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The Performance of ETFs vs. Mutual Funds on the Euronext Amsterdam in the period 2010-2021

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Abstract

Knowing which investment management strategy, passive or active, generates the best performance is of high interest to all investors. The purpose of this dissertation is to understand which financial instrument is the ideal choice, in terms of gross and net returns, and also in terms of risk-adjusted returns. In this way, different types of instruments are attached to each strategy: considering ETFs as representative of passive management and Mutual Funds as representative of active management.

Hence, this study is performed through econometric methods, with data related to Euronext Amsterdam between 2010-2021. After selecting an ideal number of ETFs and Mutual Funds, there is an efficient allocation of these based on the Markowitz Portfolio Theory (elaboration of two representative portfolios of each type of fund).

The methodology is developed in several phases. Initially, it is accomplished a general analysis of the performance of the funds over the years. Then, OLS regressions and some hypotheses tests are performed considering gross and net returns. Additionally, there is an exhaustive analysis of two performance measures: Sharpe Ratio and Treynor Ratio. Finally, the Shapiro-Wilk test is conducted to support the validity of the results of these performance measures.

According to the analysed literature, several similar studies have divergent conclusions. Therefore, considering the net returns of funds, this analysis agrees with some studies mentioned throughout the essay.

Overall, the results of this study show that the ETFs portfolio has a better performance than the Mutual Funds portfolio. Besides the higher gross and net returns, ETFs portfolio also has better results considering the risk of the funds and, consequently, the volatility. Therefore, with this analysis, it is also important to highlight the existence of efficient financial markets since active investment management did not achieve the expected performance.

Keywords: Passive Management, Active Management, ETFs, Mutual Funds

JEL-Codes: G11, G15

Resumo

Saber qual a estratégia de gestão de investimento, passiva ou ativa, gera o melhor desempenho é de grande interesse para todos os investidores. O objetivo desta dissertação é perceber qual dos instrumentos financeiros é a escolha ideal, em termos de retornos brutos e líquidos, e também em termos de retornos ajustados ao risco. Desta forma, diferentes tipos de instrumentos são anexados a cada estratégia: ETFs representam um investimento de gestão passiva e os Fundos de Investimento (tradicionais) representam a gestão ativa.

Nesta perspetiva, este estudo é realizado através de métodos econométricos, com dados referentes à Euronext Amsterdam durante o período de 2010 até 2021. Após uma seleção de um número ótimo de ETFs e Fundos de Investimento, há uma alocação eficiente destes com base na Teoria Moderna do Portfolio (construção de dois portfolios representativos para cada tipo de fundo).

A metodologia é desenvolvida em várias fases. Inicialmente, é realizada uma análise geral do desempenho dos fundos ao longo dos anos. Depois, são elaboradas regressões geométricas e testes de hipótese considerando os retornos brutos e líquidos. Adicionalmente, há uma análise exaustiva de duas medidas de performance: Sharpe Ratio e Treynor Ratio. Por fim, é realizado o Teste de Normalidade de Shapiro Wilk para suportar a validade dos resultados destas medidas.

De acordo com a literatura analisada, estudos semelhantes têm conclusões divergentes entre si. Portanto, quando se considera os retornos líquidos dos fundos, esta análise está em concordância com alguns estudos citados ao longo do trabalho.

Em geral, os resultados deste estudo mostram que os portfolios constituídos por ETFs têm uma melhor performance do que os Fundos de Investimento. Para além de obter retornos brutos e líquidos maiores, o portfolio constituído por ETFs tem também melhores resultados considerando o risco dos fundos e, consequentemente, a volatilidade. Portanto, com esta análise, é também importante salientar a existência mercados financeiros eficientes, uma vez que a gestão ativa de investimento não obteve a performance esperada.

Palavras-chave: Investimentos de gestão passiva e ativa, ETFs, Fundos de Investimento

JEL-Codes: G11, G15

Table of Contents

List of Tables

List of Figures

List of Equations

1. Introduction

Nowadays, the world is constantly changing. People changed their behaviors and their traditions in the last decades (FINRA Foundation & NORC at the University of Chicago, 2021). Consequently, society became more consumerist, and the love of money grew. People started to love trading and gambling in financial markets, leading to a substantial development of these. Additionally, according to Cox (2021), the number of investors grow every day, and an issue is always asked to everyone: How do I build my optimal investment portfolio? Investors need to an investment strategy to balance their portfolios in an efficient way. There are mainly two strategies to investors manage their assets: passive management and active management. The goal is to find out which will be the best strategy for investors obtain the highest possible returns in financial markets.

Over the years, new types of investment have appeared and, especially for individual investors, understanding all the mechanisms and all the ways to invest becomes very difficult. As aforementioned, it is important to study the differences between passive management and active management. To have a more practical analysis, the study will be developed with two significant investment instruments in equity markets: Exchange-Traded Funds (ETFs) and Mutual Funds. These two forms of financial investment have been growing in recent times, leading to increased curiosity by the investors. This dissertation will specifically consider ETFs as representative of passive management and Mutual Funds as representative of active management.[1]

In the passive management strategy, investors tend to minimize the research and transaction costs and try to replicate a benchmark portfolio (same assets and same weights). Also, portfolio managers attempt to reproduce a market index, which does not take much time for investors. According to this strategy, the expected returns depend completely on the market performance and investors accept the market return since it is based on the efficient market hypothesis. The efficient market hypothesis states that securities markets reflect efficiently all information about

[1] Note that, despite these representations in this specific report, there are mutual funds that are passively managed, such as index mutual funds. (Crane & Crotty, 2018) In addition, in recent years, active ETFs began to emerge, that is, ETFs that are actively managed. (Pham, Marshall, Nguyen, & Visaltanachoti, 2021)

individual stocks and about the stock market as a whole (Malkiel, 1989). Nevertheless, some studies have come to contradict this, as it will be analysed in the literature review.

Alternatively, the active management strategy is more associated with institutional investors, with high knowledge about securities and markets, looking for profitable opportunities in the market (Taylor et al., 2015). These opportunities exist when similar securities have different prices and, so, investors can profit from strategic positions in the market by buying the security with lower price and selling it at the price of the overpriced security. These positions are arbitrage[2] processes which exist to equilibrate prices in stock markets. Consequently, it shows that there are situations that disagreeing the efficient market hypothesis. Beside the fact that this strategy contradicts various theories related to financial markets, active management also consumes much time for investors. Therefore, there are some issues which will be discussed throughout the dissertation.

The aim of the dissertation will be providing an econometric analysis, interpreting data on performances of ETFs and Mutual funds, between 2010 and 2021 in Euronext Amsterdam. Besides the lack of studies on this topic in this market, Amsterdam Stock Exchange presents some curiosities, such as the fact that it is the oldest market in the world (Chen, 2019). Additionally, Amsterdam belongs to the largest stock trading market in Europe, Euronext as a whole (Statista Research Department, 2022), and, during the year 2021, Amsterdam has overtaken London in equity trading. (Stafford, 2022)

This study will investigate only sixty financial instruments existing on the Euronext Amsterdam, which will be chosen with high accuracy, in order to obtain a homogeneous sample. Namely, a group of funds that share the same characteristics to obtain reliable and trusting conclusions. The examined period will be restricted between May 2010 and December 2021.

Therefore, to perform a correct analysis, a wide range of specifications will be required. It is necessary mainly because gross returns of investments could not be enough to correctly evaluate performances of different financial instruments, associated to different management strategies. Unpredictability of fund values beyond the period is associated with risk and can be considered

[2] In other words, arbitrage is also specified as "The simultaneous purchase and sale of the same, or essentially similar, security in two different markets for advantageously different prices". (Sharpe & Gordon, 1990) (Shleifer & Vishny, 1997, p. 35)

an element of performance, mainly for individual investors. In this sense, throughout the study, it is always considered a risk-averse investor, who seeks to minimize the variance of the returns, that is, minimize the risk.

Despite all limitations that an analysis of this type may be subject to, throughout the dissertation, some reliable assumptions will be highlighted, taken from accredited articles, so that precise conclusions can be drawn.

The structure of the essay will be as follows. After this introductory part, the second chapter will discuss the relevant literature. This chapter will contain the concepts of passive management strategy and ETFs, active management strategy and Mutual Funds, and, lastly, the performance between these two strategies, specifically, between ETFs versus Mutual Funds. Subsequently, the data and methodology applied in this empirical study will be described in chapter 3. Then, chapter 4 will explain and debate the results obtained. To finish, in chapter 5, the conclusions and some proposals for future research will be presented.

Hence, the conclusions of this analysis suggest that passive management outperform active management, considering gross and net returns and, also, taking into account the risk. These findings are in agreement with some conveniently referred studies.

2. Literature Review

The discussion between passive versus active investment strategies is something that has been debated over the years. The portfolio management strategy is no longer solely dependent on the condition of market efficiency, but also dependent on the investors' behavior and attitudes. In this sense, there are many studies that study both strategies separately and others, where the authors make a comparison between them, as it will be seen throughout this dissertation.

2.1. Passive management strategy and ETFs

Passive investment strategy reflects the market portfolio in form of benchmark indices or index funds. Passively managed portfolio basically has represented a specific sector or market indexes, such as the S&P500. Investors who use this strategy believe in market efficiency and, consequently, they only have market returns since there are no opportunities to get more. Fama (1970) introduces the Efficient Market Hypothesis, which argues that it is impossible to constantly "beat the market" mainly because security prices must reflect all publicly available information and new information induce price movements. Later, the same author shows, with new research, that there are long-term return anomalies. However, these anomalies tend to disappear with reasonable changes in the way they are quantified, and the Efficient Market Hypothesis should not be rejected (Fama, 1998). Moreover, Malkiel (2003) also agrees to keep passive investment management, since when he tests data from efficient markets, new information is immediately reflected in market prices, namely, market efficiency. It is interesting to highlight the advantages of this investment strategy, reflected in the passive funds, which are low transaction costs and tax efficiency. According to French (2008), when the author examines the cost of active investing, he affirms that passive investment strategies are essential, as active investment does not pay off mainly due to high transaction costs. Additionally, Poterba et al. (2002) get important results when compared returns between equity mutual fund and ETFs adjusted for taxes, concluding that passive strategy has higher net returns. Nonetheless, Fuller et al. (2010) claim that passive investment does not exist, that this term is a fallacy and that it is only an uncostly type of diversified active investment.

Despite the different opinions among the authors, passive investment, and its associated funds, such as index mutual funds and ETFs have been expanding substantially. Particularly, ETFs belong to the fastest growing investment products worldwide, seeking for low transaction costs, high liquidity, and potential portfolio diversification (Liebi, 2020). Gastineau (2001) argues that ETFs appeal to the interest of researchers and are attractive to all types of investors (large institutions and individual investors), who want to improve their exposure to a diversified market. Furthermore, Meziani (2016) also has the same view, and justifies it with ETFs' characteristics, like flexible trading, low operating costs, and more beneficial taxation possibilities. Therefore, Exchange-Traded Funds (ETFs) are open-ended investment funds, which are composed of a group of securities, and strictly follow a benchmark index. Recently, due to the worldwide pandemic, ETFs have been seen as a Source of Stability. BlackRock (2020), the largest asset management company in the world, claims that ETFs proved their resilience at the beginning of the pandemic, a period of an unprecedented volatility. U.S. Securities and Exchange Commission (2012) has an important article where defines some crucial concepts, comparing ETFs with mutual funds. ETFs are identical to mutual funds, since they offer investors a way to put their savings in a fund that make investments in a wide range of securities and, in return, to receive an interest in that investment. "Unlike mutual funds, however, ETF shares are traded on a national stock exchange and at market prices that may or may not be the same as the net asset value ("NAV") of the shares." (SEC, 2012, p. 1)

In fact, passive investment strategy is presently needful. Investors look at this strategy as a "safe haven". The fact of having a performance and the EMH associated is also important.

