DEPARTMENT OF ECONOMICS AND FINANCE

Chair: Asset Management

Equity Mutual Funds

Performance in the Italian Financial Market

Prof. Paolo Porchia
Supervisor

Prof. Nicola Borri
Co-Supervisor

Cecilia Zaghini (ID 696071)
Candidate

Academic Year 2019/2020

Index

Introduction

Investing in equity mutual funds is becoming increasingly popular around the world. Although the investment presents a certain degree of risk, the funds are managed by professionals whose role is finalized to eliminate part of it through the diversification of the assets. Among the universe of financial instruments, mutual funds are still considered as a relatively safe investment with modest returns, they are attractive especially to long-term investors, who adopt them as one of the major financial tools to grow their wealth and save for retirement.

Throughout this last decade, an upward trend is witnessed in the development of the mutual fund industry. The number of mutual funds worldwide augmented by 43.36% in ten years, from nearly 83 thousand in 2009 to almost 119 thousand in 2018. By the end of 2018, about 100 million individual Americans invested US$ 18.9 trillion in mutual funds. In Europe, in the same period mutual funds' assets under management accounted for about half the size of the US industry. Based on total assets, the six main European mutual fund markets are France, Italy, United Kingdom, Spain, Germany and the Netherlands, together accounting for almost 90% of total mutual fund assets in Europe. Overall the total net assets in the United States is significantly higher than in Europe. However, the total number of European mutual funds exceed the US ones. In all the countries, the mutual fund market developed at a constant increasing pace, with a slight decrease in 2008, as a consequence of the financial crisis.

This dissertation focuses on studying the performance and the performance persistence of open-end equity mutual funds all registered to sell in the Italian market by means of multiple analyses. The period under examination goes from January 2009 to December 2019. The work is organized in three chapters. The first chapter describes the theoretical framework of the financial instrument of mutual funds, the pillars upon which are organized and managed. Subsequently, it is exposed specific law requirements regarding the portfolio structures that mutual funds must accomplish, instituted by the Investment Company Act of 1940. In the next section, it is outlined the three distinct types of mutual funds, diverging in the way share sales and redemptions are handled: open-end mutual funds, closed-end funds and exchange traded funds. A further categorization of funds is based on the nature of their principal investments: stock or equity, bond or fixed income funds, hybrid or balanced funds and money market funds. To follow, a comparison between the evolution of mutual funds in Europe and in the United States and their distribution among the different types. Successively, it is presented the diverging literature of mutual fund performance, the determinants that affect it and the persistence in the performance results, for both Europe and the United

States. It is then addressed the topic of self-designated benchmark indexes and how they can strategically influence the funds' flows and thus the performance. The last section of the first chapter tackles the increasing investments in a specific category which faced a momentous development in the financial market in the last 30 years, the social and ethical mutual funds. Its main characteristics are exposed and it is carried out a comparison between its performance and the one of conventional mutual funds. The second chapter describes the data and the methodology adopted in this study. In the third chapter, it is presented the empirical results, a detailed analysis of the resulting data and an economic interpretation on the overall performance of open-end equity mutual funds. The last section concludes by summarizing and elaborating the findings.

CHAPTER I - Mutual Funds

1.1 The financial instrument of mutual funds

"Funds give savers of even modest means access to top-quality investment management combined with a high level of convenience and service, all at a reasonable price." (Don Phillips)

At the end of 2018, approximately 101.6 million of individuals in the United States invested a portion of their money through a fund. Particular attention goes to the term through rather than in a fund. This precise terminology is adopted because a mutual fund is not an investment itself but it is a financial intermediary. Mutual funds ease both individuals and institutions, as corporations, foundations or pension funds, to pool their money together to buy stocks, bonds, and other investments. The word 'mutual' in front of 'fund' highlights its main characteristic that all expenses and all returns, for instance interests, dividends, and capital gains, are shared among the fund's investors.

Mutual funds are financial vehicles pulling investors' capital to buy a diversified portfolio of financial instruments. Mutual funds invest money in different asset classes, representing the kinds of securities they invest in, such as stocks, bonds or money market instruments, depending on its investment fund strategy and on the type of returns they seek. The fund's portfolio is structured and maintained to match all investment objectives identified in its prospectus. Considering the economic climate, investors are appealed differently by these fund types. Although investing in mutual funds still presents a certain degree of risk, its practice is becoming more and more common around the world. Fund assets are managed by professionals, whose task is eliminating part of the risk involved in investments of individual stocks and bonds through the diversification of assets.

Mutual funds are one of the major financial tools adopted by investors to grow their wealth and save for retirement. These funds provide an easy, relatively safe investment option that present modest returns, appealing especially to long-term investors. Since 2000, over two out of five US households have owned mutual funds and the total net assets have more than doubled. In 2018, about 100 million individual Americans invested US$ 18.9 trillion in mutual funds[1]. The total worldwide assets invested in regulated open-end funds amounted to US$ 46.7 trillion.

1.1.1 Purchasing and selling fund shares

The market for mutual funds presents several channels for distribution, through direct sales, through financial intermediaries as well as through retirement plans.

Traders in the marketplace do not establish the fund's share price, which instead is equal to the fund's net asset value (NAV). NAV= (Assets – Liabilities)/Number of shares outstanding. Purchasing a share, investors pay the offering price corresponding to the NAV and, if present, the sales load. When selling, they gain back the NAV, reduced by any redemption fees. In a fund, liabilities are generated by complex investment strategies, as short selling or option writing. Also the borrowings of a fund, for example to meet redemptions or to create leverage, will appear as liabilities. Finally, funds' liabilities will be accrued by the fees to be paid to providers of services, for example investment management.

By law, every day the New York Stock Exchange is open, a mutual fund must buy back, or redeem, its shares according to its investors' willingness. In particular cases in which a fund intends to suspend redemptions, due to dire emergency or severe disruptions in the markets, it must first receive permission from the Securities and Exchange Commission (SEC). An exception is made for money market funds, which are allowed to stop redemptions without SEC approval.

The ability to sell almost instantaneously a mutual fund position is a major benefit for investors, but not for the fund itself. Daily redemptions imply that funds must calculate NAV every day and the process of doing so is not as simple. It is extremely demanding for any fund, and in particular for those with many positions or complex investments, to enter securities transactions, record liabilities, reconcile holdings and calculate all positions meticulously on a tight schedule. Furthermore, investment portfolios must be

[1] Investment Company Institute. (2019). *INVESTMENT COMPANY FACT BOOK, A Review of Trends and Activities in the Investment Company Industry 2019.* Retrieved March 18, 2020, from ICI: https://www.ici.org/pdf/2019_factbook.pdf

structured in a way that enables the funds to raise cash rapidly, in order to meet any level of withdrawal requests. Rules regarding portfolio structure were indicated in the Investment Company Act of 1940. In order to accomplish this, it limited portfolio holdings in two ways by shrinking borrowings and setting standards for diversification. Firstly, by law, the value of a fund's borrowings cannot exceed one-third of the value of its assets. The borrowings of a fund are collateralized, or secured, by fund assets, meaning that those assets cannot be sold unless the loans are paid off. Secondly, compliant with the 1940 Act, as regards to 75 percent of the assets, diversified funds cannot invest more than 5 percent of total fund assets within a single investment and the owned voting securities cannot exceed 10 percent of a single company. As for the other 25 percent, they have complete freedom, therefore theoretically they could invest the whole 25 percent of assets in one single issuer and subsequently 5 percent in each of the other 15 issuers.

In practice, the majority of diversified mutual funds hold more than 50 positions and rarely more than 10 percent of their assets are invested in any one issuer. Smaller positions are easier to sell than larger ones, so diversified funds are better positioned to accommodate redemption requests. Non-diversified funds concentrate investments in a smaller number of issuers or in a single industry sector and they could face more difficulties in raising cash when needed. Furthermore, the SEC established additional limits to funds to ensure that they are able to meet redemption requests. For instance, to meet redemption with short notice, funds may not invest in illiquid securities, which cannot be sold within seven days, more than 15 percent of their assets, 5 percent for money market funds.

Limiting fund concentration, borrowing and illiquid securities does not allow mutual funds to use the most aggressive investment strategies, potentially resulting in higher returns. This is feasible for mainstream investors, but alternatives such as hedge funds are often preferred by those interested in high risk–high reward approaches.

The Investment Company Act of 1940, together with the Revenue Act of 1936, which established the regulations allowing funds to pass through taxation to shareholders, represent the laws that supported the creation of the mutual fund industry as known nowadays.

1.1.2 What mutual funds offer to investors: pros and cons

Funds provide investors numerous advantages over buying and selling securities directly. First, the allocation of investments among various financial instruments and industries, guarantees investment diversification, reduced risk. Through funds, investors have the possibility to own more securities than they would if they were acting just for themselves and to diversify even further by acquiring more than one fund. Investing in a fund assures the benefit of a high level of expertise of a professional money manager to buy and sell securities on their behalf. Furthermore, it gives access to investment strategies that otherwise might not be accessible to smaller investors, as it might be investing overseas or securities affordable only to investors with significant assets. Another benefit is the right to daily sell the investment back to the fund at a price equal to their share value of the fund's holdings, without incurring in costs. Not to mention, the administrative convenience, the presence of a variety of shareholder services, as tax reporting, automatic purchase programs, or access to retirement planning. Fundamental, a high level of investor safeguards is ensured, by the oversighting of an independent board of directors, with legitimate power of investing mutual fund assets. Lastly, crucial for investors is also the ability to easily compare different funds, thanks to a regular full reporting of their holdings and investment strategy in a standardized format.

The benefits became popular within the investors, who, at the end of 2009, held a total of more than US$ 23 trillion in fund assets worldwide[2].

The table below indicates the number of mutual funds worldwide from 2009 to 2018. It can be noticed an upward increasing trend in the development of this industry throughout this last decade.

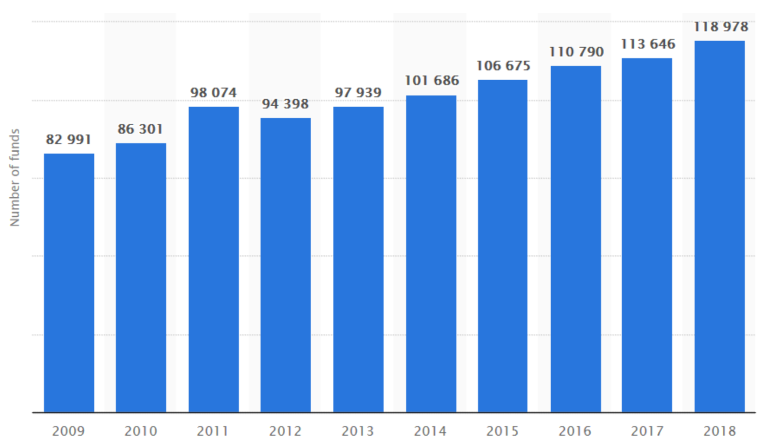

Figure 1 - Number of mutual funds worldwide from 2009 to 2018

Source: https://www.statista.com/statistics/278303/number-of-mutual-funds-worldwide/ accessed on 3 April 2020

[2] Pozen, R., & Hamacher, T. (2011). The Fund Industry. How Your Money Is Managed (third ed.). John Wiley & Sons, Inc., Hoboken, New Jersey, 3.

However, all these benefits come at a cost for investors. Investors pay an annual fee, known as expense ratio, corresponding to a small percentage of the total value of the shares, typically it ranges between 1% and 3%. These fees cover the costs of the ongoing expenses, such as management services, fund administration and operating costs. Actively managed funds have higher expense ratios compared to the passively managed funds since they require experienced financial professionals and other overhead costs. Another type of expenses are the sales loads, compensations paid to financial professionals, as a broker or investment advisor, to buy mutual fund shares. These commissions are paid when purchasing share, front-end loads, and when redeemed, back-end loads.

An ulterior disadvantage for the investor is that mutual funds do not allow to control the timing of capital gains. Differently, investors who own individual stocks or bonds can independently choose the appropriate time to sell a security in order to recognize a tax gain or loss. Mutual funds' managers decide when to sell the securities the fund holds and, that same year, taxes on the net capital gain are charged to investors.

In mutual funds, dividends and interest incomes are less predictable, investors who place a priority on steady income might be better off owning individual securities by buying bonds for example and holding them until maturity, knowing that interest payment is regular until the bonds are redeemed. In contrast, due to the frequent buying and selling of bonds, mutual funds' income varies a lot more, depending on the specific combination of securities owned on any given date.

Final drawback to mutual funds is that they do not allow for any customization. Every fund investor gets exactly the same deal. In fact, a given special treatment is often leading to scandal in the industry.

1.1.3 Open-end mutual funds, closed-end funds and exchange traded funds

There are three distinct types of funds, outlined in the Investment Company Act of 1940: open-end funds, closed-end funds and exchange-traded funds. These differ from each other in the way share sales and redemptions are handled. The different structures influence also the fees paid.

Open-end funds are the only ones that enable investors to redeem their shares every business day. All the buying and selling characteristics of funds illustrated so far are typical of these type of funds. Open-end funds do not present any limit to the number of investors or shares. The NAV per share is proportional to the fluctuation of the value of the fund.

Closed-end funds issue new shares only once, in the moment they collect money from investors at their creation. Distinguishable is their limited number of shares offered during an Initial Public Offering (IPO). These mutual investment instruments can be subscribed only in a certain lapse of time and the return of the capital can be requested only at the expiry date of the fund or after a certain number of years. The shares are listed for trading on a stock exchange. Therefore, shareholders who desire to convert their investment into cash beyond the regulated time period cannot, as in the open-end funds, just turn them into the fund, but they must first find a buyer on the open market. Thus, the price earned from the share sale is determined by supply and demand, which often results to be lower than the NAV.

At the outset of the industry, closed-end funds were more common compared to open-end funds. However, through the years their popularity declined sharply. Investment managers prefer the closed-end format, since it provides them a pool of assets to manage, which is not subject to dramatic changes in size due to the recurring purchasing or selling by shareholders. On the other side, investors favor the open-end format, in light of the fact when investing through these funds they do not need to be concerned about selling shares at a discount with respect to NAV. Considering a less liquidity need, these funds can plan longer-term investments, resulting possibly more remunerative.

Exchange-traded funds (ETF) are the newest type of mutual fund; they have been successfully introduced in the United States only in 1992. These funds combine features of both open-end and closed-end funds. More precisely, ETF shares are traded on a stock exchange, so investors purchase and sell throughout the day on the open market, as it is for the closed-end funds. ETFs resemble also the open-end funds for their ability to adjust the number of shares outstanding. The trades on the exchange usually occur at close to, but not necessarily exactly at, a fund’s NAV. In addition, the tax regime applied is the same as that for open-end funds. ETFs are well known for being very tax-efficient. These funds often adopt a passive investment management approach, relying on an index, generating in this way little capital gains that is then reflected in low tax bills.

1.2 Types of mutual funds

Mutual funds are categorized by the nature of their principal investments, there are four main types: stock or equity funds (whether domestic or international), bond or fixed income funds, hybrid or balanced funds and money market funds. These correspond to different investors’ return expectations and levels of risk.

In 2017, domestic equity funds were the most popular category in the United States, representing 42 percent of all mutual fund and exchange-traded fund (ETF) assets.

Equity funds are one of the most aggressive forms of investment funds, they carry the greatest risk along with the greatest potential returns. The assets of these funds are almost entirely invested in equities and the remaining part in the money market instruments. Equity funds may yield higher returns, but in case of turbulence in the financial markets, the investors might deal with the loss of their invested capital. Thus, fluctuations in the market can severely affect the returns of equity funds. There are several types of equity funds that preserve the portfolio of stocks with some characteristics, like growth funds, income funds and sector funds. The fund strategy establishes which shares the fund invests in global companies or those located in a specific region, single country or a particular industry sector. Equity funds are the most popular type of mutual funds. By the fourth quarter of 2019, 45% of worldwide regulated open-end fund assets were held in equity funds.[3]

Differently from the previous ones, bond funds provide a safer choice to investors. The resources are invested in fixed income securities of maturity over one year, like treasury bills, municipal bonds or corporate bonds. As a matter of fact, the safest bonds are those offered by the governments with the most stable economy worldwide. The asset share of bond funds accounted for 21% at the end of 2019[4].

Hybrid or mixed funds invest part of a fund portfolio in equities and part in debt instruments, therefore they are also called asset allocation funds. The more assets are invested in equities, the riskier the fund is. Balanced funds are often a "fund of funds" since they invest in a group of other mutual funds. The asset share of balanced funds amounted to 12% in the fourth quarter of 2019.

Money market funds offer the lowest returns. However as an offset, they carry the lowest risk, affording a high degree of safety. These funds are legally required to invest in high quality, short-term investments usually issued by the US government or corporations. When investing in a money market fund, it is reasonable to expect that its value will only grow over time and not diminish. Money market fund assets constitute 13% of the worldwide total open-end fund assets.

[3] Investment Company Institute. Worldwide Regulated Open-End Fund Assets and Flows Fourth Quarter 2019 https://www.ici.org/research/stats/worldwide/ww_q4_19 accessed on 15 April 2020

[4] Investment Company Institute. Worldwide Regulated Open-End Fund Assets and Flows Fourth Quarter 2019 https://www.ici.org/research/stats/worldwide/ww_q4_19 accessed on 15 April 2020

1.3 *European vs US mutual funds*

By the end of 1998, European mutual funds amounted to US$ 2.66 trillion of assets under management, about half the size of the US industry, which in the same year recorded almost US$ 5.2 trillion in assets. The six main European mutual fund markets, based on total assets, are accordingly France, Italy, United Kingdom, Spain, Germany and the Netherlands, which together account for almost 90% of total mutual fund assets in Europe. While the six European mutual fund markets account for less than half of the US one, the total number of Europe funds, equal to 10,828, exceeds the US ones corresponding to 7,123. The average size of the mutual fund is much smaller for European than for US, whose values correspond respectively to US$ 256 million and US$ 723 million.

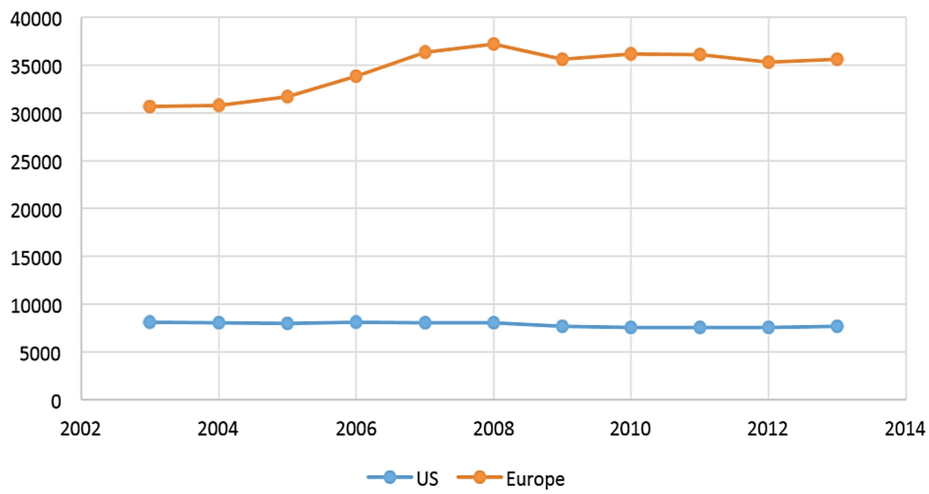

Figure 2 - Number of Mutual Funds in Europe and in the U.S. from 2003 to 2013 (Year-end)

Source: Revol, T. (2015). Mutual Funds in Europe and in the United States. A Comparison Analysis of Performance. France. 47

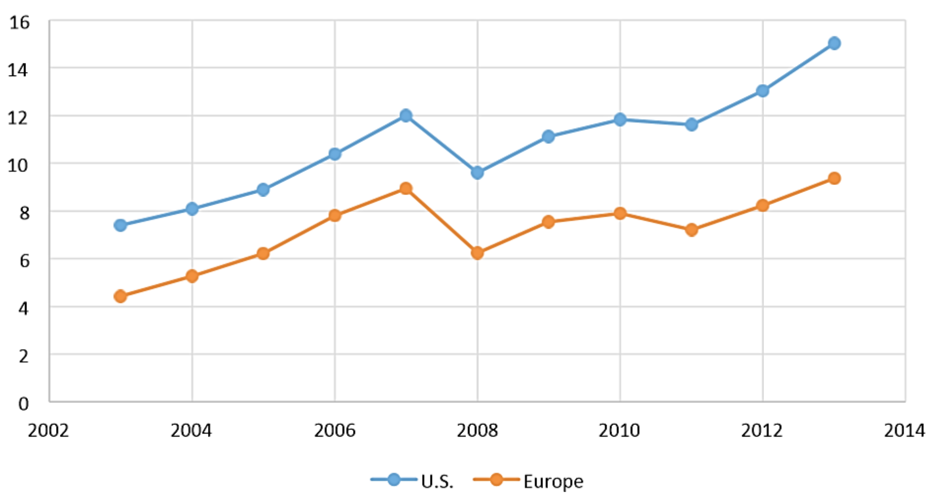

Figure 3 - Total Net Assets of the U.S. and the European Mutual Fund Industry from 2003 to 2013 (in trillions of $, year-end)

Source: Revol, T. (2015). Mutual Funds in Europe and in the United States. A Comparison Analysis of Performance. France. 48

Further in detail, the number of mutual funds in the US increased considerably, from 6,778 in 1997 to 9,599 in 2018. The largest increase in the number of mutual funds is witnessed from 1997 to 2000. For the remaining period, going from 2001 to 2018, there is evidence of a slower upward trend. During the years after the financial crisis, from 2008 to 2010, there has been a slight decrease. However, during the recovery the number of funds increased at a constant pace, in particular from 8523 in 2010 to 9599 in 2018[5]. Accordingly, the total net assets of US mutual funds throughout the same decade, 1998-2018, faced a remarkable increment, shifting from 5.53 trillion US dollar in 1998 to 12 trillion in 2007. The market witnessed a drop in 2008 due to the financial crisis, with a sharp decrease to 9.62 trillion US dollar, and subsequently followed the recovery with a peak in 2017 of 18.76 trillion US dollar, ending with approximately 17.71 trillion in 2018[6].

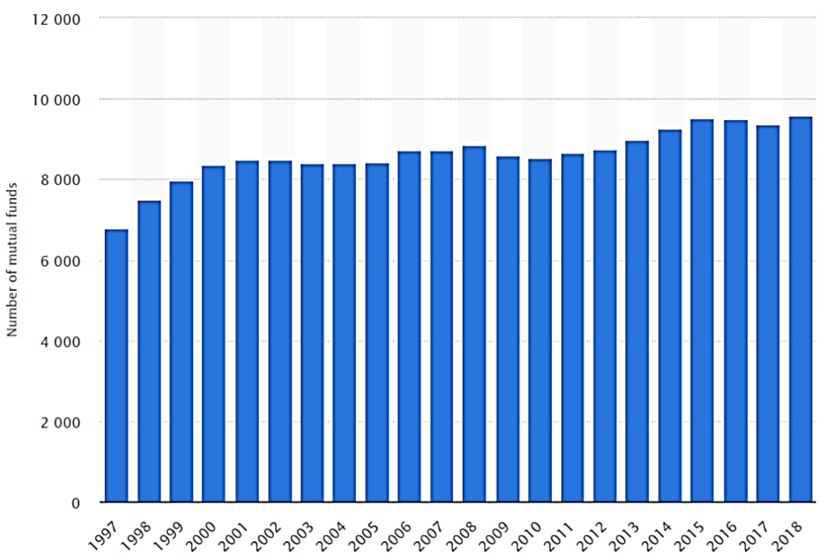

Figure 4 - Number of mutual funds in the United States from 1997 to 2018

Source: https://www.statista.com/statistics/255590/number-of-mutual-fund-companies-in-the-united-states/ accessed on 3 April 2020

[5] https://www.statista.com/statistics/255590/number-of-mutual-fund-companies-in-the-united-states/ accessed on 3 April 2020

[6] https://www.statista.com/statistics/255518/mutual-fund-assets-held-by-investment-companies-in-the-united-states/ accessed on 3 April 2020

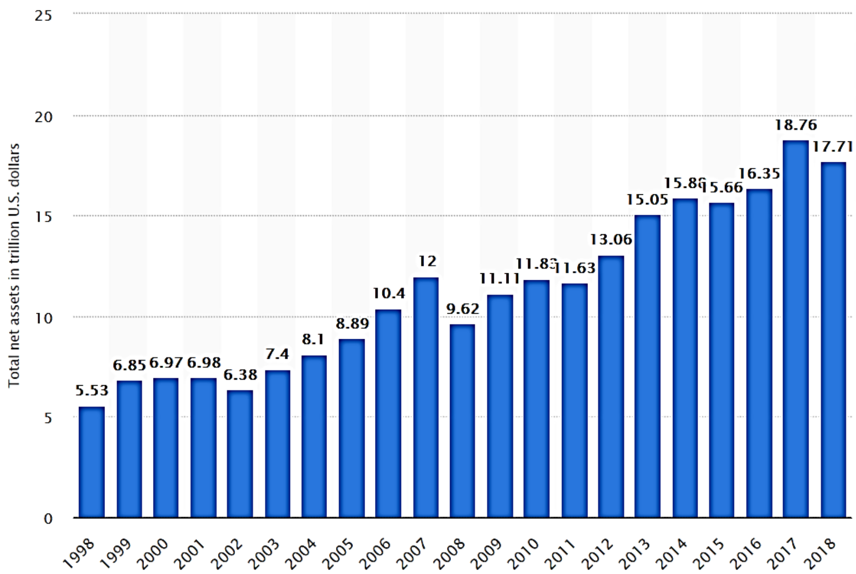

Figure 5 - Total net assets of US-registered mutual funds worldwide from 1998 to 2018 (in trillion U.S. dollars)

Source: https://www.statista.com/statistics/255518/mutual-fund-assets-held-by-investment-companies-in-the-united-states/ accessed on 3 April 2020

Mutual funds' asset allocation includes equity, bond, balanced, money and other. A remarkable difference consists in the prevalence of equity-oriented funds in the United States, while investors in Europe put money consistently into bond funds, revealing their preference for fixed income mutual funds. This difference can probably be attributed to a general different equity culture within the two regions, for instance the strong presence of banks and dissimilar pension systems. By examining the lapse of time from 1990 till 1998, it emerges that the asset allocation of European mutual funds dealt with a transition caused by the dramatic rise in the percentage of assets invested in equity mutual funds, mainly at the expense of money market funds. In particular, considering the average asset allocation of the six main European markets, the assets invested in equity mutual funds shifted from 10% in 1990 to 40% in 1998, compensated by a downward trend of the investment in the money market funds corresponding to 40% in 1990 and only 16.4% in 1998[7]. European investors do not necessarily have less exposure to the equity market, although smaller, as they can directly purchase equities themselves or through other institutions such as pension funds and insurance companies.

[7] Otten, R., & Bams, D. (2002). European Mutual Fund Performance. European Financial Management, 8(1)

Shown below a comparison between the repartitions of mutual funds total assets in the United States and in Europe over the period 2003-2013.

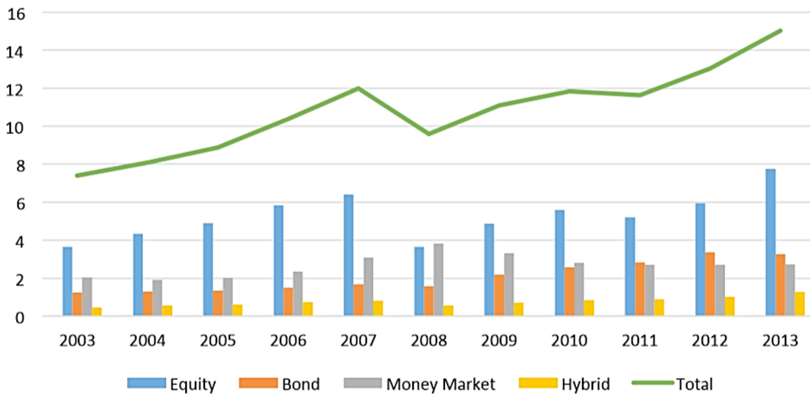

Figure 6 - Repartition of U.S. Mutual Fund Total Assets from 2003 to 2013 (in $ trillions, year-end)

Source: Revol, T. (2015). Mutual Funds in Europe and in the United States. A Comparison Analysis of Performance. France. 44

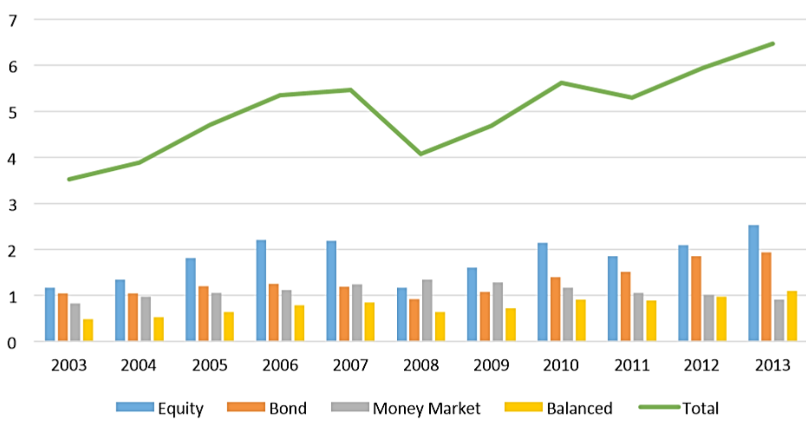

Figure 7 - Repartition of European Mutual Fund Total Assets from 2003 to 2013 (in $ trillions, year-end)

Source: Revol, T. (2015). Mutual Funds in Europe and in the United States. A Comparison Analysis of Performance. IESEG School of Management, Department of Finance. France. 46.

