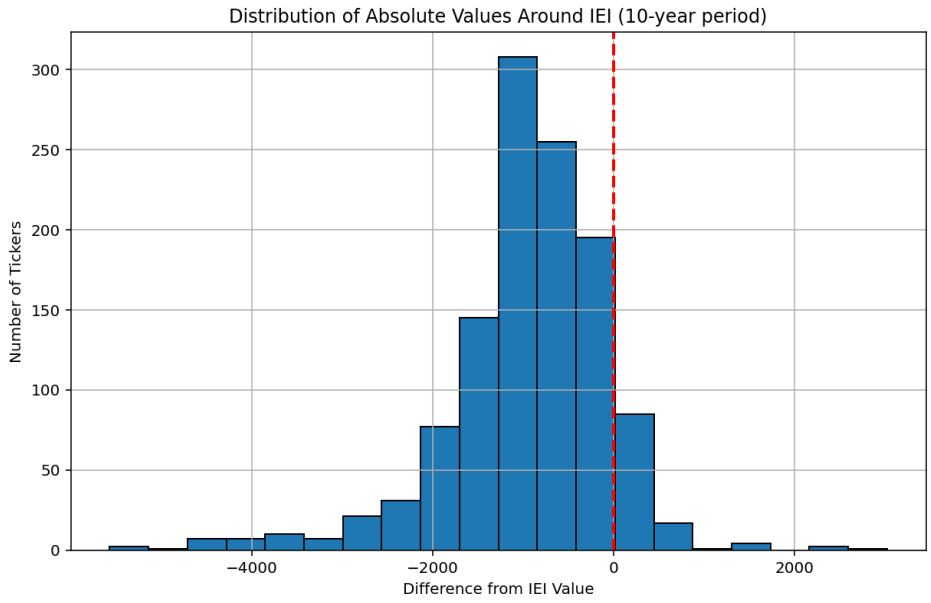

Figure 34

In the adjusted 10-year analysis, IEI continues to overperform with a 98,30% frequency even with the lower return of -4,33%. As we can see from Table 32 below, it also continues to be a safer option compared to active funds, whose average return is -21,67%. Moreover, we can also see how the selected ETF standard deviation stays close to that of the absolute case, at 464,43, while for active funds there has been a huge increase with it reaching 747,54.

ADJUSTED (10-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	20	1,70%	-21,67%	747,54	-0,000357	-$433,06
IEI	1156	98,30%	-4,33%	464,43	-0,000201	-$300,27

Table 34

Notably, IEI also have an adjusted Sharpe ratio of -0,000201, which even if negative is compared favorably to active funds' -0,000357. The ETF lower VaR of

$300,27, also reaffirms its capability in minimizing risk compared to active alternatives, where the value reached $433,06.

The graph below (Figure 35), again shows us the touch of costs on performances of active funds. As a matter of fact, no meaningful change happened on the shape of the distribution, the only thing that differs is the arrangement of it, which is now more to the left of the red line indicating higher % of Mutual Funds underperformances.

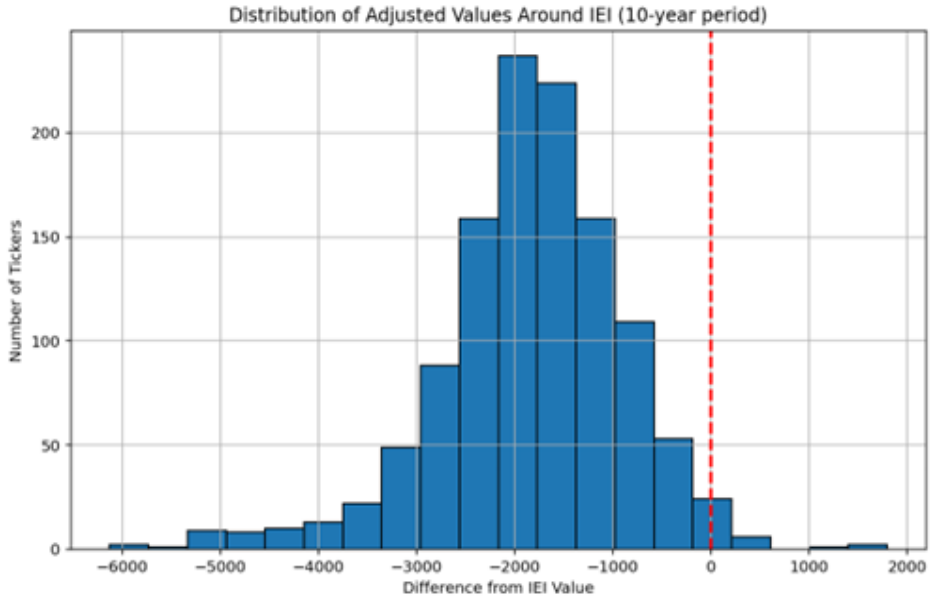

Figure 35

In the 5-year period, IEI's overperformance narrows slightly, but it still led with a 63,92% outperformance rate on an absolute basis. On Table 35 below, we see that return returns for both type of funds doesn't look good, with the ETF reaching -7,07%, which is still a little bit higher than the compared active funds' average of 10,22%.

ABSOLUTE (5-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	534	36,08%	-10,22%	670,51	-0,000227	-$590,36
IEI	946	63,92%	-7,07%	587,55	-0,000205	-$313,85

Table 35

Moreover, even if for a few, the Sharpe ratio for IEI, is higher with a negative value at -0,000205, exceeding that of active funds of 0,000227. This was also thanks to the volatility which turn out to be higher for Mutual Funds at 670,51, compared to that of the ETF at 587,55.

The VaR delta instead is peculiarly notable, with IEI's value measured at $313,85 versus active funds of $590,36, indicating a noticeable gap in possible losses for the two funds.

On the graph below (Figure 36) we can visualize how performances of active versus passive investments are almost even. As a matter of fact, we can see how the red line is located around the middle of the distribution, with still a little bit more Mutual Funds on its left.

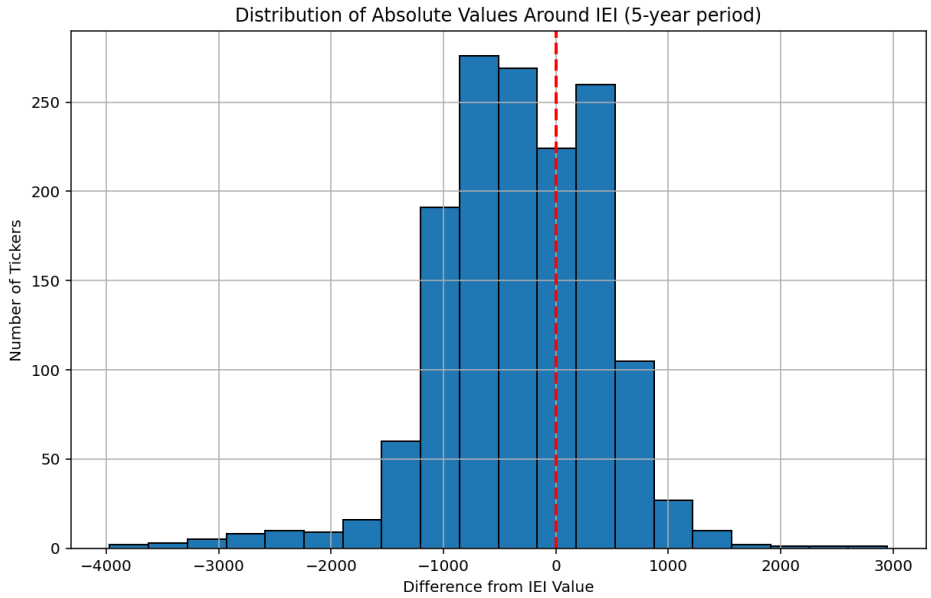

Figure 36

As reported in Table 36, adjusted for expenses, IEI's outperformance grow importantly to 87,23%, with a slimly lower return of 7,77%, a temperate increase in standard deviation to 603.94, and a Sharpe ratio of -0,000211.