2.2. Active management strategy and Mutual Funds

Nevertheless, the efficient market hypothesis has been criticized in the last years. Grossman and Stiglitz (1980) explained that there are incentives for investors obtain information faster than it reflected in market prices, therefore the market can not be perfectly efficient. In this way, active management strategy emerges since this strategy presumes that markets are not efficient and there is meaningless information incorporated in stock prices. Therewith, active managers can take advantages of these investment opportunities, doing arbitrage strategies, i.e., realize gains

by setting up an appropriate allocation of assets. Active investment strategy is predominantly adopted by institutional investors since they have skilled knowledge and powerful analytical skills. Those investors try to distinguish overvalued and undervalue securities whose purchase can generate enough profitability to cover the transaction costs and the risk assumed, like methods of arbitrage. A study elaborated by Fama and French (2010) concludes that active managers can exhibit higher stock picking skills to cover their management fees. Additionally, this management strategy helps to balance prices in financial markets. Stiglitz and Grossman (1980) state that active managed funds should perform well than passively managed ones, when markets are distinguished according to efficiency, as aforementioned. Furthermore, the active investment strategy generally includes the Capital Asset Pricing Model (CAPM), which describes the linear relationship between the expected return for a portfolio and the systematic risk, reflected in market beta. In this sense, alpha, the difference between the portfolio's return and the benchmark, that is, the excess return, is measured through this model. In fact, there is a study that find that mean-variance investors who are unconvinced about active management skills can detect mutual funds that generate ex ante positive alphas. (Baks et al., 2001)

In line with this management strategy, there are some actively managed funds with a variety of advantages (compared to passive funds). Avramov and Wermers (2006, p. 353) affirm that actively managed funds "allow investors to capitalize on predictability in benchmarks and fund risk loadings in a way that can not be achieved through long-index fund positions." Among all actively managed funds, mutual funds should be highlighted. Mutual Funds have been important in financial markets. Essentially, these instruments are investment companies whose their business is to make investments on behalf of investors (individual and institutional investors) sharing a common goal: get high returns. Likewise, Poterba et al. (2002) evidence the tax laws that are attached to mutual funds, which are essential to pass realized capital gains from trading into shareholders. Economies of scale is the main advantage of mutual funds. Moreover, since these funds are managed by professional investors, it is supposed that investors get a higher return, greater profitability, and more diversification.

There are several studies that analyse benefits and drawbacks of actively managed mutual funds. Arnott and Darnell (2003) assert that investors could add value to their portfolios with mutual funds, as showed by investment management experiences and by capital market observations.

In addition, Wermers (2000) indicates that mutual funds fixed assets portfolios that outperform a broad market index by 1.3 percent per year, over the period 1975-1994. In spite of that, mutual funds may not be "as good as it seems". For example, some authors defend mutual funds are inefficient because there are agency problems among managers and investors (Chevalier & Ellison, 1995). Moreover, some studies suggest that returns may not be as high due to transaction costs and taxes and fees to implement these instruments.

2.3. The performance of ETFs versus Mutual Funds

The literature related to the performance comparison between passive and active management strategies is diversified and, consequently, divergent. In general, studies conclude that active management underperform passive management. Gruber (1998), when analyses the period between 1984-1995, recognize inferior performance of active funds. Other results in similar studies, such as Harper et al. (2005) conclude that a passive investment strategy (applying ETFs) could have high returns to an active management strategy (utilizing closed-end country funds).

Nevertheless, when Nanigian (2021, p. 1) compares the risk-adjusted performance between these two investment strategies over a prolonged period, the author writes that "investing in passively management funds does not meaningfully improve investor outcomes", provided that investors are cost-aware in their fund selection process. As well, Avramov and Wermers (2006) determine that, considering return predictability, actively managed funds are considerably further attractive compared to index funds.

Specifically, when comparing the two forms of investment, ETFs and Mutual Funds, most of studies determine that ETFs underperform mutual funds, but passively managed funds have a cost advantage relative to the actively managed ones. This conclusion is explained by Fan and Lin (2020, p. 163), "Mutual funds have a tendency of wider return ranges compared with ETFs. All of the maximal returns of the mutual funds are higher than those of ETFs. All of the minimal returns of the mutual funds are lower than those of the ETFs except for Financials. Mutual funds that are actively managed are more likely to have more risk and, thus, have a wider range in returns."

Additionally, Kremnitzer (2012) concludes that, in emerging markets, mutual funds should be deemed the better investment since that, even with high taxes, these funds have higher performance compared to ETFs. As aforesaid, Baistrocchi (2015) finds that actively managed funds outperform passively managed instruments, in terms of gross returns. However, when the author takes into consideration net of fees returns, the opposite is observed: ETFs, representatives of passive management strategy, earn higher returns than Mutual Funds, illustrating active management strategy.

3. Data and Methodology

The purpose of this chapter is to provide information related to data collection and selection. Additionally, it is explained the methodology that will be applied to compare the funds' performance.

3.1. Data

3.1.1. Data Description and Collection

The sample of financial instruments used for this study comes from the Euronext Amsterdam. According to the website, there are 348 equity ETFs in Amsterdam and 128 Fund Services, associated with mutual funds, in same market (Euronext, 2022). The data collection, regarding the instruments' performance, was done in the Refinitiv Eikon Datastream. The sample was built from this all-encompassing universe with the highest average return value of Mutual Funds and ETFs. Therefore, the cross-section is constituted by 30 Mutual Funds and 30 ETFs monthly data on performance.[3] Note that, a similar number of funds has been used in order to do a balanced comparison. Additionally, this selection criterion was applied so that investment instruments can be compared more fairly, since it was unfeasible to select funds according to their types (or other characteristics) within this specific market, using this datastream.

Afterwards, as a proxy for the risk-free interest rate, in this analysis, it was used "Netherlands Long-Term Government Bond Yields, 10-Year". Monthly data for this rate was collected on the Refinitiv Eikon Datastream (2022). It is an adequate benchmark return since a comparison of funds belonging to Euronext Amsterdam.

A period of approximately 12 years, between May 2010 and December 2021, was chosen with the aim of minimizing any anomalies that may exist and to be easily compared with previous studies. Moreover, it is important to highlight the fact that monthly returns were employed in

[3] See Appendix A

this comparison, which support a more precise econometric analysis than yearly returns. To adjust some data, it was also necessary to resort to other databases, such as Morningstar.

3.1.2. Fundamental variables

In this way, two datatypes from the Refinitiv Eikon Datastream were used to calculate the main variables: Net Returns and Gross Returns (both expressed in monthly percentages). To determine the monthly percentage net returns of each fund, the Total Return Index[4] was collected for each month from 2010 to 2021. The second datatype was the Total Expense Ratio[5], which was used to calculate the monthly percentage gross returns. Regarding the calculation of gross returns, the following formula was applied:

$$GRi = \left[\frac{(1 + TRi)}{(1 - {}^{ej}/_{12})} - 1\right] * 100$$

Equation (3.1) Gross Return

This formula was taken from Morningstar Office, where GRi is the Gross Return for month i, TRi is the Total Return for month i and, finally, ej represents the Total Expense Ratio. (Glossary - Morningstar, 2022) Additionally, other variables were considered for some precise analyses, which will be noted throughout this study.

3.1.3. Limitations

To carry out this study, unfortunately, some constraints have been applied. The essay is restricted to 60 financial instruments, which is a high limitation considering the total number of ETFs and Mutual Funds that exist in Euronext Amsterdam. Moreover, this essay only analyses monthly

[4] Total Return Index "shows a theoretical growth in value of a share holding over a specified period, assuming that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date." (Refinitiv Eikon Datastream , 2022)

[5] Total Expense Ratio quantifies how much of a fund's assets are applied for administrative and other operating costs. (Hayes, The Definition of Expense Ratio, 2021) This specific datatype is calculated "after waivers/reimbursements are subtracted, but before expense offsets/brokerage service arrangements are subtracted." (Refinitiv Eikon Datastream , 2022)

returns, which is a positive point compared to annual periods, but something negative if we consider daily returns. However, there is a lack of data related to the daily returns, which would have led to an unbalanced and so, non-meaningful examination.

Furthermore, there are various performance measures that can be applied to investigate funds' performance. However, this research focuses on two measures. Ultimately, throughout the study, it is always assumed that investors have homogeneous profiles and have the same risk aversion.

3.1.4. Survivorship Bias

Over a long period of time like the one used in this report, it is hard to avoid gaps in the data analysis process of performance measurement. In this case, it is important to understand survivorship bias. Basically, the sample could be biased upward because it could exclude the worst-performing mutual funds since companies take them out of the market. Namely, the average measured performance of mutual funds could be overestimated. (Bodie, Kane, & Marcus, 2018)

Accordingly, "through independent research, it is suggested that survivorship bias accounts for about 0.4% - 0.6% of risk-adjusted yearly returns". (Fahling et al., 2019, p. 80) Thus, this analysis ignores the survivorship bias.

3.2. Methodology

To perform a meaningful comparison between ETFs and Mutual Funds' performance (passive and active fund performance), this dissertation has applied a quantitative method observed by some comparative features. The research follows specific calculations with variables collected in some databases, as mentioned earlier. Moreover, the econometric analysis consists of regression analysis and performance measures. To implement these approaches, the methodologies adopted in Baistrocchi (2015) and Fahling et al. (2019) are very similar, and, for that reason, these papers are important references for the empirical work that was carried out.

3.2.1. Selection of Mutual Funds and ETFs

After collecting the data and examining some comparison studies, it was necessary to understand what the best method would be to analyse all the information. There are several prospects for data processing, however some of them may be unviable or may give results that are difficult to interpret. For example, using sample average values could hide some fund behavior and could provide few results, reading to a senseless analysis. Also, comparing funds one by one could lead to biased results by the specificity of the funds counted in each comparison and, so, would not serve for a general interpretation.

Therefore, based on some of the above-mentioned studies, this analysis was developed from the ideal perspective of an ex-post saver. Namely, an investor with risk aversion and, simultaneously, willing to obtain the highest possible profit. In line with this strategy, two portfolios were built: one composed of four ETFs and the other made with four Mutual Funds. These funds were selected with the aim of revealing the characteristics of the sample relative to the overall market.

To construct the two mean-variance portfolios, the following steps were taken: average performance (using returns and standard deviations) of each fund during the period considered (2010-2021); in accordance with the mean results were chosen the top four performance ETFs and Mutual Funds. Each group of the top four performance funds was used to build the two portfolios, designated by: ETF portfolio and Mutual Fund portfolio (MF portfolio). The two portfolios were created by connecting weights to each of the chosen funds for each period's

years. This was done according to the Markovitz Portfolio Theory, usually named by Modern Portfolio Theory, in order to optimize both portfolios. This theory is based on the assumption that investors search for a combination of available securities to maximize their expected returns while utilizing diversification to minimize variance (Markowitz, 1952). Hence, computing the variance-covariance matrix for each year and then minimizing the variance, the optimal weights for each ETF and for each Mutual Fund, respectively and separately, were found.

This explained operation was made two times: firstly, examining Gross Returns, and secondly considering Net Returns. In the end, four portfolios were obtained, which are summarized in the following tables.[6]

Table 3.1 Optimal weights, gross returns, and standard deviations for portfolios of ETFs (2010-2021)[7]

ETFs	ISHARES S&P 500 UCITS ETF USD (DIST)	ISHM.NA.UCITS ETF USD (DIST)	SPDR DJ.INAG. ETF TST	ISHARES CORE MSCI WLD. UCITS ETF USD (ACC)	Gross Returns	Standard Deviation
2010	0.00%	41.17%	58.83%	0.00%	10.30%	13.47%
2011	0.00%	91.25%	8.75%	0.00%	1.26%	15.47%
2012	84.05%	0.00%	15.95%	0.00%	10.15%	7.17%
2013	0.00%	0.00%	67.30%	32.70%	24.50%	9.30%
2014	0.00%	0.00%	100.00%	0.00%	11.56%	8.18%
2015	0.00%	100.00%	0.00%	0.00%	3.10%	7.98%
2016	34.01%	0.00%	18.24%	47.75%	27.02%	11.31%
2017	0.00%	0.00%	45.06%	54.94%	17.13%	5.60%
2018	0.00%	0.00%	19.90%	80.10%	-4.70%	14.07%
2019	0.00%	0.00%	14.21%	85.79%	24.85%	10.59%
2020	0.00%	0.00%	0.00%	100.00%	12.00%	21.11%
2021	0.00%	28.17%	37.30%	34.52%	22.65%	5.69%

[6] See Appendix B

[7] This table shows the optimal weights of each fund that creates the portfolio. For example, in 2021, the optimal portfolio is constituted by 41.17% of the iShares MSCI North America UCITS ETF and 58.83% of the SPDR Dow Jones Industrial Average ETF. Additionally, the table indicates the expected gross return regarding the funds that form the portfolio for each year, and the associated standard deviation, that is, the portfolio's volatility. In 2021, the expected annual gross return is around 10.30%, and the portfolio's volatility for this year has a value of 13.47%. The following tables (3.2, 3.3 and 3.4) have an identical interpretation to this one.