In 1998 the total market value of all equity mutual funds, as a percentage of total stock domestic market capitalization in the US, reached a value of 27%, which corresponds to nearly two times and a half the European ratio of 11%. This clearly evidences that European investors purchase equities by means of other channels, the mutual fund sector is still not as spread as it is in the United States. However, through time there has been a significant and consistent increase in the diffusion of the sector both in the USA and in Europe. The US rate was 16% in 1992, 22% in 1994, 28% in 1996 and 27% in 1998. Analogously, the values for Europe was 6% in 1992, 8% in 1994, 8% in 1996 and 11% in 1998. Further in detail, France and United Kingdom are the most stagnant countries, as their values do not oscillate much through these years, while the greatest variation has been registered in Spain, which started with a null percentage in 1992 to reach a value of 14% in 1998. Italy, Germany and the Netherlands present an increase by respectively 6%, 5% and 4% in six years. (FEFSI, ICI and Datastream)

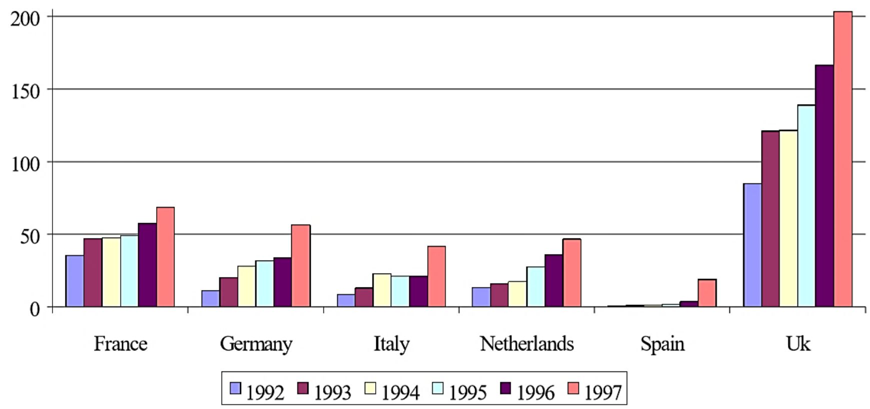

Figure 8 - Growth in equity mutual fund in six European countries, 1992-1997

Source: Otten, R. (2002). A Comparison Between the European and the U.S. Mutual Fund Industry. Managerial Finance, 28(1), 29

1.4 Determinants of mutual funds' performance

Past literature focused on analyzing the determinants of mutual fund risk-adjusted performance and tried to identify to what extent these several fund characteristics influence. Analysts tried to answer the question about whether specialization of mutual fund companies is based on any managerial skill or is merely a marketing strategy to attract capital.

Within a country, funds are divided using stated investment styles to test whether this yields differences in performance.

Investment style classifications are based on investment focus, i.e. growth, value and blend, and mutual funds' market capitalization, i.e. small, mid and large cap.

The fund size indicates the total market value of the securities in a fund. Open-ended mutual funds increase their asset size in case of strong performance of stocks and/or bonds in its portfolio, with the growth in value of the underlying assets. Asset sizes increase also thanks to the inflow of investors' money. In fact, the asset size of a fund will continue to grow even in case of negative returns.

A growth stock is a share in a company whose growth is expected to increase at a rate significantly above the average in the market. To guarantee such accelerated growth in the short term, these companies generally want to reinvest any earnings, enabled by avoiding the payment of dividends. Investors can earn money through capital gains by eventually selling their shares. Whereas value stocks trade at a lower price compared to its fundamentals, such as dividends, earnings, or sales; its equity price is typically lower than stock prices of companies in the same industry. Characterized by high dividend yield, low P/B ratio and low P/E ratio. Value stocks are considered riskier than growth stocks due to the skeptical attitude the market has toward them and it often includes a bargain-price as investors perceive the company as unfavorable in the marketplace. Thus, a value stock is generally more likely to have a higher long-term return than a growth stock, consequence of the underlying risk. A blend equity mutual fund is defined as a type of fund that includes both value and growth stocks. This type of fund aims to create a diversified portfolio, taking advantage of the capital gains potential of the growth stocks segment and the dividend income and stability of the value stocks segment.

The Morningstar Equity Style Box is a nine-square grid providing a graphical representation of the investment style of mutual funds. For equities and equity funds, it classifies securities based on market capitalization (vertical axis) and growth and value factors (horizontal axis). The Morningstar equity fund styles included are Small Growth, Small Blend, Small Value, Mid Blend, Mid Growth, Mid Value, Large Value, Large Blend and Large Growth. Fixed income funds are classified in relation to credit quality (vertical axis) and sensitivity to changes in interest rates (horizontal axis). The Style Box also forms the basis for Morningstar's style-based fund categories and market indexes.

With a study on the impact of industry and country factors on stock returns, Heston and Rouwenhorst (1994)[8] show that the country factor has actually a strong influence. In 2009, Sonney[9] highlights that stock analysts with major expertise in certain countries have an informational advantage over sector specialists due to their better knowledge about country-specific factors and the companies they research.

---

[8] Heston, S.L. & Rouwenhorst, K.G., (1994). Does industrial structure explain the benefits of international diversification? Journal of financial Economics 36, 3–27

[9] Sonney, F., (2009). Financial Analysts' Performance: Sector versus country specialization. Review of Financial Studies 22, 2087–2131

1.5 Mutual fund performance

With global asset and wealth management industry expected to rise exponentially from US$ 84.9 trillion in 2016 to US$ 145.4 trillion in 2025[10], and with nearly 9600 mutual funds in the USA alone in 2018[11], the need for unbiased performance evaluation becomes increasingly important.

Studies focused on the US market since long-term data is available. Most academic studies reach the conclusion that mutual funds' net performance, after expenses, is significantly inferior to that of a comparable passive market proxy. When adjusted for survivorship bias, mutual funds underperform on average the market proxy, by the amount of expenses they charge the investor. Therefore, investing in a low cost index fund is preferred to choosing an actively managed fund.

However, in the late 1980s and early 1990s this thesis was undermined by some studies. Grinblatt and Titman (1992)[12] and Ippolito (1989)[13] sustain that mutual funds possessed enough private information to offset the expenses. Whereas Carhart (1997)[14] states that persistence in mutual fund performance over short-term horizons is mainly explained by simple momentum strategies and thus not by superior fund management.

1.5.1 European mutual fund performance

The European mutual fund industry, despite its economic importance, is an under-research topic. Few studies examined the performance of equity funds investing in the main European financial markets over a long-time period; this may be due to the integration of European financial markets only in the last decade. However, with the introduction of the single European currency, Euro, the comparison of the performances of mutual funds in different European countries is more feasible.

[10]PWC. (2017). Asset & Wealth Management Revolution: Embracing Exponential Change' report. Retrieved from https://www.pwc.com/gx/en/asset-management/asset-management-insights/assets/awm-revolution-full-report-final.pdf accessed 16 March 2020

[11] M., S. (2019, August 9). Finance, Insurance & Real Estate; Banks & Financial Services. Retrieved March 16, 2020, from Statista: https://www.statista.com/statistics/255590/number-of-mutual-fund-companies-in-the-united-states/

[12] Grinblatt, M. & Titman, S., (1992). The persistence of mutual fund performance, Journal of Finance, 47, 1997-1984

[13] Ippolito, R., (1989). Efficiency with costly information: a study of mutual fund performance, Quarterly Journal of Economics, 104, 1-23

[14] Carhart, M., (1997). On persistence in mutual fund performance. Journal of Finance 52, 57–82

The European mutual fund market lags the US market for both size and market importance. Nonetheless, during the last 20 years the European mutual funds experienced large inflows, encouraging studies on the evaluation of performance for such funds.

Rogger Otten and Dennis Bams (2002)[15] carry out a study on the performance of European funds, including both dead and surviving ones, investing only in the domestic market. In particular, they evaluate fund performance by means of a unique survivorship bias controlled database, consisting of 506 mutual funds from five different European countries, i.e. Germany, Italy, United Kingdom and the Netherlands. The sample period considered is from January 1991 to December 1998. From the application of the Carhart 4-factor model, both the conditional and unconditional versions, European mutual funds and, especially small cap funds, resulted to have a positive after-cost alphas. When considering before-cost alpha, where management expenses are included, then most European countries exhibit significant out-performance at an aggregate level. The only country that underperforms the market is Germany, even though not significantly. Contrary to US funds, European ones are sufficiently successful in finding new information to offset their expenses and implementing it, therefore adding value for the investor. This could be attributable to the smaller market importance of the European as opposed to the US industry. If the European mutual fund sector grows bigger, relative to the market, it would become harder to outperform the market as a group. As a consequence of their smaller market importance, European mutual funds could be able to follow or even beat the market.

Most European mutual funds benefit from the advantages of easy diversification and lower transaction costs. Results suggest that they deliver positive risk-adjusted performance to their investors. The risk-adjusted performance of a fund is influenced by its characteristics. In particular, evidence shows that the expense ratio and age are negatively related to risk-adjusted performance, while fund assets are positively related to it.

1.6 Evaluating mutual fund performance

Past academic literature addressed the performance of actively managed equity funds topic, observing a recurring negative after-fee alpha and the non-persistence of performance of winner funds, becoming a

[15] *Otten, R. & Bams, D., (2002). European mutual fund performance.* European Financial Management 8*, 75–101*

challenging task for investors to select the best performing funds ex-ante, on the contrary loser funds manifest persistence.

This encourages the extension of the original CAPM model (Capital Asset Pricing Model), where considered is only the market risk, to describe funds' monthly returns and the development of Fama-French (1993) three-factor model, in which size and style risks are related to high book-to-market ratio firms.

Fama-French 3-factors model regressions:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,m}*(R_{M,t} - R_{f,t}) + \beta_{i,SMB}*SMB_t + \beta_{i,HML}*HML_t + \varepsilon_{i,t}$$

Where $R_{i,t}$ is the return of fund i and $R_{f,t}$ is the risk-free rate, which accounts for the time value of money, both calculated in month t. $(R_{M,t} - R_{f,t})$ is the excess return for the market. SMB represents a size factor obtained as the difference between small and large cap firms returns. HML is the style factor achieved as the difference in returns between firms with high book-to-market (value firms) and low book-to-market ratio (growth firms). α_i represents the fund's excess return after these three risk factors are taken into account.

Nevertheless, numerous studies denote the model's inability to fully describe the cross section of returns and highlights the need for additional risk proxies. Carhart (1997) reckon first the abnormal return of momentum portfolios, just as persistent anomaly.

Carhart model is obtained by adding the momentum factor to the Fama-French three-factor model.

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,m}*(R_{M,t} - R_{f,t}) + \beta_{i,SMB}*SMB_t + \beta_{i,HML}*HML_t + \beta_{i,WML}*WML_t + \varepsilon_{i,t}$$

Where WML is the momentum factor realized as the differences between winner and loser returns, corresponding to the top and to the bottom 30% of firms with respectively the highest and lowest 11-month returns.

These two models have become widely accepted in the academic field and applied in several studies evaluating mutual fund performance and persistence in performance.

When anomalies in asset pricing occur, a notable branch of literature seeks to add "missing" factors to the standard models, thus beyond size, value and momentum, in order to explain such anomalies. There have been identified a wide range of potential factors which improved the fit of the model, however none of them is fully able to explain all anomalies. Furthermore, when these missing factors are added, the overall performance and performance persistence appear to remain mostly unchanged. Not to mention, more recent academic literature raises awareness on potential statistical biases[16] and data mining[17] to which are subject studies that analyze a vast number of priced factors. Fama-French model (1993)[18] and Carhart model are the most widely accepted and applied models by academics. By applying these standard models, results on the performance of mutual funds validate that active managers do not add value for investors and that a significant positive alpha may be due only to "luck" in the short as well as in the long run. Cuthbertson et al. (2010)[19] unveil that 75% of active funds in the USA and the UK produce no true alphas, 20% are depicted with significant negative alphas and only up to 5% of funds can be categorized as true outperformers.

Irina B. Mateus, Cesario Mateus, Natasa Todorovic (2018)[20] in their studies, based on US and UK evidence, publish modifications of the standard factor models aiming to a less biased mutual fund performance evaluation and considering the issues related to the presence of non-zero alphas in benchmark indices. One of the main issues that arises is the selection of a benchmark for the fund, which frequently does not match its objectives. Furthermore, a bias in the construction of Fama-French risk factors occurs since standard models provide alphas that do not account for the ones embedded in the passive indices assumed as benchmarks. In fact, there will be skills conferred to a manager if he merely replicates the benchmark, making no active bets on that benchmark. This is a matter of particular relevance for investors, who overall consult the funds' prospectus benchmarks as a reference when evaluating fund performance. For the former topic, the authors concentrate on models that account for non-zero benchmark alphas, signaling a bias in construction of Fama and French risk factors, and successively examine benchmark-adjusted performance of mutual funds.

---

[16]McLean, R.D. & Pontiff, J. (2016). Does academic research destroy stock return predictability? The Journal of Finance, 71 (1), 5–32

[17] Hsu, J., Kalesnik, V. & Viswanathan, V. (2015). A framework for assessing factors and implementing smart beta strategies. The Journal of Index Investing, 6(1), 89

[18] Fama, E.F. & French, K.R. (1993). Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33, 3–56.

[19] Cuthbertson, K., Nitzsche, D. & O'Sullivan, N. (2010). Mutual fund performance: Measurement and evidence. Journal of Financial Markets, Instruments and Institutions, 19(2),95–187

[20] Mateus, I. B., Mateus, C., & Todorovicc, N. (2019). Review of new trends in the literature on factor models and mutual fund performance. International Review of Financial Analysis, 63, 344-354

1.6.1 *Adding the "missing" variables*

Through the examination of the top finance and economic journals, Harvey et al. distinguish 316 different factors tested in the pricing models. To better fit returns, various economists proceed with the extensions of the standard factor models.

Otten and Reijnders (2012)[21] extend the Carhart four-factor model by including the liquidity factor, defined as the difference in return of the low and high turnover portfolio. "Turnover is defined as the total monthly trading volume in shares divided by the number of shares outstanding for a specific stock."[22] In particular, LMH is the return difference between illiquid stocks, i.e. 30% lowest turnover, and liquid stocks, i.e. 30% highest turnover, with stocks ranked on their previous 12-month turnover. All components are value-weighted and rebalanced annually, except for the biannually reformed momentum factor. Applying the extended model to 76 British mutual funds, investing in smaller companies in the period 1992-2011, yields a statistically and economically significant alpha of 4.08% for small-cap funds. This result is sharply in contrast with previous studies regarding performance of mutual fund.

Foran and O'Sullivan (2014)[23] add two liquidity factor mimicking portfolios to Carhart four-factor model: "illiquidity level" mimicking portfolio, realized by returns of stocks with low minus high liquidity, and a "systematic liquidity risk" mimicking portfolio, which captures commonality in liquidity among stocks. Testing the liquidity-adjusted performance on 1141 British mutual funds reveals the underperformance with a 1% significant alpha of −0.16%, which does not differ much in magnitude from the value obtained applying the Carhart model, −0.14%. In the cross section, Foran and O'Sullivan find that liquidity level and systematic liquidity risk are both positively priced. This model including liquidity comes out to be the one with the best fit.

Moreno and Rodríguez (2009)[24] add to the Carhart model the co-skewness factor. By comparison of the two models, on a sample composed of 6819 US equity mutual funds from 1962 to 2006, they detect a

---

[21] Otten, R., & Reijnders, M. (2012). The performance of small cap mutual funds: Evidence for the UK. Working paper, Maastricht University Department of Finance

[22] Roger, O., & Reijnders, M. (2012). The Performance of Small Cap Mutual Funds: Evidence for the UK. SSRN Electronic Journal, 26. Retrieved from https://www.efmaefm.org/0EFMSYMPOSIUM/2012/papers/Otten.pdf

[23] Foran, J., & O'Sullivan, N. (2014). Liquidity risk and the performance of UK mutual funds. International Review of Financial Analysis, 35, 178–189

[24] Moreno, D., & Rodríguez, R. (2009). The value of coskewness in mutual fund performance evaluation. Journal of Banking & Finance, 33(9), 1664–1676

marginal increase of R-squared, from 84% to 85%. In both the Carhart and co-skewness models, the market, size, value and momentum risk are all positively priced and of the same magnitude and significance. The impact of the co-skewness factor on mutual fund returns is relatively small, i.e. alpha equals -0.0004, with only a 10% of significance level, suggesting that the co-skewness model does not change the overall perception of alphas.

Ferguson and Shockley (2003)[25] esteem financial distress, by redefining the market portfolio comprising debt instruments, as the relative leverage factor, defined as debt-to-equity ratio, and the relative distress factor. In the cross section of returns, the R-squared increases considerably from 67% in the three-factor to 81% in the extended model. Despite the substantial contribution of the leverage and distress measures in describing the cross section of returns, no remarkable impact has been depicted on the intercept in the time series of returns of 25 Fama and French portfolios. This is proved by the fact that the alphas of the CAPM, the three-factor Fama and French and the extended model are all of alike significant negative magnitude. This confirms that these additional factors are unlikely to delineate differently performance in a time series compared to the standard three-factor model.

Jordan and Riley (2015)[26] augment the standard four-factor model with a volatility factor denoting the difference between the returns of low and high volatility stocks. For both low and high volatility mutual funds, it has registered a decrease in annual alphas from 5% in the Carhart model to 0.36% in the five-factor model, suggesting that this model, including the volatility factor, is more effective in capturing fund risks.

Novy-Marx (2013)[27] propose to adjust the Carhart four-factor model by enrolling the market and industry-adjusted value, momentum, and profitability factors, considering gross profitability and industry-adjusted factors are able to price a wide range of earnings anomalies.

Fama and French (2015)[28] leave their mark in the asset pricing literature presenting the five-factor model, which includes investment and profitability factors besides the standard three-factor model. The additional factors take into consideration that the returns of firms, characterized by higher operating profitability and

[25] Ferguson, M.F., & Shockley, R.L. (2003). Equilibrium anomalies. Journal of Finance, 58(6), 2549–2580

[26] Jordan, B., & Riley, T.B. (2015). Volatility and mutual fund manager skill. Journal of Financial Economics, 118(2), 289–298

[27] Novy-Marx, R. (2013). The other side of value: The gross profitability premium. Journal of Financial Economics, 108, 1–28

[28] Fama, E., & French, K. (2015). A five-factor asset pricing model. Journal of Financial Economics, 116, 1–22

lower growth in total assets, are above the average. Juxtaposing the three-factor and five-factor model regressions highlights that alphas for small-growth portfolios remain significantly negative while significantly positive for small-value portfolios and large-growth portfolios. By applying the five-factor model, a sample of 3870 active funds for the period 1984–2015, underperforms by 0.08% per month, an amount close to their fees, and only 2.4% of funds' alphas is significantly positive, resulting in line with Fama and French (2010)[29] previous findings regarding the standard three-factor model. However, this model presents some limitations when it comes to anomalies that remain unexplained, like net share issues and volatility anomalies. Furthermore, the model evinces poor performance for portfolios formed on momentum, in fact adding momentum as the sixth factor consistently improves its explanatory power.

Stambaugh and Yuan (2017)[30] introduce two 'mispricing' factors, by averaging anomaly rankings within the set of 11 anomalies, with the aim to address the 'no model fits all' anomalies or stocks, arguing that anomalies reflect general mispricing with common components across stocks. In order to form factors, the set of anomalies is categorized in two groups based on anomalies' similarities. The four-factor model with the mispricing factor is able to describe the set of 11 anomalies better than the Fama and French (2015).[31]

A more recent study of Hou et al. (2017)[32] evinces that the q-factor model encompassing the market, size (i.e. market equity), investment (i.e. investment-to-assets), and profitability (i.e. return on equity) factors outperforms the three-factor, four-factor and five-factor Fama and French multiple standard models. Results provide clear evidence that the following model is effective in pricing a higher number of anomalies than the standard models.

From a general overview of the literature, it is evident that none of the augmented factor models is fully successful to explain all anomalies or constitute the best fit for all stocks. Additional factors may provide a more adequate fit, although only marginally. The contribution of new models in the literature of mutual fund performance is quite limited. Evidence with the application of new models still points towards mutual fund underperformance, as earlier documented by the standard three- and four-factor models. The

---

[29] Fama, E.F., & French, K.R. (2010). Luck versus skill in the cross-section of mutual fund returns. Journal of Finance, 65(5), 1915–1947

[30] Stambaugh, R.F., & Yuan, Y. (2017). Mispricing factors. The Review of Financial Studies, 30(4), 1270–1315

[31] Fama, E., & French, K. (2015). A five-factor asset pricing model. Journal of Financial Economics, 116, 1–22

[32] Hou, K., Xue, C., & Zhang, L. (2017). Replicating anomalies (no.w23394). Working paper. National Bureau of Economic Research, https://www.nber.org/papers/ w23394

exploding number of potential factors might be the cause of multiple comparison problems[33], lack theoretical motivation[34], and represent "simply noise" stemming from data mining[35].

A trend of new literature seeks to construct standard factors, leading to the presence of non-zero alphas in passive benchmark indices needed in performance measurement.

1.6.1 Refining performance measurements: dealing with non-zero benchmark alpha

Cremers et al. (2012)[36] provide evidence that the standard factor models suffer from biases and question the arbitrary nature of Fama and French factor construction method, manifesting through non-zero alphas in passive benchmark indices. Further in detail, the size factor allocates disproportionate weight to value stocks, leading the SMB and HML betas correlation of cap-weighted portfolios to be positive. Analogously, the value factor distributes disproportionate weight to small-cap stocks, amplifying the returns on the SMB factor. This leads to an underweighting and an overweighting of small value stocks in the benchmark respectively for large-cap and small-cap portfolios, leading to an alpha positive for large stocks and negative for small stocks.

Cremers et al. (2012) confirm that standard benchmark models generate statistically and economically significant non-zero alphas even for passive benchmark indices. Given a passive benchmark with positive and significant Fama and French or Carhart alpha, an active fund can produce a significant alpha by merely replicating that index. On the other hand, when the benchmark reports negative alphas, the fund's performance may be underestimated.

In light of the fact that passive indices serving as benchmark for equity mutual funds are characterized by the presence of alphas, it reveals the need for an unbiased pricing model that accounts for the benchmark alphas.

In order to build a model that removes alphas in a passive index, Cremers et al. (2012) suggest the redesign in three aspects of the factors adopted in the US equity mutual fund performance evaluation. First, the

[33] Fama, E., & French, K. (2018). Choosing factors. Journal of Financial Economics, 128(2), 234–252

[34] Blitz, D., Hanauer, M.X., Vidojevic, M., & vanVliet, P. (2018). Five concerns with the five-factor model (Quantitative Special Issue 2018). Journal of Portfolio Management, 44(4), 71–78

[35] Hou, K., Xue, C., & Zhang, L. (2015). Digesting anomalies: An investment approach. The Review of Financial Studies, 28(3), 650–705.

[36] Cremers, M., Petajisto, A., & Zitzewitz, E. (2012). Should benchmark indices have alpha? Revisiting performance evaluation. Critical Finance Review, 2, 1–48

market portfolio would include only US equities. The S&P 500 index alpha with returns solely from the US market reduced from 0.82% to 0.52%, both significant at 1%. Second, substitute equally weighted by value weighted SMB and HML factors, reducing alpha to statistically insignificant 0.33%. Third, HML factors are decomposed into value premium for big, medium and small stocks distinctly and institute size factors that resemble more precisely size categories used in the industry, such as the difference of mid-cap and large-cap returns and small-cap and mid cap returns. With these further augmentations alpha reduced even more.

In order to avoid any misstatement of performance, the manager skill should be measured relative to their self-reported benchmark instead of a passive portfolio with equal risk characteristics. To account for the benchmark-adjusted return of a fund, Angelidis, Giamouridis, and Tessaromatis (2013)[37] propose a model that modifies the left-hand side of the Carhart model. The benchmark-adjusted alpha turns out to be the new alpha, a measure of fund performance relative to a benchmark index. The factor loading is a differential factor loading between the fund and the benchmark. The underperformance of the benchmark alpha, taking in consideration the benchmark-adjusted model, is not as poor and statistically significant as the alpha of the original four-factor model.

Mateus et al. (2016)[38] apply alpha estimation methodology by Angelidis et al. (2013) to 887 British equity mutual funds in the period 1992–2013 and adjusted fund alphas for a bias imposed by the performance of the FTSE 100 benchmark index. The fund performance, after accounting for negative alphas of the FTSE 100, is superior than originally implied by the standard three- or four-factor model. What is most relevant is the change of alpha from negative and significant to positive and significant when switching from the Carhart model to the benchmark-adjusted model. Hence, as implied by evidence, the variation in fund's benchmark-adjusted alpha relative to the Carhart alpha is more significant the larger the magnitude of this latter benchmark's (Carhart) alpha.

A fund underperformance versus the standard Carhart factors may still result in an outperformance versus its benchmark, with a positive benchmark-adjusted alpha. In contrast, in presence of strong benchmark outperformance, it may come out that funds, although have significant positive Carhart alphas, in fact fail

---

[37] Angelidis, T., Giamouridis, D., & Tessaromatis, N. (2013). Revisiting mutual fund performance evaluation. Journal of Banking & Finance, 37(5), 1759–1776

[38] Mateus, I.B., Mateus, C., & Todorovic, N. (2016). UK equity mutual fund alphas make a comeback. International Review of Financial Analysis, 44(C), 98–110

to beat their benchmark. These findings evidence the importance of the role of benchmarks in establishing accurate fund performance and in various cases may invert investors' perceptions about fund performance.

Similarly, Chinthalapati, Mateus, and Todorovic (2017)[39] advance an optimization algorithm that calculates minor fixed adjustments to be added to the time series of the three, four or five factors model, achieving the aim of assuring a zero alpha for any self-designated benchmark index chosen without changing in any way the model parameters. This method of estimating a mutual fund's adjusted alpha maintains unchanged the factor loadings and R-square, avoiding to "search for new factors", which may cause unreliable statistical inferences. The sample employed in the test is constituted by 1383 active and tracker US equity mutual funds reporting as their prospectus benchmark the S&P 500 index, showing slight outperformance over their whole sample period. The outcomes of the estimated alphas with adjusted Carhart factors for mutual funds reporting S&P 500 are lower than the standard Carhart alphas of active and tracker funds, by respectively 40bp and 43bp. The discrepancy in alphas is overall small as the alpha-adjustment is based on small positive S&P 500 Carhart alphas documented in the USA. Therefore, the general inferences on the US funds' underperformance do not change, nonetheless the benchmark adjusted fund's performance is less than initially reported by the standard Carhart model.

In general, taking into account benchmarks in mutual fund performance measurement is highly relevant. Significantly positive benchmark alphas imply lower benchmark adjusted alphas relative to Carhart alphas of a fund. A fund reporting a significant positive alpha in the Carhart model, when adjusted for benchmark, may however reveal no outperformance or even negative alphas. It may claim to be an active fund but it might just perform in line with the index, replicating it. While, the more the alpha of the fund's benchmark index is negative, the higher is the likelihood that the fund's alpha will reverse to positive in the benchmark-adjusted models from significantly negative in the Carhart model. This implies that in times of distress, although the fund does not perform very well with the Carhart risk parameters it still performs better than its benchmark.

1.7 Persistence of mutual fund performance

In the past literature, there has been a wide discussion on the topic of performance persistence. Its economic importance for investment management is fundamental, since if previous return performance

[39] Chinthalapati, V.L., Mateus, C., & Todorovic, N. (2017). Alphas in disguise: A new approach to uncovering them. International Journal of Finance and Economics, 22(3), 234–243

could be used to forecast future returns, then market efficiency would face an important challenge. Indeed no persistence in performance would push investors to engage in completely passive asset management, although this last result is unlikely. Some degree of active management should exist.

There is high disagreement on whether and to what degree persistence is present. Various authors as Bollen and Busse (2005)[40], Avramov and Russ (2006)[41], and Kosowski et al. (2006)[42] sustain the hypothesis of predictability in fund performance even after accounting for momentum. In contrast, Carhart (1997)[43], based on a sample of survivorship-free US equity funds, supports that persistence shrinks after accounting for momentum in stock returns. Similarly, Henriksson (1984)[44], Barras et al. (2010)[45], Fama and French (2010)[46] and Busse et al. (2010)[47] demonstrate barely any evidence of persistence over long time horizons. Most studies that address this issue are based on US equity mutual funds.

1.7.1 The persistence of performance in European mutual funds

In 2012, Javier Vidal-García publishes an article focusing on European mutual funds, *The persistence of European mutual fund performance*. In particular, his goal is to determine whether an investor can follow a determined successful investment strategy by actively selecting European mutual funds with a persistent performance objective, accounting for European risk factors. The author's results aim to determine whether specific country or investment style funds outperform generalist funds investing more broadly across Europe and whether macroeconomic factors are relevant, and to what extent, in identifying superior European mutual funds.

---

[40] Bollen, N. & Busse, J., (2005). Short-term persistence in mutual fund performance. Review of Financial Studies 18, 569–597

[41] Avramov, D. & Russ, W., (2006). Investing in mutual funds when returns are predictable. Journal of Financial Economics 81, 339–377

[42] Kosowski, R., Timmermann, A., Wermers, R. & White, H., (2006). Can mutual fund stars really pick stocks? New evidence from a bootstrap analysis. Journal of Finance 61, 2551–2595

[43] Carhart, M., (1997). On persistence in mutual fund performance. Journal of Finance 52, 57–82

[44] Henriksson, R., (1984). Market timing and mutual fund performance: an empirical Investigation. Journal of Business 57, 73–97

[45] Barras, L., Scaillet, O., Wermers, R., (2010). False discoveries in mutual fund performance: measuring luck in estimated alphas. Journal of Finance 65, 179–216

[46] Fama, E., French, K., (2010). Luck versus skill in the cross section of mutual fund returns. Journal of Finance 65, 1915–1947

[47] Busse, J., Goyal, A., Wahal, S., (2010). Performance and persistence in institutional investment management. Journal of Finance 65, 765–790

The author considers a dataset of local currency monthly returns formed by 1050 actively managed equity mutual funds registered in United Kingdom, France, Italy, Spain, Germany and the Netherlands. These countries represent the six largest European mutual fund markets, accounting for almost 90% of total mutual fund assets in Europe. All returns include any dividend paid and only the primary share class. They are net of fund operating expenses, including management and distribution fees, but not sales loads. The time range is starting on January 1, 1988 and ending on December 31, 2010. On the initial set of data, several filters were applied. First, the selection is restricted to domestic equity funds since the focus is in European-domiciled mutual funds. Second, equity funds with return history long enough to reliably estimate a factor model regression, at least 24 months of data. Excluded are the index funds, sector funds, equity funds that invest internationally, funds that do not have style identification information, funds that enclose non-equity components such as convertible debt and funds that became one of these types subsequently during the sample period. The Morningstar equity fund styles included are the following: Small Growth, Small Blend, Small Value, Mid Blend, Mid Growth, Mid Value, Large Value, Large Blend and Large Growth. In order to avoid survivorship biases, in the sample, dead funds are included until they disappear and successively the portfolios are re-weighted with only the surviving funds. The test methodology considers the look-ahead bias, this results from excluding from the sample those funds that do not survive a minimum period of 20 months after the ranking period. This leads to a total of 137,956 monthly observations, with an average life of a fund of 9 years.