ADJUSTED (5-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	189	12,77%	-15,20%	757,88	-0,000267	-$582,53
IEI	1291	87,23%	-7,77%	603,94	-0,000211	-$313,85

Table 36

Meanwhile, active funds report an adjusted average return of -15,20% with a standard deviation of 757,88, and a negative Sharpe ratio of -0,000267. As we can see comparing the results of the ETF to that of the Mutual Funds, we can see how after considering costs the gap between each of the metrics analyzed increases, highlighting the importance to look at the adjusted performances when deciding which investment to undertake.

The only gap that didn't increase is the one of VaR, which for IEI remains fixed at $313,85, while for active funds decreases but only to $582,53, underscoring the elevated downside risk for active investors over the short period considered, even after accounting for costs.

Figure 37 below, represent a meliorate tangible visualization, more adapt to real life comparison considering that it includes the effect of costs on each fund. The red line is still not on the far right of the distribution as seen in the past time periods. However, it still shifted to the right compared to the absolute case, underlying why IEI got back to being the best choice when expenses are considered.

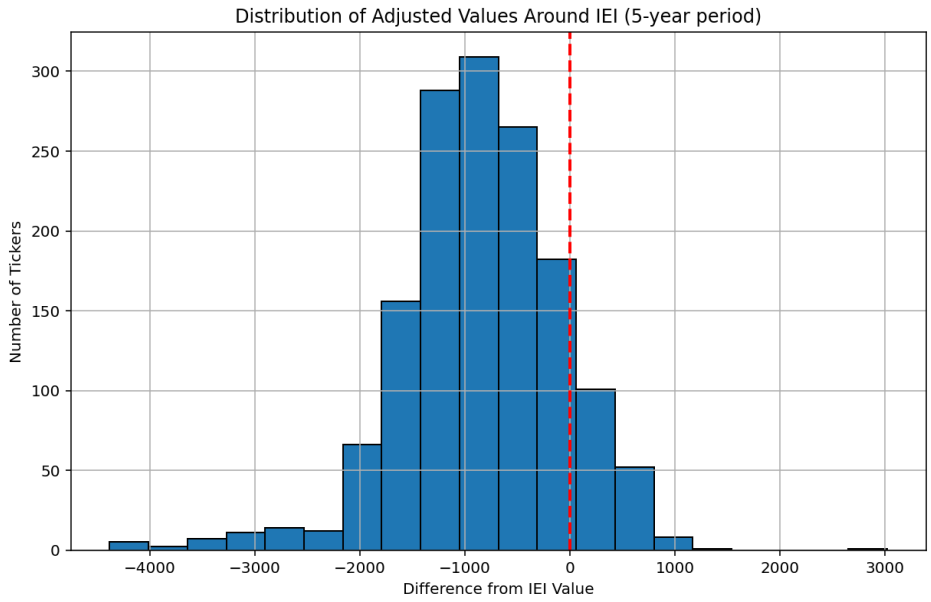

Figure 37

4.7 US Equity results

In my analysis of the US Equity asset class, I selected OEF, an iShares S&P 100 ETF managed by BlackRock Fund Advisors, to represent passive investing strategies. As summarize by Table 37 below, it was chosen for different key reasons: its outstanding 5-star Morningstar rating which tells about its track of lasting performances, its meaningful fund size of $13,48 billion ensuring high liquidity and last but not least, it's extremely low net expense ratio of 0,002 making it a cost-efficient option compared to active funds.

Ticker	Fund Management Company	Morningstar Rating for Funds	Asset Class	Fund Size	Net Expense Ratio	Minimum Initial Investment	Management Style
OEF	BlackRock Fund Advisors	5	US Equity	13,48 Bil	0,002	0	Passive

Table 37

These characteristics align with the preferences of retail investors who prioritize liquidity, low fees, and dependableness when selecting investments, reinforcing OEF's suitableness as a passive benchmark for this analysis.

Starting with the maximal period's absolute comparison from 01/04/2005, OEF well outperforms active funds, recording an outperformance in 1.064 instances which represents 96,38% of the comparisons.

As we can see on Table 38 below, in this period, OEF yields a return of 392,16% with a standard deviation of 10.235,54, which allowed it to achieve a Sharpe ratio of 0,000378 and a Value at Risk at the 99% confidence level of $1069,06. This level of overperformance has been achieved because the counter party of mutual funds present only an average return of 108,03%, with a standard deviation of 4.320,73, a Sharpe ratio of 0,000238, and a notably higher VaR at $1.649,41.

ABSOLUTE (max period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	40	3,62%	108,03%	4320,73	0,000238	-$1.649,41
OEF	1064	96,38%	392,16%	10235,54	0,000378	-$1.069,06

Table 38

These results show that OEF delivers importantly meliorated risk adjusted returns over this period, benefiting from lower variance and better risk-adjusted performance comparative to active funds.

Figure 38 shown below, represents the distribution of Mutual Funds performances around that of the passive investment. We can see how the overperformance before analyzed is visualized by the fact that almost all active funds are on the left of the breakeven point, with the highest density reached in the underperformance range of -40.000 and -20.000.

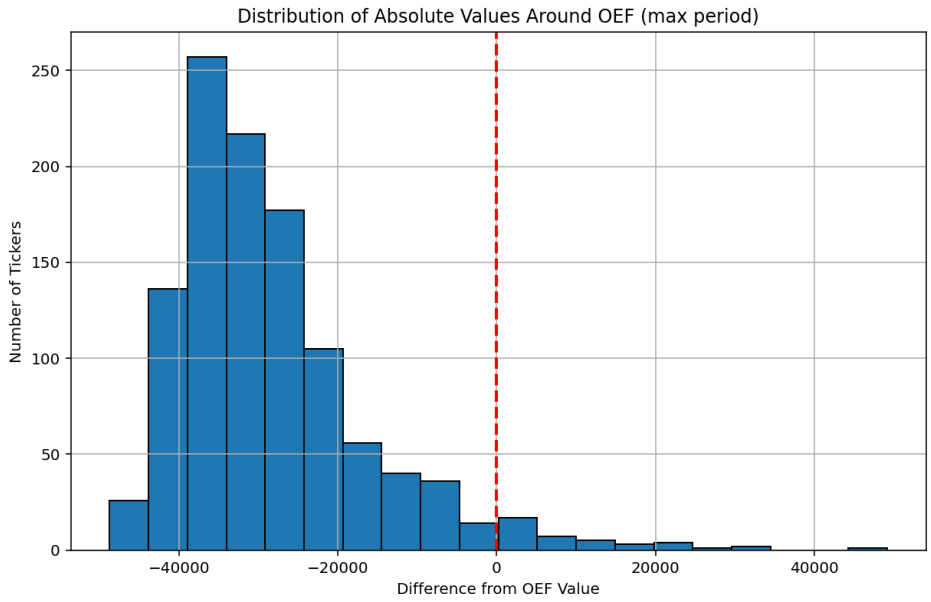

Figure 38

Even after adjusting for fees and expenses, OEF's reward stays consistent over the same maximal period. With 1089 outperformed instances, the ETF achieves a similar percentage of overperformance of 98.64%. OEF still maintains a high return of 373,49%, a slimly reduced standard deviation of 9.777,7, and a Sharpe ratio of 0,000377, while its VaR stiff uniform at $1.069,06.