Table 3.2 Optimal weights, gross returns, and standard deviations for portfolios of Mutual Funds (2010-2021)

MUTUAL FUNDS	NN DUURZAAM AANDELEN FONDS	NN EQUITY INVESTMENT FUND	ASN DUURZAAM AANDELENFONDS	ROBECO SUST.GLB. STARS EQTIES.FD.	Gross Returns	Standard Deviation
2010	64.42%	35.58%	0.00%	0.00%	14.63%	9.42%
2011	65.28%	0.00%	34.72%	0.00%	-5.02%	7.52%
2012	38.68%	0.00%	61.32%	0.00%	15.55%	6.99%
2013	61.35%	38.65%	0.00%	0.00%	13.66%	6.63%
2014	58.47%	41.53%	0.00%	0.00%	17.59%	7.22%
2015	0.00%	0.00%	100.00%	0.00%	14.55%	12.71%
2016	0.00%	64.95%	12.84%	22.21%	8.05%	13.89%
2017	0.00%	0.00%	12.80%	87.20%	11.34%	5.44%
2018	0.00%	0.00%	18.11%	81.89%	-6.00%	13.47%
2019	0.00%	84.48%	15.52%	0.00%	34.16%	11.13%
2020	0.00%	0.00%	0.00%	100.00%	15.39%	21.92%
2021	0.00%	35.74%	38.46%	25.80%	26.88%	6.68%

Table 3.3 Optimal weights, net returns, and standard deviations for portfolios of ETFs (2010-2021)

ETFs	ISHARES S&P 500 UCITS ETF USD (DIST)	ISHM.NA.UCITS ETF USD (DIST)	SPDR DJ.INAG. ETF TST	ISHARES CORE MSCI WLD. UCITS ETF USD (ACC)	Net Return	Standard Deviation
2010	0.00%	41.17%	58.83%	0.00%	10.23%	13.47%
2011	0.00%	91.25%	8.75%	0.00%	1.27%	15.47%
2012	84.05%	0.00%	15.95%	0.00%	10.16%	7.17%
2013	0.00%	0.00%	66.15%	33.85%	24.75%	9.31%
2014	0.00%	0.00%	100.00%	0.00%	11.56%	8.18%
2015	0.00%	100.00%	0.00%	0.00%	3.10%	7.99%
2016	34.01%	0.00%	18.24%	47.75%	27.03%	11.31%
2017	0.00%	0.00%	45.62%	54.38%	17.28%	5.59%
2018	0.00%	0.00%	19.90%	80.10%	-4.74%	14.07%
2019	0.00%	0.00%	14.21%	85.79%	24.86%	10.59%
2020	0.00%	0.00%	0.00%	100.00%	12.00%	21.11%
2021	0.00%	28.17%	37.30%	34.52%	22.65%	5.69%

Table 3.4 Optimal weights, net returns, and standard deviations for portfolios of Mutual Funds (2010-2021)

MUTUAL FUNDS	NN DUURZAAM AANDELEN FONDS	NN EQUITY INVESTMENT FUND	ASN DUURZAAM AANDELENFONDS	ROBECO SUST.GLB. STARS EQTIES.FD.	Net Return	Standard Deviation
2010	64.42%	35.58%	0.00%	0.00%	14.65%	9.43%
2011	65.28%	0.00%	34.72%	0.00%	-5.02%	7.53%
2012	38.68%	0.00%	61.32%	0.00%	15.56%	7.00%
2013	60.72%	39.28%	0.00%	0.00%	13.52%	6.62%
2014	59.05%	40.95%	0.00%	0.00%	17.60%	7.23%
2015	0.00%	17.96%	82.04%	0.00%	16.93%	13.99%
2016	0.00%	100.00%	0.00%	0.00%	11.82%	12.57%
2017	0.00%	0.00%	12.80%	87.20%	11.35%	5.45%
2018	0.00%	0.00%	18.11%	81.89%	-6.00%	13.47%
2019	0.00%	84.48%	15.52%	0.00%	34.16%	11.13%
2020	0.00%	0.00%	0.00%	100.00%	15.39%	21.92%
2021	0.00%	35.74%	38.46%	25.80%	26.88%	6.68%

Therefore, in each table shown above, it is possible to observe the optimal portfolio for each year, that is, the optimal weight of each fund that creates the portfolio. As it is noted, the last two columns describe the portfolio return and its standard deviation for the corresponding year. In other words, the main objective of this process was to consider two synthetic variables (returns and standard deviation) and, at the same time, one geometric variable in terms of weights. In this way, the profile of the investor (risk aversion and willingness to profit) and the effectiveness of passive and active management investments were taken into account.

After finding the optimal portfolios, the representative portfolios are projected back, in terms of performance (monthly basis), for a proper comparison of funds during the econometric analysis. These representative portfolios were a powerful tool to conduct the analyses, mainly for a consistent and significant comparison between ETFs and Mutual Funds. This comparison will be represented in the next chapter.

3.2.2. Econometric Approach

Accordingly, data analysis will be conducted using statistical analyses. Firstly, an Ordinary Least Squares (OLS) regression[8], is constructed with the following expression:

$$Y_t = \beta_0 + \beta_1(X_{1t}) + \varepsilon$$

Equation (3.2) OLS regression

In this situation, the dependent variable Y_t is the Mutual Fund portfolio return in month *t*, β_0 is the intercept and X_{1t} is the ETF portfolio return in month *t*. Two regressions are performed, one considering gross returns and the other considering net returns. Basically, the idea is to establish a correlation between ETFs and Mutual Funds returns. To highlight the fact that, these returns are representative returns, since they are based on an optimal portfolio built through a selection of funds (already described). The ETF portfolio return is the independent variable mainly because the constituted funds are passively managed and do not have any "investor's knowledge" attached to their performance. That is to say, the returns of this portfolio are in line with market behavior, as previously mentioned in the literature.

Precisely, the purpose of these regressions is to examine whether the coefficient β_1 is statistically significant and measure its value. In addition, β_0 values are also important to analyse, as they show an estimated return for the Mutual Fund portfolio when the ETF portfolio return is zero. In some studies, this value represents the skills of the managers who control the investments. Lastly, the coefficient of determination R^2 is analysed to measure the goodness of fit. For example, when the coefficient of determination R^2 is equal to 1, the regression model allocates a perfect fit of the data. To sum up, these results will show whether, gross and net of fees, Exchange Traded Funds produce lower or higher returns than Mutual Funds.

Initially, it is crucial to examine the differences between gross and net returns. According to Carhart (1997), much of the predictability in mutual fund returns is justified by persistent differences in mutual fund expenses and transaction costs. Moreover, Wermers (2000) also concludes that there are a lot of gaps between gross and net returns. These authors state that a

[8] "OLS regression is a common technique for estimating coefficients of linear regression equations which describe the relationship between one or more independent quantitative variables and a dependent variable." (XLSTAT, 2022, p. 1)

more elevated stock turnover ratio allows for mutual funds' higher returns (due to diversification). (Baistrocchi, 2015)

Unfortunately, some interesting variables were not included in the study due to a lack of data. For example, if the study takes into account the funds' characteristics and types, if the analysis considers the price-to-earnings ratio and the market-to-book ratios, and so on. All these comparisons could have better results. In line with this, Giuseppe (2015, p. 10) states that these authors "Fama and French (1996), Jegadeesh et al. (1993) and Chan et al. (1996) have shown that these two ratios are statistically significant in the prediction of the patterns in common stock returns, although they have not had a great importance in asset pricing".

3.2.3. Performance Measures

Afterwards, it is analysed some performance ratios to obtain more results and, consequently, a better comparison. Sharpe Ratio and Treynor Ratio can be crucial measures to rule out any anomalies and biased results. In fact, the method of suggested by Harper et al. (2005), where they use Sharpe Ratio to measure risk-adjusted returns, is an important support for this study.

According to Harper et al. (2005), there is a high probability of ETFs and Mutual Funds exhibiting different levels of risk because these have different investment decisions and different exposure to premium volatility. These ratios are investigated for the purposes of examining the risk-adjusted returns of active over passive management funds and correlation between the funds.

The Sharpe Ratio, in other words reward-to-variability ratio, was developed by William Sharpe in 1966. (Sharpe, 1966) This ratio measures the excess portfolio return compared to the total risk that it is taken. The formula is showed below:

$$Sharpe\ Ratio\ = \frac{E(r_p) - E(r_f)}{\sigma_p}$$

Equation (3.3) Sharpe Ratio

In this formula, $E(r_p)$ denotes the average monthly portfolio return, $E(r_f)$ implies the monthly risk-free rate and σ_p is the standard deviation of the portfolio return, used to measure the portfolio's volatility. A rational investor seeks a high-risk premium and a low-risk level. For this reason, a higher Sharpe Ratio is preferred, since it implies that the portfolio generates a superior return in relation to its risk level. (Treynor & Mazuy, 1966)

According to these definitions, after calculating all the monthly ratios for each portfolio, a new linear regression is created, identical to the first regression:

$$Y_t = \beta_0 + \beta_1(X_{1t}) + \varepsilon$$

Equation (3.4) OLS Regression [for the performance measures]

However, in this formula these variables have different meanings from the ones previously described: Y_t represents the Sharpe Ratio of the representative Mutual Funds portfolios in month *t* and X_{1t} is the Sharpe Ratio of the representative ETFs portfolios in month *t*. Therefore, after completing the study of this regression, there are an analysis of the residuals and the construction of the Probability Distribution Functions for both portfolios, which also leads to the comparison to the Gaussian Model.[9]

The Treynor Ratio is other well-known quantitative method to analyse the management of the portfolios. (Treynor, 1965) Despite the Treynor Ratio also writes down the excess portfolio return in relation to the risk, this ratio uses the systematic risk. The ratio is expressed as follows:

$$Treynor\ Ratio = \frac{E(r_p) - E(r_f)}{\beta_p}$$

Equation (3.5) Treynor Ratio

Here, $E(r_p)$ represents the average monthly portfolio return, $E(r_f)$ is the monthly risk-free rate and β_p is the portfolio beta, which is the measure of sensitivity to systematic risk.[10] In addition, the higher the value of the ratio, the better efficiency and performance of the portfolio (Glossary - Morningstar, 2022) In order to have a detailed analysis of the Treynor Ratio (in both portfolios), the same methods previously used are conducted.

Finally, other hypotheses tests are performed. For example, it is computed the Shapiro-Wilk test to determine whether both portfolio returns fit a normal distribution.

[9] Gaussian Model has the shape of a normal curve, i.e., it is like a normal distribution.
[10] The portfolio beta is a weighted sum of the individual fund's betas. In this study, the monthly historical betas of each fund were collected in each respective month during the 12 years. (Refinitiv Eikon Datastream , 2022)

4. Results

In this chapter, the results of the measures are analysed and interpreted. The comparison between ETFs and Mutual Funds is divided into various subchapters. Firstly, an overview of the performance of the funds over the years is reviewed. Secondly, using the representative portfolios for each type of management (passive or active), gross and net returns are compared. Finally, some performance measures are interpreted, followed by tests to validate their conclusions. All results presented are expressed from 2010 to 2021.

4.1. General analysis of gross and net returns

The difference between gross returns and net returns becomes important when there is a comparison between passively and actively managed funds. Accordingly, gross returns are the total returns of the funds before the deduction of taxes, fees, or other commissions, whereas net returns are the total returns after these deductions. (Hayes, Gross Rate of Return, 2020)

Figure 4.1 Gross percentage returns on portfolios of ETFs and Mutual Funds from 2010 to 2021 in Euronext Amsterdam