In each country mentioned above, a European version of the 4-factor and 3-factor models were created and for each all stocks incorporated in the Worldscope database were considered. The selection was limited to primary quotes of major securities. For each country, the market excess return is calculated as the outcome of the MSCI country total return index minus the 1-month Treasury Bill rate.

The study focuses on measuring the persistence in a 1-year period of fund performance by examining whether funds, which performed well in the past, can replicate it in the following periods and the consistency in performance of a defined investment style. Each investment style is formed by value-weighted returns originated from all the mutual funds enclosed in that category. The weights are based on fund size, because if fees are proportional to the value of assets under management, bigger mutual funds pay a higher fee to fund managers, in accordance with the fact that they provide a better service and major effort in managing bigger funds.

Performance persistence is measured using benchmark-adjusted returns. The quality of this benchmark adjustment is the same across investment styles, thus well-researched multifactor models can be utilized to analyze all European mutual funds.

Tests on performance-ranked portfolio strategies classify funds each year into portfolios according to past performance. Funds are ranked according to their average return in the ranking period and on the basis of this ranking, style portfolios are classified, each with a different number of funds. In particular, in the ranking period, funds with the highest average abnormal returns are included in the top portfolio, while the bottom portfolio is formed by those with the lowest average abnormal returns. Each 1st January, value-weighted portfolios for each investment style are created, net of management fees but before subtracting any sales charges. Mutual funds merged or liquidated during the year are incorporated in the value-weighted average until they disappear, then the portfolio weights are rebalanced accordingly. Successively, monthly returns are calculated for each style portfolio of mutual funds, obtaining a time-series going from January 1988 to December 2010.

"Mutual fund performance is measured as the average abnormal return on the funds under management in every investment style portfolio, and the abnormal returns for each mutual fund are calculated from an asset pricing model."[48] The primary approach adopted by the author to measure performance is by calculating factor models with time-series regressions. Main models of performance measurement are the Carhart four-factor model (1993), due to its common acceptance in the literature, and Fama and French model (1993), due to its ability in explaining cross-sectional variation in returns. Carhart (1997)[49] shows that the momentum factor accounts for the differences in the performance of past winners and losers. Wermers (1997)[50] highlights that the momentum strategies undertaken by the outperforming mutual funds are those that generate short-term persistence.

As an investment alternative, most investors and fund managers use the benchmark-adjusted returns as a performance measure, since it is an index fund duplicating the stock index return and their investment

[48] Vidal-García, J. (2013). The persistence of European mutual fund performance. Research in International Business and Finance, 28, 49

[49] Carhart, M., (1997). On persistence in mutual fund performance. Journal of Finance 52, 57–82

[50] Wermers, R., (1997). Momentum investment strategies of mutual funds, performance persistence, and survivorship bias. Working paper, University of Maryland. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.201.9845&rep=rep1&type=pdf

objective is replicating such index. Benchmark-adjusted returns are obtained by subtracting the return of the benchmark from the annual raw return. In the paper analyzed, the benchmarks used to adjust raw returns are the MSCI style indices, based on the investment style of each portfolio. Thus, individual country style indices are included among the benchmarks, safeguarding partial market segmentation.

The style portfolio ranking proposed by the author follows the benchmark-adjusted returns instead of raw returns, this in order to avoid distortions in the ranking that may be caused by classifying raw returns. By using benchmark-adjusted returns, the ranking is based on the abnormal returns of the portfolios instead of those of their asset class. In a given year, the resulting alpha is equal to the portfolio performance in that year after ranking.

Furthermore, Vidal-García examines the persistence of mutual fund investment style performance by the contingency tables, analyzing the frequency of maintaining the category of winners or losers funds over consecutives time periods. The contingency table analysis evaluates also the effects of changes in the methodology.

Contingency tables classify funds as winners and losers according to the median fund benchmark-adjusted return for each investment style portfolio every year for the period 1988-2010, counting for the different combinations: winner-winner (WW), winner-loser (WL), loser-loser (LL), loser-winner (LW). Performance persistence manifests if statistical evidence presents in the WW or LL categories a significantly larger number of observations than in the other two. The contingency tables display the fund's probability in a ranking position remaining in the same rank in the successive period. This method is preferred to others when there is a limited sample of funds.

The analyses of fund performance report different results depending on the type of returns employed. The use of raw returns often reveals performance reversals, while risk-adjusted returns indicates the existence of performance persistence. In order to account for consistency due to management skills, the author evaluated the contingency tables considering benchmark-adjusted alphas.

Whether persistence in ability for a portfolio of funds is present, the alphas and returns for a fund will be correlated with those estimated over other months. Thus, there is a potential issue with the post-ranking tests of return significance since the independence assumption, necessary for a parametric test, may be breached. Bootstrap procedure of Kosowski et al. (2006)[51] addresses this issue. The mutual funds' returns are bootstrap under the null of zero alpha and then their inference is based on the cross-section of simulated alphas and t-statistics. For all months, the three-factor and four-factor models are used to implement this test and finally it is calculated a single bootstrap mean alpha.

By evaluating the performance of mutual fund portfolios with simple style benchmarks, it results that on average the investment style portfolios manifest a positive performance. The intercepts for value-weighted returns in the three and four factor models are negative, i.e. the values of the Fama-French alpha range from -1.95 for Italy to -0.27 for Spain, while of the Carhart alpha from -1.59 for Italy to -0.23 for Germany. In general, controlling for momentum makes a substantial difference, implying that mutual funds have significant exposure to such factor. Differently, R-squares are similar in both models, meaning that the momentum factor explains only a relatively small proportion of the variability of mutual funds' excess returns. Furthermore, large funds on average present bigger benchmark-adjusted returns relative to small funds and larger the capitalization of the fund, the higher the positivity of alpha. Overall, the investment style portfolios under examination do not deliver benchmark-adjusted excess returns.

Performance persistence is important from an economical perspective since it may imply violations of market efficiency and value-increasing opportunities for investors. Once more, using the Fama-French model, the top-ranked portfolios have more small stocks than the bottom-ranked. Significantly positive for all countries are the size factor, except for the United Kingdom, and the book-to-market, except for the United Kingdom and the Netherlands. In line with the previous literature, the average alphas among the different portfolio rankings are negative, showing poor performance to be more persistent and reason why normally active management does not create value. Whereas, the four-factor model consider a bigger cross-sectional variation in expected returns on mutual funds' portfolios sorted on one-year return. It is evident a larger difference in abnormal returns between the top-ranked and bottom-ranked funds. Concerning the sensitivities to the factors, they are similar to the previous model, in particular with momentum and book-to-market factors being significant for a higher number of portfolios. The one year momentum factor depicts a stronger positive correlation with the bottom rank returns than with the top rank returns, explaining the observed persistence. Relative to the Fama-French model, when controlling for momentum, the estimated alphas are slightly more negative. In the European mutual fund market, the

[51] Kosowski, R., Timmermann, A., Wermers, R. & White, H., (2006). Can mutual fund stars really pick stocks? New evidence from a bootstrap analysis. Journal of Finance 61, 2551–2595

fees incurred are not covered by the value added by active management. Mutual funds with poor performance have a higher chance to discontinue operations, the number of funds that will disappear is higher in the bottom-rank than in the top-rank. Carhart (1997) highlights that momentum has an important role in persistence. Portfolios in the top ranks are more probable to have winner stocks, creating persistence among winner portfolios.

From the results, it can be evinced that the one year horizon shows resilient aggregate persistence in overall performance, as measured by alpha. Moreover, in contrast to previous studies, although persistence is present also in the bottom rank, significant underperformance is evident also in the top-performing funds.

The contingency tables results do not differ much from the ones found in the regression estimates and reveal that persistence is significant for all mutual fund investment style portfolios all over countries. Overall, the number of funds that remain winners or losers is larger than those that change their status. All the top and bottom mutual funds' portfolios have ranks that persist. The author rejects, at 5% level, the hypothesis of no persistence for all fund portfolios in each European country. This is an important result suggesting that investors can benefit from past performance data.

Contrary to previous studies' conclusions that persistence is typical mainly of poorly performing funds, Vidal-García sustains that persistence is due to both good and poor performing funds. Concluding, this study demonstrates a solid phenomenon of performance persistence for European mutual funds, unveiling the usefulness of previous fund performance information for potential investment strategies to achieve higher returns.

Standard measures of performance are affected by a number of biases, relying upon unconditional models may lead to inaccurate inference about mutual fund returns performance. Applying instruments for the time-varying expectations, is a method for controlling predetermined information and reducing this source of bias. Publicly available information influences expected returns and risks. In unconditional multifactor models, betas and alphas are constant over time but they could change across funds. In conditional models, betas are time varying, but fixed alphas reflect abnormal performance. Ferson and Schadt (1996)[52] produce conditional models of the standard mutual fund performance regressions, discovering the influences of using public information on average performance in an open-ended mutual funds' sample. Conditional

[52] Ferson, W. & Schadt, R., (1996). Measuring fund strategy and performance in changing economic conditions. Journal of Finance 51, 425–462

performance evaluation is interesting for two main reasons. First, traditional performance measures are not capable of dealing with dynamic behavior or returns. Second, the trading behavior of fund managers entails more complex patterns than those of traded underlying assets. The authors claim that benchmark parameters should be conditioned on economic variables. They also propose that the market timing skills of fund managers should be evaluated whereas it should be removed the predictable component of market movement. Introducing public information variables alters the estimated performance of many funds and there is evidence that these are correlated with mutual fund betas.

Christopherson et al. (1998)[53] prove the existence of investment performance persistence for institutional equity managers. They affirm that conditional performance measures approach is more able to detect persistence and estimate the expected future performance of the funds. The authors are confident that plan sponsors influence their expectations accounting for the state of the economy.

Vidal-García estimates the conditional version of the four-factor model:

$$R_{it} - R_{ft} = \alpha_i + b_i^*(Z_{t-1})^*(R_{Mt} - R_{ft}) + s_i^*SMB_t + h_i^*HML_t + m_i^*MOM_t + e_{it}$$

Z_t represents a vector of instruments for the information available in time t. $b_i^*(Z_t)$ are time t conditional betas. According to Ferson and Schadt (1996)[54], their function linearity is approximated by: $b_i^*(Z_t) = b_0 + B'(z_{t-1})$, where $z_{t-1} = Z_{t-1} - E(Z)$ is a vector of the deviation of Z from the unconditional means. The publicly available conditioning state variables adopted in the analyses are four: dividend yield; Treasury bill spread, i.e. difference between long- and short-term government bond yields; yield on a 3-month Treasury Bill; corporate bond yield spread, i.e. difference between low- and high-quality corporate bonds.

Results indicate that variables are related to performance. Although when considering conditional measures, fund ranking on performance persistence does not change. Actually, on the basis of lagged macroeconomic variables on the market portfolio, mutual funds resulted to time the overall market factor. In the sample considered, the performance of mutual funds is slightly inferior when evaluated using conditional measures rather than unconditional ones. With the contingency tables' tests, also the significance of persistence is more robust compared to the one found with the unconditional models.

[53] Christopherson, J., Ferson, W. & Glassman, D., (1998). Conditioning manager alphas on economic information: another look at the persistence of performance. Review of Financial Studies 11, 111–142

[54] Ferson, W. & Schadt, R., (1996). Measuring fund strategy and performance in changing economic conditions. Journal of Finance 51, 425–462

According to various persistence tests, mutual fund performance is principally influenced by macroeconomic variables rather than past performance of funds. Moreover, the average R-square illustrates a modest improvement from unconditional models, motivating the use of conditional models for performance measures. For all investment style portfolios, it is highly significant the incremental explanatory power of the conditioning variables. Thus, conditional models are better able to capture returns across funds compared to models assuming that betas are constant. The not as strong evidence on persistence for the unconditional abnormal returns suggests that the unconditional factors do not disclose the fund managers' true abilities, therefore relying on conditional alphas will bring to better investment decisions.

Carhart (1997)[55] affirms that whether manager skill is present, a 1-year return is probably a noisy measure and to reduce it in past-performance rankings, he constructs mutual funds' portfolios on lagged 2- to 5-years returns. According to Carhart, sorting mutual funds on alphas based on the same model should evaluate stock-picking talent more accurately. As an ultimate test, Vidal-García investigates whether the results on performance persistence hold also over longer time horizons of 2 and 3 years. In fact, based on results it can be evinced that performance persistence is greater when expanding the period of historical data and discovers significant negative persistence at longer horizons. The coefficients of the regression evidence of persistence evince that performance predicts future returns.

1.8 Self-designated benchmark indexes in the mutual fund industry

Performance evaluation is carried out by less sophisticated principals, not fully able to distinguish which are the useful benchmarks. Agents are sequentially incentivized to figure out a way to strategically influence the benchmark used. However, it is difficult to find systematic evidence since it is really challenging to identify which benchmark agents prefer and to what degree principals consider them.

From 1999, the Securities and Exchange Commission (SEC) requires that funds' prospectus reports historical returns of both the funds and a passive benchmark index.[56] The SEC does not impose the adoption of any specific index, leaving completely free choice to the fund. However, some self-designated benchmarks did not fully capture their exposures to common factors in returns and consequently were not

[55] Carhart, M., (1997). On persistence in mutual fund performance. Journal of Finance 52, 57–82

[56] ADI 2019-09 - Performance and Fee Issues available at https://www.sec.gov/investment/accounting-and-disclosure-information/performance/adi-2019-09-performance-and-fee-issues, accessed on 12 March 2020

very useful in evaluating funds' skill at originating abnormal returns. When deciding whether to invest or not in a mutual fund, unsophisticated investors may behave in a way not consistent with theories of optimal performance evaluation. The most accurate performance can be predicted when the chosen reference benchmark is based on the fund's holdings and objectives. Nevertheless, in practice it is not uncommon that mutual funds in the same peer-group, meaning the same investment style as per Morningstar classification, expound a number of different passive indices.

1.8.1 Mismatched self-designated benchmark indexes

The study of Kim, Shukla, and Tomas (2000)[57] compares information declared by funds to the funds' attributes, classified by characteristics, investment style, and risk-return, acquired from Morningstar database. More than half of the 1043 funds have stated objectives that differ from their attributes-based objectives and more than one third are severely misclassified. However, the authors note that funds do not deviate all into higher risk objectives. Therefore, they conclude that the tendency of diverging into lower risk objectives cannot be explained by gaming behavior.

Cremers and Petajisto (2009)[58] show that most mutual funds have a high proportion of holdings different from those in the funds' correct benchmark index.

The analyses of Bams, Otten, and Ramezanifar (2016)[59], based on a sample of 1866 US equity funds through the 2003–2015 period, evidence that 14% of funds are significantly misclassified according to long-term style analysis. Furthermore, they recognize that misclassified funds tend to be identified with funds that are younger, smaller in size and charge higher expense ratios.

Berk A. Sensoy, in his article *Performance evaluation and self-designated benchmark indexes in the mutual fund industry* (2009), employs a new database of self-designated mutual fund benchmark indexes for evaluating the performance in the industry, of both the managers and the determinants of the fund flows. Most actively managed diversified US equity funds use S&P or Russell benchmark index defined on size and book-to-market values. These benchmarks are in 31.2% of cases not matching exactly the

[57] Kim, M., Shukla, R., & Tomas, M. (2000). Mutual fund objective misclassification. Journal of Economics and Business, 52(4), 309–323

[58] Cremers, K.M., & Petajisto, A. (2009). How active is your fund manager? A new measure that predicts performance. Review of Financial Studies, 22(9), 3329–3365

[59] Bams, D., Otten, R., & Ramezanifar, E. (2016). Investment style misclassification and mutual fund performance. School of Business and Economics, Maastricht University, 39

funds' exposure to these two factors, thus not maximizing the usefulness in netting out priced common factors in returns. Sensoy defines funds' "corrected" benchmark as alternative both S&P or Russell benchmarks based on size and value/growth better harmonize these funds' size and value/growth characteristics and, of utmost importance, are more correlated with their returns.

In a recent study, I. Mateus, C. Mateus, and N. Todorovic (2018)[60], by means of the Morningstar style categories, unveil that two thirds of the funds that report S&P 500 as their benchmark, have risks and objectives that differ from those of the S&P 500 index.

According to a 2006 survey of the Investment Company Institute, before purchasing a mutual fund, 34% of fund investors consult the fund prospectus.[61] Due to this percentage, it can be stated that mismatched self-designated benchmarks influence investors when directing fund flows. Fund advertising often features a comparison of a fund's benchmark with that of the performance, when the comparison is favorable.

A significant determinant for subsequent funds' cash inflows is its performance related to mismatched self-designated benchmark, even controlling for performance measures better capturing the fund's exposure to size and value/growth factors in returns. These non-linearities in the relation between performance and flows, in particular, holds for a large majority of funds that beat those mismatched benchmarks.

Sensoy estimates that the expected incremental gain in flows to funds with mismatched self-designated benchmarks is 2.3% of assets under management per year, corresponding to 14.6% of the average annual flow. This is consistent with the hypothesis that mismatched self-designated benchmarks resulting from strategic fund behavior will be an incentive to improve fund expected flows. For instance, typically style drift or changing of fund styles are not the cause of mismatched self-designated benchmarks, which are not purely incidental. Furthermore, the funds most likely to have mismatched self-designated benchmarks are the value funds and the small-cap funds relative to growth funds and large-cap funds. As well, large and high-fee funds will have a higher probability to adopt mismatched self-designated benchmarks since

[60] Mateus, I.B., Mateus, C., & Todorovic, N. (2018). The impact of benchmark choice on US mutual fund benchmark-adjusted performance and ranking. Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3014010

[61] West, S., & Leonard-Chambers, V. (2006). *Understanding Investor Preferences for Mutual Fund Information.* Investment Company Institute (ICI). Retrieved April 3, 2020, from Investment Company Institute (ICI): https://www.ici.org/pdf/rpt_06_inv_prefs_full.pdf

the benefit they garner from the increase in flows, represented by the percentage of assets under management, is greater. Lastly, once more supporting that mismatched benchmarks are not random, fund family effects have been proved to be significant determinants. As such, mismatched benchmarks make it more difficult to identify a fund's true factor exposures and may lead to excess flows. This argument is consistent also with Carlin (2008)[62] assumption that financial service providers strategically complicate their pricing schedules incentivized by the possibility of earning higher economic rents.

Morningstar is the main database containing information for 1,981 actively managed diversified US equity mutual funds on self-designated benchmark, semiannual holdings and monthly returns for the period 1994-2004. Results are analogous when restricting the sample period to 1999-2004, the starting date coincides with the year the SEC published the requirement on the returns to report on the prospectus. Sensoy pays particular attention to ensuring that the funds' benchmark is not mismatched, by eventually substituting them with a second benchmark.

Out of 1,981 funds, 1,815, corresponding to 91.6%, are associated to the indexes S&P or Russell, defined on size and value/growth: S&P 500, Russell 1000, Russell 1000 Value, Russell 1000 Growth, S&P Midcap 400, Russell Midcap, Russell Midcap Value, Russell Midcap Growth, S&P Smallcap 600, Russell 2000, Russell 2000 Value, or Russell 2000 Growth. These 12 benchmarks include 94.6% of total net assets, corresponding to US$ 985.1 billion in assets on June 30, 2004. Further in detail, S&P 500 is the most popular benchmark choice since it represents 44.4% of funds and 61.3% of June 2004 net assets, respectively US$ 637.4 billion.

Benchmark usage summary.

Summary statistics on mutual fund self-designated benchmarks. The sample period is 1994–2004. The sample consists of actively managed, diversified U.S. equity mutual funds. "Benchmark style" refers to the size and value/growth style of the benchmark, not necessarily the fund. Rank is relative to all benchmarks in the database. Percentages are based on all funds with benchmark data. "Assets" are total net assets, in billions of dollars, on June 30, 2004.

Benchmark	Benchmark style	# funds rank	# funds	% funds	Assets	% assets
S&P 500	Large blend	1	879	44.4	637.4	61.3
Russell 2000	Small blend	2	263	13.3	105.1	10.1
Russell 1000 Growth	Large growth	3	116	5.9	35.8	3.4
Russell 1000 Value	Large value	4	111	5.6	36.5	3.5
Russell 2000 Growth	Small growth	5	108	5.5	29.9	2.9
S&P Midcap 400	Medium blend	6	89	4.5	29.8	2.9
Russell 2000 Value	Small value	7	56	2.8	18.8	1.8
Russell Midcap Growth	Medium growth	8	54	2.7	32.4	3.1
Russell Midcap Value	Medium value	9	40	2.0	17.9	1.7
Russell Midcap	Medium blend	10	37	1.9	24.1	2.3
Russell 1000	Large blend	11	33	1.7	13.3	1.2
S&P Smallcap 600	Small blend	13	29	1.5	4.1	0.4
		Total	1,815	91.8	985.1	94.6

[62] Carlin, B., (2009). Strategic price complexity in retail financial markets. Journal of Financial Economics 91, 278-287

Figure 9 – Benchmark usage summary

Source: Sensoy, B. A. (2009). Performance evaluation and self-designated benchmark indexes in the mutual fund industry. Journal of Financial Economics 92, 25, 39, 15.

1.8.2 Alignment of funds' characteristics to their benchmarks

Many authors, among these Fama and French (1992)[63], retain that size and value/growth are associated with average returns and return covariance. Sensoy compares funds to their respective self-designated benchmarks with the purpose of studying how useful these benchmarks are to fund investors.

Starting with Fama-French 3-factors model regressions to describe funds' monthly benchmark adjusted returns, as follows:

$$R_{i,t} – R_{bench,i,t} = \alpha_i + \beta_i*(R_{M,t} – R_{f,t}) + s_i*SMB_t + h_i*HML_t + e_{i,t}$$

Where cboth calculated in month t. The funds included in the regression have at least 24 months of observed returns. The aim is to identify differences between the fund's and the benchmark's average exposures to the factors through the factor loadings in each of these regressions.

Results show that 40.0% of funds are subject to significantly different market exposures than their self-designated benchmarks, in particular 27.6% have less market exposure while 12.4% more; this pattern is uniform across benchmarks. This percentage ranges from 21.5% to 50.0% for funds that used as benchmarks respectively Russell 1000 Growth and Russell 1000. A higher percentage of funds, 57.9%, present significant loadings on the SMB factor relative to their benchmarks, of this 41.5% of funds have positive and 16.5% negative loadings, tending towards positive expected benchmark-adjusted returns. Funds that exhibit significant HML loadings relative to their benchmarks correspond to 61.6%, with a predisposition to value assets, sustained by the fact that 33.3% of funds have significant positive and 28.3% negative HML loadings relative to their benchmark. In general, these data on 1994, 1999 and 2003 cross-sections highlight that funds and their corresponding self-designated benchmarks have statistically and economically significantly different factor loadings. The difference leans towards small and value stocks, tending towards higher expected returns consistent with the aim to beat the benchmark.

An alternative way to the covariance method of capturing funds' factor exposures, is through the comparison of fund characteristics. This can be achieved through Morningstar's stylebox classifications,

[63] Fama, E., French, K., (1992). The cross-section of expected stock returns. Journal of Finance 47, 427–465

which categorize a fund portfolio by means of size and value/growth characteristics of the fund's stock holdings. The categories are large value, large blend, large growth, medium value, medium blend, medium growth, small value, small blend, and small growth.

Results are analogous with the ones that emerged with the preceding method. There are recurrent differences between funds' characteristics of size and even more of value/growth, as measured by the Morningstar's styleboxes, and of their self-designated benchmarks.

These differences suggest that some funds' self-designated benchmarks do not fully capture the funds' exposures to the two factors in returns. However, the former differences do not permit to merely conclude that some funds have suboptimal benchmarks, for instance despite significant typical differences, it may still be the closest match possible and it may be able to capture the fund's exposure to common factors in returns. The frequency and magnitude of such differences imply that at least for some funds, there may be an alternative benchmark among the 12 considered that better captures the fund's exposure to common factors in returns. The benchmark whose style matches the fund's Morningstar style is defined as the fund's candidate corrected benchmark. For 49.6% of the funds, the candidate corrected benchmark does not coincide with the actual benchmark. Of this fraction, 62.9% of funds, corresponding to 31.2% of the total sample, have a respective corrected benchmark that is more correlated with the fund's return than the actual benchmark, turning out to be also a better match for the fund. Sensoy denominates these funds' self-designated benchmarks as "mismatched". Supporting this evidence, the average R^2 equals 70.6% with the actual benchmark and 82.6% with the corrected one.

Mismatched self-designated benchmarks.

The first column displays the percentage of funds with a given self-designated benchmark whose characteristics do not match those of the benchmark (from Table 3). The second, most important, column displays the percentage of funds that are more correlated with the fund's candidate corrected benchmark than with the actual benchmark. These funds' actual benchmarks are mismatched because the corrected benchmark does a better job capturing the fund's exposure to common factors in returns. The last column displays, for funds with mismatched benchmarks, the average difference in R^2 of regressions of fund returns on those of the corrected benchmark and those of the actual (mismatched) benchmark.

Benchmark	Characteristics difference (% funds)	Benchmark mismatched (% funds)	# funds	Average R^2 difference if mismatched
S&P 500	62.0	40.7	879	0.13
Russell 1000	51.5	24.2	33	0.10
Russell 1000 Value	14.4	7.2	111	0.08
Russell 1000 Growth	3.4	3.4	116	0.07
S&P Midcap 400	76.4	44.9	89	0.14
Russell Midcap	51.4	32.4	37	0.14
Russell Midcap Value	35.0	17.5	40	0.06
Russell Midcap Growth	1.9	0.0	54	
S&P Smallcap 600	41.4	17.2	29	0.08
Russell 2000	69.6	44.1	263	0.09
Russell 2000 Value	41.1	5.4	56	0.12
Russell 2000 Growth	12.0	4.6	108	0.04
Overall	50.4	31.2	1,815	0.12

Figure 10 – Mismatched self-designated benchmarks

Source: Sensoy, B. A. (2009). Performance evaluation and self-designated benchmark indexes in the mutual fund industry. Journal of Financial Economics 92, 25,39, 15.

1.8.3 *The influence of mismatched self-designated benchmarks on fund flows*

Investors direct flows in response to risk-adjusted return. As mentioned above, 34% of investors consult the fund prospectus before purchasing a mutual fund, having a significant effect on flows. Sensoy's tests are based on regressing flows to mismatched self-designated benchmark funds on different measures and various controls of fund performance. Flows are calculated as following:

$$\text{Flows}_{i,t+1} = \frac{\text{TNA}_{i,t+1}}{\text{TNA}_{i,t}} - (1 + \text{R}_{i,t+1})$$

Significant nonlinearities in the relation between flows and historical returns were documented in past researches. Chevalier and Ellison (1997)[64] underline that fund investors respond quicker to good performance relative to the market than bad, suggesting that flows are more strongly related to positive market-adjusted performance than negative.

In light of this, Sensoy tries to account for nonlinearities by letting positive and negative performance relative to a reference index to affect differently flows. The regression includes 457 funds, which must have at least two years old at the end of year t, have at least $10 million in assets at the end of year t, and have in year t+1 flows of less than 10 (1,000%). Consistent with previous literature, fund size and age have a consistently negative effect of fund flows, whereas there are no effects reported of a fund's expense ratio on flows. In essence, performance relative to a mismatched self-designated benchmark has determinant explanatory power for fund flows and overcoming the benchmark is associated with higher flows. Results illustrate that the reduction of flows is mainly due to the negative performance relative to the corrected benchmark and negative Fama-French alpha. Sophisticated investors are identified to be the ones who penalize poor fund performance. Considering the model of self-designated benchmark-adjusted return as the unique explanatory return variable, the author predicts that beating the benchmark by one percentage point resulted in a 3.13 percentage point increase in inflows the following year, and vice versa

[64] Chevalier, J., Ellison, G., 1997. Risk-taking by mutual funds as a response to incentives. Journal of Political Economy 105, 1167–1200

trailing the benchmark by the same percentage would decrease inflows by 1.20 percentage point the subsequent year.

1.8.4 Responses of flows to performance

Fund investors have a high influence on the funds' agents' compensation through cash inflows and outflows, since fees are usually a fixed percentage of assets under management. The fund companies' aspiration for higher compensation is a great incentive for them to increase flows by maximizing risk-adjusted returns, meeting the interests of the fund investors.

The following theory tries to give an answer whether there are aspects of risk adjusted return, measured from the performance relative to the mismatched benchmark, that are not seized by the corrected benchmark, having incremental explanatory power for the cross-section of expected returns. The pricing tests are run for each mismatched-corrected benchmark pair and it controls for the Fama-French factors R_m- R_f, SMB, HML and the corrected benchmark. In the first set of tests, with the sample period January 1994 - July 2004, for each of the 36 mismatched-corrected benchmark pairs, the first model consists in excess-return time-series regressions. Here, the 25 Fama-French size and book-to-market portfolios are the dependent portfolios to be explained as the cross-section of assets and the explanatory portfolios are the Fama-French factors (R_m- R_f, SMB, and HML) and the excess returns of the corrected benchmarks. The 25 dependent portfolios are the intersection of five portfolios formed on the size and five formed on the ratio book-to-market. The two breakpoints are the NYSE quintiles. In the second model, the same regression is estimated by adding the excess returns of the mismatched benchmarks as an additional explanatory portfolio. The null hypothesis to be tested is whether the two models equally explain the cross-section of expected returns presented by the 25 Fama-French portfolios for each mismatched-corrected benchmark pair. Examination of the pricing errors, which do not differ, match across the two models, and GRS statistics of Gibbons, Ross, and Shanken (1989)[65], which also are similar across the two models, confirm that all 25 intercepts are equal to 0.0. The general results for this first test are consistent with the null hypothesis that the mismatched benchmark does not contribute to price the 25 Fama-French portfolios with the Fama-French factors and the corrected benchmark.