ADJUSTED (max period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	15	1,36%	64,72%	3311,59	0,000180	-$1.619,36
OEF	1089	98,64%	373,49%	9777,07	0,000377	-$1.069,06

Table 39

Mutual Funds, however, even considering a similar percentage in underperformances, see an important decrease in the average return reaching 64,72%. A positive note has been a reduction in the standard deviation which got valued at 3.311,59, that is anyway offset by a reduction of the Sharpe ratio ending up to 0,000180. VaR is not even worth mentioning considering that its value stays almost constant, now at $1.619,39. This fitting indicates that OEF's disbursement efficiency hike solidifies its control over

active funds in the long term, as these last incurs in higher costs, reducing their net performance.

As for the cases analyzed for the other asset classes. This disbursement efficiency and the related improver in the outperforming % is visualized in the graph reported below (Figure 39). We can see, as a matter of fact, that there had been a shift of the distribution toward the left with respect to the red line, indicating a proportionally higher decrease in the performance due to costs for Mutual Funds.

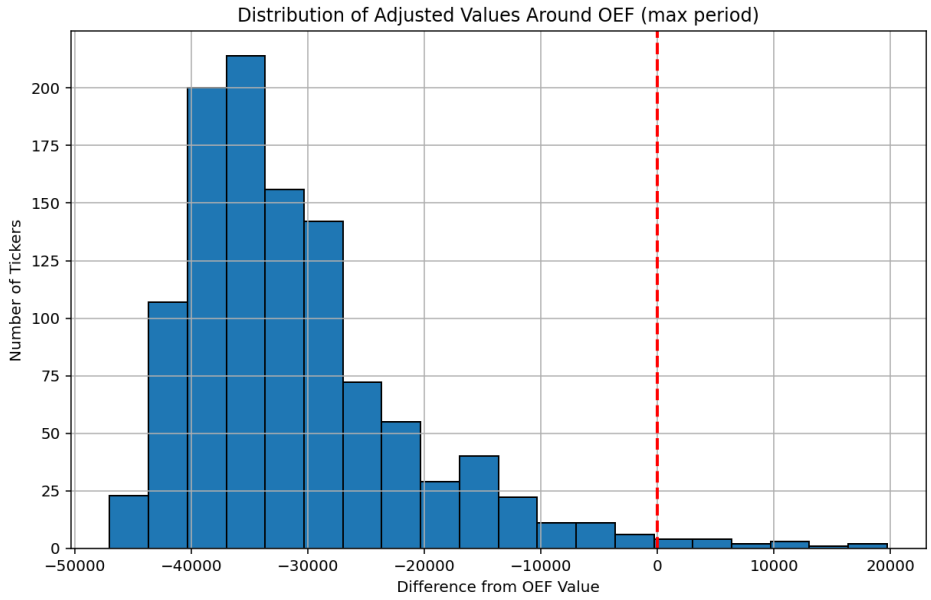

Figure 39

Analyzing the 10-year period, OEF's absolute performances continues to eclipse that of active funds, recording 1.669 overperformed instances, 98,64% of all the Mutual Funds considered.

As Table 40 shows us, during this period, OEF achieves a return of 216,90%, a standard deviation of 5.899,82, a Sharpe ratio of 0,000359, and a VaR of $992,22, underscoring its comparative constancy and lower risk.

As a matter of fact, Mutual funds, conversely display only an average return of 36,27% as well as a standard deviation of 2.102,63, Sharpe ratio of 0,000149, and a much high VaR of $1.697,48, indicating lower performance even when considering risks.

ABSOLUTE (10-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	23	1,36%	36,27%	2102,63	0,000149	-$1.697,48
OEF	1669	98,64%	216,90%	5899,82	0,000359	-$992,22

Table 40

I'll account down the distribution graph (Figure 40) a visualization tool. Given the similarity between this case to the maximal period one, not many considerations are worth making. The only thing that changed is the number of Mutual Fund represented, this is due to the possibility that many of those may have been released only after the 01/04/2005 (the maximum period analyzed), and so while they were not included in the analysis before they are being considered now.

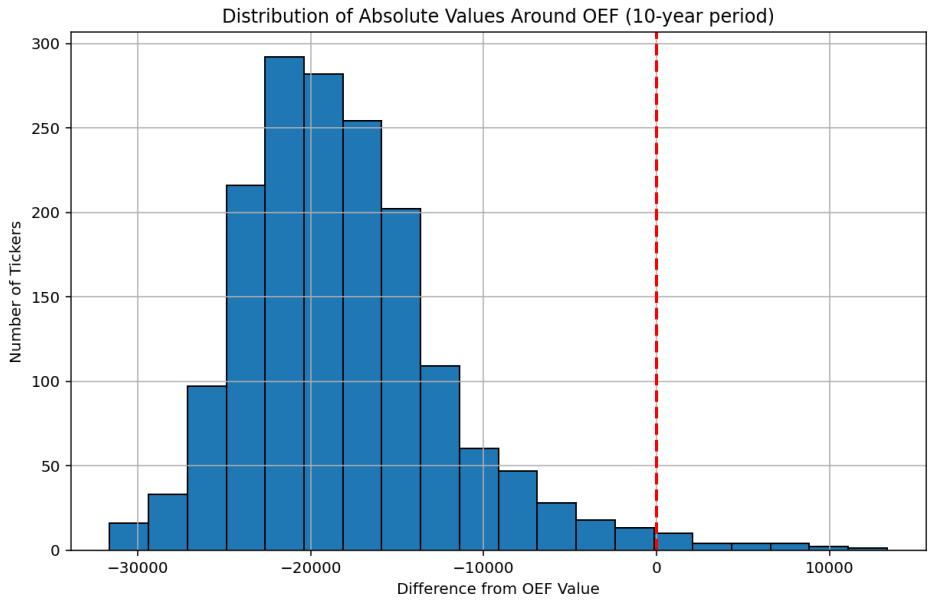

Figure 40

When adjusting for fees and expenses over this period, OEF's outperformance rose slimly to 1.681 instances or 99,35%. As Table 41 below shows, all of this has been achieved while the return, on the other hand, slightly decreased to 210,57% as well as standard deviation of 5.734,66. The combination of these aspects allow the ETF to maintain a constant level of the Sharpe ratio to 0,000358, and of the VaR to $992,22.

ADJUSTED (10-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	11	0,65%	19,98%	1827,28	0,000082	-$1.667,87
OEF	1681	99,35%	210,57%	5734,66	0,000358	-$992,22

Table 41

In contrast, active funds adjusted average return have a bigger impact, falling to 19,98% as well as standard deviation decreasing to 1.827,28. While the VaR as for OEF remains almost equal with a value of $1.667,87, the same is not true for the Sharpe ratio which felt down to a mediocre 0,000082. This hike illustrates that fee adjusted returns expand OEF's control by highlighting the subtraction touch of expenses on returns, exponentially higher than in the case of a passive investment which usually present lower costs.