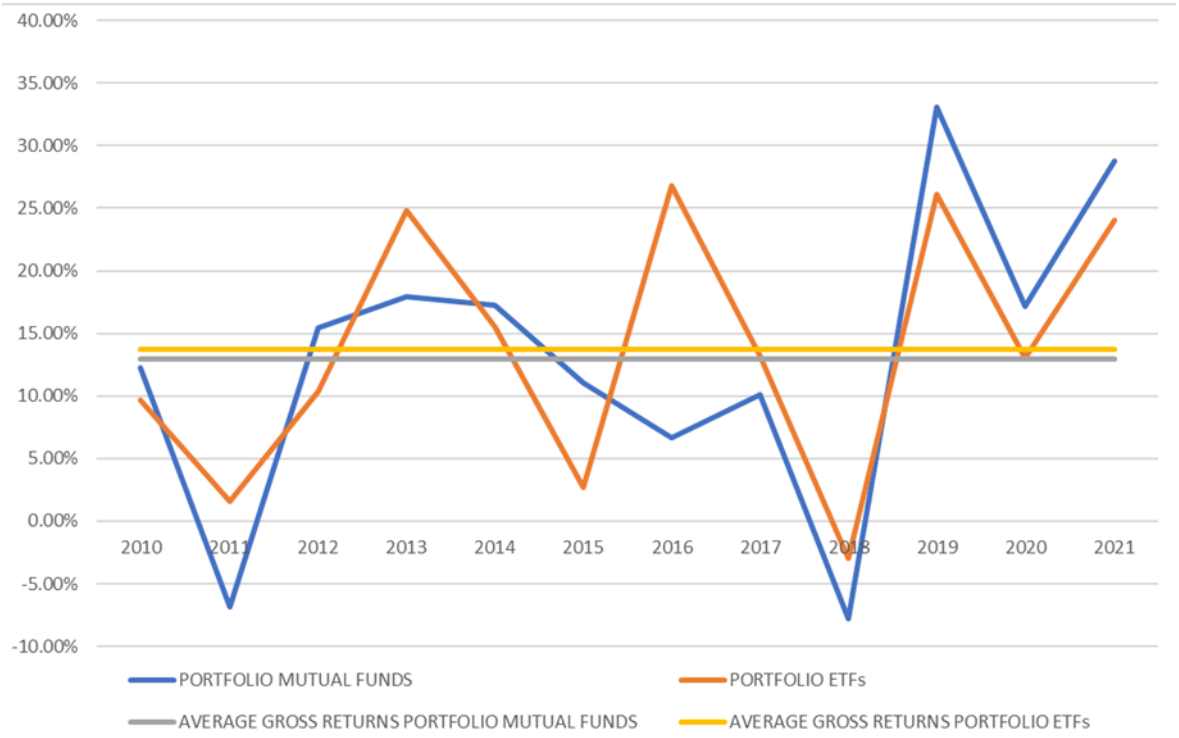
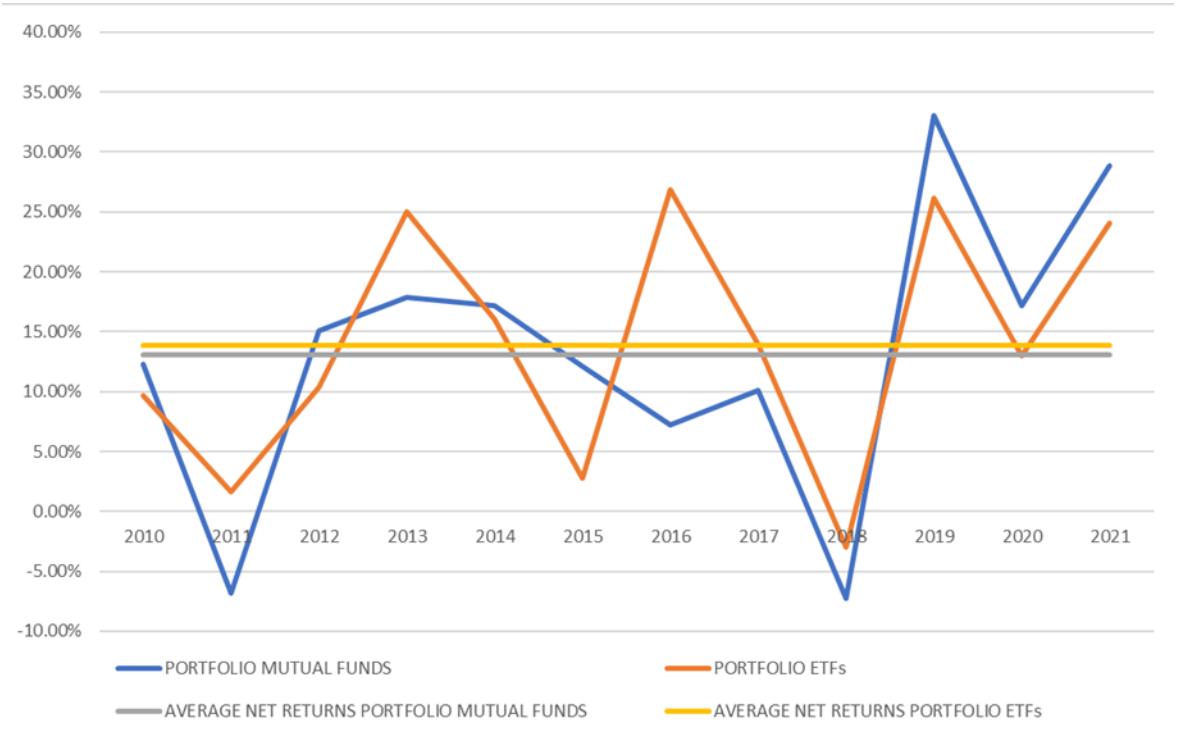


Figure 4.2 Net percentage returns on portfolios of ETFs and Mutual Funds from 2010 to 2021 in Euronext Amsterdam



In the figure 4.1 shown above, it is represented the gross percentage returns of ETFs' portfolio and Mutual Funds' portfolio and their averages over the period 2010 to 2021. In addition, the figure 4.2 displays the net percentage returns of ETFs' portfolio and Mutual Funds' portfolio and their averages. Note that, only in this subchapter, annual returns of the portfolios are used, and these portfolios are not risk-adjusted. In other words, to achieve a comparative overview of the passive and active management of the funds in Euronext Amsterdam, all the funds that constitute each portfolio have the same weight.

The differences in terms of performance between gross and net returns are not very evident in the figures. This is because apart from the Total Expense Ratio remaining almost constant over time, there is some lack of data in some years. Consequently, as the analysis is done with the percentage variation of returns over the months, the percentage difference between gross and net returns is minimal.

In both figures, ETFs' portfolio has, on average, higher returns than Mutual Funds' portfolio. Furthermore, there are several phenomena that can be detectable. For example, in 2011 and in

2018, there is a huge drop in the performance of both ETFs and Mutual Funds. From 2013 to 2015, there is a sharp decrease in the ETFs portfolio returns, which is recovered in 2016 with a return percentage above 25%. Also, it is important to underline the paradigm shift since 2019: the percentage of annual return became higher in the portfolio made up of Mutual Funds. The last event that it is possible to observe in the figures is the global world pandemic, in 2020.

Following a chronological order, in 2011, there was a stock markets fall, namely, Black Monday. This event was the worst since the 2008 financial crisis. (Sweet, 2011) Indeed, a weak U.S. economy and the debt crisis in Europe diminished investor confidence, leading them to losses. (Hargreaves, 2011) Consequently, both analysed funds had a drop in their returns. Between 2015-2016 was a period of the stock market selloff, where the value of stock prices declined globally. A wide range of situations, such as the Chinese stock market turbulence, the end of quantitative easing in the U.S., a drop in petroleum prices, the Greek debt non-payment, and the Brexit vote, led to a high level of volatility. (Williams, 2022) This can explain the huge drop in ETFs returns and a milder decline in Mutual Fund returns through 2016.

During the year 2018, the financial markets faced the biggest drops in the main world indices and, also, some of the biggest sudden increases. "Volatility was been driven by signs of a global economic slowdown, concerns about monetary policy, political dysfunction, inflation fears and worries about increased regulation of the technology sector." (Isidore, 2018, p. 1) This market volatility may have led to the worst performance of both ETFs and Mutual Funds, in the period and market under analysis.

As aforementioned, it is crucial to highlight what happens since 2019, as it is displayed in the figures, there is a change in terms of returns of the two portfolios.

At the beginning of the year 2020, there was the Coronavirus Stock Market Crash. Although this collapse did not last very long, many studies attempt to understand what happened in financial markets. (Williams, 2022) Further, ETFs and Mutual Funds had not fallen that steep. According to BlackRock (2020), ETFs were resilient and a source of firmness. Another study related to Mutual Funds, in another stock market, concludes that "mutual funds should concentrate on investing in human capital as resulting efficiency leads to robust performance during periods marked with uncertainties and turmoil." (Yarovaya, Mirza, Abaidi, & Hasnaoui, 2021, p. 590)

This conclusion can justify the better return of the Mutual Funds portfolio since 2019, compared to ETFs portfolio' returns.

Accordingly, through empirical observation, these figures show the correlation between ETFs and Mutual Funds. Nevertheless, it is crucial to explore the degree of correlation between these funds and understand whether other variables have major impacts on the funds' performance over the years under analysis.

4.2. Gross monthly returns: regression analysis

After an annual graphical analysis, it is necessary to increase the number of degrees of freedom to obtain more accurate results. Thus, the following analyses will be based on monthly percentage returns. Additionally, the following studies will also be prepared based on representative portfolios with the optimal weights of each fund, indicated in the tables represented in the previous chapter (tables 3.1, 3.2, 3.3 and 3.4).

Then, a linear regression is performed between the gross monthly percentage returns of the Mutual Funds portfolio and the gross monthly percentage returns of the ETFs portfolio.

Figure 4.3 Regression between Mutual Funds portfolio (dependent variable) and ETFs portfolio (independent variable) gross average monthly percentage returns

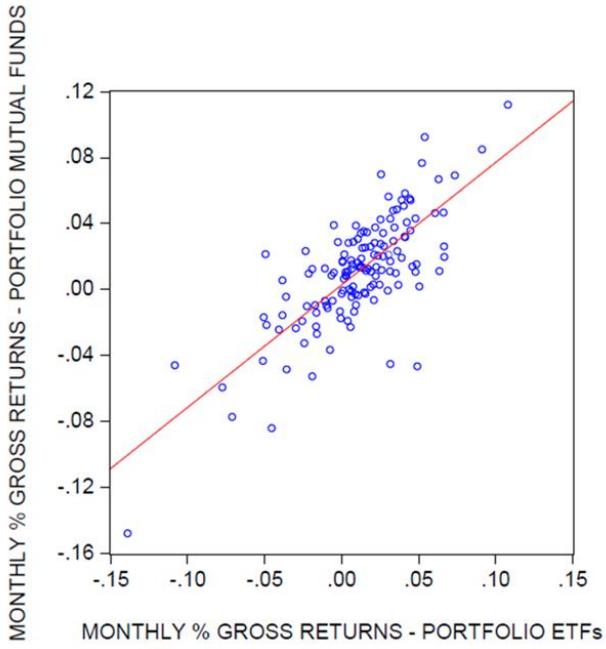


Table 4.1 Details of the linear regression [gross returns]

Dependent Variable: Monthly % Gross Returns - Portfolio MF				
Method: Least Squares				
Sample: 2010M05 2021M12				
Included observations: 140				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
c	0.0028	0.0020	1.4527	0.1486
Monthly % Gross Returns - Portfolio ETFs [Independent Variable]	0.7425	0.0539	13.7800	0.0000
R-squared	0.5791			
Adjusted R-squared	0.5761			

The figure 4.3 and the table 4.1[11] show the results of the linear regression described above. The adjusted R-squared of this regression is approximately 0.58. This means that the variations of ETFs portfolio gross returns explain 58% of the variations of Mutual Funds portfolio gross returns.

Moreover, β_1, the regression coefficient of the Efficient Monthly Gross Returns of the ETFs portfolio, has a value of 0.7425, which reflects that for a 1% of increment of the ETFs portfolio performance, it is expected that the Mutual Fund performance changes 0.7425%, remaining other constant factors. Also, this coefficient is statistically significant (since $t_{obs} \geq t_c$).[12]

Regarding these results and the literature already mentioned, a different result would be expected, since gross returns are used. Appropriately, when costs and transaction fees are not being considered, one would expect better performance from actively managed funds. (Baistrocchi, 2015)

[11] This table shows the results of the linear regression that was performed. According to the equation (3.2), the variable c stands for the values for β_0, the coefficient of the independent variable is β_1. Therefore, the values of this regression are: $Y_t = 0.0028 + 0.7425\ (X_{1t})$. Additionally, R-squared signifies the coefficient of determination R^2. The closer this value is to 1, the better the equation provides a adjust of the data. See Appendix C for more information. The following tables (4.2, 4.3 and 4.4) have a similar interpretation to this one.

[12] T_{obs}=*t-Statistic*≈*13.78;* t_c≈1.98

4.3. Net monthly returns: regression analysis

In the next subchapters of the study, the results are expressed in net returns. As aforementioned, net returns are the funds' returns after the deduction of the transaction costs and other fees associated. Also, net monthly percentage returns are obtained with a variable from Refinitiv Eikon Datastream, and, subsequently, with a few calculations. The second linear regression is elaborated on relating the net monthly percentage returns of the Mutual Funds portfolio and the net monthly percentage returns of the ETFs portfolio.

Figure 4.4 Regression between Mutual Funds portfolio (dependent variable) and ETFs portfolio (independent variable) net average monthly percentage returns

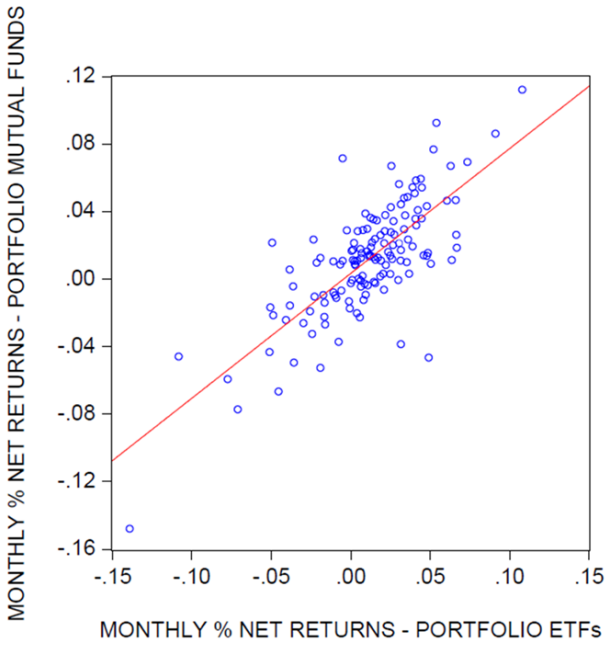


Table 4.2 Details of the linear regression [net returns]

Dependent Variable: Monthly % Net Returns - Portfolio MF				
Method: Least Squares				
Sample: 2010M05 2021M12				
Included observations: 140				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
c	0.0033	0.0020	1.6772	0.0958
Monthly % Net Returns - Portfolio ETFs [Independent Variable]	0.7388	0.0541	13.6451	0.0000
R-squared	0.5743			
Adjusted R-squared	0.5712			

The figure 4.4 and the table 4.2[13] show the results of the linear regression described above, about net returns. The adjusted R-squared of this regression is approximately 0.57. This means that the variations of ETFs portfolio net returns explain 57% of the variations of Mutual Funds portfolio net returns.