The second test aims to explain jointly the differences in expected returns of each pair of mismatched and corrected benchmarks by means of the Fama-French three-factor model. Sensoy constructs portfolios that

[65] Gibbons, M., Ross, S., Shanken, J., (1989). A test of the efficiency of a given portfolio. Econometrica 57, 1121–1152

are long the mismatched benchmark and short the corrected benchmark, characterized by zero investment spread. Successively, each spread portfolio is regressed on the Fama-French factors, with the objective to test whether the GRS test provides jointly zero intercepts. Results of the GRS test fail to reject at the 5% level the hypothesis that the intercepts are all equal to zero, consistent with the hypothesis that Fama-French model can jointly price the spread portfolios.

From these two tests, it can be concluded that the incremental responses of flows to performance relative to mismatched self-designated benchmarks are probably not rational responses to abnormal returns, but they are actually a reflection of a behavioral element to the composition of mutual fund flows. These certainly offer an incentive to funds to have benchmarks and portfolios that systematically differ in their risk attributes. According to Sensoy, as a consequence of the non-observability of the pricing kernel, it is highly unlikely, but it is not impossible to completely rule out the probability that mismatched benchmarks have incremental pricing power and are a rational response to abnormal returns.

1.8.5 The direction of incremental flows

As for self-designated benchmark-adjusted return, the coefficients in the regressions imply that funds are rewarded for overcoming a mismatched benchmark, conditional on the other performance measures, but are barely penalized for trailing it. An estimate of the gain in expected flows due to the mismatched self-designated benchmark, is evaluated by the product of a fund's self-designated benchmark-adjusted return and the estimated coefficient, from this it is subtracted the estimated expected flows with the corrected benchmark instead of its actual mismatched one. The model with full controls estimates a statistically significant 2.3% of fund assets per year, which corresponds to 14.6% of the average annual flow to funds with mismatched self-designated benchmark.

From a fund investor's viewpoint, the risk profile of the fund is essentially reflected in the self-designated benchmark and purchasing a fund with a mismatched self-designated benchmark offers on average a worse risk-return trade-off than a fund whose benchmark is corrected. For instance, by comparing the value of the average benchmark-adjusted return, it emerges that it corresponds to -0.018% per month for funds whose self-designated benchmarks are not mismatched, with an average fund's standard deviation of 2.074% per month, whereas it is -0.024% per month for funds whose self-designated benchmarks are mismatched, with an average fund's standard deviation of 3.435% per month. As evidenced by the values assumed from the expense ratio, funds with mismatched benchmarks charge higher fees than those whose benchmarks are not mismatched. These results suggest that for fund investors it may not be fruitful to direct incremental flows to funds with mismatched self-designated benchmarks.

The disposition of incremental flows is assumed to remain in the same funds with mismatched self-designated benchmarks for the entire period of the sample. An ulterior study consists in comparing the excess return and Sharpe ratio incremental flows earned to what they would have earned if invested in the corresponding corrected benchmark index or in the corresponding actual mismatched benchmark index. The results drawn are that incremental flows, for either the corrected or the mismatched benchmark index, are better directed to a low-cost index fund.

1.8.6 Are mismatched self-designated benchmarks strategic?

Sensoy sustains the thesis that if the benchmark of a fund drifted away through time from being suitable to mismatched, then not necessarily this behavior can be identified as strategic. On the contrary, if from the beginning a fund's benchmark was recognized to be mismatched, then this might indicate that it has been strategically chosen. Self-designated benchmarks are as frequently mismatched in 1999, the first year of the SEC requirement to report returns along with those of a benchmark, as in the overall sample period. Moreover, the majority of funds with mismatched self-designated benchmarks did not match those benchmarks in 1999. This would be the evidence that mismatched self-designated benchmarks are not a result of any style drift or changing of fund styles, which in fact are generally stable over time.[66]

An additional hypothesis proposes that the funds more likely to have mismatched benchmarks on value/growth and on size, are value funds and small-cap funds compared to respectively growth and large-cap funds. Thus, if a broad market index is selected as a benchmark for a small cap fund, then this will probably outperform its benchmark, having knowledge of outperformance of small cap stocks in the long run.

The thesis that mismatched self-designated benchmarks are consistent with strategic incentives to attract flows, brings forward the notion that they are more frequent among funds benefiting most from an economically significant increase in flows. Since flows improve fund profits through fees and a change in flows as a percentage of assets is a bigger capital for funds with more assets under management, funds

[66] Chan, L., Chen, H., Lakonishok, J., (2002). On mutual fund investment styles. Review of Financial Studies 15, 1407–1437

with higher fees and more assets under management have as well a higher probability to have mismatched benchmarks.

The regression setup verifies each of the four hypotheses while controlling for the effects of the variables proposed by the other three, in so doing avoiding spurious inference.

Lastly, there are fund family effects in the pattern of mismatched benchmarks. A significant determinant for a mutual fund to have a mismatched benchmark is family affiliation due to the fact that earnings gained by a fund accrue to the parent company and individual fund benchmarks may be established at the family level.

Probability of having a mismatched self-designated benchmark.

Fund-level logit models for the probability of having a mismatched self-designated benchmark. The dependent variables are indicator variables for whether the fund has a mismatched benchmark on size, value/growth, or either. The independent variables are the time-series average of the fund's expense ratio, the time-series average of the natural logarithm of the fund's assets under management, both measured relative to all funds with the same style, and dummy variables for whether the fund is a value fund, growth fund, small-cap fund, or large-cap fund. The models also include fund family fixed effects for each of the 44 fund families that have at least 10 funds in the sample. Heteroskedasticity-robust standard errors (in parentheses) are clustered by fund family. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Benchmark mismatched on value/growth	Benchmark mismatched on size	Benchmark mismatched on either or both
Value fund	3.74*** (0.24)	0.31* (0.17)	2.48*** (0.15)
Growth fund	3.56*** (0.27)	−0.23 (0.15)	2.21*** (0.18)
Small-cap fund	−0.49*** (0.13)	−3.13*** (0.32)	−0.99*** (0.16)
Large-cap fund	−0.08 0.12	−4.95*** (0.37)	−0.71*** (0.15)
Expense ratio	0.52*** (0.11)	0.20*** (0.05)	0.49*** (0.12)
ln (Assets)	0.24*** (0.08)	0.09 (0.08)	0.23** (0.09)
% family dummies significantly >0	36.4	36.4	31.8
% family dummies significantly <0	54.5	54.5	54.5
Pseudo R^2	0.25	0.39	0.19
# funds	1,563	1,402	1,563

Figure 11 – Probability of having a mismatched self-designated benchmark

Source: Sensoy, B. A. (2009). Performance evaluation and self-designated benchmark indexes in the mutual fund industry. Journal of Financial Economics 92, 25, 39, 15.

An example of the theory presented by Gibbons and Murphy (1990)[67] is the strategically assigned mismatched self-designated benchmarks of mutual funds, in which an agent, the fund company, subject to relative performance evaluation, selects a reference group different from the one preferred by the principal, the investor. Murphy (1995)[68] reports that companies apparently chose their peer groups strategically to make their performance appear more favorable when comparing performance in the annual reports of the company. Likewise, Dye (1992)[69] sustains that relative performance evaluation incentivizes companies to operate in industries with inept rivals and Carmichael (1998)[70] states that untenured faculty has a stimulus to recruit inferior colleagues.

1.8.7 Potential solution for the mismatched benchmark issues

Numerous studies advance solutions to the problem of mismatched benchmarks. The choice of a referred benchmark and of the methodology to use for performance evaluation impacts the performance, since changing any of the two incurs a change in fund alphas.

Sharpe's (1992)[71] method consists in decomposing historical portfolio returns into asset classes it invests in. Nonetheless, this method is not very effective in capturing sudden style drifts in a fund. Daniel, Grinblatt, Titman, and Wermers (1997)[72] employ characteristics-based benchmarks, benchmarks matching characteristics of stocks that mutual funds include in their portfolios. However, this method cannot be applied unless funds share complete information of their holdings, which is not the case for several markets. Chan et al. (2009)[73] suggest to estimate performance relative to characteristic-matched benchmarks and the Russell style indexes, assigned to each active portfolio consistent with its style, provided on the reports by money managers.

---

[67] Gibbons, R., Murphy, K., 1990. Relative performance evaluation for chief executive officers. Industrial and Labor Relations Review 43, 30S–51S

[68] Murphy, K., (1995). Politics, economics, and executive compensation. University of Cincinnati Law Review 63, 713–748

[69] Dye, R., (1992). Relative performance evaluation and project selection. Journal of Accounting Research 30, 27–52

[70] Carmichael, H., (1988). Incentives in academia: Why is there tenure? Journal of Political Economy 96, 453–472

[71] Sharpe, W.F. (1992). Asset allocation: Management style and performance measurement. Journal of Portfolio Management, 18(2), 7–19

[72] Daniel, K., Grinblatt, M., Titman, S., & Wermers, R. (1997). Measuring mutual fund performance with characteristics-based benchmarks. Journal of Finance, 52, 1035–1058

[73] Chan, L. K. C., Dimmock, S. G., & Lakonishok, J. (2009). Benchmarking money manager performance: Issues and evidence. The Review of Financial Studies, 22(11), 4553–4599

A variation in the value of alpha does not necessarily modify the ranking of the fund within a group, of essence to investors seeking the best fund in the group. The ranking in the peer group is biased if a benchmark does not match the objectives of a fund, this because a fund may strategically choose a benchmark easy to beat. Furthermore, if funds in the same peer group have different passive benchmark indices, then their benchmark-adjusted alphas are not comparable directly.

Hunter et al. (2014)[74] emphasize that the manager's true skill should not include the commonalities in fund strategies of a peer group. Hence, they debate that, instead of augmenting the standard models with a number of factors, there should be only one factor added, the Active Peer Benchmark (APB). This accounts for peer group commonalities in idiosyncratic risk-taking, guaranteeing the estimation of unique manager skills, not correlated to the average of the peer group. The APB is an equally weighted portfolio of all the funds in the peer group. The Carhart model is augmented with an additional fifth-factor, the APB adjusted factor, represented by the estimated four-factor alpha of the APB benchmark added to the error term from that four-factor model, i.e. $\hat{a}_{ABP,i} + \hat{e}_{ABPi,t}$. The alpha in the APB model, i.e. $\alpha_{i,ADJ}$, is the peer-group adjusted alpha.

$$R_{i,t} - R_{f,t} = \alpha_{i,ADJ} + \beta_{i,M} *(R_{M,t} - R_{f,t}) + \beta_{i,SMB} *SMB_t + \beta_{i,HML} *HML_t + \beta_{i,WML} *WML_t +$$

$$\beta_{i,ADJ} *(\hat{a}_{ABP,i} + \hat{e}_{ABPi,t}) + \varepsilon_{i,ADJ,t}$$

The APB benchmark avoids the need to use potentially biased funds self-reported benchmark. Therefore, APB adjusted alpha in the new APB model will result positive and significant whether the skills of a fund manager are above common strategies undertaken within the reference group. Adding commonalities in fund strategies to the standard Carhart model develops greater explanatory power of their model. The purpose of the inclusion of the APB is not merely to search for a 'missing' priced factor, but to facilitate and improve the choice of performing funds for the investor within a comparable peer group of funds and to identify managerial skills that outperform the average group's skill. For relative performance evaluation of funds, investors have to assess it compared to the peer group, as a fund may report a positive Carhart alpha but actually perform worse than the average in its same group. Hence, it is highly relevant also the selection of the comparable peer group, which should be based on broadly accepted standards, as CRSP

[74] Hunter, D., Kandel, E., Kandel, S., & Wermers, R. (2014). Mutual fund performance evaluation with active peer benchmarks. Journal of Financial Economics, 112(1), 1–29

classification codes or monitoring groupings of a widely accepted industry performance, such as Morningstar, where a style category is assigned to equity funds based on historical holdings.

Lastly, the purpose of these economists' models is to contribute to performance measurement, either relative to the fund's benchmark or to their peer group, and not to assure a more accurate asset pricing by accounting for pricing anomalies, as in the preceding asset pricing augmented models.

1.9 Ethical mutual fund

1.9.1 Evolution of ethical mutual funds

Ethical investing is deeply rooted more than a century ago, but the modern concepts date back to the 1960s, characterized by a political climate that increased social awareness on specific issues such as environment, civil rights and nuclear energy. In fact, mutual funds were set up with the specific intent of including ethical criteria in the investments. During the last 30 years, a momentous development in the financial community is denoted by the increasing investments in the social and ethical mutual funds. The ethical mutual fund market witnessed an unprecedented growth in assets, although still representing a small fraction of the entire retail market.

The US industry rose from US$ 12 billion in 1995 to US$ 153 billion at the end of 2000. In 2000, including also all US private and institutional ethically screened portfolios, it amounted to US$ 2 trillion, representing in total nearly 12% of capital under professional management. Whereas, the European market is still in an early stage of development in Germany, France, Belgium and Italy. Ethical funds in these countries do not even account for 1% of the total domestic market of mutual funds. Switzerland has an equal number of mutual funds of Germany, but the value as a percentage of total mutual fund assets is slightly above 1% (i.e. 1.12%). Among European countries, the United Kingdom and Sweden are characterized by the highest number of ethical mutual funds, respectively 55 and 42, each corresponding to 1.35% and 1.46% of total assets, which relevance however corresponds to only half of the one in the USA, counting 2.26% at the end of 2000. These values are evidence of the fact that the ethical mutual fund industry plays a marginal role with respect to the conventional market. Due to the increasing spread of this movement, the financial consequences in investing in ethical funds became of great relevance and object of studies.

Country	# of ethical mutual funds	Ethical assets under management in million USD	As a % of total mutual fund assets
Belgium[a]	26	602	0.80%
France[a]	14	371	0.01%
Germany	22	1,317	0.04%
Italy[a]	5	2,077	0.45%
Sweden[a]	42	1,190	1.46%
Switzerland[a]	22	1,011	1.12%
The Netherlands	11	1,309	1.20%
United Kingdom	55	6,390	1.35%
United States	230	153,000	2.26%

Figure 12 - Overview of ethical mutual fund market as of 30/12/2000

Source: Bauer, R., Koedijk, K., & Otten, R. (2005). International evidence on ethical mutual fund performance and investment style. Journal of Banking & Finance, 29, 1751–1767

1.9.2 Standards of ethical mutual funds

Socially responsible mutual funds draw attention to investing in companies that apply predetermined ethical standards in the running of its business or on its final product. A socially responsible investment strategy aims at achieving successful investment returns dealing with responsible corporate behavior. What can be defined as ethical varies widely across fields as environmental, social, moral and religious. When determining the stocks to include in the ethical funds, managers have to undergo a detailed screening process to decide which values to assume in order to attract the largest possible number of investors. Once the investors become shareholders, they can actually influence management by suggesting proposals or by exercising their voting rights through proxy, allowing management to vote on their behalf.

Managers' additional ethical research is compensated by the attribution of higher fees with respect to the ones imposed to regular funds. The characteristic of ethical mutual fund management is that it is generally administered by smaller mutual fund companies and also the size of the assets under management is relatively small, due to this fact these funds benefit less from economies of scale. However, it is still possible and fundamental for the funds' returns, to diversify as much as possible the portfolio, without the need of not complying or making compromises for the values of the funds.

1.9.3 Performance of ethical mutual funds

After controlling for investment style, the results suggest there are no significant differences in risk-adjusted returns between ethical and conventional funds for the decade 1990-2001. However, ethical mutual funds went through a catching-up phase before actually reaching similar financial returns to that of conventional mutual funds.

The performance of ethically managed mutual fund assets is tracked through several indexes, like the MSCI KLD 400 Social Index (initially called the Domini Social 400 Index) whose annualized return between May 1994 and June 2018 was 10.01%. Over the past 10 years, the annualized return of the index amounted to 10.63% compared to 10.17% of the S&P 500.

According to Moskowitz (1972)[75], the hypothesis that the expected returns on stocks of ethical firms are higher than the returns on conventional stocks, derives from the incorrect pricing of social responsibility from the market. Likewise Hamilton et al. (1993)[76] suggest that investors may underestimate the possibility of the release of negative information on companies regarded as controversial from an ethical prospect.

The literature on mutual funds is mainly focused on US and British retail markets. As stated before, as for the US market, ethical screening results in similar or slightly weaker performance with respect to comparable unrestricted portfolios. Diltz (1995)[77], Guerard (1997)[78], Sauer (1997)[79] show that the differences between the returns of ethically screened and unscreened universes are not statistically significant. In support of the theory, a more recent study in 2000 of Hamilton et al. (1993) and Statman[80] compares returns of ethical and regular US funds to each other and to both indexes, S&P 500 and Domini Social Index (DSI). The results demonstrate that the risk-adjusted returns of ethical and conventional funds are not different due to the value of the estimated Jensen's alpha. Whereas, empirical evidence on UK data reveals weak outperformance compared to the general market indexes. Results obtained by Luther et al. (1992)[81] comparing the returns of 15 ethical funds to market-wide indices as the FT allshare index.

---

[75] Moskowitz, M., (1972). Choosing socially responsible stocks. Business and Society Review, 71–75

[76] Hamilton, S., Jo, H., Statman, M., (1993). Doing well while doing good? The investment performance of socially responsible mutual funds. Financial Analysts Journal 49 (6), 62–66

[77] Diltz, J.D., (1995). Does social screening affect portfolio performance? The Journal of Investing 1, 64–69

[78] Guerard, J.B., (1997). Is there a cost to being socially responsible in investing? The Journal of Investing, 11– 18

[79] Sauer, D.A., (1997). The impact of social-responsibility screens on investment performance: Evidence from the Domini 400 social index and domini equity mutual fund. Review of Financial Economics 6 (2), 137–149

[80] Statman, M., (2000). Socially responsible mutual funds. Financial Analysts Journal (May–June), 30–39

[81] Luther, R.G., Matatko, J., Corner, D., (1992). The investment performance of UK ethical unit trusts. Accounting, Auditing and Accountability Journal 5 (4), 57–70

Luther and Matatko (1994)[82] subsequently validate a bias towards smaller companies for ethical funds and make a comparison with small cap benchmark, which improved the relative performance. The outperformance of the DSI index has been attributed to sector and style biases.

In 2003, R. Bauer, K. Koedijk and R. Otten[83] carry out a study on ethical funds, evaluating the international performance and investigating whether their risk-adjusted return and investment style differ from a matched sample of conventional mutual funds, controlling for such biasing influences.

The sample is composed of 103 US, UK and German domestic ethical open-ended equity mutual funds with at least 12 months of data: the first two represent the most developed ethical mutual fund markets and the last is relatively new but a fast growing market. Portfolios of mutual funds are formed by ethically managed assets employing Morningstar for the USA, EIRIS for the United Kingdom and Ecoreporter for Germany. A sample of 4384 conventional equity mutual funds in a certain country, not subject to any ethical value, are selected as reference. To improve comparability, the funds were allocated between two investment categories with domestic or international focus.

For the period from January 1990 to March 2001, monthly returns in local currency comprise any distributions and are net of annual management fees. The US data is survivorship-bias free, while for the United Kingdom and Germany, funds that closed anytime in the 1990-1991 period were included to mitigate a possible survivorship bias that would otherwise cause an overestimation of the average performance. The sample included dead funds until they disappeared, at that time the mutual fund portfolios were weighted accordingly. Funds that disappeared during the sample period under consideration cannot be neglected since the corresponding number is significant, i.e. 19% for USA, 28% for UK and 6% for Germany. Indeed, considering a sample with only surviving mutual funds would overestimate average returns by 0.31% for USA, 0.17% for UK and 0.14% for Germany.[84]

As of 2000, the average ethical fund is smaller not only in the number of funds but also in size compared to a conventional fund, while its expense ratio value is higher. Conventional funds tend to be older than ethical mutual funds, considering the fund age measured in years.

---

[82] Luther, R.G., Matatko, J., (1994). The performance of ethical unit trusts: Choosing an appropriate benchmark. British Accounting Review 26, 77–89

[83] Bauer, R., Koedijk, K., & Otten, R. (2005). International evidence on ethical mutual fund performance and investment style. Journal of Banking & Finance, 29, 1751–1767

[84] Source: CRSP Survivor-bias Free US Mutual fund Database for US. Datastream for Germany and UK

Country	Fund size (in mln USD)	Fund expense ratio	Fund age (in years)	# of Funds
Germany				
International				
Ethical	73	1.40	5.0	16
Conventional	323	1.04	4.8	114
United Kingdom				
Domestic				
Ethical	48	1.24	6.4	20
Conventional	176	1.19	9.2	300
International				
Ethical	89	1.49	7.5	12
Conventional	107	1.33	8.5	96
United States				
Domestic				
Ethical	154	1.49	5.4	50
Conventional	610	1.32	9.5	2806
International				
Ethical	140	1.71	4.1	5
Conventional	385	1.64	7.3	1068

Figure 13 - Characteristics of ethical versus conventional funds (31/12/2000)

Source: Bauer, R., Koedij, K., & Otten, R. (2005). International evidence on ethical mutual fund performance and investment style. Journal of Banking & Finance, 29, 1756

The authors compare the performance of each ethical fund with equal-weighted returns of a matched sample of three conventional funds, applying fund age and size criteria. Throughout the 1990-2001 period, it results that the German ethical mutual funds underperform the conventional funds and the Worldscope World index, while in the United Kingdom and USA the difference in performance is less notable. Worldscope World index is a market-wide equity index, which covers 98% of market capitalization. The Fama & French market index is used to approximate the market portfolio for the domestic US mutual fund.

The principal model to study the performance of an ethical mutual fund is the CAPM model based on a single index. The intercept of the model α_i, Jensen's alpha, represents a measure of out- or under-performance related to a market proxy and it is estimated for both the portfolio of ethical funds and the matched portfolio of conventional funds. By examining the resulting outcomes of both funds' α_i, no significant difference in the performance emerges. Furthermore, focusing on the exposure to market betas, ethical funds are less market sensitive than their conventional counterparts.

Recent literature affirms the presence of cross-sectional variation of stock returns. So in order to evaluate performance, the authors retain more appropriate the Carhart (1997)[85] 4-factor model, consistent with a market equilibrium model with four risk factors. The model includes a value-weighted market proxy, equity portfolios with returns sorted by size, book-to-market ratio and momentum, formed by ranking all stocks on their prior 12 month return. All factor portfolios are value weighted. For the excess market return, they consider the difference between returns of all stocks in the Worldscope universe for each region, that are larger than US$ 25 million and the 1-month inter-bank rate. This model can be considered as a performance attribution model, since the premia and coefficients on the factor-mimicking portfolios indicate the portion of mean return assignable to four widely pursued investment strategies. The increase in the average R_2^{adj} is a first evidence of the superiority in explaining mutual fund returns by multi-factor models, instead of the 1-factor CAPM model. Confirming the results obtained by the CAPM model, ethical funds are less exposed to the market portfolio compared to conventional funds. Differently from the US funds that invest mainly in large caps, ethical funds in Germany and United Kingdom are highly exposed to small caps. In addition, HML ratios of all ethical mutual funds are inferior to those of conventional funds, indicating that they are either more growth-oriented or less value-oriented. In fact, a high proportion of growth stock orientation may be due to the exclusion of traditional value sectors such as energy, chemical and other basic industries from the investment, since these typically are characterized by high environmental risk. After controlling for the four factor risks for Germany, United Kingdom and USA, the difference in return between ethical and conventional funds remains statistically insignificant.

In general, ethical funds are more expensive than conventional funds, calculated by the expense ratio. In order to examine the influence of this fund characteristic on performance, the alpha is assessed both before and after deducting management fees. To calculate the alpha before management fees, the fund returns taken into consideration for the regression have to be added to management fees. However, there has not been detected any statistically significant difference in performance for neither of the three regions.

It has been registered a relative development of increasing performance through time as a consequence of the undergoing changes of the ethical fund sector. The analysts divide the sample period 1990-2001, into three non-overlapping subsamples. During the first period, 1990-1993, risk-adjusted return of ethical mutual funds was lower than the conventional ones. During the subsequent years, this underperformance weakened and changed even its sign. For instance, over the period 1998-2001, ethical mutual funds had a

[85] Carhart, M., (1997). On persistence in mutual fund performance. Journal of Finance 52, 57–82

superior risk-adjusted return. The United Kingdom presents an exception: there is no statistically significant performance differential of the domestic ethical mutual fund and the conventional fund throughout the entire sample period. In general, ethical mutual funds experienced a so-called catching-up phase before providing financial returns like those of conventional mutual funds.

Finally, ethical indices proved to be less useful in explaining ethical fund returns compared to standard indices, and the results regarding fund performance remain unaffected.

1.10 Key investment figures in the Italian market

Based on 2019 data, Italian investors continued to show caution in the selection of their portfolios' investments. The net sales of bank bonds, government securities and stocks have been substantial and the deposits increased noticeably. The shares allocated in asset management products augmented even more, reaching 31.6% in 2019, from 19.8% in 2007.[86] According to the data retrieved from the Bank of Italy Annual Report 2018, it emerges that the total value of the financial assets of Italian households amounted to 486 514 million of euro, of these € 221 381 million in Italian funds and € 265 133 million in foreign funds. Following a chart representing the allocation of the Italian investors' financial assets.

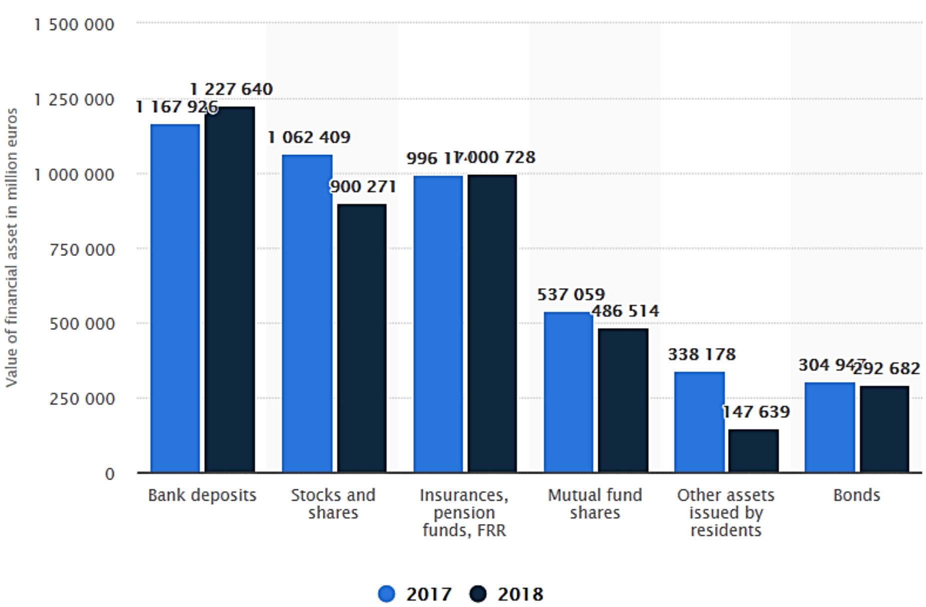

Figure 14 - Financial assets of Italian households in 2017-2018 (in million euros)

[86] *Banca d'Italia. Relazione Annuale, anno 2019.* (2020, May 29). Retrieved June 3, 2020, from bancaditalia: https://www.bancaditalia.it/pubblicazioni/relazione-annuale/2019/rel_2019.pdf

Source: https://www.statista.com/statistics/811528/financial-asset-of-italian-families-by-type/ retrieved June 5 2020

In Italy, as in the other European modern capital markets, mutual funds are becoming increasingly more important investment tools. The value of investment fund shares of Italian investors increased at a constant pace from 2010 to 2018, rising from € 277 546 million to € 481 649 million. As of 31st December 2018, Italy-based open-end mutual funds accounted for 737 funds, corresponding to 99% of total assets under management (AUM) operating mutual funds. Whereas, the number of Italy-based closed-end mutual funds is equivalent to 26.[87] In particular, at the end of 2017, the shares of domestic open-end investments on the Italian asset management market were committed for 42% in the flexible funds, 36% in bond funds, 10% balanced funds, 9% in equity funds, 2% in money market funds and 1% in hedge funds.[88]

CHAPTER II - Data and methodology

2.1 Data description

The dataset is constituted by 45 equity open-end mutual funds. The funds are all actively managed and only the primary class is included. All returns are in local currency, i.e. Euro. The sample is survivorship-bias free, since no fund has ceased to exist during this sample period. The funds are registered to sell in Italy, even though a part of those not exclusively there, while they are not necessarily domiciled in the country. This is because most funds are issued in just a few financial centres, primarily in Luxembourg and Ireland. In particular, as reported more in detail in table 1 below, 20 out of 45 mutual funds are domiciled in Italy, 22 in Luxembourg and the remaining 3 in Ireland. The reference period of the data for the analyses goes from January 2009 to December 2019.