As before, I'll also report below the distribution graph (Figure 41) mainly just as a visualization tool. Given again the comparative like case to the adjusted maximal period one, the only thing I'd like to underline, that at the same time applies to the absolute case, are the value of underperformances reached by Mutual Funds. The consideration to be made is how the higher number of active funds, from the -40.000 and -30.000 range, now are in the -25.000 and -15.000 area. This makes us realize how between 2005 and 2014 there has been a period of big downsize that affected the performances of all type of funds, and which have been hard to recover afterwards.

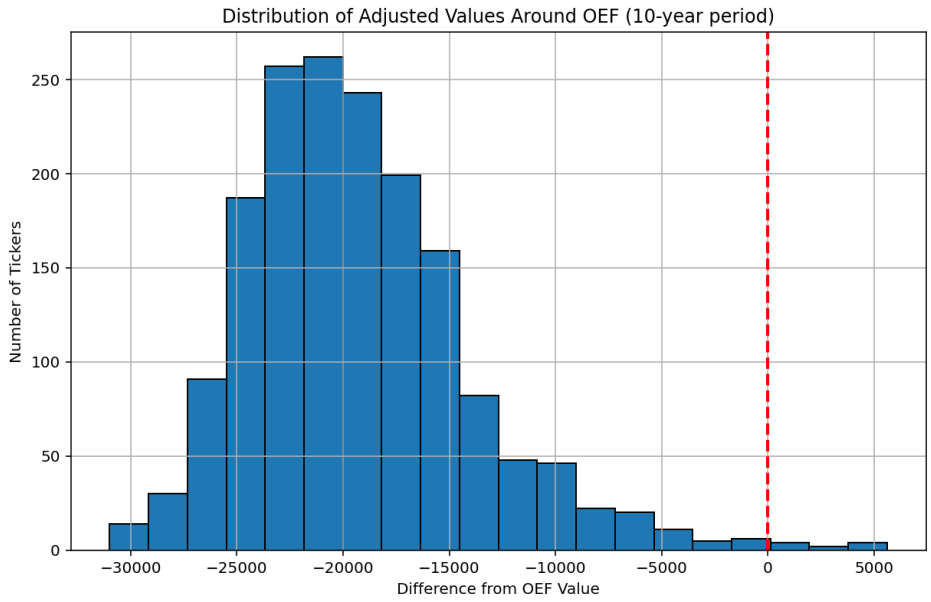

Figure 41

In the shorter 5-year period, OEF continues to overperform active funds, albeit with a littler adjustment due to more challenging market conditions. As a matter of fact, as reported in Table 42 below, the selected ETF records 946 outperformance instances or 63,92% of available comparison. This lower value with respect to the previous period can be explained by the exponential decrease that return got, ending up in the negative area with a value of -7,07%. Given the shorter period for price movement also the volatility saw a huge dropdown achieving 587,55 as well as for the VaR of $313,85. These movements in return and standard deviation also cause the Sharpe ratio to fall to a negative value of -0,000205, indicating a worsening in performance also when considering the risk, yet maintaining lower risk comparative to active funds.

ABSOLUTE (5-year period)	Absolute Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	534	36,08%	-10,22%	670,51	-0,000227	-$590,36
OEF	946	63,92%	-7,07%	587,55	-0,000205	-$313,85

Table 42

As a matter of fact, active funds are hit by the short period similar to OEF, with the average return achieving -10,22%, the standard deviation 670,51, and the VaR of

$590,36. Seeing how everything worsened for Mutual Funds too, it's not hard to accept the fact that also the Sharpe ratio saw a huge drop getting in negative range at -0,000227. This again confirms how even in the shorter period, even if still a bad choice, OEF outperforms active funds also when considering risk.

When adjusted for fees, things got a little bit better with OEF's outperformance rate rising to 87,23%. However, as Table 43 reports, it still shows a negative return that, even if it decreased by less than 1%, still presents bad performance at -7,77%. Also, for volatility and risk-adjusted metric thing got worse with the standard deviation increasing to 603,94 and the Sharpe ratio falling to -0,000211, while VaR at the 99% confidence level stays constant at -$313,85.

ADJUSTED (5-year period)	Adjusted Outperformance	Percentage Overperformance	Average Return	Standard Deviation	Sharpe Ratio	VaR 99%
Mutual Funds	189	12,77%	-15,20%	757,88	-0,000267	-$582,53
OEF	1291	87,23%	-7,77%	603,94	-0,000211	-$313,85

Table 43

The only good aspect for a passive investor is that for Mutual Funds things got even worst. As a matter of fact, active funds adjusted average return fall becoming even more negative at -15,20%. As for OEF, the other metrics don't have any good influence from fees, but things getting even worse. The standard deviation increased to 757,88, the Sharpe ratio fell to -0,000267, while at least the VaR reaches less negative value at $582.53.

5. CONCLUSION

It is finally time to retrieve my conclusion based on the empirical analysis conducted, as described in Chapter 3, and the results obtained from it, as seen in Chapter 4.

To do a summary, based on the literature reviewed in Chapter 2, is clear how expertise has been agreeing on the ability of passive investment to overperform active ones, even more when considering for costs. As a matter of fact, based on their research, even though some active managed funds can overperform their relative benchmark, after taking in consideration fees and expenses the positive performances vanished.

This is perfectly in line with the results obtained from my study. As a matter of fact:

- In the maximum period available, out of all the 3398 actively managed Mutual Funds considered, only 186 (=5,47%) were able to overperform in absolute case compared to their respect peer. If this weren't enough to persuade a retail investor to try to select a successful Mutual Funds, he should just consider how after taking into consideration costs this value narrows down to 92 (=2,71%).
- For the medium period term of 10 years instead, things got a little bit better in the absolute case, with 248 overperforming Mutal Funds out of the 5864 instances considered (=7,30%). However, looking at the adjusted case we see how things become even worse with the number of Mutual Funds overperforming their respective benchmarks falling to 62 (=1,82%).
- Finally, even in the short-term period of 5 years, when active managers should have been able to show their ability to adapt to different market conditions, results are flourishing. As a matter of fact, even if things got better in the absolute case with 1299 over performing Mutual Funds, out of the 6646 considered (=38,23%), this value again exponentially decrease reaching 468 instances (=13,77%)

Looking instead at the standard deviation as measure of volatility we can see how the prediction made by expertise, and better presented in Chapter 2, are not met. The idea was that, given the intrinsic characteristics of passive investment with their low trade and high diversification, they would have been able to present a less risky profile compared to active ones. As the following results show however, this result has not been confirmed by my study:

- In the maximum period available the average standard deviation of Mutual Funds has been lower than the corresponding ETF in 5 of the 6 asset classes considered, with the results changing only in the case of International Equity. Things change in the adjusted case, with the volatility of Mutual Funds being higher in the cases of International Equity, Municipal Bond and Taxable Bond. Definitely a better result, but not enhance enough to declare a superiority of passive investment.
- Things got slightly better, but still not enough, in the medium 10-year period, with the average standard deviation of Mutual Funds being higher in the Municipal Bond and Taxable Bond cases. Results stayed consistent even after taking into account costs.
- Finally, in the short term 5-year period, results remain consistent with the 10-year case, with the only exception of lower volatility for the passive investment also in the US Equity asset class, both in the absolute and adjusted case.

However, a more defined alignment with the literature is seen in the case of the Sharpe ratio. Metric that from my point of view is more relevant than the mere standard deviation, given that a higher volatility is not necessarily seen as bad if it carries higher excess return with it. More specifically in my analysis results are straightforward, considering how in every case the active Mutual Funds on average have a Sharpe Ratio lower than their corresponding peers, for every asset class and period analyzed, as well as both in absolute and adjusted terms. The only exception is in the 5-year absolute case of the asset class Municipal Bond, where however the difference is so small that can be consider almost irrelevant.