Additionally, β_1, the regression coefficient of the Efficient Monthly Net Returns of the ETFs portfolio, has a value of around 0.7388, which reflects that for a 1% of increment of the ETFs portfolio performance, it is expected that the Mutual Fund performance changes 0.7388%, remaining other constant factors. Also, this coefficient is statistically significant (since $t_{obs} \geq t_c$).[14] It is important to discuss the regression coefficient β_0, the regression intercept which, is positive (0.0033) but is not statistically significant (since $t_{obs} < t_c$).[15] Despite being a value without statistical significance, it could represent the managers' skill to manage the Mutual Funds portfolio.

In fact, the results between gross and net returns do not differ substantially, which can be explained by the lack of data and by what was mentioned in the previous subchapter. Nevertheless, according to the data collected, the average of the Total Expense Ratio (TER) for the higher 30 Mutual Funds in Euronext Amsterdam is approximately 1.02, a high value when

[13] See Appendix D
[14] T_{obs}=*t-Statistic*$\approx$*13.65;* $t_c \approx 1.98$
[15] T_{obs}=*t-Statistic*$\approx$*1.68;* $t_c \approx 1.98$

compared to the TER for the 30 ETFs in the same market, which is 0.44. (Refinitiv Eikon Datastream , 2022) Furthermore, it is also interesting to underline the conclusions that Harper et al. (2005, p. 109) mention: "the expense ratio of traditional closed-end funds is substantially higher than the expense ratio of ETFs".

4.4. Performance Measures

4.4.1. Sharpe Ratio analysis

4.4.1.1. Regression line among the funds' Sharpe Ratios

Analysing these measures is important in order to obtain more evidence about the performance of funds. Sharpe ratio is not linked to any specific market, which allows to compare different funds by standardizing the criterion. (Reboredo, 2019) In this way, regressing the Sharpe Ratio of the Mutual Funds portfolio on the Sharpe Ratio of ETFs portfolio, controlling for risk, may provide a considerable outcome on the effective return difference between active and passive management.

Figure 4.5 Regression between Sharpe Ratio of Mutual Funds portfolio (y-axis) and Sharpe Ratio of ETFs portfolio (x-axis)

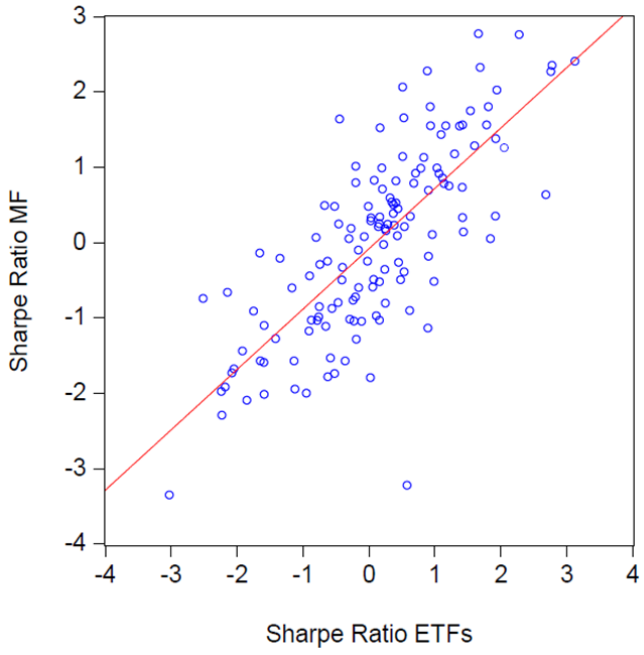


Table 4.3 Details of the linear regression [Sharpe Ratios]

Dependent Variable: Sharpe Ratio - Portfolio MF				
Method: Least Squares				
Sample: 2010M05 2021M12				
Included observations: 140				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
c	-0.0784	0.0689	-1.1369	0.2576
Sharpe Ratio - Portfolio ETFs [Independent Variable]	0.8019	0.0588	13.6422	0.0000
R-squared	0.5742			
Adjusted R-squared	0.5711			

The figure 4.5 and the table 4.3[16] show the results of the linear regression described above, regarding the Sharpe Ratios of the representative portfolios. According to the table 4.3, β_1, the correlation coefficient, is approximately 0.80. Therefore, there is a positive relation between the Sharpe Ratio of Mutual Funds portfolio and the Sharpe Ratio of ETFs portfolio and, likewise, for a 1% increase in the ETFs portfolio' Sharpe Ratio, a 0.80% change in the Mutual Funds' Sharpe Ratio is expected. In addition, this coefficient is statistically significant (since $t_{obs} \geq t_c$)[17], and, as it has a value less than 1, it could represent the over-performance of ETFs in relation to Mutual Funds. As said, a higher Sharpe Ratio means that the portfolio has yield a higher return with respect to the risk that is taken.

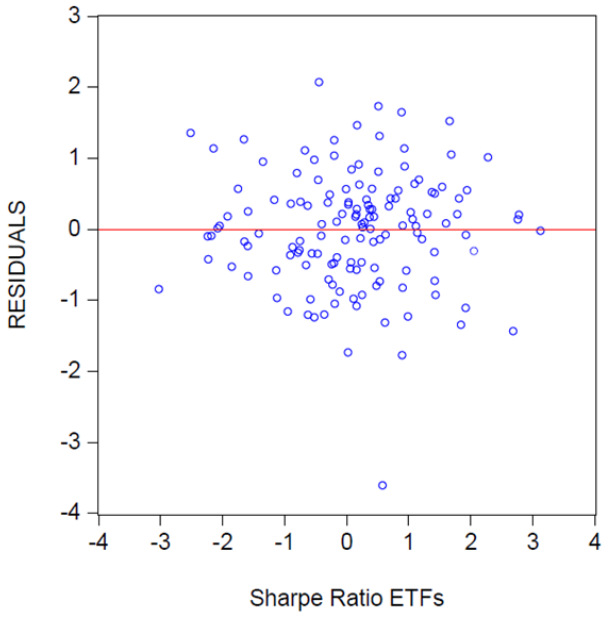
Hence, the ETFs portfolio outperform the Mutual Funds portfolio during the analysed period, when the risk was controlled through the Sharpe Ratios regression. Even considering returns and volatility in the same equation, passive management has better results. Baistrocchi (2015) states that, in face of this situation, active management fees still do not compensate investors. Moreover, even when the risk is monitored, the correlation coefficient has gone up to 0.80 from the earlier 0.74, which can mean a slight difference in relation to considering only net returns.

[16] See Appendix E, Table E.1
[17] T_{obs}=*t-Statistic*≈*13.64;* t_c≈1.98

4.4.1.2. Study of the Residuals

It is important to perform an analysis of the residuals in other to prove if a linear model fits or not the data well. When there is not a good fit, it is necessary to use a non-linear model. Besides that, there is an analyse of the correlation between the residuals and the independent variable, which also indicates whether it is worth reckoning other variables. Then, it is calculated the residuals against the Sharpe Ratio of ETFs portfolio, which is the independent variable.

Figure 4.6 Residual Plot: on the y-axis the residuals of the dependent variable, on the x-axis the Sharpe Ratio of the ETFs portfolio



The figure 4.6 shows the residual plot.[18] As it is possible to observe, the residual plot presents a random patter. This suggests that the linear model utilized adjusts well the analysed data. Another conclusion that can be obtained from the graphical analysis is the inexistence of correlation between the variables presented, since the line that best fits the scatter of point is a straight horizontal line with intercept on the y-axis equal to zero.[19] Accordingly, other variables would not include significant knowledge to the regression.

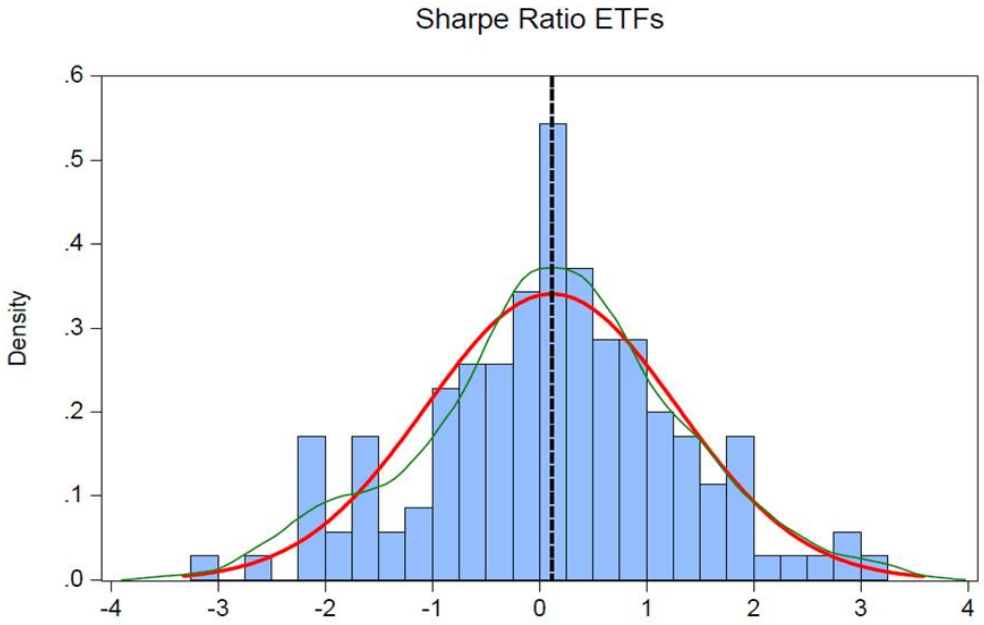
[18] See Appendix E, Table E.2

[19] According to the Table E.2 (Appendix E), it is also possible to confirm this statement because p-value=1.

4.4.1.3. Probability Density Function

A Probability Density Function (PDF) is "a statistical expression that defines a probability distribution (the likelihood of an outcome)". (Kenton, What is Probability Density Funcion (PDF)?, 2020, p. 1) Furthermore, this function could be used to measure the likely outcome of a continuous value, specifically, the Sharpe Ratio for the two portfolios. After the PDF of the Sharpe Ratio of the ETFs portfolio and Mutual Funds portfolio are plotted, it is crucial interpret the Kurtosis[20] and Skewness[21] values for both portfolios. The next figures show the results obtained.

Figure 4.7 Probability Density function of the Sharpe Ratio of ETFs against the standard Probability Density function (red line)

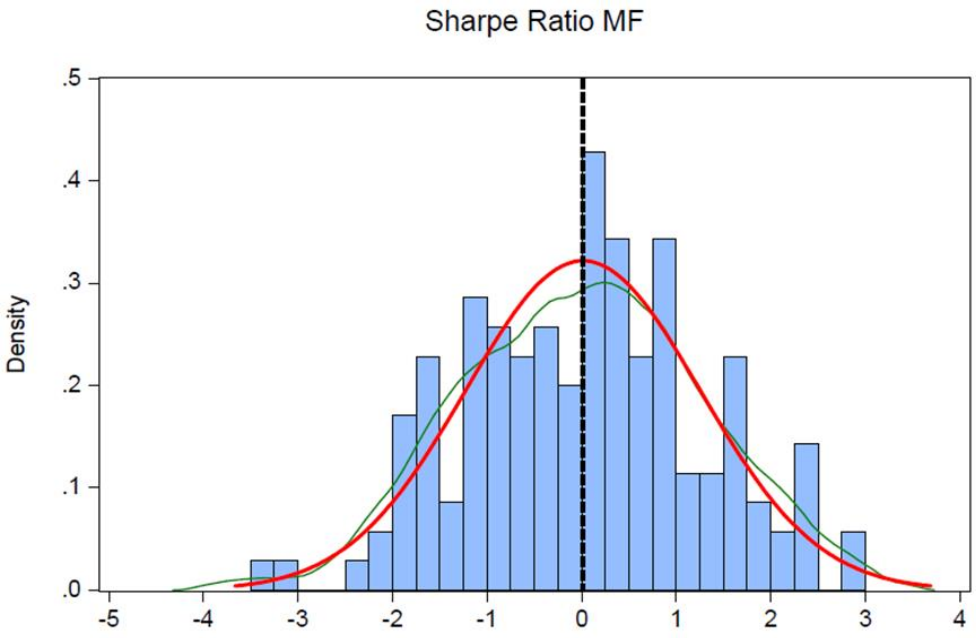


[20] "The Kurtosis determines whether the shape of the data distribution matches the Gaussian distribution." (Baistrocchi, 2015, p. 22)

[21] The Skewness measures the level of asymmetry of the distribution in relation to a symmetrical distribution. (Corporate Finance Institute, 2022)

The figure 4.7 displays the data distribution of the ETFs portfolio' Sharpe Ratio, contrasted to the normal distribution (Gaussian Model).[22] Additionally, it is possible to see the mean value (0.1152) represented by the dashed vertical line. The Skewness is equal to -0.1, which means that the distribution is slightly long-tailed to the left or, in other words, lightly shifted to the right. Moreover, the Kurtosis has a K value of 3.03, which indicates that the data of the Sharpe Ratio of the ETFs portfolio follows almost a normal distribution. (Kenton, Kurtosis, 2021)

Figure 4.8 Probability Density function of the Sharpe Ratio of Mutual Funds against the standard Probability Density function (red line)



[22] See Appendix E, Figure E.1

The figure 4.8 presents the data distribution of the Mutual Funds portfolio' Sharpe Ratio, contrasted to the normal distribution.[23] Additionally, it is possible to look at the mean value (0.0140) symbolized by the dashed vertical line. The Skewness has, as in the previous distribution, a negative value, which is equal to approximately -0.06. This value does not diverge significantly from the standard value of 0 and indicates that the distribution is slightly shifted to the right. Furthermore, the Kurtosis has a K value of 2.67, which is close to 3. Thus, the values of the Sharpe Ratio of the Mutual Funds portfolio can be interpreted as predictable and stable. (Kenton, Kurtosis, 2021)

This approach is a strong implement to determine the probability of losses or gains of the two portfolios with respect to their mean values of the Sharpe Ratios. The findings show a greater dispersion of data related to the Sharpe Ratio of Mutual Funds portfolio.[24] In addition, the distribution of data related to the Sharpe Ratio of the Mutual Funds portfolio may have less extremes as it has the lowest Kurtosis value (but very little difference compared to the Sharpe Ratio of the ETFs portfolio data).