According to the Lipper Global Classification (LGC), the funds encompassed in the sample are classified all as either Equity Italy or Equity Italy Sm&Mid Cap. In particular, the former classification is attributed to most funds, with the exclusion of only four funds which are categorized as Equity Italy Sm&Mid Cap, i.e. Symphonia Azionario Small Cap Italia Classe I; Fondersel PMI A; Eurizon Azioni PMI Italia R; Symphonia Azionario Small Cap Italia. The LGC is structured in order to establish homogeneous groups

[87] Statista Research Department. (2019, November 25). Investment fund shares' value of Italian households from 2010 to 2018. Retrieved June 5, 2020, from Statista: https://www.statista.com/statistics/1073585/households-investment-fund-shares-value-in-italy/

[88] Distribution of domestic open-end investment funds on the Italian asset management market as of December 2017, by asset class . (2020, May 28). Retrieved June 5, 2020, from Statista: https://www.statista.com/statistics/796605/domestic-open-end-investment-funds-by-asset-class-the-italian-asset-management-market/

of funds with comparable investment objectives, which may be achieved through the adoption of different investment strategies or styles. Funds assorted in one specific LGC sector invest in the same financial markets or in specific segments of those. Funds are classed according to their geographic stock market exposure, local or regional, or in alternative to their prevalent exposure to a specific industry sector, if they focus more than 75% of their investments on the industry. Finally, funds directing their investments to equities of small- and/or middle-capitalization companies are cataloged in the appropriate small- and mid-cap sector.[89]

The risk free rate adopted in the analysis is the Euro OverNight Index Average (EONIA). The Eonia rate denotes the 1-day interbank interest rate for the whole Euro zone. Banks provide loans to each other at this rate with a duration of 1 day. Eonia rates are calculated by the European Central Bank as a weighted average of all unsecured lending transactions in the interbank market overnight, undertaken by the Panel Banks in the member countries of the European Union and European Free Trade Association (EFTA). Banks are qualified as panel banks if they are active players, as well as the largest participants, in the Euro money markets both in the euro-zone and worldwide and they contribute to the EURIBOR. These are consolidated banks, which usually transact the highest volumes within the Euro market, providing liquidity and stability overall. Panel banks are characterized for enjoying an excellent reputation, being banks of first class credit standing and with high ethical standards. Although all panel banks are subject to the Eonia Code of Conduct, approved by the European banking industry on 15 December 1997, there has not been proposed any clear definition of 'interbank market', leaving to a subjective assessment of what is an 'interbank loan'. Eonia is gradually been replacing by the Euro short-term rate (€STR), having the ECB published the new rate since 2nd October 2019. As for the benchmarks, my study considers two distinct ones: MSCI Italy Index (MSITALL) and FTSE MIB Index (FTSEMIB). With 24 constituents, MSCI Italy Index (Morgan Stanley Capital International Italy Index) is a measure of performance of the countries' large and mid-cap segments of the market, covering approximately 85% of the equity universe in Italy. The FTSE MIB Index (Financial Times Stock Exchange Milano Indice di Borsa) is the primary benchmark index for the Italian stock exchange markets. The index measures the performance of the 40

[89] *REFINITIV LIPPER GLOBAL CLASSIFICATION, Category Definitions.* (2019, February 15). Retrieved April 29, 2020, from REFINITIV: https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/lipper-global-fund-classification-methodology.pdf

most-traded and highly liquid Italian stock classes on the exchange, capturing around 80% of the domestic market capitalization, and tries to replicate the broad sector weights of the country stock market.

All the data are collected from Thomson Reuters Datastream. The European Small Minus Big (SMB), High Minus Low (HML) and Momentum or Winner Minus Loser (WML) factors have been provided by Kenneth R. French website, in the section *Data Library* and under the subsection *International Research Returns Data*. In order to calculate these, Morgan Stanley Capital International supplies raw data from 1975 to 2006 and Bloomberg from 2007 to present.

Table 1 reports the 45 equity mutual funds included in the database, their ISIN, Reuters Instrument codes (RIC) and the country where they are domiciled.

Table 1 – Equity open-end mutual fund sample

Name (or Code)	ISIN	RIC	Domicile
Fidelity Funds - Italy A-EUR-DIS	LU0048584766	LP60033976	Luxembourg
Synergia Azionario Italia	IT0004464217	LP65154895	Italy
CS (Lux) Italy Equity Fund UB EUR	LU1144402218	LP68292938	Luxembourg
Symphonia Azionario Small Cap Italia Classe I	IT0005154445	LP68354733	Italy
AXA WF Framlington Italy AC EUR	LU0087656699	LP60000584	Luxembourg
AXA WF Framlington Italy FC EUR	LU0087656855	LP60000585	Luxembourg
Arca Azioni Italia P	IT0000388907	LP60017372	Italy
Eurizon Azioni Italia R	IT0001021192	LP60017445	Italy
Euromobiliare Azioni Italiane A	IT0001013520	LP60017661	Italy
Fondersel PMI A	IT0000386489	LP60017768	Italy
Anima Italia A	IT0001040051	LP60017861	Italy
Investimenti Azionari Italia A	IT0001023628	LP60017919	Italy
Fideuram Italia R	IT0000388147	LP60017937	Italy
Interfund Equity Italy	LU0074298604	LP60017972	Luxembourg
BNL Azioni Italia	IT0000382561	LP60017988	Italy
AcomeA Italia A1	IT0000390044	LP60018289	Italy
ZENIT Pianeta Italia R	IT0001070645	LP60018402	Italy
Mediolanum Challenge Italian Equity L A	IE0004905604	LP60031204	Ireland
Eurizon Azioni PMI Italia R	IT0001470183	LP60032329	Italy
Fonditalia Equity Italy R	LU0058495788	LP60032371	Luxembourg
CS (Lux) Italy Equity Fund B EUR	LU0055733355	LP60033322	Luxembourg
OYSTER Italian Opportunities C EUR PR	LU0069164738	LP60035121	Luxembourg
Schroder ISF Italian Equity A Dis AV	LU0067016716	LP60035727	Luxembourg
Schroder ISF Italian Equity B Acc	LU0106239360	LP60035728	Luxembourg
Schroder ISF Italian Equity B Dis AV	LU0067017284	LP60035729	Luxembourg

AZ Fund 1 - Italian Trend A-AZ FUND (ACC)	LU0107991985	LP60044241	Luxembourg
Unipol Performance Italia Fund	IE0005407881	LP60046013	Ireland
Schroder ISF Italian Equity A Acc	LU0106238719	LP60053005	Luxembourg
Schroder ISF Italian Equity C Acc	LU0106239527	LP60053007	Luxembourg
Eurizon Fund Equity Italy Smart Volatility R EUR	LU0130323438	LP60059437	Luxembourg
OYSTER Italian Opportunities N EUR PR	LU0133192608	LP60064061	Luxembourg
Mediolanum Challenge Italian Equity S A	IE0004394007	LP60065629	Ireland
Pramerica Azioni Italia	IT0003242408	LP60069775	Italy
Schroder ISF Italian Equity A1 Acc	LU0133712025	LP60070114	Luxembourg
AZ Fund 1 - Italian Trend B-AZ FUND (ACC)	LU0107995895	LP60078075	Luxembourg
AXA WF Framlington Italy EC EUR	LU0189847337	LP60085574	Luxembourg
AXA WF Framlington Italy IC EUR	LU0297965641	LP65071095	Luxembourg
Amundi Dividendo Italia B	IT0004253800	LP65086404	Italy
Fidelity Funds - Italy Y-ACC-EUR	LU0318940342	LP65094105	Luxembourg
Allianz Azioni Italia All Stars A	IT0004287840	LP65100637	Italy
ZENIT Pianeta Italia I	IT0004374937	LP65122892	Italy
Fonditalia Equity Italy T	LU0388707183	LP65139913	Luxembourg
Symphonia Azionario Small Cap Italia	IT0004464233	LP65154896	Italy
Anima Geo Italia A	IT0001036315	LP60017612^D20	Italy
Anima Geo Italia Y	IT0004301153	LP65100620^D20	Italy

2.2 Methodology

In my study, I carried out multiple analyses, by regressing the funds' excess returns with respect to two different benchmark indexes.

The mutual fund investment vehicle generates returns by two means: capital appreciation and dividend payouts. The first refers to the increase or decrease in the market price, corresponding to the NAV, of the security.

In order to determine the monthly returns, for each open-end equity mutual fund, I retrieved the monthly NAV and the dividends paid by the fund in the same period, from January 2009 to December 2019. Mutual fund returns, net of management fees, are calculated monthly:

$$\mathrm{r}_{i,t} = \frac{\mathrm{NAV}_{i,t} + \mathrm{DD}_t}{\mathrm{NAV}_{i,t-1}} - 1$$

with i =1,…,N and t =1,…,T

where:

N is the number of equity mutual funds in the sample;

t is the time period considered;

$NAV_{i,t}$ is the net asset value of the i-th fund at time t;

$NAV_{i,t-1}$ is the net asset value of the i-th fund at time t-1;

DD_t is the dividend paid by the i-th fund at time t.

For the two benchmarks, I retrieved the Total Return Index (RI). Until February 2018, only capital appreciation was taken under consideration to map the performance of a fund. In fact, funds' returns were compared with the Price Return Index (PRI) of the benchmark, which captured only this aspect of index constituents. It ignored completely the dividend payment component of mutual fund schemes. In order to include both the capital gains and dividend component, the Total Return Index was introduced to determine returns.

Analogously, I calculated for each market benchmark the return at time t:

$$r_{i,t} = \frac{RI_t}{RI_{t-1}} - 1$$

i= MSCI ITALY; FTSE MIB INDEX.

Successively, I calculated the excess return for each mutual fund and for the two benchmarks, by subtracting the risk free rate from the respective returns in each period.

2.3 Mutual fund performance measurement models

With the purpose of studying the performance of Italian funds, I adopted three distinct models: the single factor Capital Asset Pricing Model, the Fama-French three-factor model and the Carhart four-factor model.

2.3.1 The single factor Capital Asset Pricing model

The Capital Asset Pricing Model (CAPM) is the most common model used to determine the rate of return of an asset or a fund. The CAPM was introduced independently by Jack Treynor (1961), William F. Sharpe (1964), John Lintner (1965) and Jan Mossin (1966), building on diversification and modern portfolio theory, an earlier work of Harry Markowitz. This risk-adjusted performance measure was introduced to examine the stock picking ability of a fund manager. It takes into account the expected return of the market and of a theoretical risk-free asset, and the asset's sensitivity to market risk or systematic risk, indicated by the quantity beta (β), which represents a non-diversifiable type of risk.

The CAPM undertakes the following assumptions:

- investors are risk averse;
- investors maximize expected utility, they are mean-variance optimizers;
- all investors can borrow and lend unlimited amounts at the risk free rate;
- all investors face the same one-period horizon;
- investors have homogenous expectations for risk and return;
- markets are highly efficient and investors have equal access to all available information;
- investors are price takers, not makers, i.e. their trades cannot affect security prices;
- no transaction costs, taxes nor inflation;
- no restrictions on short selling;
- assets are infinitely divisible;
- returns of all available assets have a normal distribution function.

The CAPM expressed in terms of expected returns:

$E(R_i) = R_f + \beta_{i,m} * (E(R_M) - R_f)$

with $i = 1, \ldots, N$

where:

N is the number of securities;

$E(R_i)$ is the expected return of the fund;

R_f is the risk-free rate of interest;

$\beta_{i,m}$ is the sensitivity of the expected excess returns of the asset relative to the expected excess returns of the market;

$E(R_M)$ is the expected market return.

The graphical representation of the above formula embodying the linear relationship of the fund excess return and its beta, is known as the Security Market Line (SML). The risk, beta, is portrayed on the x-axis and the expected return on the y-axis. The slope of the SML corresponds to the market risk premium and the intercept is the risk free rate available for the market.

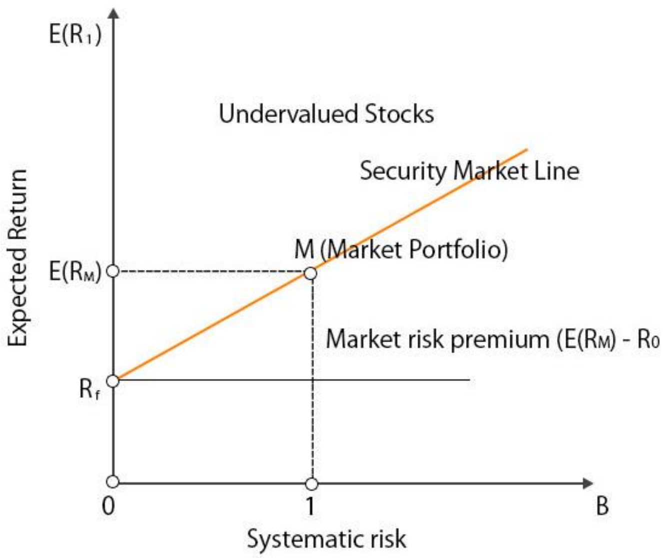

Figure 15 - Security market line (SML)

Source: https://theintactone.com/2019/05/18/saim-u2-topic-5-securities-market-line/ retrieved May 3 2020

The graph plots individual securities, and if the expected returns of these are above the SML, then the securities are undervalued since the investor expects a greater return from the inherent risk. Vice versa, if the security is below the SML, it is overvalued in price since the expected return does not overcome the risk assumed by investors. From the CAPM equation, it can be evinced that the expected return of a risky asset is determined by the risk free rate plus a risk premium, proportional to the systematic risk of the asset.

Beta represents the measure of market risk or systematic risk. It is the only risk rewarded, since non-systematic risk can be eliminated through diversification. In fact, mutual funds should bear systematic risk only since one of the main characteristics of this type of instrument is that it is diversified. Beta measures how much the securities’ values move in synchrony with the market. It is proportional to the covariance between the asset return and the market’s trend:

$$\beta_i = \frac{Cov\ (R_i,R_M)}{Var(R_M)} = \rho_{i,M} * \frac{\sigma_i}{\sigma_M}$$

with i=1,…,N

where:

N is the number of funds in the sample;

$\rho_{i,M}$ is the correlation coefficient between the investment (i) and the market (m);

σ_i is the standard deviation for the investment i;

σ_M is the standard deviation for the market m.

By examining the value of beta, it is possible to determine the riskiness of the fund compared to the market. If β_i=1 the fund can be declared as risky as the market, if β_i<1 it will be less risky than the market and last if β_i>1 the fund undergoes a higher risk compared to the market.

The CAPM can be expressed also in terms of excess returns. It is an equilibrium model that considers expected returns, trying to determine what the price for risky securities should be, whereas in practice what we consider are the realized returns. The single index model uses realized returns and a market index as benchmark, and not the market portfolio as in the CAPM.

Single index model equates individual risk premium with the market premium times the market coefficient $\beta_{i,m}$:

$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,m} * (R_{M,t} - R_{f,t}) + \varepsilon_{i,t}$

where $\varepsilon_{i,t}$ is the stochastic error. It is a random component with zero expected value, embodying the idiosyncratic, firm-specific risk. Differently from the CAPM, the single index model considers two components of total risk: systematic (market-wide) risk and non-systematic (idiosyncratic) risk.

Jensen's alpha (α_i) is a risk-adjusted performance measure, which represents the excess return of a security above the return that would be justified by its systematic risk, as predicted by the Capital Asset Pricing Model:

$\alpha_i = r_i - E(r_i)$

where:

r_i is the realized return of the fund;

$E(r_i)$ is the expected return as predicted by CAPM.

According to the CAPM model, the expected value of alpha (α_i) should be equal to zero. Analogously, for the single index model based on realized returns, for a sample of mutual fund returns the average alpha value should be zero. If α is significantly different from zero, the CAPM model is not fully able to explain the funds' excess returns. This implies that there may exist factors other than the excess market index returns that affect the fund returns. If $\alpha>0$ or $\alpha<0$ the fund excess returns are respectively higher or lower than predicted by CAPM.

Mutual funds exhibiting a significantly positive α over more consecutive years are able to beat the market, gaining a higher expected return than is consistent with the amount of systematic risk. The ability of the fund manager to buy undervalued securities and sell overvalued ones, determines the achievement of higher excess returns. Differently, equity mutual funds displaying significantly negative α over the years are not able to beat the market.

The theory that the cost of equity capital is determined only by beta has been frequently questioned and the CAPM failed numerous empirical tests. Despite this, the model remains very popular due to its simplicity in the application and utility in a variety of situations.

2.3.2 The Arbitrage Pricing Theory

Numerous empirical studies suggest that multiple variables are needed in order to explain securities' expected returns. A general theory of asset pricing is the Arbitrage Pricing Theory (APT). According to this, assets' expected returns can be modeled by various factors or market indices through a linear function and the sensitivity to changes in each factor is indicated by a factor-specific beta coefficient.

The theory was developed by the economist Stephen Ross in 1976. The APT defines a multiple linear relationship between asset returns and several risk factors, which are not explicitly outlined, assigning however a key role to variables as for example GDP, unemployment and inflation. Differently, models like Fama-French or Carhart specify such fundamental factors, as market capitalization, book value and momentum.

2.3.2.1 Fama-French three-factor model

The Fama and French three-factor model is an asset pricing model developed in 1992 that adopts three variables to describe the returns of a portfolio. It expands the capital asset pricing model by adding to the market risk factor, the size risk and the value risk factors. The size factor is based on the market capitalization of a company and the value factor corresponds to the book-to-market ratio. The theory evolved with the observation that small cap stocks and high book-to-market ratio stocks (value stocks) tended to outperform the market as a whole.

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,m}*(R_{M,t} - R_{f,t}) + \beta_{i,SMB}*SMB_t + \beta_{i,HML}*HML_t + \varepsilon_{i,t}$$

with $i = 1,\dots,N$ and $t = 1,\dots,T$

where:

N is the number of funds in the sample;

$R_{M,t} - R_{f,t}$ is the market risk premium, i.e. the difference between the market return and the risk free rate;

SMB_t is the size effect, it measures the historic excess returns of small-cap companies over big-cap companies;

HML_t is the value premium, it measures the difference in returns between companies with high and low book-to-market value ratio;

$\beta_{i,m}$, $\beta_{i,SMB}$ and $\beta_{i,HML}$ are the slopes coefficients of respectively the market, SMB and HML factors.

Fama and French (1993) proved that the risk premiums did not depend on systematic risk only, as it was in the single index model, but that there was a high sensitivity to all the three factors when considered together.

2.3.2.2 Carhart four-factor model

The Carhart four-factor model is an extension of the Fama-French model, with one additional factor. The included factor is the momentum factor. Momentum delineates the tendency for a stock to keep moving in the same direction it moved in the previous period.

In 1997, Mark M. Carhart presented a paper, *On Persistence in Mutual Fund Performance*[90], based on a research on equity mutual funds, sustaining the hypothesis that the momentum factor leads to a more accurate measurement of portfolio returns. The author shows how the momentum factor can explain most

[90] Carhart, M. M. (1997, March). On Persistence in Mutual Fund Performance. *The Journal of Finance*, *LII*(1)

of the differences in the performance of past winners and losers. The four risk factors of Carhart's model (1997) are accounted in order to avoid rewarding fund managers for taking advantage of systematic anomalies of the stock market.

The following is the description of the Carhart four-factor linear model:

$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,m}*(R_{M,t} - R_{f,t}) + \beta_{i,SMB}*SMB_t + \beta_{i,HML}*HML_t + \beta_{i,WML}*WML_{i,t} + \varepsilon_{i,t}$

with i=1,…,N and t=1,…,T

where $WML_{i,t}$ is the momentum factor and $\beta_{i,WML}$ is the momentum factor loading.

The momentum factor is determined as the difference of the equal weighted average of the highest and the lowest performing firms, lagged by one month. A stock presents momentum if its prior 12-month returns' average is positive.

The four-factor model is frequently employed as an active management and mutual fund evaluation model.

Analogously the previous two models, the regression intercept is a measure of the exceeding average return of a fund over the return of a passive portfolio. A significant amount of positive alpha leftover implies a good performance of the fund manager, attributing part of the returns to his skill. Otherwise, performance might just be ascribed to market conditions and luck. The slopes on the explanatory variables reflect the exposures of each mutual fund to a passive benchmarks' portfolio. The value $\varepsilon_{i,t}$ is the residual part of the model not explained by the factors.

2.4 Reward-to-variability ratio

The Sharpe ratio, named after William F. Sharpe developed it in 1966, is an important financial tool for investors since it permits to compare the return of an investment relative to its risk. It is the most widely adopted method for calculating the risk-adjusted return. The Sharpe ratio, calculated in the same lapse of time, is particularly useful when comparing mutual funds' investments. It is a resolute measure for ranking mutual funds. The ratio is the average return of a security or a fund earned in excess of the risk-free rate per unit of total risk or volatility.

Sharpe Ratio = $\frac{R_P - R_f}{\sigma_P}$

where:

R_P is the return of the portfolio;

R_f is the risk free rate;

σ_P is the standard deviation of the portfolio's excess return.

Graphically, the Sharpe ratio can be depicted on the expected return-standard deviation plane as the slope of the line passing through the risk free rate and the fund return. Higher the value of the Sharpe ratio, higher the slope of the line; the preferred fund by investors is the one situated along the straight line passing through the risk free rate having maximum slope.

The Sharpe ratio value is not significant in short periods. In order to be analyzed it must be calculated over a medium or long period of time, to integrate multiple aspects of the strategy to a higher confidence interval.

2.5 The adjusted coefficient of determination

The coefficient of determination (R^2) measures the part of the variance in the funds' returns that can be explained by the independent variables considered in the model. The measure corresponds to the ratio of the explained sum of squares (ESS) and the total sum of squares (TSS). In particular, the TSS is the variation of the values of a dependent variable, the funds' excess returns, from its mean; it quantifies the total variation in a sample. Since the TSS equals the sum of the ESS and the residual sum of squares (RSS), R^2 can be determined also considering the RSS. The ESS describes how well a regression model represents the data examined. In fact, higher the value, better the performance of the estimated model. It is equivalent to the sum of the deviations of the predicted values from the mean of the dependent variables squared. The RSS is defined as the variation in the error between the realized data and modelled values, representing the portion of the variation in the data set not explained by the regression model. Generally, a lower residual value indicates that the regression model can better explain the data.

$TSS = \sum_{i=1}^{n}(y_i - \bar{y})^2$; $ESS = \sum_{i=1}^{n}(\hat{y}_i - \bar{y})^2$; $RSS = \sum_{i=1}^{n}(\epsilon_i)^2 = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2$

where $\hat{y}_i$ is the value estimated by the linear regressions and $\bar{y}$ is the mean excess return of the mutual funds. Thus,

$$R^2 = \frac{ESS}{TSS} = 1 - \frac{RSS}{TSS}$$

In the analyses of this dissertation, the measure adopted is the adjusted coefficient of determination (R^2_{adj}) which takes into consideration the number of variables of the data set. In general, the value of R^2_{adj} ranges between 0 and 1. When the value is close to reaching 1, it indicates that the estimated equation of regression line fits the sample data. It may also assume negative values, signifying that the model does not fit the data. Both the R^2 and the R^2_{adj} determine the fitting of the multiple regression equations. However, the main difference between the two is that the coefficient of determination presumes that every single variable contributes in explaining the variation in the dependent variable, while the adjusted R^2 measures the percentage of variation due to only the independent variables affecting the dependent variable. The value of R^2_{adj} increases only if the independent variables added in turn increase the explanatory power of the regression equation. In this case, the addition of independent variables that do not fit the model are penalized. The adjusted coefficient of determination is widely used in the multiple regression analysis, revealing to be more useful than the former measure. The adjusted R^2 is always less than or equal to the R^2. The adjusted coefficient of determination is calculated as:

$$R^2_{adj} = 1 - \frac{RSS}{TSS}\frac{n-1}{n-k} = 1 - (1 - R^2)\frac{n-1}{n-k-1}$$

where n is the number of funds in the sample and k is the number of independent explanatory variables in the model, excluding the constant term.

2.6 Non-parametric performance persistence test model

A common test for performance persistence is the non-parametric test, which makes use of the two-way contingency tables to examine the frequency with which funds are identified as winners and losers over successive time periods. The two-way contingency tables were introduced by Goetzmann and Ibbotson in an article published in 1994, Do *Winners Repeat? Patterns in Mutual Fund Return Behavior*. Performance persistence is calculated in 1-year interval, short-term persistence, and 2-year interval, long-term performance persistence. Funds are classified as winners or losers according to the median of either raw returns or risk-adjusted returns, Jensen’s alpha. In particular, in the first case, annual cumulative returns have to be calculated by compounding mutual funds’ monthly returns.

$$r_a = \prod_{t=1}^{T}(1 + r_{i,t}) - 1$$

with i=1,…, N and t=1,…, T

where:

r_a is the cumulative 1-year return;

$r_{i,t}$ is the monthly return of the i-th fund at time t;

N is the number of mutual funds in the sample;

T is the number of months in the time interval (i.e. T=12 and T=24).

In the second case, the Jensen's alpha is estimated using the single index model, the three-factor model and the four-factor model. Since the returns evaluated are in months, 12 and 24 monthly observations are required for 1-year and 2-year alphas respectively.

There is an intense debate on whether raw returns are more appropriate when adjusted for risk and in what form the potential risk-adjustment should be made. In applying the Jensen's alpha several assumptions are stated, all of which however are unlikely to be observable in reality. As an example, the unconditional mean-variance efficiency of the benchmark portfolio[91]; the existence of a riskless asset[92] and no binding constraints on investors[93]. Thus, it has been questioned whether Jensen's alpha represents a meaningful benchmark for the evaluation of the fund manager's performance.

In my analysis, I considered raw returns in classifying mutual funds' performance. The funds examined in the sample belong all to the same category, open-end equity mutual funds, and have similar organizational structure, thus they can be considered to have all the same level of risk. Furthermore, as Capon et al (1996) and Lawrence (1998) sustained, investors refer mostly to performance rankings which are based on raw returns, reported by consultants and in periodicals. Hence, for investors the consistency of raw returns is the most important criteria for testing persistence, since their decisions are based on this measure rather than on risk-adjusted returns.

Subsequently, mutual funds are ranked every year or every couple of years relative to their raw returns or alpha and the median is computed. The mutual funds that manifest a performance equal to or higher than the median are classified as winners (W), while the ones below the median as losers (L). The performance

[91] Roll, R. (1978). Ambiguity when Performance is Measured by the Security market Line. Journal of Finance, 33, 1051-1069
[92] Green, R. (1986). Benchmark Portfolio Inefficiency and Deviations from the Security Market Line. Journal of Finance, 41, 295-312
[93] Best, M., & Grauer, R. (1990). The Efficient Set Mathematics when Mean-Variance Problems are Subject to General Linear Constraints. Journal of Economics and Business, 42, 105-120

of mutual funds is defined to be persistent if these are either winners or losers in two consecutive periods. Winners in two consecutive periods are denoted as WW and analogously losers as LL. If funds are classified as winners in one period and losers in the following then they are labeled as WL, whereas LW if they are classified as losers in one period and winners in the following one. The null hypothesis sustains the existence of performance persistence if there is evidence of a significantly larger number of observations in the WW or LL categories than in the other two. The alternative hypothesis states that performance persistence does not exist, thus the number of repeat performers (WW or LL) is lower than the non-repeat performers (WL or LW).

The test statistic adopted is the cross product ratio (CPR), the ratio of all funds which present performance persistence over the ones that do not.

$$\text{CPR} = \frac{\text{WW x LL}}{\text{WL x LW}}$$

A CPR value above 1, indicates persistence, whereas below 1 shows a reversal in performance. The Z-statistic is used for verifying the statistical significance of the CPR test. The Z-statistic is normally distributed and it is evaluated by dividing the natural logarithm of the CPR by its standard error.

$$\text{Z} = \frac{\ln(\text{CPR})}{\sigma[\ln(\text{CPR})]},\ \text{Z} \sim N(0,1)$$

$$\sigma[\ln(\text{CPR})]=\sqrt{\frac{1}{\text{WW}}+\frac{1}{\text{WL}}+\frac{1}{\text{LW}}+\frac{1}{\text{LL}}}$$

When there is a limited number of funds in the sample, as in this case, this method for ascertaining persistence is preferred to others.

CHAPTER III - Empirical results

3.1 Performance of funds: Sharpe ratio

Table 2 reports in the first two columns the mean over an 11-year period of the excess returns and the respective standard deviation. In the third column, it tabulates the Sharpe ratio. The first two lines refer to the two benchmarks, MSCI Italy and FTSE MIB indexes, and the subsequent lines to the 45 equity mutual funds.

First, it can be noticed that the Sharpe ratio of FTSE MIB Index is higher than the MSCI Italy index, respectively 0.08213 and 0.07662. All Sharpe ratios are positive, with the exception of one (CS (Lux) Italy Equity Fund UB EUR), which exhibits general low or negative values for the excess returns, a negative mean value and the highest standard deviation of the whole sample. This represents the only case in which the investment return is lower than the EONIA risk-free rate. The positive array varies widely from 0.00370 (Unipol Performance Italia Fund) to 0.16711 (Synergia Azionario Italia). With respect to both market indices, 35 of the 45 funds in the sample present a higher Sharpe ratio. This suggests that nearly 78% of funds present a better risk-adjusted performance than the benchmark indices, accounting not only for the return of the mutual fund, but also its risk. Analogous conclusion can be evinced also by examining the mean of the funds' Sharpe ratio, equaling 0.10076, which is higher than the values of both benchmarks. On average Italian open-end equity mutual funds offer a better risk-adjusted performance than the MSCI Italy index by 2.41% and the FTSE MIB index by 1.86%.

Table 2 – Sharpe ratio. Second column: mean of the benchmarks' and funds' excess returns; third column: standard deviation of the excess returns; fourth column: Sharpe ratio of the benchmarks and funds.