Considering what just reported, what mostly stands out from the research is that the passive investments outperform actively managed mutual funds on a risk-and-cost-adjusted basis over the long, medium and short term. This is due mostly to lower fees in passive investments, which allow for a greater proportion of returns to compound over time. As a matter of fact, while active funds have larger management fees and higher trading costs, passive investments provide once-again practical opportunities for retail investors, who have less capital in a relative sense or may face other financial constraints in their investment processes.

Informative results from this study provide practical input to the individual retail investor in decision-making processes about which asset classes capital should be committed to for maximum benefit. Given the element of predictability in their structure, lower costing, and better performances as analyzed in Chapter 4, passive ETFs are more beneficiaries to retail investors who lack the resources and market knowledge compared to their institutional peers.

While this thesis has explored the key aspects of passive versus active investing for retail investors, further areas of research could add significant depth to this set of findings. For instance, analyzing the impact of different economic cycles on the performance of each strategy, particularly over a broader range of asset classes, could yield further insights. Future research might also be conducted on the emerging role of active ETFs, which wrap the breadth of active management in a less expensive ETF package that could foreseeably erode the black-and-white trade-off between active and passive strategies. Policy makers and industry participants should also consider the ongoing passive migration and consider some investor education enhancements regarding the rewards and risks of each approach.

From this comparative analysis, the present thesis develops a clear picture regarding the relative strengths and weaknesses of the passive and active investment strategies related to retail investors. While the passive investment route developed into a more advantageous route on several dimensions pertaining to cost efficiency and risk-adjusted return, active management retains its own value under particular conditions, especially in terms of volatility. Based on the results, it can be said that it is by being cost-

efficient and adopting a more disciplined, long approach that retail investors can carry out passive strategies and, therefore, be better positioned to achieve their financial goals.

These results, therefore, finally prove that the ETFs, because of the lower costs, simplicity, and closeness to general market returns, are very likely to remain a dominant choice by the retail investor. Ongoing research and education are important means to enable the retail investor to make informed choices in the ever-continuously changing investment universe for both passive and active strategies in building resilient and sustainable portfolios.

While this thesis perhaps serves useful insight on the relative performance of passive and active investment strategies, several disclaimers are vital in the accurate receipt and interpretation of its findings and appreciating its practical limitations.

Firstly, I must mention that historical performance is not adequate indication of future results. The following review is based on backtest data. Although it might give quite a good insight into what happened historically speaking, no similar results are guaranteed in the future. Market conditions and economic variables change along with investors' behavior. A strategy which performed well in the past may turn out to be less successful when different market conditions occur.

Secondly, it is important to remind how this thesis is constrained to U.S.-listed ETFs and mutual funds. Thus, this may not be as relevant to other international markets, emerging economies, or other investment vehicles designed for institutional investors. Material used in this analysis was sourced from publicly available information, which are inherently burdened with limitations such as survivorship bias.

Lastly, I must say that there is inherent risk to both passive and active strategies in their exposure to market volatility and economic downturn. In efforts to track market indices, passive strategies are fully exposed to market-wide fluctuations and do not offer any downside protection. Active strategies have the advantage of more flexibility but often come at a higher cost and, sometimes with an amplification of market risk through concentrated or tactical positions.