According to the outcomes, the probability of obtaining a return higher than the mean value of the Sharpe Ratio is greater than the probability of obtaining inferior returns, for both portfolios.[25]

After all, although it is possible to make comparisons between the two representative portfolios, these are not very significant (since the difference between the results is low).

[23] See Appendix E, Figure E.2
[24] The value of the standard deviation is greater for the Sharpe Ratio of the Mutual Funds portfolio data than for the Sharpe Ratio of the ETFs portfolio data.
[25] This can be verified a little more in the ETFs portfolio since it has a more negative value of Skewness.

4.4.2. Treynor Ratio analysis

4.4.2.1. Regression line among the funds' Treynor Ratios

Treynor ratio is other important measure to compare the funds. In this ratio, it is taking into account the systematic risk, utilizing the beta of each portfolio as the divisor. Therefore, the higher the value of the Treynor Ratio, the better the returns of the portfolio in relation to its systematic risk. Thus, regressing the Treynor Ratio of the Mutual Funds portfolio on the Treynor Ratio of ETFs portfolio, adjusting for systematic risk, may present good results relative to the comparison between the performance of passive and active management.

Figure 4.9 Regression between Treynor Ratio of Mutual Funds portfolio (y-axis) and Treynor Ratio of ETFs portfolio (x-axis)

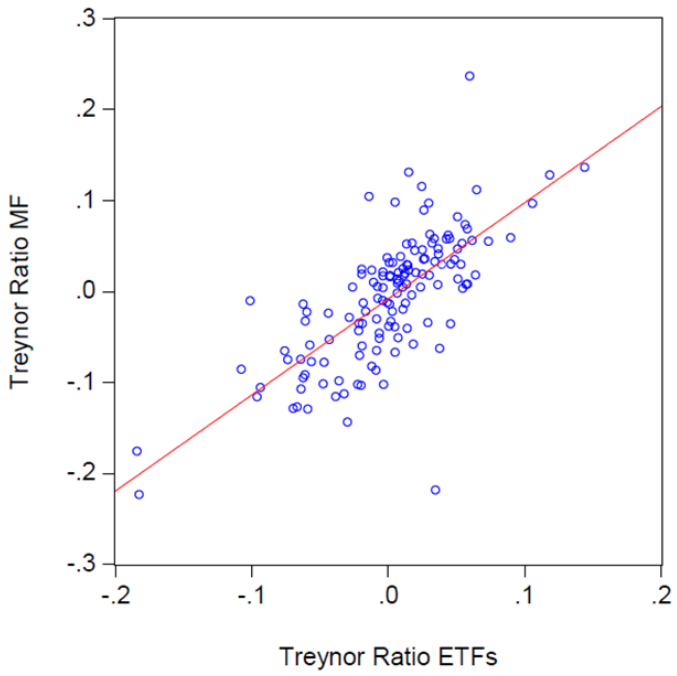


Table 4.4 Details of the linear regression [Treynor Ratios]

Dependent Variable: Treynor Ratio - Portfolio MF				
Method: Least Squares				
Sample: 2010M05 2021M12				
Included observations: 140				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
c	-0.0081	0.0042	-1.9467	0.0536
Treynor Ratio - Portfolio ETFs [Independent Variable]	1.0570	0.0863	12.2502	0.0000
R-squared	0.5209			
Adjusted R-squared	0.5175			

The figure 4.9 and the table 4.4[26] show the results of the linear regression described above, regarding the Treynor Ratios of the representative portfolios. According to the table 4.4, β_1, the correlation coefficient, is approximately 1.06. Therefore, there is a positive relation between the Treynor Ratio of Mutual Funds portfolio and the Treynor Ratio of ETFs portfolio and, also, for a 1% increase in the ETFs portfolio' Treynor Ratio, a 1.06% change in the Mutual Funds' Treynor Ratio is expected. In addition, this coefficient is statistically significant (since $t_{obs} \geq t_c$).[27]

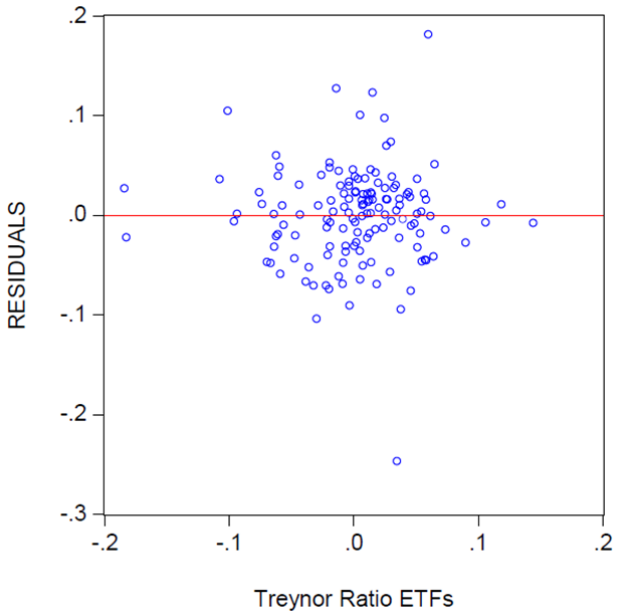
Indeed, when only risk systematic is controlled, there is a change in terms of results. This regression shows a value of β_1 above 1, which means a better performance of the Mutual Funds portfolio' Treynor Ratios.

[26] See Appendix F, Table F.1
[27] T_{obs}=*t-Statistic*≈*12.25;* t_c≈1.98

4.4.2.2. Study of the Residuals

As previously mentioned, it is important to perform an analysis of the residuals in other to prove if a linear model fits or not the data well. When there is not a good fit, it is necessary to use a non-linear model. Besides that, there is an analyse of the correlation between the residuals and the independent variable, which also indicates whether it is worth reckoning other variables. Then, it is calculated the residuals against the Treynor Ratio of ETFs portfolio, which is the independent variable.

Figure 4.10 Residual Plot: on the y-axis the residuals of the dependent variable, on the x-axis the Treynor Ratio of the ETFs portfolio



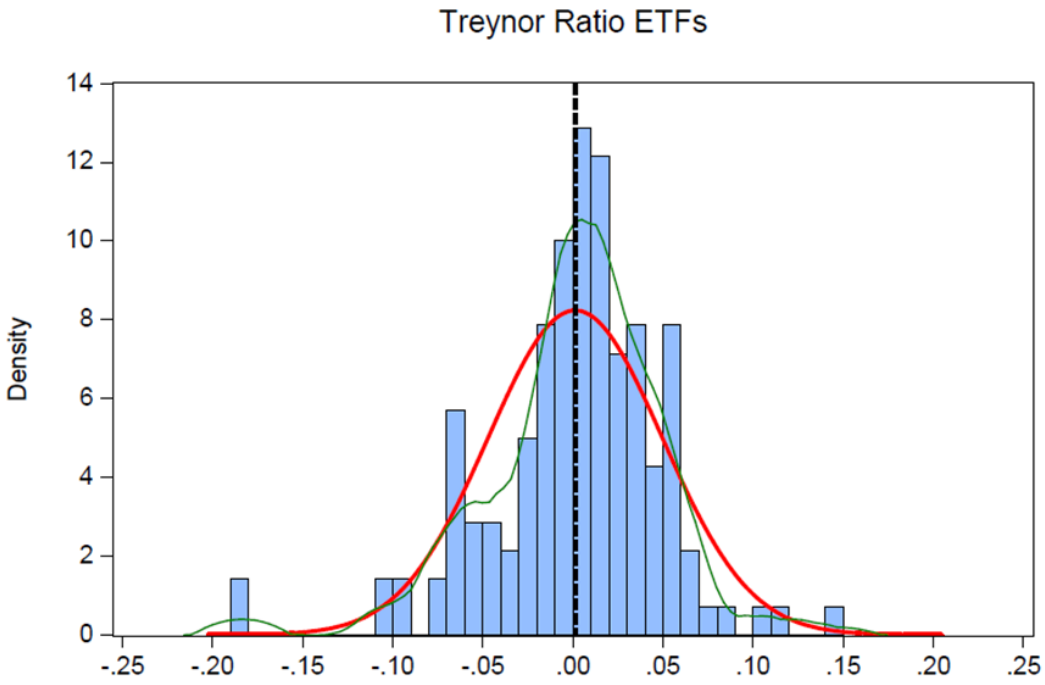
The figure 4.10 shows the residual plot.[28] As it is possible to observe, the residual plot presents a random patter. This suggests that the linear model utilized adjusts well the analysed data. Another conclusion that can be obtained from the graphical analysis is the inexistence of correlation between the variables presented. Therefore, other variables would not include significant knowledge to the regression.

[28] See Appendix F, Table F.2

4.4.2.3. Probability Density Function

It is also important to examine the probability density function of the ETFs' and Mutual Funds' portfolios.

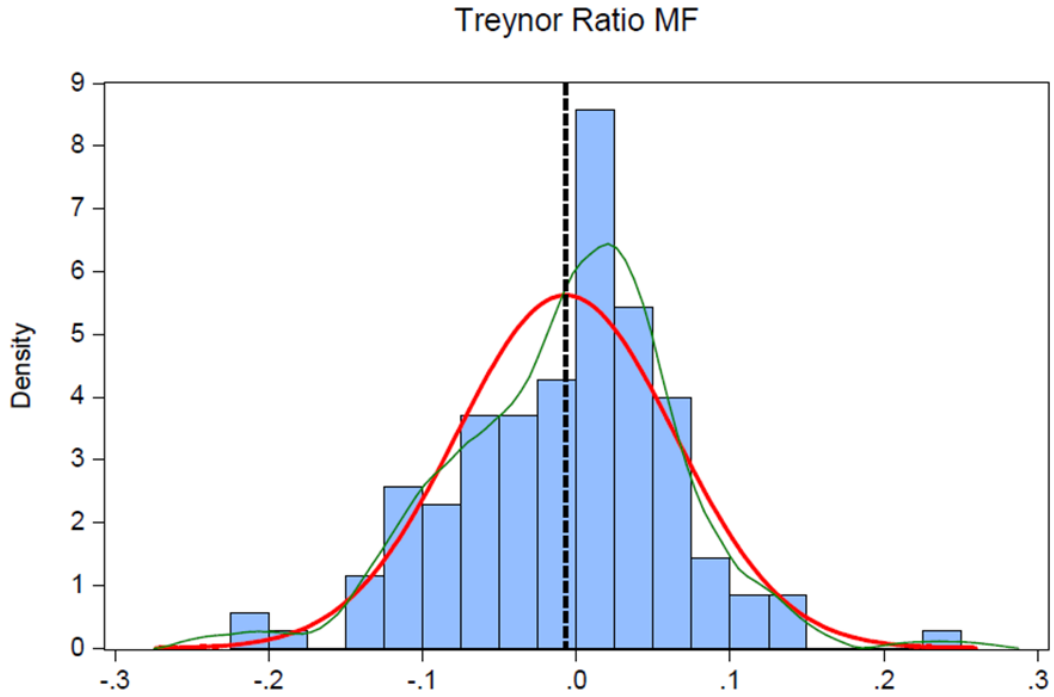
Figure 4.11 Probability Density function of the Treynor Ratio of ETFs against the standard Probability Density function (red line)



The figure 4.11 displays the data distribution of the ETFs portfolio' Treynor Ratio, contrasted to the normal distribution.[29] Additionally, it is possible to see the mean value (0.0013) represented by the dotted vertical line. The Skewness is equal to -0.71, which means that the distribution is slightly long-tailed to the left or, in other words, lightly shifted to the right. Moreover, the Kurtosis has a K value of 5.33, which indicates that this distribution could have high extremes. Thus, the data of the Treynor Ratio of the ETFs portfolio has some outliers, which could stretch the horizontal axis of the histogram graph (as it is displayed in figure 4.11). (Kenton, Kurtosis, 2021)

[29] See Appendix F, Figure F.1

Figure 4.12 Probability Density function of the Treynor Ratio of Mutual Funds against the standard Probability Density function (red line)



The figure 4.12 presents the data distribution of the Mutual Funds portfolio' Treynor Ratio, in comparison to the normal distribution.[30] Additionally, it is possible to look at the mean value (-0.0068) symbolized by the dotted vertical line. The Skewness has, as in the previous distribution, a negative value, which is equal to approximately -0.21. This value does not diverge significantly from the standard value of 0 and shows that the distribution is slightly shifted to the right. Furthermore, the Kurtosis has a K value of 3.88, which is close to 3.