Fund name	Mean excess return	Standard deviation excess return	Sharpe ratio
MSCI_ITALY	0.00534	0.06967	0.07662
FTSE_MIB_INDEX	0.00588	0.07162	0.08213
Fidelity Funds - Italy A-EUR-DIS	0.00632	0.06520	0.09690
Synergia Azionario Italia	0.00144	0.04110	0.03500
CS (Lux) Italy Equity Fund UB EUR	-0.00151	0.10800	-0.01400
Symphonia Azionario Small Cap Italia Classe I	0.00780	0.04670	0.16270
AXA WF Framlington Italy AC EUR	0.00749	0.06320	0.11850
AXA WF Framlington Italy FC EUR	0.00813	0.06330	0.12840
Arca Azioni Italia P	0.00561	0.05980	0.09390
Eurizon Azioni Italia R	0.00535	0.06100	0.08770
Euromobiliare Azioni Italiane A	0.00561	0.05730	0.09790
Fondersel PMI A	0.00887	0.05770	0.15360
Anima Italia A	0.00598	0.05830	0.10250
Investimenti Azionari Italia A	0.00628	0.05940	0.10560

Fideuram Italia R	0.00822	0.06080	0.13520
Interfund Equity Italy	0.00703	0.06080	0.11560
BNL Azioni Italia	0.00531	0.06010	0.08820
AcomeA Italia A1	0.00477	0.06410	0.07430
ZENIT Pianeta Italia R	0.00519	0.05750	0.09040
Mediolanum Challenge Italian Equity L A	0.00452	0.05980	0.07560
Eurizon Azioni PMI Italia R	0.00732	0.05460	0.13410
Fonditalia Equity Italy R	0.00684	0.06020	0.11360
CS (Lux) Italy Equity Fund B EUR	0.00623	0.06620	0.09420
OYSTER Italian Opportunities C EUR PR	0.00527	0.05970	0.08830
Schroder ISF Italian Equity A Dis AV	0.00449	0.05990	0.07490
Schroder ISF Italian Equity B Acc	0.00576	0.05960	0.09660
Schroder ISF Italian Equity B Dis AV	0.00424	0.05970	0.07110
AZ Fund 1 - Italian Trend A-AZ FUND (ACC)	0.00412	0.07110	0.05800
Unipol Performance Italia Fund	0.00014	0.03890	0.00370
Schroder ISF Italian Equity A Acc	0.00626	0.05960	0.10510
Schroder ISF Italian Equity C Acc	0.00678	0.05960	0.11370
Eurizon Fund Equity Italy Smart Volatility R EUR	0.00482	0.06510	0.07400
OYSTER Italian Opportunities N EUR PR	0.00491	0.05970	0.08220
Mediolanum Challenge Italian Equity S A	0.00418	0.06110	0.06840
Pramerica Azioni Italia	0.00608	0.05750	0.10570
Schroder ISF Italian Equity A1 Acc	0.00566	0.05960	0.09500
AZ Fund 1 - Italian Trend B-AZ FUND (ACC)	0.00413	0.07120	0.05800
AXA WF Framlington Italy EC EUR	0.00686	0.06320	0.10860
AXA WF Framlington Italy IC EUR	0.00786	0.06000	0.13090
Amundi Dividendo Italia B	0.00590	0.04180	0.14120
Fidelity Funds - Italy Y-ACC-EUR	0.00757	0.06520	0.11610
Allianz Azioni Italia All Stars A	0.00526	0.05730	0.09180
ZENIT Pianeta Italia I	0.00589	0.05750	0.10250
Fonditalia Equity Italy T	0.00740	0.06070	0.12200

Symphonia Azionario Small Cap Italia	0.00759	0.04670	0.16270
Anima Geo Italia A	0.00639	0.05770	0.11070
Anima Geo Italia Y	0.00759	0.05790	0.13120

3.2 The single factor Capital Asset Pricing model analysis

In this first analysis, I regress the fund excess returns against the market MSCI Italy index excess returns, estimating the coefficients alpha (α) and beta (β). Table 3 charts the funds' values of alphas and betas with their corresponding p-values and in the last column the adjusted R^2 value for each fund. From the results, it can be evinced that 13 funds out of 45 have a significantly positive alpha coefficient, at the 10% level. Whereas at the 5% significance level, 8 funds out of 45 have alphas that are significantly different from zero, all of which are positive. Of these funds, four (Fideuram Italia R; Interfund Equity Italy; Fonditalia Equity Italy T; Anima Geo Italia Y) have a significantly positive alpha also at 1% significance level. 8 funds present a negative alpha, but none of them at a significant level. Those remaining values of alpha that are not significantly different from zero indicate that funds are tracking perfectly with the benchmark index and thus fund's managers have not generated any additional value compared to the broad market. In general, alpha is hard to come by, especially after accounting for taxes and fees. The mean of the funds' intercept alphas equals 0.1458%. The most successful fund is Fondersel PMI A, with a significant 5% level alpha corresponding to 0.004816. The fund that performed worst is CS (Lux) Italy Equity Fund UB EUR, with a negative not significant alpha equivalent to -0.005839. The median alpha value belongs to the fund Fidelity Funds - Italy A-EUR-DIS, i.e. 0.001455, and it is not significant.

All the individual fund market beta estimates are significant at the 5% and also at the 1% significance level. The average beta is 0.799126; the values range from 0.343533 (Unipol Performance Italia Fund) to 0.979489 (AZ Fund 1 - Italian Trend A-AZ FUND (ACC)). The median value of beta is 0.823702 (AXA WF Framlington Italy FC EUR). All beta values are less than one, indicating that all funds are less volatile than the market MSCI Italy index benchmark.

The explanatory power of the regression is defined by the adjusted R^2. The highest R^2 is 0.976565 of Arca Azioni Italia P and the lowest is 0.256635 of CS (Lux) Italy Equity Fund UB EUR. The average adjusted R^2 is 0.859405, meaning that the MSCI Italy index is able to explain on average 85.94% of the total variation of mutual fund returns.

Table 3 – Results of CAPM, MSCI ITALY Index

Name	alpha	alpha p-value	beta market (***)	Beta Mkt p-value	adjusted R^2
Fidelity Funds - Italy A-EUR-DIS	0.001455	0.271296	0.910699	0.000000	0.946045
Synergia Azionario Italia	-0.001290	0.587715	0.501000	0.000000	0.559237
CS (Lux) Italy Equity Fund UB EUR	-0.005839	0.472336	0.810204	0.000000	0.256635
Symphonia Azionario Small Cap Italia Classe I	0.004398*	0.058319	0.624660	0.000000	0.678371
AXA WF Framlington Italy AC EUR	0.003100	0.188338	0.823188	0.000000	0.818449
AXA WF Framlington Italy FC EUR	0.003729	0.114341	0.823702	0.000000	0.818407
Arca Azioni Italia P	0.001088	0.174217	0.848074	0.000000	0.976565
Eurizon Azioni Italia R	0.000734	0.379813	0.865007	0.000000	0.975393
Euromobiliare Azioni Italiane A	0.001290	0.158378	0.809337	0.000000	0.966742
Fondersel PMI A	0.004816**	0.019098	0.759823	0.000000	0.836833
Anima Italia A	0.001572*	0.071449	0.825054	0.000000	0.970929
Investimenti Azionari Italia A	0.001826*	0.098967	0.833923	0.000000	0.954814
Fideuram Italia R	0.003628***	0.000069	0.861104	0.000000	0.972221
Interfund Equity Italy	0.002426***	0.003941	0.861651	0.000000	0.975562
BNL Azioni Italia	0.000835	0.513855	0.837619	0.000000	0.940570
AcomeA Italia A1	0.000976	0.786318	0.710063	0.000000	0.585583
ZENIT Pianeta Italia R	0.001032	0.533863	0.779225	0.000000	0.890365
Mediolanum Challenge Italian Equity L A	0.000271	0.890293	0.796642	0.000000	0.858148
Eurizon Azioni PMI Italia R	0.003680	0.123057	0.681131	0.000000	0.750549
Fonditalia Equity Italy R	0.002301**	0.016451	0.850545	0.000000	0.967340
CS (Lux) Italy Equity Fund B EUR	0.001261	0.274529	0.930786	0.000000	0.960095
OYSTER Italian Opportunities C EUR PR	0.000872	0.545458	0.824239	0.000000	0.923359
Schroder ISF Italian Equity A Dis AV	0.000076	0.958325	0.826962	0.000000	0.922474
Schroder ISF Italian Equity B Acc	0.001360	0.336703	0.823768	0.000000	0.925929
Schroder ISF Italian Equity B Dis AV	-0.000152	0.916282	0.823399	0.000000	0.922908
AZ Fund 1 - Italian Trend A-AZ FUND (ACC)	-0.001106	0.526224	0.979489	0.000000	0.920773
Unipol Performance Italia Fund	-0.001690	0.532300	0.343533	0.000000	0.364360
Schroder ISF Italian Equity A Acc	0.001863	0.188470	0.823950	0.000000	0.926124

Schroder ISF Italian Equity C Acc	0.002384*0	0.09401	0.824420	0.000000	0.926032
Eurizon Fund Equity Italy Smart Volatility R EUR	-0.000107	0.906407	0.923019	0.000000	0.974506
OYSTER Italian Opportunities N EUR PR	0.000508	0.725134	0.824393	0.000000	0.923124
Mediolanum Challenge Italian Equity S A	-0.000202	0.915255	0.820426	0.000000	0.873373
Pramerica Azioni Italia	0.001782	0.112187	0.804779	0.000000	0.950355
Schroder ISF Italian Equity A1 Acc	0.001263	0.371409	0.823290	0.000000	0.926163
AZ Fund 1 - Italian Trend B-AZ FUND (ACC)	-0.001085	0.554503	0.977023	0.000000	0.912540
AXA WF Framlington Italy EC EUR	0.002469	0.293682	0.822590	0.000000	0.818473
AXA WF Framlington Italy IC EUR	0.002973	0.188431	0.875000	0.000000	0.814656
Amundi Dividendo Italia B	0.003183	0.104055	0.508760	0.000000	0.713729
Fidelity Funds - Italy Y-ACC-EUR	0.002699**	0.036258	0.913050	0.000000	0.949499
Allianz Azioni Italia All Stars A	0.001206	0.534611	0.758799	0.000000	0.848761
ZENIT Pianeta Italia I	0.001732	0.298545	0.779122	0.000000	0.889783
Fonditalia Equity Italy T	0.002809***	0.001010	0.860314	0.000000	0.974985
Symphonia Azionario Small Cap Italia	0.004190*	0.070866	0.624548	0.000000	0.678594
Anima Geo Italia A	0.002042**	0.027495	0.815261	0.000000	0.966763
Anima Geo Italia Y	0.003232***	0.000556	0.817104	0.000000	0.967100

*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level.

In the second analysis, I apply the CAPM to the same sample of 45 mutual funds during the period 2009-2019, but using the FTSE MIB Index as benchmark. In table 4, in columns 2 and 4 are indicated respectively the alpha and beta market estimates of the funds; in columns 3 and 5 the p-values of alpha and beta market respectively; in column 6, it is reported the adjusted R^2 value for each fund. Analyzing the results, 10 of 45 funds have alphas whose values are significantly positive at 10% significance level. 4 funds have alphas which are positive and significant at 1% significance level and increasing the significance level to 5%, new additional funds become significant, rising to 6. In this case, the number of funds that are significant both at the 10% and 5% significance level decreased compared to the regression examined in the previous case, accounting that the same sample and period are considered. In particular, shifting from the application of the CAPM model with MSCI Italy index to FTSE MIB Index as benchmark, the funds that are characterized by a positive alpha, significant at 10% level, reduced from

28.89% to 22.22%. Similarly, the number of funds that have a positive alpha at the 5% significant level, diminished from 17.78% to 13.33%. There are 10 not significant negative alphas. The funds' alpha mean is 0.1135%. This value is slightly smaller than the one in the previous case by approximately 0.03%. Among all funds, Fondersel PMI A is the fund that presents the highest alpha, i.e. 0.004504 significant at 5% significance level, and CS (Lux) Italy Equity Fund UB EUR the lowest, i.e. non-significant -0.006195. As expected, these are the same two funds that emerged in the previous case. The alphas' median equals 0.001088 and it is not significant. Likewise in the former case, it belongs to Fidelity Funds - Italy A-EUR-DIS, even though in this case the value is lower of 0.04%.

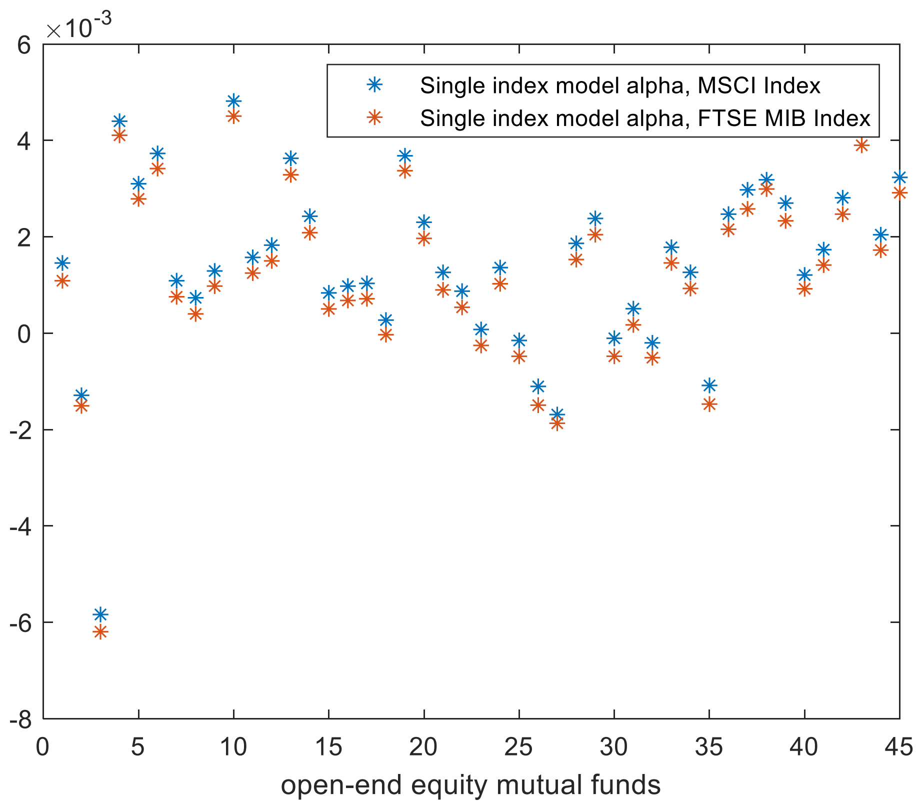

Figure 16 – Alpha estimated with the single index factor model

The funds' betas are all less volatile than the market FTSE MIB Index, being every coefficient inferior to 1, with a 1% significance level. The values span from 0.342464 (Unipol Performance Italia Fund) to 0.954997 (AZ Fund 1 - Italian Trend A-AZ FUND (ACC). The mean of the coefficient beta is 0.780600 and its median is 0.804038; an average and a median inferior to the previous ones of respectively 1.85% and 1.97%.

The result that both the intercept alpha and the coefficient beta in this second case, regressing the funds' excess return to the FTSE MIB Index, are lower than in the previous one, regressing the funds' excess return to the MSCI Italy index, is in line with the fact that the FTSE MIB Index present a higher Sharpe ratio.

The highest adjusted R^2 is 0.981504 (Eurizon Fund Equity Italy Smart Volatility R EUR) whereas the smallest is 0.262096 (CS (Lux) Italy Equity Fund UB EUR). The average adjusted R^2 value corresponds to 86.52%. This average is higher than the one calculated in the previous model, indicating that the FTSE MIB Index can explain better the total variation of mutual fund returns.

Table 4 – Results of CAPM, FTSE MIB Index

Name	alpha	alpha p-value	beta market (***)	beta Mkt p-value	adjusted R^2
Fidelity Funds - Italy A-EUR-DIS	0.001088	0.380618	0.888880	0.000000	0.952481
Synergia Azionario Italia	-0.001508	0.519345	0.498315	0.000000	0.573957
CS (Lux) Italy Equity Fund UB EUR	-0.006195	0.444308	0.795845	0.000000	0.262096
Symphonia Azionario Small Cap Italia Classe I	0.004106*	0.079906	0.624653	0.000000	0.703875
AXA WF Framlington Italy AC EUR	0.002786	0.238201	0.800341	0.000000	0.817462
AXA WF Framlington Italy FC EUR	0.003415	0.149089	0.800845	0.000000	0.817429
Arca Azioni Italia P	0.000755	0.314437	0.826169	0.000000	0.979351
Eurizon Azioni Italia R	0.000399	0.626564	0.841854	0.000000	0.976250
Euromobiliare Azioni Italiane A	0.000977	0.276765	0.787789	0.000000	0.967881
Fondersel PMI A	0.004504**	0.024601	0.742542	0.000000	0.844697
Anima Italia A	0.001247	0.126927	0.804038	0.000000	0.974430
Investimenti Azionari Italia A	0.001499	0.161404	0.812435	0.000000	0.957664
Fideuram Italia R	0.003286***	0.000086	0.839518	0.000000	0.976554
Interfund Equity Italy	0.002085***	0.006829	0.839850	0.000000	0.979431
BNL Azioni Italia	0.000503	0.683601	0.816603	0.000000	0.944721
AcomeA Italia A1	0.000678	0.849233	0.694933	0.000000	0.592955
ZENIT Pianeta Italia R	0.000713	0.655250	0.761360	0.000000	0.898373
Mediolanum Challenge Italian Equity L A	-0.000032	0.987123	0.774391	0.000000	0.856795

Eurizon Azioni PMI Italia R	0.003371	0.141664	0.670729	0.000000	0.769603
Fonditalia Equity Italy R	0.001966**	0.030133	0.828839	0.000000	0.970731
CS (Lux) Italy Equity Fund B EUR	0.000897	0.422264	0.906605	0.000000	0.962531
OYSTER Italian Opportunities C EUR PR	0.000536	0.695313	0.805043	0.000000	0.930949
Schroder ISF Italian Equity A Dis AV	-0.000255	0.856141	0.806692	0.000000	0.927673
Schroder ISF Italian Equity B Acc	0.001025	0.444449	0.804625	0.000000	0.933642
Schroder ISF Italian Equity B Dis AV	-0.000481	0.730654	0.803154	0.000000	0.927961
AZ Fund 1 - Italian Trend A-AZ FUND (ACC)	-0.001495	0.379083	0.954997	0.000000	0.925005
Unipol Performance Italia Fund	-0.001870	0.482914	0.342464	0.000000	0.383754
Schroder ISF Italian Equity A Acc	0.001527	0.254380	0.804810	0.000000	0.933854
Schroder ISF Italian Equity C Acc	0.002044	0.128402	0.805262	0.000000	0.933746
Eurizon Fund Equity Italy Smart Volatility R EUR	-0.000480	0.534742	0.901073	0.000000	0.981504
OYSTER Italian Opportunities N EUR PR	0.000172	0.900325	0.805257	0.000000	0.930864
Mediolanum Challenge Italian Equity S A	-0.000509	0.790644	0.796790	0.000000	0.870380
Pramerica Azioni Italia	0.001457	0.162980	0.785532	0.000000	0.956905
Schroder ISF Italian Equity A1 Acc	0.000927	0.487831	0.804170	0.000000	0.933905
AZ Fund 1 - Italian Trend B-AZ FUND (ACC)	-0.001472	0.412281	0.952473	0.000000	0.916499
AXA WF Framlington Italy EC EUR	0.002156	0.360496	0.799760	0.000000	0.817489
AXA WF Framlington Italy IC EUR	0.002578	0.250129	0.861670	0.000000	0.817623
Amundi Dividendo Italia B	0.002991	0.127895	0.494217	0.000000	0.711608
Fidelity Funds - Italy Y-ACC-EUR	0.002330*	0.052375	0.891224	0.000000	0.956066
Allianz Azioni Italia All Stars A	0.000920	0.638186	0.737248	0.000000	0.846580
ZENIT Pianeta Italia I	0.001413	0.378202	0.761308	0.000000	0.897906
Fonditalia Equity Italy T	0.002469**	0.001707	0.838487	0.000000	0.978707
Symphonia Azionario Small Cap Italia	0.003899*	0.079906	0.624520	0.000000	0.704058
Anima Geo Italia A	0.001724*	0.053864	0.793967	0.000000	0.968930
Anima Geo Italia Y	0.002914***	0.001268	0.795728	0.000000	0.969184

*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level.

3.3 *Fama-French three-factor model analysis*

The following analysis applies the Fama-French model to the sample, regressing the 45 funds' excess returns on three factors: market MSCI Italy index factor, size factor (SMB) and value factor (HML). Table 5 reports the resulting values of the intercept and of the three coefficients and their respective p-values, and in the last column the adjusted R^2. 12 funds' alphas out of 45 are negative, not significant, whereas of the other 33 funds, 10 are positively significant at the 10% level, 7 at the 5% significance level and 4 at the 1% significance level (Fideuram Italia R; Interfund Equity Italy; Fonditalia Equity Italy T; Anima Geo Italia Y). The highest value assumed by alpha is 0.004277, significant at the 5% level, (Fondersel PMI A) and the lowest is -0.006321 (CS (Lux) Italy Equity Fund UB EUR). The alphas' mean equals 0.000997, meaning that the average investment's return of a fund was nearly 0.10% better than the market during that same sample period. The median alpha is once more of the Fidelity Funds - Italy A-EUR-DIS, with a positive not significant value of 0.001132.

Similarly to the regressions obtained applying the CAPM, also in this case all the beta coefficients relative to the market MSCI Italy and, as it will be seen below, to the market FTSE MIB index are significant at the 1% significance level. The highest value registered for the MSCI Italy market beta coefficient is 0.974896 (AZ Fund 1 - Italian Trend B-AZ FUND (ACC)) and the lowest is 0.325945 (Unipol Performance Italia Fund). Still, the highest value coefficient does not reach 1. The market beta mean is 0.791222 and its median is 0.818874 (Schroder ISF Italian Equity B Dis AV).

The extent of the SMB beta coefficient values goes from 0.000962 (Eurizon Azioni Italia R) to 0.005607 (AcomeA Italia A1), with the highest value far from reaching the unity. However, differently from the next beta coefficients, the number of funds whose values are significant is high. In particular, the funds significant at 10% level are 38 out of 45; the number does not reduce much when lowering the significance level, at 5% level there are 32 funds and at 1% level are 24. Therefore, at the 10% (5%) significance level, 84.44% (71.11%) of funds manifest a significant relatively small positive SMB beta coefficient. All the positive coefficients' values signal that the funds are weighted toward owning small-cap stocks, known for granting higher returns. The SMB beta mean is 0.002360 and the median belongs to Fidelity Funds - Italy A-EUR-DIS, with a significant value of 0.002102.

27 out of 45 funds' HML betas are negative, of these 5 are significant at 10% level, and the remaining 18 are positive, although of these only 1 is significant at 10% level; no value is significant at a 5% or 1% level. The highest coefficient belongs to Synergia Azionario Italia and corresponds to 0.001898, whereas

the lowest is -0.002348 of the fund AcomeA Italia A1. The average and the median are both negative, respectively -0.000239 and -0.000126 (Interfund Equity Italy). A negative HML beta indicates more sensitivity to low book-to-market stocks, implying positive weights on growth stocks.

The lowest value of adjusted R^2 is 0.261815 (CS (Lux) Italy Equity Fund UB EUR) and the highest is 0.977680 (Arca Azioni Italia P). The mean of the adjusted R^2 equals 0.866355, implying that the model accounts for 86.64% of the variability of the dependent variable, the funds' excess returns.

Table 5 - Results of Fama-French model, MSCI ITALY Index

Name	alpha	alpha p-value	beta market (***)	beta Mkt p-value	beta SMB	beta SMB p-value	beta HML	beta HML p-value	adjusted R^2
Fidelity Funds - Italy A-EUR-DIS	0.001132	0.386638	0.899411	0.000000	0.002102***	0.008446	0.000240	0.665219	0.948911
Synergia Azionario Italia	-0.001089	0.646967	0.476802	0.000000	0.001702	0.236286	0.001898*	0.061641	0.574103
CS (Lux) Italy Equity Fund UB EUR	-0.006321	0.442562	0.776761	0.000000	0.004512	0.363583	0.001526	0.661949	0.261815
Symphonia Azionario Small Cap Italia Classe I	0.003991*	0.080853	0.601875	0.000000	0.003963***	0.004424	0.000694	0.472045	0.698268
AXA WF Framlington Italy AC EUR	0.001964	0.385652	0.819376	0.000000	0.004414***	0.001498	-0.001680*	0.081740	0.837317
AXA WF Framlington Italy FC EUR	0.002592	0.253038	0.819877	0.000000	0.004419***	0.001494	-0.001680*	0.081851	0.837283
Arca Azioni Italia P	0.000881	0.266791	0.842540	0.000000	0.001204**	0.012642	0.000035	0.917393	0.977680
Eurizon Azioni Italia R	0.000542	0.516768	0.861732	0.000000	0.000962*	0.057937	-0.000098	0.782623	0.976108
Euromobiliare Azioni Italiane A	0.001113	0.224876	0.804762	0.000000	0.001019*	0.066237	0.000018	0.963758	0.967604
Fondersel PMI A	0.004277**	0.033919	0.740173	0.000000	0.003574***	0.003541	0.000458	0.589331	0.847443
Anima Italia A	0.001389	0.108272	0.817658	0.000000	0.001273**	0.015350	0.000207	0.571440	0.972258
Investimenti Azionari Italia A	0.001522	0.167283	0.830253	0.000000	0.001402**	0.035713	-0.000264	0.571665	0.956535
Fideuram Italia R	0.003320***	0.000199	0.856151	0.000000	0.001520***	0.004262	-0.000179	0.627215	0.974055

Interfund Equity Italy	0.002163***	0.009048	0.857039	0.000000	0.001331***	0.007740	-0.000126	0.715437	0.976948
BNL Azioni Italia	0.000616	0.632991	0.835293	0.000000	0.000981	0.208455	-0.000211	0.699886	0.941395
AcomeA Italia A1	-0.000513	0.884205	0.707174	0.000000	0.005607***	0.009126	-0.002348	0.117698	0.616640
ZENIT Pianeta Italia R	0.000685	0.679392	0.769007	0.000000	0.002099**	0.037311	0.000124	0.860239	0.894005
Mediolanum Challenge Italian Equity L A	-0.000344	0.860197	0.797429	0.000000	0.002152*	0.069456	-0.001109	0.182389	0.864126
Eurizon Azioni PMI Italia R	0.003103	0.187918	0.660088	0.000000	0.003828***	0.007685	0.000490	0.622984	0.764154
Fonditalia Equity Italy R	0.001937**	0.037332	0.843756	0.000000	0.001876***	0.000961	-0.000147	0.707887	0.970125
CS (Lux) Italy Equity Fund B EUR	0.000938	0.410837	0.922727	0.000000	0.001834***	0.008464	0.000013	0.978600	0.962217
OYSTER Italian Opportunities C EUR PR	0.000353	0.803215	0.818404	0.000000	0.002354***	0.006633	-0.000478	0.427092	0.928256
Schroder ISF Italian Equity A Dis AV	-0.000402	0.780252	0.822012	0.000000	0.002133**	0.015134	-0.000470	0.441737	0.926527
Schroder ISF Italian Equity B Acc	0.000772	0.575840	0.820001	0.000000	0.002435***	0.003963	-0.000744	0.205082	0.931812
Schroder ISF Italian Equity B Dis AV	-0.000669	0.638254	0.818874	0.000000	0.002241***	0.009925	-0.000568	0.347364	0.927586
AZ Fund 1 - Italian Trend A-AZ FUND (ACC)	-0.001490	0.393616	0.970259	0.000000	0.002150**	0.042502	-0.000009	0.990446	0.923293
Unipol Performance Italia Fund	-0.001677	0.539217	0.325945	0.000000	0.001415	0.390734	0.001258	0.278741	0.372753
Schroder ISF Italian Equity A Acc	0.001275	0.355402	0.820079	0.000000	0.002443***	0.003801	-0.000736	0.209099	0.932016
Schroder ISF Italian Equity C Acc	0.001790	0.195532	0.820616	0.000000	0.002443***	0.003844	-0.000743	0.205207	0.931937

Eurizon Fund Equity Italy Smart Volatility R EUR	-0.000331	0.708432	0.912421	0.000000	0.001689***	0.001914	0.000360	0.338711	0.976439
OYSTER Italian Opportunities N EUR PR	-0.000015	0.991304	0.818326	0.000000	0.002389***	0.005927	-0.000470	0.435798	0.928138
Mediolanum Challenge Italian Equity S A	-0.000903	0.628708	0.817825	0.000000	0.002744**	0.015897	-0.001019	0.199711	0.881074
Pramerica Azioni Italia	0.001660	0.141575	0.797907	0.000000	0.001009	0.138257	0.000274	0.565519	0.951258
Schroder ISF Italian Equity A1 Acc	0.000680	0.621240	0.819481	0.000000	0.002415***	0.004200	-0.000730	0.213016	0.931934
AZ Fund 1 - Italian Trend B- AZ FUND (ACC)	-0.001596	0.384567	0.974896	0.000000	0.002019*	0.069478	-0.000726	0.351367	0.915545
AXA WF Framlington Italy EC EUR	0.001333	0.555174	0.818803	0.000000	0.004412***	0.001494	-0.001681*	0.081216	0.837361
AXA WF Framlington Italy IC EUR	0.001701	0.427094	0.871653	0.000000	0.005176***	0.000099	-0.001635*	0.073434	0.838500
Amundi Dividendo Italia B	0.002611	0.180239	0.514593	0.000000	0.001577	0.179582	-0.001390*	0.093570	0.724733
Fidelity Funds - Italy Y-ACC-EUR	0.002391*	0.058747	0.899677	0.000000	0.002218***	0.003982	0.000414	0.438244	0.952768
Allianz Azioni Italia All Stars A	0.000940	0.631964	0.752281	0.000000	0.001502	0.205621	0.000002	0.998307	0.850603
ZENIT Pianeta Italia I	0.001398	0.401234	0.768555	0.000000	0.002083**	0.039397	0.000170	0.809816	0.893366
Fonditalia Equity Italy T	0.002507***	0.002671	0.855562	0.000000	0.001485***	0.003161	-0.000184	0.597186	0.976751
Symphonia Azionario Small Cap Italia	0.003782*	0.097663	0.601815	0.000000	0.003966***	0.004364	0.000687	0.476322	0.698518
Anima Geo Italia A	0.001827**	0.048470	0.811638	0.000000	0.001077*	0.053621	-0.000114	0.769546	0.967766
Anima Geo Italia Y	0.003023***	0.001232	0.813468	0.000000	0.001056*	0.057708	-0.000103	0.791329	0.968056

*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level.