APPENDIX – My code

What follows is the code I've created in Python to conduct my analysis:

```
import pandas as pd
import yfinance as yf


# Define the file paths
file1 = r"C:\Users\menaa\Desktop\UniPd\Tesi\Tesi\List\etf.xlsx"
file2 = r"C:\Users\menaa\Desktop\UniPd\Tesi\Tesi\List\mutual funds.xlsx"


# Define the initial investment amount and starting date
initial_investment = 10000
start_date = pd.Timestamp('2005-04-01')
end_date = pd.Timestamp('2024-08-31')


def load_data(file_path, asset_class, management_style=None, index_fund=None):
    """Load data from an Excel file and filter based on criteria."""
    df = pd.read_excel(file_path)
    if management_style:
        df = df[(df['Asset Class'] == asset_class) & (df['Management Style'] == management_style)]
    elif index_fund:
        df = df[(df['Asset Class'] == asset_class) & (df['Index Fund'] == index_fund)]
    return df
```

```
def fetch_historical_data(tickers):
    """Fetch historical data for a list of tickers, ending on 31/08/2024."""
    history = pd.DataFrame()
    for ticker in tickers:
        data = yf.download(ticker, period='max', interval='1mo', end=end_date)['Close']
        data = data.rename(ticker)
        history = pd.concat([history, data], axis=1).sort_index(ascending=False)
    return history

def calculate_returns(history):
    """Calculate monthly returns from historical data."""
    return history.sort_index(ascending=True).pct_change().sort_index(ascending=False)

def initialize_portfolio(history, tickers, start_date):
    """Initialize the portfolio with the given tickers and start date."""
    portfolio = pd.DataFrame(index=history.index, columns=history.columns)
    columns_to_drop = []

    for ticker in tickers:
        if start_date in history.index and pd.notna(history.at[start_date, ticker]):
            portfolio.at[start_date, ticker] = initial_investment
        else:
```

```
            columns_to_drop.append(ticker)

    portfolio = portfolio.drop(columns=columns_to_drop).loc[:start_date]
    return portfolio

def calculate_portfolio_values(portfolio, returns):
    """Calculate portfolio values based on returns."""
    for ticker in portfolio.columns:
        start_loc = portfolio.index.get_loc(start_date)
        for i in range(start_loc - 1, -1, -1):
            return_value = returns.iloc[i][ticker] if pd.notna(returns.iloc[i][ticker]) else 0
            portfolio.iloc[i, portfolio.columns.get_loc(ticker)] = (
                portfolio.iloc[i + 1, portfolio.columns.get_loc(ticker)] * (1 + return_value))
    return portfolio

def adjust_portfolio_with_expenses(portfolio, df, returns, is_mutual_fund=False):
    """Adjust portfolio values based on expenses and loads."""
    adjusted_portfolio = pd.DataFrame(index=portfolio.index,
columns=portfolio.columns)

    for ticker in portfolio.columns:

        front_load = df.loc[df['Ticker'] == ticker, 'Maximum Front Load'].values[0]
        front_load = 0 if front_load == "—" else front_load
```

```
        adjusted_investment = initial_investment * (1 - front_load)
        adjusted_portfolio.at[start_date, ticker] = adjusted_investment

        net_expense = df.loc[df['Ticker'] == ticker, 'Net Expense Ratio'].values[0]
        net_expense = 0 if net_expense == "—" else net_expense

        monthly_expense = net_expense / 12

        for i in range(portfolio.index.get_loc(start_date) - 1, -1, -1):
            return_value = returns.iloc[i][ticker] if pd.notna(returns.iloc[i][ticker]) else 0
            adjusted_portfolio.iloc[i, adjusted_portfolio.columns.get_loc(ticker)] = (
                adjusted_portfolio.iloc[i + 1, adjusted_portfolio.columns.get_loc(ticker)] * (1
+ return_value))

            if adjusted_portfolio.index[i].day == 1:
                adjusted_portfolio.iloc[i][adjusted_portfolio.columns.get_loc(ticker)] *= (1 -
monthly_expense)

        deferred_load = df.loc[df['Ticker'] == ticker, 'Maximum Deferred Load'].values[0]
        deferred_load = 0 if deferred_load == "—" else deferred_load
        latest_index = adjusted_portfolio[ticker].first_valid_index()
        adjusted_portfolio.at[latest_index, ticker] *= (1 - deferred_load)

    return adjusted_portfolio
```

```
def compare_portfolios(mutual_df, etf_df):
    """
    Compares the latest (top) values between two DataFrames representing portfolios.

    Args:
    - mutual_df: DataFrame for mutual funds (rows).
    - etf_df: DataFrame for ETFs (columns).

    Returns:
    - DataFrame with 1 where mutual_df's value is higher than etf_df's, otherwise 0.
    """
    # Get the most recent (top) value for each ticker in mutual_df and etf_df
    latest_values_mutual = mutual_df.iloc[0]
    latest_values_etf = etf_df.iloc[0]

    # Initialize the result DataFrame
    result = pd.DataFrame(index=latest_values_mutual.index, columns=latest_values_etf.index)

    # Populate the DataFrame with 1 or 0 based on the condition
    for mutual_ticker in latest_values_mutual.index:
        for etf_ticker in latest_values_etf.index:
            if latest_values_mutual[mutual_ticker] > latest_values_etf[etf_ticker]:
```

```
            result.at[mutual_ticker, etf_ticker] = 1
        else:
            result.at[mutual_ticker, etf_ticker] = 0

    return result

# Process ETFs
etf_list = load_data(file1, 'US Equity', management_style='Passive')
tickers_etf = etf_list['Ticker'].tolist()
etf_history = fetch_historical_data(tickers_etf)
etf_return = calculate_returns(etf_history)
etf_absolute = initialize_portfolio(etf_history, tickers_etf, start_date)
etf_absolute = calculate_portfolio_values(etf_absolute, etf_return)
etf_adjusted = adjust_portfolio_with_expenses(etf_absolute, etf_list, etf_return)

# Process Mutual Funds
mutual_list = load_data(file2, 'US Equity', index_fund='No')
tickers_mutual = mutual_list['Ticker'].tolist()
mutual_history = fetch_historical_data(tickers_mutual)
mutual_return = calculate_returns(mutual_history)
mutual_absolute = initialize_portfolio(mutual_history, tickers_mutual, start_date)
mutual_absolute = calculate_portfolio_values(mutual_absolute, mutual_return)
mutual_adjusted = adjust_portfolio_with_expenses(mutual_absolute, mutual_list,
mutual_return, is_mutual_fund=True)
```

```
# Compare
compare_01_abs = compare_portfolios(mutual_absolute, etf_absolute)
compare_01_adj = compare_portfolios(mutual_adjusted, etf_adjusted)

import re

# Updated helper function to handle "$" and other non-numeric characters
def calculate_average(df, tickers, column_name):
    values = df[df['Ticker'].isin(tickers)][column_name].replace("—", 0)

    # Remove any non-numeric characters (like '$') and convert to float
    values = values.apply(lambda x: float(re.sub(r'[^\d.]', '', str(x))))

    return values.mean()

# Create the comparison for Funds Absolute
compare_data_abs = {
    'Number of Funds': [len(mutual_absolute.columns), len(etf_absolute.columns)],
    'Morningstar Rating for Funds (Overall)': [
        calculate_average(mutual_list, mutual_absolute.columns, 'Morningstar Rating for Funds (Overall)'),
        calculate_average(etf_list, etf_absolute.columns, 'Morningstar Rating for Funds (Overall)')
```

```
    ],
    'Maximum Deferred Load': [
        calculate_average(mutual_list, mutual_absolute.columns, 'Maximum Deferred Load'),
        calculate_average(etf_list, etf_absolute.columns, 'Maximum Deferred Load')
    ],
    'Maximum Front Load': [
        calculate_average(mutual_list, mutual_absolute.columns, 'Maximum Front Load'),
        calculate_average(etf_list, etf_absolute.columns, 'Maximum Front Load')
    ],
    'Net Expense Ratio': [
        calculate_average(mutual_list, mutual_absolute.columns, 'Net Expense Ratio'),
        calculate_average(etf_list, etf_absolute.columns, 'Net Expense Ratio')
    ],
    'Minimum Initial Investment': [
        calculate_average(mutual_list, mutual_absolute.columns, 'Minimum Initial Investment'),
        calculate_average(etf_list, etf_absolute.columns, 'Minimum Initial Investment')
    ]
}

compare_data_absolute = pd.DataFrame(compare_data_abs, index=['Mutual Funds', 'ETFs'])
```

```
# Create the comparison DataFrame for Absolute
compare_absolute = pd.DataFrame(index=['Mutual Funds', 'OEF'], columns=[
    'Absolute Outperformance', 'Percentage Overperformance',
    'Average Return', 'Standard Deviation', 'Sharpe Ratio', 'VaR 99%', 'VaR 95%'])

# 1. Absolute Outperformance
mutual_outperformance_abs = compare_01_abs['OEF'].value_counts().get(1, 0)  # count of 1's
etf_outperformance_abs = compare_01_abs['OEF'].value_counts().get(0, 0)  # count of 0's
compare_absolute.at['Mutual Funds', 'Absolute Outperformance'] = mutual_outperformance_abs
compare_absolute.at['OEF', 'Absolute Outperformance'] = etf_outperformance_abs

# 2. Percentage Overperformance
total_outperformance_abs = mutual_outperformance_abs + etf_outperformance_abs
mutual_percentage_abs = mutual_outperformance_abs / total_outperformance_abs
etf_percentage_abs = etf_outperformance_abs / total_outperformance_abs
compare_absolute.at['Mutual Funds', 'Percentage Overperformance'] = mutual_percentage_abs
compare_absolute.at['OEF', 'Percentage Overperformance'] = etf_percentage_abs

# 3. Average Return
mutual_abs_return = mutual_absolute.iloc[0].mean() / mutual_absolute.iloc[-1].mean()-1
```

```
etf_abs_return = etf_absolute['OEF'].iloc[0] / etf_absolute['OEF'].iloc[-1]-1
compare_absolute.at['Mutual Funds', 'Average Return'] = mutual_abs_return
compare_absolute.at['OEF', 'Average Return'] = etf_abs_return

# 4. Standard Deviation
mutual_std_abs = mutual_absolute.std().mean()  # average of the standard deviations of mutual funds
etf_std_abs = etf_absolute['OEF'].std()  # standard deviation of AOA
compare_absolute.at['Mutual Funds', 'Standard Deviation'] = mutual_std_abs
compare_absolute.at['OEF', 'Standard Deviation'] = etf_std_abs

# 5. Sharpe Ratio
risk_free = 0.05
mutual_sharpe_abs = (mutual_abs_return - risk_free) / mutual_std_abs
etf_sharpe_abs = (etf_abs_return - risk_free) / etf_std_abs
compare_absolute.at['Mutual Funds', 'Sharpe Ratio'] = mutual_sharpe_abs
compare_absolute.at['OEF', 'Sharpe Ratio'] = etf_sharpe_abs

#6 VaR
import numpy as np

def calculate_historical_var(returns, confidence_level):
    """Calculate historical Value at Risk (VaR) at a given confidence level."""