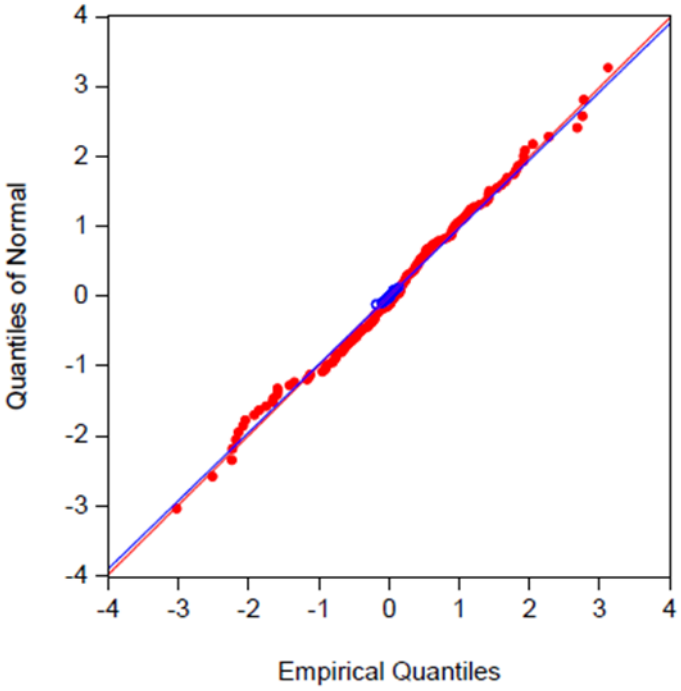
In this way, the Sharpe Ratio of the Mutual Funds portfolio data can be interpreted as predictable and stable, compared to the Sharpe Ratio of the ETFs portfolio data. Another interesting result is the fact that the average value of the Treynor Ratio data is higher for the ETFs portfolio. This portfolio also has a lower standard deviation and, consequently, less data dispersion.

[30] See Appendix F, Figure F.2

4.5. The Shapiro-Wilk Test

To support all the results obtained until here, it is necessary to perform normality tests to conclude, with more certainty, the normality of the data. (Razali & Wah, 2011) Thus, after the graphical and numerical methods, the Shapiro-Wilk Test is executed for the performance measures of both portfolios. The null hypothesis of the Shapiro-Wilk Test (H_0) is: The distribution is normal. The alternative hypothesis (H_1) states that the distribution is not normal. Accordingly, if the p-value is greater than the level of significance chosen[31], the null hypothesis can not be rejected and, consequently, the data follows a normal distribution. To complement this test hypothesis, it is presented a normal quantile-quantile plot (Q-Q plot).[32]

Figure 4.13 Q-Q plot for ETFs portfolio' performance measures [Red: Sharpe Ratio; Blue: Treynor Ratio]



[31] The standard alpha levels are: 1%, 5%, and 10%.
[32] "The normal quantile-quantile plot (Q-Q plot) is the most commonly used and effective diagnostic tool for checking normality of the data." (Razali & Wah, 2011, p. 21)

Table 4.5 Shapiro-Wilk Test for the ETFs Portfolio

Normality Test			
Sample: 2010M05 2021M12			
Included observations: 140			
Performance Measure	Test	Statistic	Prob.
Sharpe Ratio	Shapiro-Wilk	0.9914	0.5571
Treynor Ratio	Shapiro-Wilk	0.9538	0.0001

Following the results (figure 4.13 and table 4.5) presented above, there are some slight deviations from the diagonal. Therefore, for the data related to the Sharpe Ratio, the p-value displays evidence to state that the data is normally distributed. Nevertheless, regarding the data of the Treynor Ratio for the ETFs portfolio, the p-value has a low value, leading to the rejection of the null hypothesis.

Figure 4.14 Q-Q plot for Mutual Funds portfolio' performance measures [Red: Sharpe Ratio; Blue: Treynor Ratio]

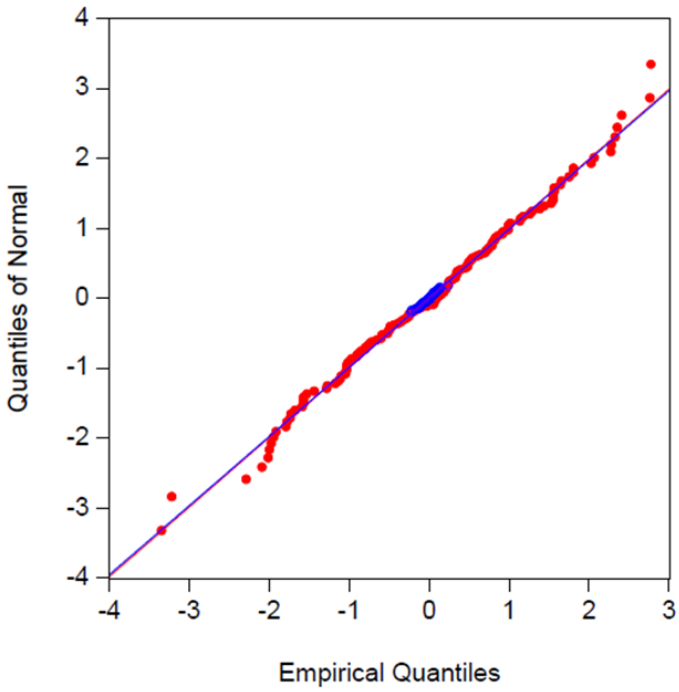


Table 4.6 Shapiro-Wilk Test for the Mutual Funds Portfolio

Normality Test			
Sample: 2010M05 2021M12			
Included observations: 140			
Performance Measure	Test	Statistic	Prob.
Sharpe Ratio	Shapiro-Wilk	0.9924	0.6583
Treynor Ratio	Shapiro-Wilk	0.9809	0.0475

According to the results (figure 4.14 and table 4.6) displayed above, there are also some slight deviations from the diagonal. Notwithstanding these deviations, both Mutual Funds portfolio performance measures have data that follows a normal distribution. Through the table 4.6, both p-values are greater than the standard alpha levels. So, it is possible to confirm this statement.

To conclude, data related to Treynor Ratio will have to be neglected, as the ETFs portfolio data does not follow a normal distribution (the distribution asymmetry is substantial). Therefore, for an assertive comparison, only the Sharpe Ratio will be used as a performance measure (risk-adjusted returns).

Finalizing, these analyses indicate that passive management, through an ETFs portfolio, provides better risk-adjusted returns than active management, through a Mutual Funds portfolio. These results are similar to some literature already mentioned, such as Harper et al. (2005).

5. Conclusions

Understanding the difference between passive and active management is crucial for the day-to-day of an investor. The research already conducted on the topic has divergent interpretations, and, consequently, different results. The results of this study are essential not only because it is implemented in a specific market, Euronext Amsterdam, but also due to the period of analysis. During the last twelve years, a lot of events happened in financial markets. Therefore, it is important to explore how performed these funds over the years.

The empirical research realized in this dissertation utilizes data regarding the ETFs and Mutual Funds in the period 2010-2021. Initially, in an overview, the average annual net return of the sample is 13.86% for the ETFs portfolio and 13.07% for the Mutual Funds portfolio, remembering that these portfolios have equal weights for the corresponding financial instruments.

Afterwards, through the formation of four representative portfolios, the main goal is to research regarding performance and risk. Note that, these portfolios are created optimizing ex-post returns and minimizing standard deviations in each year. Firstly, regressing the Mutual Funds portfolio over the ETFs portfolio, either in terms of gross returns or in terms of net returns, for a 1% increase in the ETFs portfolio' performance, there is a change of approximately 0.7% in the Mutual Funds portfolio' performance. Visibly, it is possible to perceive how passive management outperforms active management. However, in this study, it is inconceivable to identify whether there are cost advantages in ETFs, as it is feasible to observe in some studies, like Sharpe (1966). Even though, the available Total Expense Ratio is higher for Mutual Funds than for ETFs. O'Shea (2022) affirms the ETFs' cost advantages as well as their diversification benefits. (O'Shea, 2022)

Secondly, to achieve more empirical evidence, it is performed two performance measures, the Sharpe Ratio, and the Treynor Ratio. For these ratios, the analysis is done through a regression, a probability density function, and, finally, the Shapiro-Wilk test, to confirm the validity of the conclusions. This last test only validates the results related to the Sharpe Ratio.

Therefore, the Sharpe Ratio regression finds out that, even adjusting the risk, the ETFs portfolio performs better than the Mutual Funds portfolio. Additionally, considering the market volatility,

ETFs portfolio has a higher probability to have higher risk-adjusted returns concerning mean, when compared to the Sharpe Ratio of the Mutual Funds portfolio.

Concluding, it is important to highlight some limitations of this essay. The criterium used to select the funds, the highest average return value of Mutual Funds and ETFs, may not be the most accurate for an adequate comparison between the investment management strategies. For instance, Malhotra and Mc Leod (2000) propose that investors must incorporate the expense ratio as a criterion for fund selection in addition to performance, risk and financing goals. Additionally, the results of this study are particularly related to the ETFs portfolio as a representative of passive management and the Mutual Funds portfolio as a representative of active management. According to Kremnitzer (2012), ETFs are considered good proxies for passive fund performance in general. In addition, throughout the study, it is considered a risk-averse and profit-maximizing investor. But there is no reference to any other characteristics of the investor, nor about the investment period. In this sense, forthcoming research should consider better assumptions not only for selection criteria but also for investors.

Finally, it might also be interesting to understand whether ETFs and Mutual Funds can be deployed in retirement account portfolios in the future and if their application will become of high significance to the common citizen. (Kremnitzer, 2012) The comparison between ETFs versus Mutual Funds continues to be a topic of enormous interest. Thus, it could be explored from different perspectives, such as in different markets and with varying measures of performance.

Appendix

Appendix A – Descriptive Statistics of the sample summary

Table A.1 Summary of descriptive statistics of the fund sample from 2010 to 2021

		Financial Instruments	
Descriptive Statistics		30 ETFs	30 Mutual Funds
Net Returns (%)	Number of observations	4200	4200
	Maximum monthly return	18.7610%	31.4801%
	Minimum monthly return	-27.2457%	-30.1077%
	Average monthly return	0.8798%	0.8230%
	Median monthly return	1.2371%	0.8416%
	Standard Deviation	0.0472	0.0435
Total Expense Ratio (TER)	Number of observations	4146	2862
	Maximum TER	0.7500	3.8700
	Minimum TER	0.0700	0.2600
	Average value	0.4389	1.0196
	Median value	0.4000	0.8700
Gross Returns (%)	Number of observations	4146	2862
	Maximum monthly return	18.7580%	31.4686%
	Minimum monthly return	-27.2410%	-32.8416%
	Average monthly return	0.8935%	0.9227%
	Median monthly return	1.2452%	0.0109
	Standard Deviation	0.0468	0.0445

Source: (Refinitiv Eikon Datastream , 2022)

Appendix B – Details related to the funds that constitute both portfolios

Table B.1 Details related to the funds that constitute the ETFs' portfolio

Exchanged-Traded Funds (ETFs)' Portfolio				
ETF Legal Name	Type – Subtype	Issuer Name	Launch Date	Underlying index
iShares Core S&P 500 UCITS ETF USD (Dist)	ETP[33] – ETF	iShares plc.	02/07/2004	S&P 500
iShares MSCI North America UCITS ETF	ETP – ETF	iShares plc.	11/07/2006	MSCI North America
SPDR Dow Jones Industrial Average ETF Trust	ETP – ETF	PDR Services LLC	01/03/2010	Dow Jones Industrial Average
iShares Core MSCI World UCITS ETF USD (Acc)	ETP – ETF	iShares III plc.	12/10/2009	MSCI World

Source: (Euronext Amsterdam, 2022)