The following analysis regresses the funds' excess returns by means of the Fama-French three-factor model, using the FTSE MIB Index as market benchmark. Table 6 below tabulates the resulting values for each fund of the intercept alphas, the market beta, the SMB beta, the HML beta and their respective p-values, and the adjusted R^2. Considering all 45 funds, 13 manifest negative alphas, but no value is significant at a 10% level. Of the remaining 32 funds, 9 funds have an alpha significant at 10% level, 5 significant at 5% level and 3 at 1% level. The highest alpha in the fund sample is 0.003951 (Fondersel PMI A), with a 5% significance level, and the lowest is -0.006684 (CS (Lux) Italy Equity Fund UB EUR). The alphas' mean equals 0.0652% and its median is the non-significant 0.000775 (Euromobiliare Azioni Italiane A). Important to underline that the mean value of alpha resultant from the regression using FTSE MIB index as benchmark is lower than the one obtained from using the MSCI Italy index as benchmark. The conclusion drawn by the comparison between the average alphas determined using the two different benchmark indexes but the same model, is the same as the one drawn for the CAPM model.

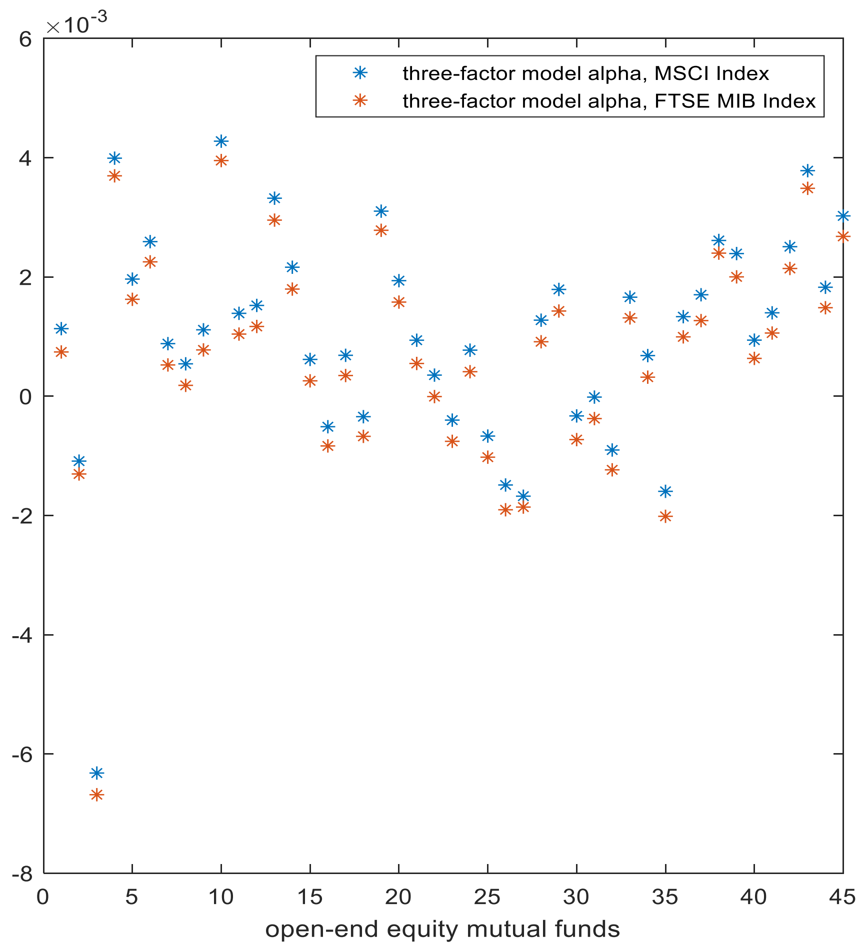

Figure 17 – Alpha estimated with the three-factor model

Fund market betas are all significantly positive at the 1% significance level. The array of values goes from 0.327293 (Unipol Performance Italia Fund) to 0.955832 (AZ Fund 1 - Italian Trend B-AZ FUND (ACC)). The mean of beta market equals 0.777083 and its median is 0.803258 (Schroder ISF Italian Equity B Dis AV). To notice that in these last two cases as well, where the Fama-French model is applied, all the market beta coefficients have values inferior to one. Highlighting that all the funds in the sample undergo a lower risk compared to the market, considering either MSCI Italy or FTSE MIB index as benchmark.

The coefficients relative to the SMB factor are all positive, of these 32 out of 45 funds are significant at 10% level, 28 at 5% level and 15 at 1% level. The SMB beta values vary from 0.000679 (Eurizon Azioni Italia R) to 0.005336 (AcomeA Italia A1). The mean equals 0.002076 and the median corresponds to 0.001817 (AZ Fund 1 - Italian Trend A-AZ FUND (ACC)).

The HML beta coefficients are for the majority negative, in particular 37 funds out of 45, of which 13 significant at 10% level, 8 significant at 5% level and none at 1% level. For the remaining 8 funds which exhibit positive HML beta coefficients, only 1 is significant at 10% level. The lowest value assumed by the coefficients is -0.002683 (AcomeA Italia A1), while the highest is 0.001696 (Synergia Azionario Italia). The average HML beta equals -0.000586 and the median is the negative not significant value -0.000497 (Interfund Equity Italy). In this analysis, there is an even higher number of funds that are characterized by a negative HML beta with respect to the previous analysis, suggesting once more the tendency to own growth stocks.

Regarding the coefficient of determination, the resulting values are not particularly dissimilar respect to the previous case. The lowest adjusted R^2 amounts to 0.266236 (CS (Lux) Italy Equity Fund UB EUR) and the highest to 0.982735 (Eurizon Fund Equity Italy Smart Volatility R EUR). The average explanatory power of the regression accounts for 87.17%.

Table 6 - Results of Fama-French model, FTSE MIB Index

Name	alpha	alpha p-value	beta market (***)	beta Mkt p-value	beta SMB	beta SMB p-value	beta HML	beta HML p-value	adjusted R^2
Fidelity Funds - Italy A-EUR-DIS	0.000741	0.547320	0.882564	0.000000	0.001785**	0.017510	-0.000158	0.763622	0.954630
Synergia Azionario Italia	-0.001305	0.578362	0.476212	0.000000	0.001455	0.305403	0.001696*	0.091498	0.585389

CS (Lux) Italy Equity Fund UB EUR	-0.006684	0.415676	0.766913	0.000000	0.004198	0.397092	0.001144	0.743384	0.266236
Symphonia Azionario Small Cap Italia Classe I	0.003696*	0.093332	0.604973	0.000000	0.003625***	0.006877	0.000413	0.658052	0.720053
AXA WF Framlington Italy AC EUR	0.001624	0.473802	0.800990	0.000000	0.004151***	0.002861	-0.002016**	0.038255	0.836689
AXA WF Framlington Italy FC EUR	0.002252	0.321388	0.801483	0.000000	0.004155***	0.002852	-0.002017**	0.038310	0.836663
Arca Azioni Italia P	0.000524	0.482588	0.825169	0.000000	0.000921**	0.042212	-0.000324	0.307662	0.980231
Eurizon Azioni Italia R	0.000181	0.825226	0.843156	0.000000	0.000679	0.172119	-0.000459	0.191159	0.976964
Euromobiliare Azioni Italiane A	0.000775	0.390004	0.787472	0.000000	0.000755	0.166878	-0.000320	0.405383	0.968578
Fondersel PMI A	0.003951**	0.045265	0.726957	0.000000	0.003308***	0.005839	0.000126	0.880365	0.853693
Anima Italia A	0.001041	0.201451	0.801034	0.000000	0.000996**	0.044048	-0.000144	0.678050	0.975296
Investimenti Azionari Italia A	0.001169	0.272014	0.813300	0.000000	0.001122*	0.081865	-0.000619	0.172561	0.959395
Fideuram Italia R	0.002953***	0.000295	0.839292	0.000000	0.001226**	0.011639	-0.000551	0.105639	0.978273
Interfund Equity Italy	0.001796**	0.017568	0.839942	0.000000	0.001038**	0.022867	-0.000497	0.120780	0.980716
BNL Azioni Italia	0.000257	0.835925	0.818919	0.000000	0.000693	0.356237	-0.000574	0.279047	0.945659
AcomeA Italia A1	-0.000835	0.810733	0.696612	0.000000	0.005336**	0.012234	-0.002683*	0.072477	0.624510
ZENIT Pianeta Italia R	0.000346	0.828712	0.755502	0.000000	0.001820*	0.061249	-0.000224	0.742998	0.901299
Mediolanum Challenge Italian Equity L A	-0.000674	0.731072	0.779477	0.000000	0.001897	0.110688	-0.001437*	0.087055	0.863344
Eurizon Azioni PMI Italia R	0.002782	0.220396	0.653918	0.000000	0.003543**	0.010468	0.000147	0.878806	0.781139

Fonditalia Equity Italy R	0.001578*	0.072689	0.826636	0.000000	0.001590***	0.003038	-0.000509	0.173083	0.973231
CS (Lux) Italy Equity Fund B EUR	0.000548	0.620964	0.903475	0.000000	0.001525**	0.024008	-0.000379	0.423216	0.964278
OYSTER Italian Opportunities C EUR PR	-0.000007	0.995736	0.803947	0.000000	0.002058**	0.012098	-0.000847	0.139960	0.935729
Schroder ISF Italian Equity A Dis AV	-0.000757	0.585672	0.806379	0.000000	0.001845**	0.029184	-0.000832	0.161207	0.931687
Schroder ISF Italian Equity B Acc	0.000410	0.752066	0.805671	0.000000	0.002137***	0.007143	-0.001115*	0.045355	0.939671
Schroder ISF Italian Equity B Dis AV	-0.001023	0.456408	0.803258	0.000000	0.001955**	0.019581	-0.000928	0.114181	0.932664
AZ Fund 1 - Italian Trend A-AZ FUND (ACC)	-0.001905	0.263672	0.951068	0.000000	0.001817*	0.078540	-0.000429	0.553643	0.927112
Unipol Performance Italia Fund	-0.001860	0.490319	0.327293	0.000000	0.001237	0.447319	0.001052	0.360127	0.389683
Schroder ISF Italian Equity A Acc	0.000913	0.481521	0.805750	0.000000	0.002145***	0.006847	-0.001107**	0.046459	0.939882
Schroder ISF Italian Equity C Acc	0.001428	0.272051	0.806274	0.000000	0.002145***	0.006928	-0.001115**	0.045309	0.939794
Eurizon Fund Equity Italy Smart Volatility R EUR	-0.000729	0.337571	0.895534	0.000000	0.001366***	0.003356	-0.000045	0.889924	0.982735
OYSTER Italian Opportunities N EUR PR	-0.000376	0.779344	0.803933	0.000000	0.002093**	0.010753	-0.000839	0.143779	0.935739
Mediolanum Challenge Italian Equity S A	-0.001235	0.513201	0.798451	0.000000	0.002490**	0.030389	-0.001347*	0.095824	0.878366
Pramerica Azioni Italia	0.001313	0.213665	0.783101	0.000000	0.000727	0.253550	-0.000079	0.859353	0.957353

Schroder ISF Italian Equity A1 Acc	0.000319	0.805586	0.805169	0.000000	0.002118***	0.007567	-0.001101**	0.047720	0.939816
AZ Fund 1 - Italian Trend B-AZ FUND (ACC)	-0.002015	0.260737	0.955832	0.000000	0.001683	0.120614	-0.001150	0.132469	0.919771
AXA WF Framlington Italy EC EUR	0.000994	0.660573	0.800431	0.000000	0.004149***	0.002852	-0.002018**	0.037971	0.836737
AXA WF Framlington Italy IC EUR	0.001267	0.550967	0.862821	0.000000	0.004842***	0.000236	-0.001989**	0.029360	0.840984
Amundi Dividendo Italia B	0.002399	0.218997	0.502933	0.000000	0.001413	0.230420	-0.001600*	0.055254	0.723865
Fidelity Funds - Italy Y-ACC-EUR	0.002001*	0.091655	0.882785	0.000000	0.001901***	0.008456	0.000016	0.973867	0.958404
Allianz Azioni Italia All Stars A	0.000633	0.748929	0.734513	0.000000	0.001268	0.289637	-0.000300	0.721723	0.848109
ZENIT Pianeta Italia I	0.001059	0.509894	0.755095	0.000000	0.001804*	0.064392	-0.000178	0.795014	0.900729
Fonditalia Equity Italy T	0.002141***	0.005150	0.838429	0.000000	0.001193***	0.009684	-0.000553*	0.086771	0.980376
Symphonia Azionario Small Cap Italia	0.003486	0.112956	0.604892	0.000000	0.003629***	0.006788	0.000406	0.663289	0.720269
Anima Geo Italia A	0.001484*	0.096666	0.794720	0.000000	0.000805	0.134773	-0.000459	0.226613	0.969895
Anima Geo Italia Y	0.002680***	0.002994	0.796472	0.000000	0.000784	0.144610	-0.000448	0.237157	0.970097

*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level.

Comparing the last two analysis based on the same reference period and sample of funds applying the Fama-French model, being the choice of the market benchmark the only difference, it emerges that the average values of the intercepts alpha and of all the three beta coefficients are higher when adopting the MSCI Italy index than the FTSE MIB Index. Whereas, the goodness-of-fit for the two regression models is relatively similar; in particular, the mean adjusted R^2 is slightly higher for the regressions based on the FTSE MIB Index relative to the MSCI Italy index by 0.53%.

3.4 *Carhart four-factor model analysis*

Table 7 reports for each of the 45 equity mutual funds the intercepts alpha, the market beta coefficients, the SMB beta coefficients, the HML beta coefficients, the WML beta coefficients, their corresponding p-values and the adjust R^2, estimated applying the Carhart Four-Factor Model with MSCI Italy as benchmark for the market factor. 33 funds out of 45 have positive alphas, although only 8 with 10% significance level, 6 with 5% significance level and 3 with 1% significance level (Fideuram Italia R; Fonditalia Equity Italy T; Anima Geo Italia Y). The alphas that assume negative values are all not significant. The mean of the funds' alpha equals 0.0794%. The highest value is 0.003275 (Fideuram Italia R), significant at 1% significance level and the lowest is -0.006323 (CS (Lux) Italy Equity Fund UB EUR), not significant. The median equals 0.001010 (Euromobiliare Azioni Italiane A).

All the funds' market beta are positively significant at 1% level. The market beta values range from 0.323422 (Unipol Performance Italia Fund) to 0.975709 (AZ Fund 1 - Italian Trend B-AZ FUND (ACC)), ant its median is 0.820276 (Schroder ISF Italian Equity B Dis AV). The mean value is 0.791582.

The SMB beta coefficients are all relatively small positive numbers, of these 24 are significant at 1% level, 34 at 5% level and broadening the significance level at 10% adds 4 more funds, for a total of 38 funds out of 45. The coefficients' average equals 0.002384. The median SMB beta coefficient corresponds to 0.002145 (ZENIT Pianeta Italia R), the smallest value undertaken is 0.000996 (Eurizon Azioni Italia R) and the largest is 0.005635 (AcomeA Italia A1).

By analyzing the values of the HML beta coefficient, it appears that 25 funds out of 45 have positive values, however only one of these is significant at the 5% level. When increasing the significance level from 5% to 10%, no additional funds are included (European Banking Federation - EURIBOR, 2013). The highest value is 0.002603 (Synergia Azionario Italia) and the lowest is -0.001964 (AcomeA Italia A1).The HML beta's mean equals 0.000111 and its median is non-significant 0.000174 (Fidelity Funds - Italy A-EUR-DIS). In this case, since only one value is significant, due to its p-value inferior to 1%, it can be stated that the empirical evidence is not sufficiently adverse to the null hypothesis that HML beta equals 0, and therefore it cannot be rejected.

The values the WML beta coefficients undertake are positive for 41 funds out of 45, of these 11 are significant at 10% level and when narrowing the significance level to 5% the number of funds reduces to 4. Of the other 4 funds that present a negative coefficient, only one is significant at 5% and when widening to 10% significance level the number remains unchanged. The highest WML beta value is 0.000409 (Arca Azioni Italia P) and the lowest is -0.001609 (Unipol Performance Italia Fund). The mean equals 0.000436 and the median value corresponds to 0.000518 (AZ Fund 1 - Italian Trend B-AZ FUND (ACC)).

The values of the adjusted R^2 range from 0.261815 (CS (Lux) Italy Equity Fund UB EUR) to 0.978213 (Arca Azioni Italia P). In particular, only two funds of the sample have values inferior to 50%, more than 82% of funds have values superior to 80%, and more than 60% superior to 90%. In fact, the average adjusted R^2 is 86.78%.

Table 7 - Results of Carhart model, MSCI ITALY Index

Name	alpha	alpha p-value	beta market (***)	beta Mkt p-value	beta SMB	beta SMB p-value	beta HML	beta HML p-value	beta WML	beta WML p-value	adjusted R2
Fidelity Funds - Italy A-EUR-DIS	0.001165	0.378431	0.899286	0.000000	0.002097***	0.008878	0.000174	0.787129	-0.000079	0.839236	0.948928
Synergia Azionario Italia	-0.001879	0.432890	0.473306	0.000000	0.001729	0.228782	0.002602**	0.027173	0.001088	0.125678	0.578585
CS (Lux) Italy Equity Fund UB EUR	-0.006323	0.447674	0.776770	0.000000	0.004512	0.365663	0.001531	0.705946	0.000006	0.998095	0.261815
Symphonia Azionario Small Cap Italia Classe I	0.003512	0.127616	0.599754	0.000000	0.003979***	0.004367	0.001122	0.317096	0.000660	0.331165	0.699548
AXA WF Framlington Italy AC EUR	0.001682	0.460561	0.820432	0.000000	0.004455***	0.001367	-0.001119	0.314668	0.000673	0.317866	0.838605
AXA WF Framlington Italy FC EUR	0.002310	0.311706	0.820934	0.000000	0.004459***	0.001363	-0.001119	0.315005	0.000674	0.317723	0.838572
Arca Azioni Italia P	0.000710	0.370166	0.843182	0.000000	0.001229**	0.010386	0.000376	0.331156	0.000409*	0.081665	0.978213
Eurizon Azioni Italia R	0.000312	0.706822	0.862597	0.000000	0.000995**	0.046464	0.000361	0.371957	0.000551**	0.025674	0.977037
Euromobiliare Azioni Italiane A	0.001010	0.274557	0.805149	0.000000	0.001034*	0.062706	0.000223	0.619835	0.000247	0.365462	0.967815
Fondersel PMI A	0.004125**	0.042678	0.740741	0.000000	0.003595***	0.003445	0.000759	0.441193	0.000362	0.544477	0.847889
Anima Italia A	0.001263	0.146249	0.818131	0.000000	0.001290**	0.013877	0.000458	0.279589	0.000301	0.240117	0.972561
Investimenti Azionari Italia A	0.001256	0.252112	0.831251	0.000000	0.001441**	0.029264	0.000266	0.618047	0.000636**	0.050647	0.957838
Fideuram Italia R	0.003275***	0.000279	0.856319	0.000000	0.001526***	0.004246	-0.000090	0.834243	0.000107	0.678762	0.974091
Interfund Equity Italy	0.002125**	0.011128	0.857178	0.000000	0.001336***	0.007737	-0.000052	0.896551	0.000089	0.715578	0.976973
BNL Azioni Italia	0.000290	0.821082	0.836517	0.000000	0.001029	0.182125	0.000439	0.483825	0.000780**	0.041206	0.943309
AcomeA Italia A1	-0.000705	0.842957	0.707896	0.000000	0.005635***	0.009044	-0.001964	0.258732	0.000461	0.661370	0.617226
ZENIT Pianeta Italia R	0.000367	0.825278	0.770204	0.000000	0.002145**	0.032508	0.000759	0.349664	0.000763	0.121805	0.896007
Mediolanum Challenge Italian Equity L A	-0.000578	0.769090	0.798309	0.000000	0.002186*	0.065420	-0.000643	0.503708	0.000561	0.336112	0.865124

Eurizon Azioni PMI Italia R	0.002949	0.215423	0.660666	0.000000	0.003850***	0.007544	0.000797	0.491457	0.000369	0.599273	0.764673
Fonditalia Equity Italy R	0.001904**	0.042852	0.843877	0.000000	0.001881***	0.000981	-0.000082	0.856464	0.000077	0.778919	0.970144
CS (Lux) Italy Equity Fund B EUR	0.000666	0.557702	0.923749	0.000000	0.001873***	0.006624	0.000555	0.317165	0.000651*	0.054000	0.963318
OYSTER Italian Opportunities C EUR PR	0.000185	0.896996	0.819036	0.000000	0.002378***	0.006149	-0.000143	0.837576	0.000403	0.340625	0.928773
Schroder ISF Italian Equity A Dis AV	-0.000772	0.589845	0.823404	0.000000	0.002186**	0.011731	0.000268	0.701163	0.000887**	0.037557	0.929016
Schroder ISF Italian Equity B Acc	0.000467	0.734438	0.821145	0.000000	0.002479***	0.003129	-0.000137	0.838660	0.000729*	0.074951	0.933513
Schroder ISF Italian Equity B Dis AV	-0.001042	0.461360	0.820276	0.000000	0.002295***	0.007497	0.000176	0.798591	0.000894**	0.033870	0.930137
AZ Fund 1 - Italian Trend A-AZ FUND (ACC)	-0.001671	0.343023	0.970941	0.000000	0.002176**	0.040401	0.000353	0.680969	0.000435	0.403770	0.923718
Unipol Performance Italia Fund	-0.001006	0.711512	0.323422	0.000000	0.001317	0.418981	-0.000081	0.951143	-0.001608**	0.046931	0.392177
Schroder ISF Italian Equity A Acc	0.000972	0.480425	0.821217	0.000000	0.002487***	0.003002	-0.000132	0.843759	0.000725*	0.076036	0.933700
Schroder ISF Italian Equity C Acc	0.001486	0.281754	0.821759	0.000000	0.002487***	0.003032	-0.000136	0.839017	0.000729*	0.074902	0.933635
Eurizon Fund Equity Italy Smart Volatility R EUR	-0.000272	0.761169	0.912199	0.000000	0.001680***	0.002085	0.000242	0.579212	-0.000142	0.591953	0.976493
OYSTER Italian Opportunities N EUR PR	-0.000182	0.898831	0.818950	0.000000	0.002413***	0.005501	-0.000138	0.843105	0.000398	0.346523	0.928643
Mediolanum Challenge Italian Equity S A	-0.001077	0.567748	0.818480	0.000000	0.002769**	0.015198	-0.000671	0.465286	0.000417	0.453859	0.881605
Pramerica Azioni Italia	0.001602	0.160423	0.798125	0.000000	0.001018	0.136484	0.000390	0.482259	0.000139	0.679477	0.951324
Schroder ISF Italian Equity A1 Acc	0.000380	0.782407	0.820609	0.000000	0.002458***	0.003336	-0.000131	0.845593	0.000719*	0.078418	0.933593

AZ Fund 1 - Italian Trend B-AZ FUND (ACC)	-0.001813	0.327529	0.975709	0.000000	0.002050*	0.065530	-0.000295	0.743753	0.000518	0.343155	0.916147
AXA WF Framlington Italy EC EUR	0.001051	0.644291	0.819863	0.000000	0.004452***	0.001362	-0.001118	0.314514	0.000676	0.315611	0.838660
AXA WF Framlington Italy IC EUR	0.001246	0.564260	0.869643	0.000000	0.005192***	0.000098	-0.001225	0.246063	0.000634	0.321416	0.839224
Amundi Dividendo Italia B	0.002238	0.251324	0.515995	0.000000	0.001631	0.163025	-0.000645	0.496815	0.000894	0.121732	0.729936
Fidelity Funds - Italy Y-ACC-EUR	0.002434*	0.057139	0.899514	0.000000	0.002211***	0.004237	0.000328	0.597145	-0.000103	0.782968	0.952797
Allianz Azioni Italia All Stars A	0.000619	0.753346	0.753485	0.000000	0.001548	0.190903	0.000641	0.505423	0.000768	0.188958	0.852643
ZENIT Pianeta Italia I	0.001081	0.516802	0.769744	0.000000	0.002128**	0.034442	0.000801	0.325552	0.000758	0.125588	0.895341
Fonditalia Equity Italy T	0.002455***	0.003576	0.855755	0.000000	0.001492***	0.003119	-0.000082	0.839869	0.000123	0.615820	0.976798
Symphonia Azionario Small Cap Italia	0.003296	0.152174	0.599666	0.000000	0.003982***	0.004304	0.001120	0.317458	0.000668	0.324653	0.699831
Anima Geo Italia A	0.001705*	0.067110	0.812094	0.000000	0.001094**	0.049873	0.000128	0.777440	0.000290	0.289023	0.968054
Anima Geo Italia Y	0.002901***	0.002042	0.813927	0.000000	0.001073*	0.053660	0.000141	0.754736	0.000293	0.284350	0.968346

*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level.

The last analysis examines the regressions run applying the Carhart four-factor model and adopting the FTSE MIB Index as market benchmark. The resulting values are listed in Table 8 in the following way: alpha, alpha p-value, beta market, beta market p-value, beta SMB, beta SMB p-value, beta HML, beta HML p-value, beta WML, beta WML p-value and adjusted R^2. By scrutinizing the second column of intercepts, it can be observed that 28 funds out of 45 have positive alphas, of these 6 significant at 10% level, 4 significant at 5% level and when reducing the significance level to 1%, the number of funds diminishes by only one. Whereas, the remaining negative values are all not significant. The values' array goes from -0.006763 (CS (Lux) Italy Equity Fund UB EUR) to 0.003728 (Fondersel PMI A). The mean of the funds' alpha is 0.000377 and its median is 0.000595, not significant (Euromobiliare Azioni Italiane A).

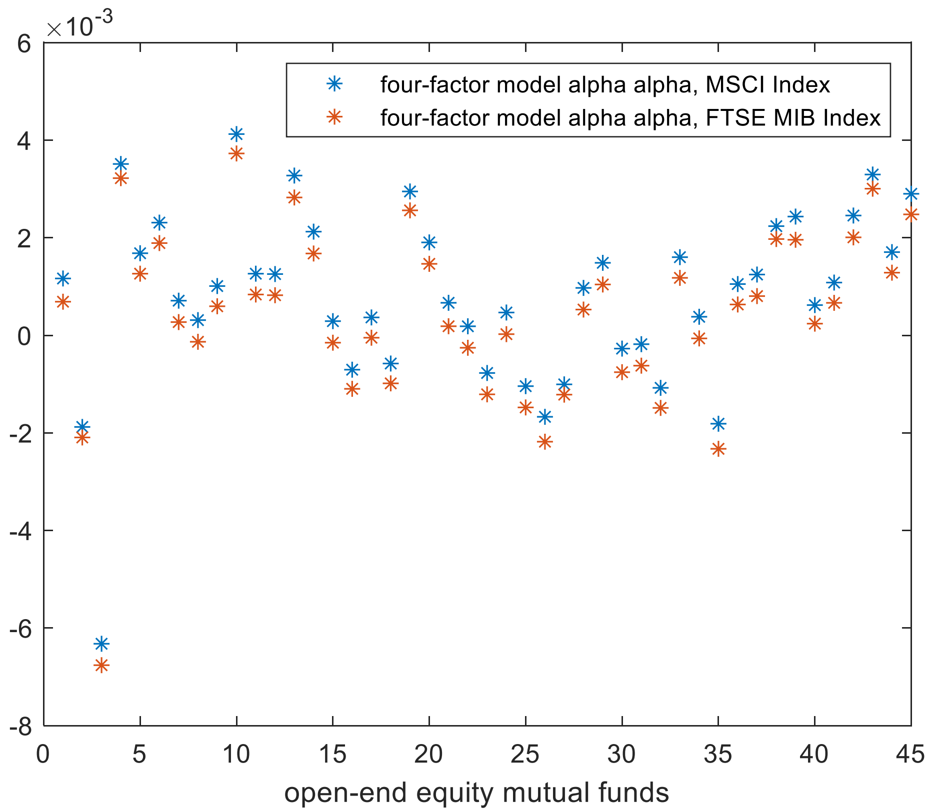

Figure 18 – Alpha estimated with the four-factor model

Once more, the funds' market betas are all positively significant at 1% level. The highest value the coefficient assumes is 0.957379 (AZ Fund 1 - Italian Trend B-AZ FUND (ACC)) and the lowest is 0.324092 (Unipol Performance Italia Fund). The market beta's mean corresponds to 0.777991 and its median to 0.805157 (OYSTER Italian Opportunities N EUR PR).

The SMB beta coefficients of the funds are also in this case characterized by the positivity of the values. 32 SMB beta values out of 45 present a significance level of 10%. This is a relatively high percentage of funds, 71.11%, indicating that the values are for the majority relatively small but significantly different from zero. Lowering the significance levels to 5% and 1%, still includes a high number of funds, respectively 28 and 16. The lowest value the coefficient assumes is 0.000720 (Eurizon Azioni Italia R) and the highest is 0.005370 (AcomeA Italia A1). The SMB beta mean equals 0.002108 and its median 0.001856 (ZENIT Pianeta Italia I).

Regarding the HML beta coefficients, 25 values out of 45 are negative and 20 are positive. However, with the exception of one positive value significant at 5% level, i.e. 0.002402 (Synergia Azionario Italia), no one else is significant. The lowest negative value amounts to -0.002167 (AcomeA Italia A1) and the positive highest value to 0.002402 (Synergia Azionario Italia). The HML beta mean and median are both negative and correspond respectively to -0.000100 and -0.000054 (Anima Geo Italia Y). In this case, since only one coefficient has a significant value, it is hard to draw any conclusion concerning the influence of the HML factor.

The WML beta coefficients are all positive except for one, significant at 10% level, i.e. -0.001530 (Unipol Performance Italia Fund). The total number of funds whose coefficient is significant at 10% level is 18, at 5% level is 14 and it halves at 7 when considering 1% significance level. The lowest among the positive HML beta values is 0.000065 (Eurizon Fund Equity Italy Smart Volatility R EUR) and the highest is 0.001088 (Synergia Azionario Italia). The WML beta mean is equivalent to 0.000603 and its median to 0.000654 (AZ Fund 1 - Italian Trend A-AZ FUND (ACC)).

Concerning the adjusted coefficient of determination, the average value corresponds to 0.873682. In particular, the values' width of the adjusted R^2 goes from 0.266269 (CS (Lux) Italy Equity Fund UB EUR) to 0.982747 (Eurizon Fund Equity Italy Smart Volatility R EUR).