    return np.percentile(returns, (1 - confidence_level) * 100)
```

```
# Step 1: Calculate VaR for each mutual fund ticker at 99% and 95%, then find the average VaR
mutual_var_9_abs = []
mutual_var_5_abs = []

# Get the indices from max_mutual for the calculation
abs_mutual_indices = mutual_absolute.index

for ticker in mutual_absolute.columns:
    # Get the bottom value for the ticker (last value in max_mutual)
    start_value_abs = mutual_absolute[ticker].iloc[-1]

    # Filter returns for the current ticker based on indices in max_mutual
    ticker_returns_abs = mutual_return.loc[abs_mutual_indices, ticker].dropna()

    # Multiply each return by the bottom value for this ticker
    weighted_returns = ticker_returns_abs * start_value_abs

    # Calculate VaR at 99% and 95% confidence levels for this ticker
    avg_mutual_var_99_abs = calculate_historical_var(weighted_returns, confidence_level=0.99)
    avg_mutual_var_95_abs = calculate_historical_var(weighted_returns, confidence_level=0.95)
```

```
    # Append the individual VaRs to the respective lists
    mutual_var_9_abs.append(avg_mutual_var_99_abs)
    mutual_var_5_abs.append(avg_mutual_var_95_abs)

# Calculate the average VaR across all mutual funds
mutual_var_99_abs = np.mean(mutual_var_9_abs)
mutual_var_95_abs = np.mean(mutual_var_5_abs)

# Calculate VaR for AOA at 99% and 95%
etf_returns_abs = []
start_etf_abs = etf_absolute['OEF'].iloc[-1]  # Last value of AOA in max_etf
for index in etf_absolute.index:
    if index in etf_return.index and pd.notna(etf_return.at[index, 'OEF']):
        return_value_abs = etf_return.at[index, 'OEF']
        etf_returns_abs.append(return_value_abs * start_etf_abs)


# Calculate VaR for AOA at 99% and 95%
etf_var_99_abs = calculate_historical_var(pd.Series(etf_returns_abs),
confidence_level=0.99)
etf_var_95_abs = calculate_historical_var(pd.Series(etf_returns_abs),
confidence_level=0.95)
```

```
# Step 3: Update the max_comparison DataFrame with new columns
compare_absolute['VaR 99%'] = [mutual_var_99_abs, etf_var_99_abs]
compare_absolute['VaR 95%'] = [mutual_var_95_abs, etf_var_95_abs]

# Create the comparison DataFrame for Adjusted
compare_adjusted = pd.DataFrame(index=['Mutual Funds', 'OEF'], columns=[
    'Adjusted Outperformance', 'Percentage Overperformance',
    'Average Return', 'Standard Deviation', 'Sharpe Ratio', 'VaR 99%', 'VaR 95%'])

# 1. Absolute Outperformance
mutual_outperformance_adj = compare_01_adj['OEF'].value_counts().get(1, 0)  # count of 1's
etf_outperformance_adj = compare_01_adj['OEF'].value_counts().get(0, 0)  # count of 0's
compare_adjusted.at['Mutual Funds', 'Adjusted Outperformance'] = mutual_outperformance_adj
compare_adjusted.at['OEF', 'Adjusted Outperformance'] = etf_outperformance_adj

# 2. Percentage Overperformance
total_outperformance_adj = mutual_outperformance_adj + etf_outperformance_adj
mutual_percentage_adj = mutual_outperformance_adj / total_outperformance_adj
etf_percentage_adj = etf_outperformance_adj / total_outperformance_adj
compare_adjusted.at['Mutual Funds', 'Percentage Overperformance'] = mutual_percentage_adj
compare_adjusted.at['OEF', 'Percentage Overperformance'] = etf_percentage_adj
```

```
# 3. Average Return
mutual_adj_return = mutual_adjusted.iloc[0].mean() / mutual_adjusted.iloc[-1].mean()-1
etf_adj_return = etf_adjusted['OEF'].iloc[0] / etf_adjusted['OEF'].iloc[-1]-1
compare_adjusted.at['Mutual Funds', 'Average Return'] = mutual_adj_return
compare_adjusted.at['OEF', 'Average Return'] = etf_adj_return

# 4. Standard Deviation
mutual_std_adj = mutual_adjusted.std().mean()  # average of the standard deviations of mutual funds
etf_std_adj = etf_adjusted['OEF'].std()  # standard deviation of AOA
compare_adjusted.at['Mutual Funds', 'Standard Deviation'] = mutual_std_adj
compare_adjusted.at['OEF', 'Standard Deviation'] = etf_std_adj

# 5. Sharpe Ratio
mutual_sharpe_adj = (mutual_adj_return - risk_free) / mutual_std_adj
etf_sharpe_adj = (etf_adj_return - risk_free) / etf_std_adj
compare_adjusted.at['Mutual Funds', 'Sharpe Ratio'] = mutual_sharpe_adj
compare_adjusted.at['OEF', 'Sharpe Ratio'] = etf_sharpe_adj

#6 VaR
```

```
# Step 1: Calculate VaR for each mutual fund ticker at 99% and 95%, then find the average VaR
mutual_var_9_adj = []
mutual_var_5_adj = []

# Get the indices from max_mutual for the calculation
adj_mutual_indices = mutual_adjusted.index

for ticker in mutual_adjusted.columns:
    # Get the bottom value for the ticker (last value in max_mutual)
    start_value_adj = mutual_adjusted[ticker].iloc[-1]

    # Filter returns for the current ticker based on indices in max_mutual
    ticker_returns_adj = mutual_return.loc[adj_mutual_indices, ticker].dropna()

    # Multiply each return by the bottom value for this ticker
    weighted_returns_adj = ticker_returns_adj * start_value_adj

    # Calculate VaR at 99% and 95% confidence levels for this ticker
    avg_mutual_var_99_adj = calculate_historical_var(weighted_returns_adj, confidence_level=0.99)
    avg_mutual_var_95_adj = calculate_historical_var(weighted_returns_adj, confidence_level=0.95)
```

```
    # Append the individual VaRs to the respective lists
    mutual_var_9_adj.append(avg_mutual_var_99_adj)
    mutual_var_5_adj.append(avg_mutual_var_95_adj)

# Calculate the average VaR across all mutual funds
mutual_var_99_adj = np.mean(mutual_var_9_adj)
mutual_var_95_adj = np.mean(mutual_var_5_adj)

# Calculate VaR for ETF at 99% and 95%
etf_returns_adj = []
start_etf_adj = etf_adjusted['OEF'].iloc[-1]  # Last value of AOA in max_etf
for index in etf_adjusted.index:
    if index in etf_return.index and pd.notna(etf_return.at[index, 'OEF']):
        return_value_adj = etf_return.at[index, 'OEF']
        etf_returns_adj.append(return_value_adj * start_etf_adj)


# Calculate VaR for AOA at 99% and 95%
etf_var_99_adj = calculate_historical_var(pd.Series(etf_returns_adj), confidence_level=0.99)
etf_var_95_adj = calculate_historical_var(pd.Series(etf_returns_adj), confidence_level=0.95)

# Step 3: Update the max_comparison DataFrame with new columns
```

```
compare_adjusted['VaR 99%'] = [mutual_var_99_adj, etf_var_99_adj]
compare_adjusted['VaR 95%'] = [mutual_var_95_adj, etf_var_95_adj]

# Define the file path
file_path = r'C:\Users\menaa\Desktop\UniPd\Tesi\Tesi\List\Results\US Equity max.xlsx'

# Save all DataFrames to a single Excel file with multiple sheets
with pd.ExcelWriter(file_path) as writer:
    compare_data_absolute.to_excel(writer, sheet_name= 'Compare Max', index=True)
    compare_absolute.to_excel(writer, sheet_name= 'Max Absolute', index=True)
    compare_adjusted.to_excel(writer, sheet_name= 'Max Adjusted', index=True)
    etf_absolute.to_excel(writer, sheet_name='Max ETF', index=True)
    mutual_absolute.to_excel(writer, sheet_name='Max Mutual', index=True)
    etf_adjusted.to_excel(writer, sheet_name='Adjusted ETF', index=True)
    mutual_adjusted.to_excel(writer, sheet_name='Adjusted Mutual', index=True)
    compare_01_abs.to_excel(writer, sheet_name='Compare 01 Absolute', index=True)
    compare_01_adj.to_excel(writer, sheet_name='Compare 01 Adjusted', index=True)
    etf_history.to_excel(writer, sheet_name= 'Hisotry ETF', index=True)
    mutual_history.to_excel(writer, sheet_name= 'Hisotry Mutual', index=True)

import matplotlib.pyplot as plt

# Step 1: Extract the top cell value of the AOA ticker in adjusted_etf
```

```
etf_values = etf_absolute.loc[etf_absolute.index[0], 'OEF']

# Step 2: Calculate the differences for all tickers in adjusted_mutual
differences = []
for ticker in mutual_absolute.columns:
    ticker_value = mutual_absolute.loc[mutual_absolute.index[0], ticker]
    difference = ticker_value - etf_values
    differences.append(difference)

# Step 3: Create the histogram
plt.figure(figsize=(10, 6))
plt.hist(differences, bins=20, edgecolor='black')
plt.axvline(x=0, color='red', linestyle='--', linewidth=2)  # Adding the red vertical line at x=0
plt.xlabel('Difference from OEF Value')
plt.ylabel('Number of Tickers')
plt.title('Distribution of Absolute Values Around OEF (max period)')
plt.grid(True)
plt.show()

# Step 1: Extract the top cell value of the AOA ticker in adjusted_etf
etf_value = etf_adjusted.loc[etf_adjusted.index[0], 'OEF']

# Step 2: Calculate the differences for all tickers in adjusted_mutual
```

```
differences = []
for ticker in mutual_adjusted.columns:
    ticker_value = mutual_adjusted.loc[mutual_adjusted.index[0], ticker]
    difference = ticker_value - etf_value
    differences.append(difference)

# Step 3: Create the histogram
plt.figure(figsize=(10, 6))
plt.hist(differences, bins=20, edgecolor='black')
plt.axvline(x=0, color='red', linestyle='--', linewidth=2)  # Adding the red vertical line at x=0
plt.xlabel('Difference from OEF Value')
plt.ylabel('Number of Tickers')
plt.title('Distribution of Adjusted Values Around OEF (max period)')
plt.grid(True)
plt.show()

# Step 1: Set up the plot
plt.figure(figsize=(12, 6))

# Step 2: Plot the mutual funds' performances
for ticker in mutual_absolute.columns:
    plt.plot(mutual_absolute.index, mutual_absolute[ticker], color='blue', alpha=0.5)
```

```
# Step 3: Plot the AOA performance
plt.plot(etf_absolute.index, etf_absolute['OEF'], color='red', linewidth=2)

# Step 4: Customize the plot (without y-label and legend)
plt.title('Historical Performance of an Absolute Portfolio \nMutual Funds vs OEF (max peirod)')
plt.xlabel('Date')
plt.ylabel('Portfolio Value')
plt.axhline(0, color='black', linewidth=0.5, linestyle='--')  # Optional: Add a horizontal line at y=0
plt.grid(True)

# Step 5: Show the plot
plt.show()

# Step 1: Set up the plot
plt.figure(figsize=(12, 6))

# Step 2: Plot the mutual funds' performances
for ticker in mutual_adjusted.columns:
    plt.plot(mutual_adjusted.index, mutual_adjusted[ticker], color='blue', alpha=0.5)

# Step 3: Plot the AOA performance
plt.plot(etf_adjusted.index, etf_adjusted['OEF'], color='red', linewidth=2)
```

```
# Step 4: Customize the plot (without y-label and legend)
plt.title('Historical Performance of an Adjusted Portfolio \nMutual Funds vs OEF (max period)')
plt.xlabel('Date')
plt.ylabel('Portfolio Value')
plt.axhline(0, color='black', linewidth=0.5, linestyle='--')  # Optional: Add a horizontal line at y=0
plt.grid(True)

# Step 5: Show the plot
plt.show()
```