Table B.2 Details related to the funds that constitute the Mutual Funds' portfolio

Mutual Funds' Portfolio				
Fund Name	Type – Subtype	Issuer Name	Issuer country	Morningstar Category
NN Europa Duurzaam Aandelen Fonds N.V.	Funds – EU Closed Ended Fund	NN Europa Duurzaam Aandelen Fo	Netherlands	Shares Europe Flex-Cap
NN Equity Investment Fund N.V.	Funds – EU Closed Ended Fund	NN Equity Investment Fund N.V.	Netherlands	Global Large-Cap Growth Equities
ASN DUURZAAM AANDELENFONDS	Funds – EU Closed Ended Fund	ASN BELEGGINGSFONDSEN UCITS N.	Netherlands	Global Large-Cap Mixed Equities
ROBECO GLOBAL STARS EQUITIES FUND	Funds – EU Closed Ended Fund	Robeco Asset Management		Global Large-Cap Blend Equity

Source: (Euronext Amsterdam, 2022) and (Morningstar, 2022)

[33] ETP = Exchange-Traded Product

Appendix C – Linear regression complete data [Gross Returns]

Table C.1 Linear regression complete data [Gross Returns]

Dependent Variable: MONTH_GROSSRET_PORT_MF
Method: Least Squares
Sample: 2010M05 2021M12
Included observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002842	0.001957	1.452666	0.1486
MONTH_GROSSRET_PORT_ET	0.742500	0.053882	13.77999	0.0000

R-squared	0.579125	Mean dependent var	0.011136
Adjusted R-squared	0.576075	S.D. dependent var	0.033834
S.E. of regression	0.022029	Akaike info criterion	-4.778731
Sum squared resid	0.066968	Schwarz criterion	-4.736707
Log likelihood	336.5111	Hannan-Quinn criter.	-4.761654
F-statistic	189.8882	Durbin-Watson stat	2.222594
Prob(F-statistic)	0.000000		

Appendix D – Linear regression complete data [Net Returns]

Table D.1 Linear regression complete data [Net Returns]

Dependent Variable: MONTH_NETRET_PORT_MF
Method: Least Squares
Sample: 2010M05 2021M12
Included observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003299	0.001967	1.677226	0.0958
MONTH_NETRET_PORT_ET	0.738753	0.054140	13.64514	0.0000

R-squared	0.574324	Mean dependent var	0.011569
Adjusted R-squared	0.571239	S.D. dependent var	0.033812
S.E. of regression	0.022140	Akaike info criterion	-4.768690
Sum squared resid	0.067644	Schwarz criterion	-4.726667
Log likelihood	335.8083	Hannan-Quinn criter.	-4.751613
F-statistic	186.1900	Durbin-Watson stat	2.228469
Prob(F-statistic)	0.000000		

Appendix E – Sharpe Ratio results summary

Table E.1 Linear regression complete data [Sharpe Ratio]

Dependent Variable: SHARPE_RATIO_MF
Method: Least Squares
Sample: 2010M05 2021M12
Included observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.078380	0.068944	-1.136875	0.2576
SHARPE_RATIO_ET	0.801946	0.058784	13.64218	0.0000

R-squared	0.574217	Mean dependent var	0.014010
Adjusted R-squared	0.571132	S.D. dependent var	1.239626
S.E. of regression	0.811807	Akaike info criterion	2.435074
Sum squared resid	90.94617	Schwarz criterion	2.477097
Log likelihood	-168.4552	Hannan-Quinn criter.	2.452151
F-statistic	186.1090	Durbin-Watson stat	1.980547
Prob(F-statistic)	0.000000		

Table E.2 Details of the linear regression between the residuals (dependent variable) and the Sharpe Ratio of ETFs portfolio (independent variable)

Dependent Variable: RESIDUALS
Method: Least Squares
Sample: 2010M05 2021M12
Included observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.60E-17	0.068944	-3.77E-16	1.0000
SHARPE_RATIO_ET	5.64E-18	0.058784	9.59E-17	1.0000

R-squared	0.000000	Mean dependent var	-7.69E-17
Adjusted R-squared	-0.007246	S.D. dependent var	0.808881
S.E. of regression	0.811807	Akaike info criterion	2.435074
Sum squared resid	90.94617	Schwarz criterion	2.477097
Log likelihood	-168.4552	Hannan-Quinn criter.	2.452151
Durbin-Watson stat	1.980547		

Figure E.1 Sharpe Ratio of the ETFs portfolio' data: histogram and descriptive statistics

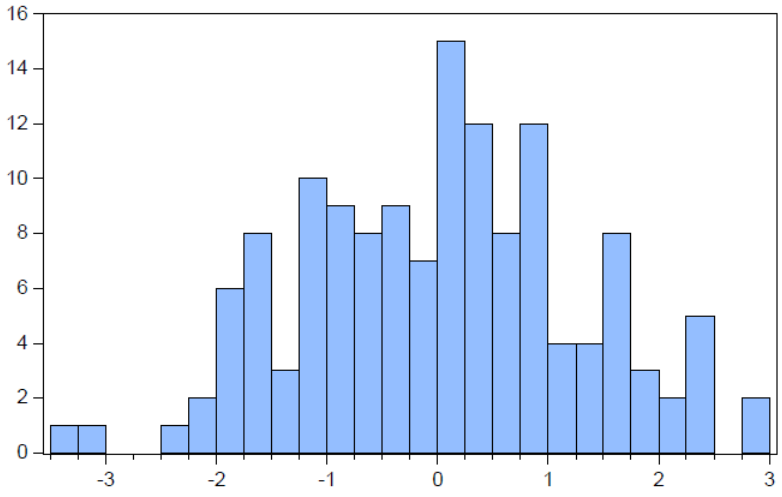
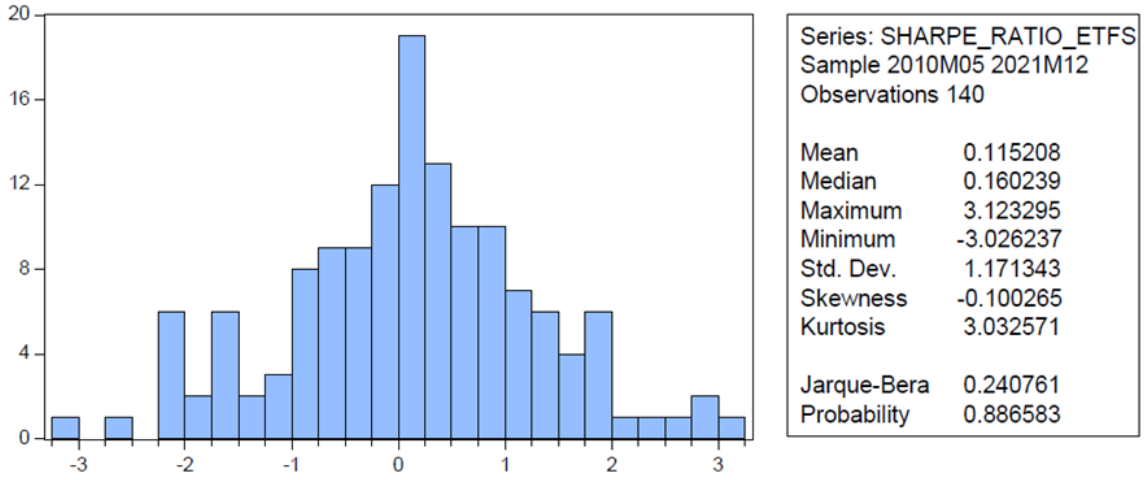


Figure E.2 Sharpe Ratio of the Mutual Funds portfolio' data: histogram and descriptive statistics



Appendix F – Treynor Ratio results summary

Table F.1 Linear regression complete data [Treynor Ratio]

Dependent Variable: TREYNOR_RATIO_MF
Method: Least Squares
Sample: 2010M05 2021M12
Included observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.008107	0.004164	-1.946707	0.0536
TREYNOR_RATIO_ET	1.057024	0.086286	12.25024	0.0000

R-squared	0.520947	Mean dependent var	-0.006768
Adjusted R-squared	0.517476	S.D. dependent var	0.070908
S.E. of regression	0.049256	Akaike info criterion	-3.169396
Sum squared resid	0.334807	Schwarz criterion	-3.127372
Log likelihood	223.8577	Hannan-Quinn criter.	-3.152319
F-statistic	150.0684	Durbin-Watson stat	1.943038
Prob(F-statistic)	0.000000		

Table F.2 Details of the linear regression between the residuals (dependent variable) and the Treynor Ratio of ETFs portfolio (independent variable)

Dependent Variable: RESIDUALS
Method: Least Squares
Sample: 2010M05 2021M12
Included observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.97E-18	0.004164	7.13E-16	1.0000
TREYNOR_RATIO_ET	1.59E-16	0.086286	1.85E-15	1.0000

R-squared	0.000000	Mean dependent var	2.42E-18
Adjusted R-squared	-0.007246	S.D. dependent var	0.049078
S.E. of regression	0.049256	Akaike info criterion	-3.169396
Sum squared resid	0.334807	Schwarz criterion	-3.127372
Log likelihood	223.8577	Hannan-Quinn criter.	-3.152319
Durbin-Watson stat	1.943038		

Figure F.1 Treynor Ratio of the ETFs portfolio' data: histogram and descriptive statistics

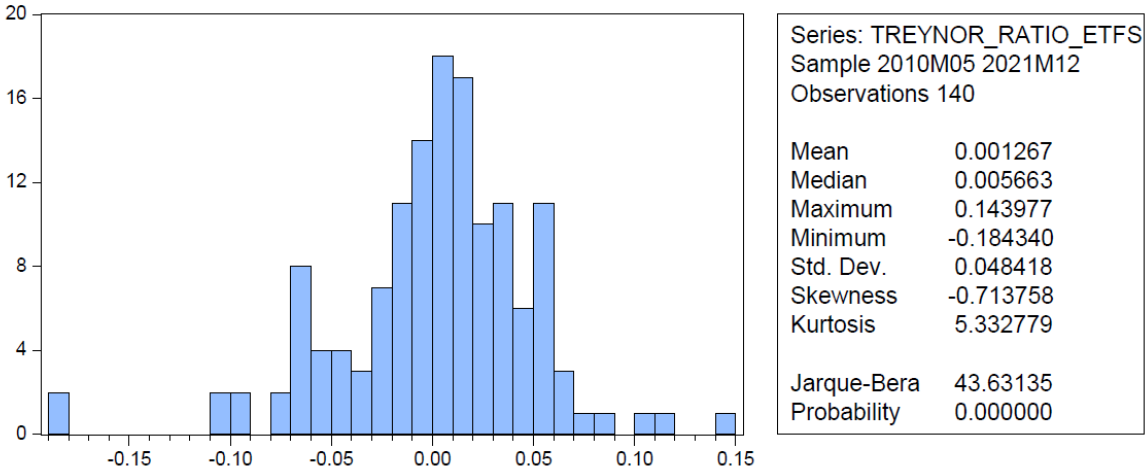
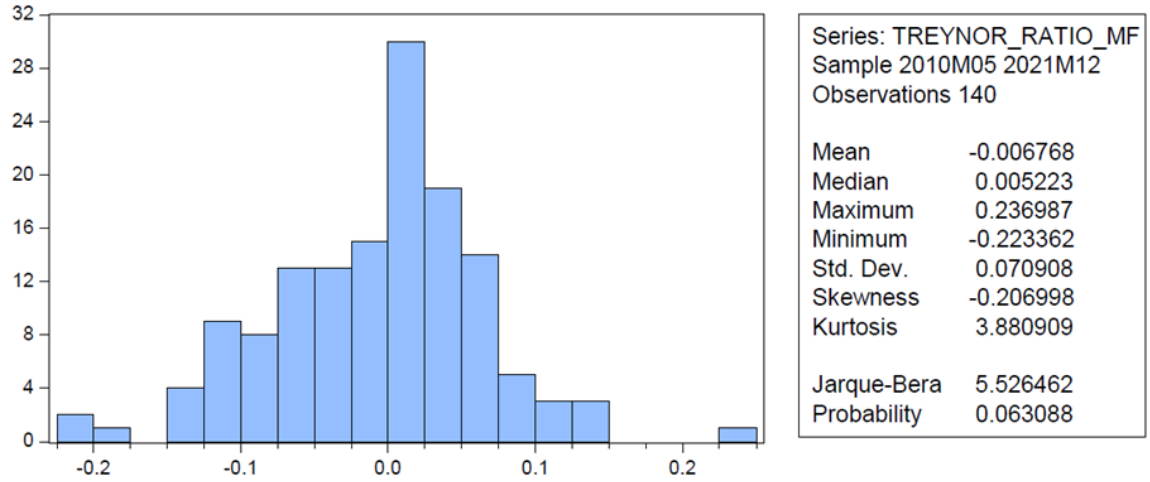


Figure F.2 Treynor Ratio of the Mutual Funds portfolio' data: histogram and descriptive statistics



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