BIBLIOGRAPHY

- Abner, D.J. (2010, April 16). The ETF Handbook: How to Value and Trade Exchange-Traded Funds
- Baker, M., Bradley, B., and Wurgler, J. (2010, April 14). Benchmarks as Limits to Arbitrage: Understanding the Low-Volatility Anomaly. *Financial Analysts Journal*
- Barber, B.M. and Odean, T. (2011, September). The Behavior of Individual Investors
- Bogle, J.C. (2000, Octobre 19). Common Sense on Mutual Funds: New Imperatives for the Intelligent Investor
- Bogle, J.C. (2007, March 30). The Little Book of Common Sense Investing
- Cao, C., Chen, Y., Liang, B., and Lo, A. W. (2013, August). Can Hedge Funds Time Market Liquidity? *Journal of Financial Economics*
- Carhart M. (1997, March). On Persistence in Mutual Fund Performance
- Curry, D. (2024, November 8). Robinhood Revenue and Usage Statistics (2024). *Business of Apps*
- Curry, D. (2024, November 8).eToro Revenue and Usage Statistics (2024). *Business of Apps*
- Ellis, C.D. (2013, July 9). Winning the Loser's Game: Timeless Strategies for Successful Investing
- Elton, E. J., Gruber, M. J., and Busse, J. A. (2002, November 8). Are Investors Rational? Choices Among Index Funds. *Journal of Finance*
- Fama, E.F. and French, K.R. (2010, October 5). Luck versus Skill in the Cross-Section of Mutual Fund Returns
- French, K. R. (2008, April 12). The Cost of Active Investing

- Ferri, R.A. (2009, August 5). The ETF Book: All You Need to Know About Exchange-Traded Funds
- Jensen, M.C. (1968, May). The Performance of Mutual Funds in the Period 1945–1964
- Lo, A.W. (2004, October). The Adaptive Markets Hypothesis: Market Efficiency from an Evolutionary Perspective
- McAlpine, J. (2024, June 6). The Rise of Passive Investing in Today's Market. *Mornigstar*
- Malkiel, B.G. (2008, January 22). A Random Walk Down Wall Street
- Malkiel, B. G. (2003, April). The Efficient Market Hypothesis and Its Critics
- Markowitz, H.M. (1991, August 26) Portfolio Selection: Efficient Diversification of Investments
- Nanigian, D. (2022, April 31). The Historical Record on Active versus Passive Mutual Fund Performance. *The Journal of Investing*
- Nofsinger, John R. (2010, January). The Psychology of Investing
- Rekenthaler, J. (2024, February 14). Index Funds Have Officially Won. *Morningstar*
- Sharpe, W.F. (1991, January 1). The Arithmetic of Active Management
- Sharpe, W.F. (2018, December 30). The Arithmetic of Investment Expenses
- Shefrin, H. (2002, September 26). Beyond Greed and Fear
- Shleifer, A., and Vishny, R. W. (2012, April 18). The Limits of Arbitrage. *Journal of Finance*
- Swedroe L. (2009, November). Mutual Funds Portfolio Structures Analysis Management and Stewardship
- Van Loo, L.J.P. and Molander J. (2020, May). Active versus Passive Investing