To be noted that, as it was verified applying the previous two models, also in these last two analyses the mean value of the intercept alpha in the first case, adopting MSCI Italy index, is higher than in the second case, where FTSE MIB Index is used as market benchmark. Furthermore, the mean values for market beta, SMB beta and the HML beta are lower for the second analysis. The momentum factor seems to present a slightly higher mean and median for the second regression that uses the FTSE MIB Index as market benchmark than the first. However, this difference is particularly low, i.e. 0.02%.

Table 8 - Results of Carhart model, FTSE MIB Index

Name	alpha	alpha p-value	beta market (***)	beta Mkt p-value	beta SMB	beta SMB p-value	beta HML	beta HML p-value	beta WML	beta WML p-value	adjusted R2
Fidelity Funds - Italy A-EUR-DIS	0.000689	0.580316	0.882825	0.000000	0.001792**	0.017522	-0.000055	0.928408	0.000125	0.734715	0.954672
Synergia	-0.002094	0.376055	0.472801	0.000000	0.001482	0.295848	0.002402**	0.038862	0.001088	0.120586	0.589876
CS (Lux) Italy Equity Fund UB	-0.006763	0.415725	0.767303	0.000000	0.004209	0.397974	0.001298	0.748762	0.000186	0.939522	0.266269
Symphonia Azionario Small	0.003221	0.146851	0.602924	0.000000	0.003641***	0.006756	0.000837	0.438587	0.000654	0.317710	0.721309
AXA WF Framlington Italy	0.001263	0.579348	0.802783	0.000000	0.004198***	0.002519	-0.001308	0.240860	0.000857	0.204125	0.838774
AXA WF Framlington Italy	0.001891	0.407365	0.803278	0.000000	0.004203***	0.002512	-0.001308	0.241126	0.000858	0.204021	0.838749
Arca Azioni Italia	0.000271	0.711040	0.826423	0.000000	0.000954**	0.031040	0.000171	0.631739	0.000599***	0.006307	0.981372
Eurizon Azioni	-0.000133	0.868110	0.844715	0.000000	0.000720	0.134281	0.000158	0.685623	0.000745***	0.001957	0.978659
Euromobiliare Azioni Italiane A	0.000595	0.509741	0.788366	0.000000	0.000778	0.151662	0.000034	0.938434	0.000428	0.110411	0.969210
Fondersel PMI A	0.003728*	0.060829	0.728067	0.000000	0.003337***	0.005481	0.000564	0.558603	0.000530	0.363979	0.854651
Anima Italia A	0.000837	0.302049	0.802051	0.000000	0.001022**	0.036489	0.000258	0.513696	0.000485**	0.043724	0.976083
Investimenti Azionari Italia A	0.000822	0.432184	0.815024	0.000000	0.001167*	0.064019	0.000063	0.902444	0.000823***	0.008464	0.961577
Fideuram Italia R	0.002826***	0.000554	0.839922	0.000000	0.001242**	0.010425	-0.000302	0.439716	0.000301	0.203843	0.978551
Interfund Equity	0.001677**	0.027204	0.840533	0.000000	0.001053**	0.020679	-0.000263	0.474126	0.000282	0.204994	0.980961
BNL Azioni Italia	-0.000151	0.901568	0.820949	0.000000	0.000747	0.308852	0.000228	0.702542	0.000969***	0.008094	0.948612
AcomeA Italia A1	-0.001097	0.755348	0.697917	0.000000	0.005370**	0.011944	-0.002167	0.208789	0.000624	0.549065	0.625583
ZENIT Pianeta	-0.000049	0.975388	0.757466	0.000000	0.001872*	0.051671	0.000553	0.477886	0.000938**	0.047946	0.904328
Mediolanum Challenge Italian	-0.000985	0.617270	0.781024	0.000000	0.001938	0.102569	-0.000825	0.391593	0.000739	0.205530	0.865078
Eurizon Azioni PMI Italia R	0.002561	0.263456	0.655014	0.000000	0.003572**	0.010016	0.000580	0.603029	0.000524	0.438137	0.782185
Fonditalia Equity	0.001465*	0.097825	0.827196	0.000000	0.001605***	0.002792	-0.000287	0.503903	0.000268	0.304402	0.973455
CS (Lux) Italy Equity Fund B	0.000186	0.864424	0.905273	0.000000	0.001573**	0.017340	0.000332	0.533028	0.000859***	0.008538	0.966194

OYSTER Italian Opportunities C	-0.000256	0.849454	0.805180	0.000000	0.002090**	0.010505	-0.000360	0.584398	0.000589	0.139882	0.936836
Schroder ISF Italian Equity A	-0.001210	0.376901	0.808627	0.000000	0.001905**	0.021369	0.000056	0.932593	0.001073***	0.008710	0.935332
Schroder ISF Italian Equity B	0.000024	0.985187	0.807589	0.000000	0.002188***	0.005084	-0.000357	0.569375	0.000916**	0.016819	0.942357
Schroder ISF Italian Equity B	-0.001478	0.274544	0.805518	0.000000	0.002014**	0.013841	-0.000034	0.958241	0.001080***	0.007563	0.936385
AZ Fund 1 - Italian Trend A-	-0.002181	0.203423	0.952436	0.000000	0.001853*	0.072186	0.000112	0.893595	0.000654	0.196713	0.928074
Unipol Performance Italia	-0.001216	0.651022	0.324092	0.000000	0.001152	0.474569	-0.000213	0.870750	-0.001529*	0.055675	0.407233
Schroder ISF Italian Equity A	0.000528	0.680370	0.807661	0.000000	0.002196***	0.004870	-0.000352	0.573697	0.000912**	0.017086	0.942545
Schroder ISF Italian Equity C	0.001042	0.417328	0.808192	0.000000	0.002196***	0.004922	-0.000356	0.569451	0.000916**	0.016772	0.942477
Eurizon Fund Equity Italy Smart	-0.000756	0.325308	0.895670	0.000000	0.001369***	0.003403	0.000009	0.980638	0.000065	0.774125	0.982747
OYSTER Italian Opportunities N	-0.000623	0.643953	0.805157	0.000000	0.002125***	0.009334	-0.000355	0.589050	0.000585	0.142979	0.936828
Mediolanum Challenge Italian	-0.001488	0.434483	0.799706	0.000000	0.002523**	0.028263	-0.000851	0.360253	0.000600	0.286938	0.879460
Pramerica Azioni	0.001178	0.267837	0.783770	0.000000	0.000745	0.242295	0.000185	0.720589	0.000320	0.308066	0.957704
Schroder ISF Italian Equity A1	-0.000063	0.960604	0.807067	0.000000	0.002168***	0.005428	-0.000350	0.575563	0.000907**	0.017818	0.942449
AZ Fund 1 - Italian Trend B-	-0.002327	0.196332	0.957379	0.000000	0.001724	0.110730	-0.000539	0.538651	0.000739	0.164841	0.920995
AXA WF Framlington Italy	0.000632	0.781168	0.802230	0.000000	0.004196***	0.002510	-0.001307	0.240696	0.000860	0.202441	0.838837
AXA WF Framlington Italy	0.000804	0.707822	0.860814	0.000000	0.004859***	0.000232	-0.001570	0.135404	0.000647	0.308051	0.841738
Amundi Dividendo Italia B	0.001974	0.311247	0.505046	0.000000	0.001469	0.209009	-0.000765	0.420905	0.001010*	0.080714	0.730496
Fidelity Funds - Italy Y-ACC-EUR	0.001959	0.102511	0.882995	0.000000	0.001906***	0.008533	0.000099	0.864378	0.000100	0.775809	0.958431
Allianz Azioni Italia All Stars A	0.000239	0.903911	0.736471	0.000000	0.001320	0.267682	0.000474	0.624683	0.000936	0.111856	0.851138

ZENIT Pianeta	0.000665	0.677469	0.757048	0.000000	0.001855*	0.054550	0.000594	0.447020	0.000933**	0.049934	0.903723
Fonditalia Equity	0.002008***	0.008839	0.839090	0.000000	0.001210***	0.008468	-0.000292	0.430372	0.000316	0.158998	0.980684
Symphonia Azionario Small	0.003006	0.175285	0.602815	0.000000	0.003645***	0.006661	0.000836	0.439072	0.000662	0.311123	0.721559
Anima Geo Italia	0.001284	0.149468	0.795710	0.000000	0.000832	0.119499	-0.000067	0.876467	0.000473*	0.072804	0.970657
Anima Geo Italia	0.002479***	0.005851	0.797467	0.000000	0.000811	0.128390	-0.000054	0.899908	0.000476*	0.070928	0.970864

*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level.

3.5 *Non-parametric persistence test*

The mutual funds in the sample are ranked every year, according to their compound annual raw returns. Funds are successively classified as winners (W) or losers (L) based on whether they are respectively on or above, or below the median. In table 9 are reported the number of winner and loser mutual funds each year for the period 2009-2018.

Table 9 – Number of winners (W) and losers (L) in each 1-year period, from 2009-2018, based on raw returns

Year	W	L	Total funds
2009	21	20	41
2010	23	22	45
2011	23	22	45
2012	23	22	45
2013	23	22	45
2014	23	22	45
2015	23	22	45
2016	23	22	45
2017	23	22	45
2018	23	22	45

The two-way contingency tables are then constructed and reported in the set of table 10 below. Following, table 11 presents the estimated cross product ratio (CPR) and Z-statistic for each year. The non-parametric test on performance persistence is executed at the 5% significance level. Consequently, a value of the Z-statistic higher than the critical value 1.645 provides evidence of statistical significance. The non-parametric test for the short-term persistence is carried out in 9 different sub-periods, from 2009-2010 to 2017-2018.

Table 10 – Two-way contingency tables based on 1-year raw returns, 2009-2018

	2010 W	2010 L
2009 W	14	9
2009 L	6	12

	2011 W	2011 L
2010 W	11	12
2010 L	12	10

	2012 W	2012 L
2011 W	13	10
2011 L	10	12

	2013 W	2013 L
2012 W	16	7
2012 L	7	15

	2014 W	2014 L
2013 W	11	12
2013 L	12	10

	2015 W	2015 L
2014 W	10	13
2014 L	13	9

	2016 W	2016 L
2015 W	11	12
2015 L	12	10

	2017 W	2017 L
2016 W	11	12
2016 L	12	10

	2018 W	2018 L
2017 W	8	15
2017 L	15	7

Table 11 – Non-parametric test based on 1-year raw returns, 2009-2018

	WW	**LL**	**WL**	**LW**	**N. funds**	**CPR**	**ln(CPR)**	**standard error**	**Z-statistic**
2009-2010	14	12	9	6	41	3.1111	1.1350	0.6577	1.7257
2010-2011	11	10	12	12	45	0.7639	-0.2693	0.5980	-0.4504
2011-2012	13	12	10	10	45	1.5600	0.4447	0.6002	0.7409
2012-2013	16	15	7	7	45	4.8980	1.5888	0.6441	2.4667
2013-2014	11	10	12	12	45	0.7639	-0.2693	0.5980	-0.4504
2014-2015	10	9	13	13	45	0.5325	-0.6301	0.6041	-1.0430
2015-2016	11	10	12	12	45	0.7639	-0.2693	0.5980	-0.4504
2016-2017	11	10	12	12	45	0.7639	-0.2693	0.5980	-0.4504
2017-2018	8	7	15	15	45	0.2489	-1.3907	0.6334	-2.1957
Combined results	105	95	102	99	401	0.9878	-0.0123	0.1999	-0.0613

By analyzing the results, it emerges that in three lapses of times out of nine the estimated CPR is greater than 1 and in two cases the values are significant at 5% level, since the Z-statistic critical values are above 1.645. The overall CPR, accounting for the total of the repeat and non-repeat performers of all the period considered, is close to but does not reach 1, i.e. 0.9878 and its Z-statistic is -0.0613. Thus, in only a third of the periods considered, all of which before 2013, the number of repeat performers is higher than the number of reversal performers. Therefore, the null hypothesis sustaining the existence of general performance persistence is rejected. The fact that the results from the 1-year interval based on raw return are not statistically significant, with the exception of two periods, may be due to the small sample size, constituted by 45 funds, which is far inferior to the number of mutual funds tested by Goetzmann and Ibbotson (1994), who considered 728 US mutual funds over the period 1976-1988. An additional reason may be the absence of extreme numbers of repeat performers in the period examined. Furthermore, non-persistence of mutual funds' performance can also be a consequence of the generally unstable Italian stock market from 2009 to 2018, not less important to point out that the first period of the study is the period of post-crisis for the economy as a whole.

Table 12 reports the number of mutual funds classified as winners and losers each two-year interval for the period 2009-2018, resulting in five sub-periods. In order to evaluate the equity mutual fund's performance in the long term, monthly raw returns are compounded to generate 2-year raw returns.

Table 12 – Number of winners (W) and losers (L) in each 2-year period, from 2009-2018, based on raw returns

Year	W	L	Total funds
2009-2010	21	20	41
2011-2012	22	23	45
2013-2014	22	23	45
2015-2016	22	23	45
2017-2018	22	23	45

Following, table 13 reports the two-way contingency tables based on 2-years raw returns and table 14 the estimated CPR and related Z-statistic for each of the two-year subsample. The non-parametric test for the long-term persistence is carried out on 4 different sub-periods, from 2009/2010 - 2011/2012 to 2015/2016 - 2017/2018.

Table 13 – Two-way contingency tables based on 2-year raw returns, 2009-2018

	2011-2012 W	2011-2012 L
2009-2010 W	12	9
2009-2010 L	10	10

	2013-2014 W	2013-2014 L
2011-2012 W	13	10
2011-2012 L	10	12

	2015-2016 W	2015-2016 L
2013-2014 W	15	8
2013-2014 L	8	14

	2017-2018 W	2017-2018 L
2015-2016 W	17	6
2015-2016 L	6	16

Table 14 – Non-parametric test based on 2-year raw returns, 2009-2018

	WW	LL	WL	LW	N. funds	CPR	ln(CPR)	standard error	Z-statistic
2009/2010- 2011/2012	13	10	8	10	41	1.6250	0.4855	0.6340	0.7658
2011/2012- 2013/2014	13	12	10	10	45	1.5600	0.4447	0.6002	0.7409
2013/2014- 2015/2016	15	14	8	8	45	3.2813	1.1882	0.6230	1.9073
2015/2016- 2017/2018	17	16	6	6	45	7.5556	2.0223	0.6743	2.9992
Combined results	58	52	32	34	176	2.7721	1.0196	0.3117	3.2714

In this second analysis, where the two-year interval raw returns are examined, the CPR values are greater than 1 for all the years. In two cases out of four they are statistically significant at 5% level. Furthermore, the overall result, obtained by combining all the values in the whole sample period considered, highlights that the number of repeat performers is considerably higher than the number of non-repeat performers. This is revealed by the CPR ratio of 2.7721, which is statistically significant at 5% and 1% significance level, since the Z-statistic equals 3.2714 which is higher than respectively 1.645 and 2.576 critical values. Moreover, evidence proves that persistence is slightly more pronounced for the top performers than the bottom ones. It can be concluded that the long-term performance persistence based on raw returns exists and is statistically significant at 5% significance level. The results are consistent with Goetzmann and Ibbotson (1994) study, and show that equity open-end mutual funds in Italy can present persistence in their performance in the long-term, maintaining their ranking positions through the years.

Conclusion

In this dissertation, I examine the performance and the persistence in performance of open-end equity mutual funds in the period from 2009 to 2019.

The performance is investigated by considering a sample composed of 45 open-end equity mutual funds, all actively managed and registered to sell in Italy, although not exclusively there. The funds are domiciled mainly in Italy and in Luxembourg, and only a few in Ireland. The data are collected for the period January

2009 to December 2019. No fund has ceased to exist during this sample period, the sample is avoiding the survivorship-bias issue.

I carry out multiple analyses, by regressing the funds' excess returns against two distinct benchmark indexes' excess returns: MSCI Italy Index (MSITALL) and FTSE MIB Index (FTSEMIB). The Euro OverNight Index Average (EONIA) is the risk free rate adopted in the regressions, it is a 1-day interbank interest rate determined by the Panel Banks for the whole Euro zone. From the monthly net asset value (NAV) and dividends, the monthly returns were calculated for each equity mutual fund. Nearly 78% of equity mutual funds offer a better risk-adjusted performance than either the benchmark indices, according to the higher values assumed by the Sharpe ratios.

Three distinct models are used in order to identify the exposure to traditional factors, the funds portfolio's "style". The regression coefficients on the excess returns of factor-based portfolios generate estimates of the portfolio's factor exposure. The analyses of multiple models is crucial to understand how the interpretation of regression loadings might be affected by the inclusion of different mimicking portfolios.

On average, by applying the single index model, a quarter of the funds present a positive alpha significant at the 10% level over an 11-year time period. Restricting the significance level to 5%, also the number of funds that have positive alpha reduce at approximately 15%. When considering the three-factor and four-factor regression models, the number of funds that have positive alpha, significant at the 10% level, reduce at a slightly higher than a quintile in the first case and at approximately 15% in the second case. A positive regression intercept indicates an exceeding average excess return of the funds over the return of a passive portfolio. An average positive alpha, observable in all models, is a measure of performance that indicates that the portfolio and the strategy undertaken have been well managed to beat the market return over the sample period. Thus, for these funds that present a significant positive alpha it can be evinced that there is a general good performance of the fund manager and part of the returns, not explained from the traditional factors, can be attributed to the manager's skill. An alpha, which is significantly different from zero, is the result of the active return on an investment. In the Italian equity mutual fund market, the augmented value by active management is able to cover to cover the fees incurred.

The coefficients of the regressions' models, the beta, measure how the fund performed compared to the referenced benchmark index, intended to represent the market's movement as a whole. Differently from the alpha measure, it can be earned through passive index investing. The market beta is a relative risk measurement, it depicts a fund's volatility against a benchmark and it helps investors to recognize whether the mutual fund is appropriate for their risk tolerance. The values obtained in all regression models are all significant at 1% level, on average the beta are less than one, suggesting that the funds are less volatile than both indexes. Along with this, the corresponding adjusted R^2 is relatively high, indicating reliable and meaningful beta. The factor loadings reveal significant positive SMB coefficients for the majority of mutual funds, implying that the returns are being driven relatively more by smaller stocks. The HML coefficients, resulting from the two distinct three-factor model regression analyses, are significant at 5% and 10% level only in a small part, and these are characterized by a negative sign. This can be interpreted as evidence of exposure to growth companies. As for the momentum factor, the coefficients' values result positive and significant at 10% level for nearly a quarter of sample's funds in the regression model carried out using the MSCI Italy index as market benchmark and for 40% of funds using the FTSE MIB index. The positive sign of the momentum beta highlights that the funds are at large more sensitive to 'winners' mutual funds than 'losers'.

In general, the fitting of the various regressions result to be high, it can be observed elevated values of the index adjusted R^2. Similarly for both benchmarks, the average adjusted coefficient of determination does not vary substantially when shifting from the single index model to the three-factor model, and even less extensively when switching from the three-factor to the four factor model. This suggests that the SMB and HML factors improve only in small part the fitting of the multiple regression equations for the mutual funds' sample data and analogously, the momentum factor explains a particularly small proportion of the variability of the excess returns on equity mutual funds. Furthermore, in all three regression models, the average adjusted R^2 is higher when FTSE MIB index is adopted as market benchmark, indicating that it is able to better explain the equity mutual fund performance.

There is strong evidence of significant long-term performance persistence for our equity mutual funds. To study the existence of this phenomenon, a non-parametric methodology based on the two-way contingency tables is adopted. To evaluate the percentage of equity mutual funds that manifests performance persistence based on raw returns, the test statistic deployed is the cross product ratio (CPR) and the Z-statistic was utilized to verify the statistical significance of the CPR test itself. From the results obtained in this dissertation, it can be stated that performance persistence exists when increasing the period of historical data, from one to two years. These results highlight that past performance can pave the way for predicting future returns, and they may represent a reliable benchmark to future performance. Past fund performance information may be a tactical and pivotal tool for potential investment strategies for the achievement of higher returns. This is consistent with the study of Carhart (1997), arguing that assuming the existence of managerial skill, a 1-year return is probably a highly noisy measure. Thus, for reducing the noise in past-performance rankings, it is necessary to consider portfolios of mutual funds whose returns are lagged at least two years. The knowledge of long-term persistence represents a great deal of value for investors.

Besides the advantages of vast diversification and low transaction costs of mutual funds, the results suggest that open-end equity mutual funds in the Italian market deliver positive risk-adjusted performance, adding value for their investors. Contrary to US evidence, a relevant portion of Italian equity mutual funds seems to be able to take advantage of their vast money capitals available, through which they are able to exploit specific investment strategies, and the high level of their managers' expertise to offset their expenses.

Appendix: Matlab code

```
%%
clear;
clc;

NAV=xlsread('Open-end equity funds data',1);
MSCI_ITALY=xlsread('Open-end equity funds data',2,'B:B');
FTSE_MIB_INDEX=xlsread('Open-end equity funds data',2,'D:D');
rfr=xlsread('Open-end equity funds data',3,'B:B');
SMB=xlsread('Open-end equity funds data',4,'B:B');
HML=xlsread('Open-end equity funds data',4,'C:C');
WML=xlsread('Open-end equity funds data',4,'D:D');

n_funds=size(NAV,2);

% monthly risk-free rate
rfr_EONIA=rfr(2:end)./100;

% returns from NAV & dividends of funds

rets_funds = ((NAV(2:end,:)./ NAV(1:end-1,:)))- 1;

% returns from Total Return Index of the benchmarks

rets_MSCI_ITALY=((MSCI_ITALY(2:end,1)./ MSCI_ITALY(1:end-1,1)))- 1;
rets_FTSE_MIB_INDEX=((FTSE_MIB_INDEX(2:end,1)./ FTSE_MIB_INDEX(1:end-
1,1)))- 1;

% Excess returns of funds and benchmarks
exc_ret_funds = (rets_funds - rfr_EONIA);
exc_ret_MSCI_ITALY=(rets_MSCI_ITALY-rfr_EONIA);
exc_ret_FTSE_MIB_INDEX=(rets_FTSE_MIB_INDEX-rfr_EONIA);


% Sharpe ratio of the MSCI_ITALY index (SR_MSCI_ITALY)

mean_exc_ret_MSCI_ITALY=mean(exc_ret_MSCI_ITALY);
std_exc_ret_MSCI_ITALY=std(exc_ret_MSCI_ITALY);
SR_MSCI_ITALY=mean_exc_ret_MSCI_ITALY./std_exc_ret_MSCI_ITALY;

% Sharpe ratio of the FTSE_MIB_INDEX(SR_FTSE_MIB_INDEX)

mean_exc_ret_FTSE_MIB_INDEX=mean(exc_ret_FTSE_MIB_INDEX);
std_exc_ret_FTSE_MIB_INDEX=std(exc_ret_FTSE_MIB_INDEX);
SR_FTSE_MIB_INDEX=mean_exc_ret_FTSE_MIB_INDEX./std_exc_ret_FTSE_MIB_I
NDEX;
```

```
% Sharpe ratio of funds(SR_funds)
for i=1:n_funds
mean_exc_ret_funds(i)=nanmean(exc_ret_funds(:,i));
std_exc_ret_funds(i)=nanstd(exc_ret_funds(:,i));
SR_funds(i)=mean_exc_ret_funds(i)./std_exc_ret_funds(i);
end

%% CAPM model with MSCI_ITALY benchmark

n_months=size(exc_ret_funds,1);

alphas=zeros(n_funds,1);
betas=zeros(n_funds,1);
var_error=zeros(n_funds,1);
resid=zeros(131,45);
Rsquared=zeros(n_funds,1);

X= [ones(n_months,1),exc_ret_MSCI_ITALY];

for i=1:n_funds

[b,bint,r,rint,stats] = regress(exc_ret_funds(:,i),X);
alphas(i)=b(1);
betas(i)=b(2);
var_error(i)=stats(4);
resid(:,i)=r;
Rsquared(i)=stats(1);
end

mean_alphas=mean(alphas);
std_dev_alphas=std(alphas);
median_alphas=median(alphas);

mean_betas=mean(betas);
std_dev_betas=std(betas);
median_betas=median(betas);

% variance-covariance matrix of beta|X and standard error for each
fund
Vx=zeros(90,2);
STD=zeros(45,2);

for i=1:n_funds
Vx(i*2-1:i*2,:)=var_error(i,1)*inv(X'*X);
STD(i,:)=sqrt((diag(Vx(i*2-1:i*2,:)))');
end
```

```
% t-test statistic
t_test_alpha=zeros(45,1);
t_test_beta=zeros(45,1);

for i=1:n_funds
t_test_alpha(i)=(alphas(i,:))./STD(i,1);
t_test_beta(i)=(betas(i,:))./STD(i,2);
end

% number of regressors (including the intercept)
K=size(X,2);

% p-value (two sided test)
for i=1:n_funds
pvalue_alpha(i)=2*(1-tcdf( abs(t_test_alpha(i)), n_months-K ));
pvalue_beta(i)=2*(1-tcdf( abs(t_test_beta(i)), n_months-K ));
end

% CHECK: estimator of the variance of epsilon
for i=1:n_funds
s(i)=(resid(:,i)'*resid(:,i))/(n_months-K);
end

% Rsquared_adjusted for each fund
Rsquared_adj=zeros(45,1);
for i=1:n_funds
Rsquared_adj(i)=1-[(1-Rsquared(i))*(n_funds-1)./(n_funds-1-1)];
end
%% CAPM model with FTSE_MIB_INDEX benchmark

alphas2=zeros(n_funds,1);
betas2=zeros(n_funds,1);
var_error2=zeros(n_funds,1);
Rsquared2=zeros(n_funds,1);

X2= [ones(n_months,1),exc_ret_FTSE_MIB_INDEX];

for i=1:n_funds

[b2,bint2,r2,rint2,stats2] = regress(exc_ret_funds(:,i),X2);
alphas2(i)=b2(1);
betas2(i)=b2(2);
var_error2(i)=stats2(4);
Rsquared2(i)=stats2(1);
end
```

```
mean_alphas2=mean(alphas2);
std_dev_alphas2=std(alphas2);
median_alphas2=median(alphas2);

mean_betas2=mean(betas2);
std_dev_betas2=std(betas2);
median_betas2=median(betas2);

% variance-covariance matrix of beta|X and standard error for each
fund

Vx2=zeros(90,2);
STD2=zeros(45,2);

for i=1:n_funds
Vx2(i*2-1:i*2,:)=var_error2(i,1)*inv(X2'*X2);
STD2(i,:)=sqrt((diag(Vx2(i*2-1:i*2,:)))');
end

% t-test statistic
t_test_alpha2=zeros(45,1);
t_test_beta2=zeros(45,1);

for i=1:n_funds
t_test_alpha2(i)=(alphas2(i,:))./STD2(i,1);
t_test_beta2(i)=(betas2(i,:))./STD2(i,2);
end

% p-value (two sided test)
for i=1:n_funds
pvalue_alpha2(i)=2*(1-tcdf( abs(t_test_alpha2(i)), n_months-K ));
pvalue_beta2(i)=2*(1-tcdf( abs(t_test_beta2(i)), n_months-K ));
end

% Rsquared_adjusted for each fund
Rsquared_adj2=zeros(45,1);
for i=1:n_funds
Rsquared_adj2(i)=1-[(1-Rsquared2(i))*(n_funds-1)./(n_funds-1-1)];
end
%%  Fama-French 3 factor models with MSCI_ITALY benchmark

alphas3=zeros(n_funds,1);
beta_mkt3=zeros(n_funds,1);
beta_SMB3=zeros(n_funds,1);
beta_HML3=zeros(n_funds,1);
var_error3=zeros(n_funds,1);
Rsquared3=zeros(n_funds,1);
```

```
X3= [ones(n_months,1),exc_ret_MSCI_ITALY,SMB,HML];

for i=1:n_funds

[b3,bint3,r3,rint3,stats3] = regress(exc_ret_funds(:,i),X3);
alphas3(i)=b3(1);
beta_mkt3(i)=b3(2);
beta_SMB3(i)=b3(3);
beta_HML3(i)=b3(4);
var_error3(i)=stats3(4);
Rsquared3(i)=stats3(1);
end

mean_alphas3=mean(alphas3);
std_dev_alphas3=std(alphas3);
median_alphas3=median(alphas3);

mean_beta_mkt3=mean(beta_mkt3);
std_dev_beta_mkt3=std(beta_mkt3);
median_beta_mkt3=median(beta_mkt3);

mean_beta_SMB3=mean(beta_SMB3);
std_dev_beta_SMB3=std(beta_SMB3);
median_beta_SMB3=median(beta_SMB3);

mean_beta_HML3=mean(beta_HML3);
std_dev_beta_HML3=std(beta_HML3);
median_beta_HML3=median(beta_HML3);

% variance-covariance matrix of beta|X and standard error for each
fund

Vx3=zeros(180,4);
STD3=zeros(45,4);

for i=1:n_funds
Vx3(i*4-3:i*4,:)=var_error3(i,1)*inv(X3'*X3);
STD3(i,:)=sqrt((diag(Vx3(i*4-3:i*4,:)))');
end

% t-test statistic
t_test_alpha3=zeros(45,1);
t_test_beta_mkt3=zeros(45,1);
t_test_beta_SMB3=zeros(45,1);
t_test_beta_HML3=zeros(45,1);
```

```
for i=1:n_funds
t_test_alpha3(i)=(alphas3(i,:))./STD3(i,1);
t_test_beta_mkt3(i)=(beta_mkt3(i,:))./STD3(i,2);
t_test_beta_SMB3(i)=(beta_SMB3(i,:))./STD3(i,3);
t_test_beta_HML3(i)=(beta_HML3(i,:))./STD3(i,4);
end

% number of regressors (including the intercept)
K3=size(X3,2);

% p-value (two sided test)
for i=1:n_funds
pvalue_alpha3(i)=2*(1-tcdf( abs(t_test_alpha3(i)), n_months-K3 ));
pvalue_beta_mkt3(i)=2*(1-tcdf( abs(t_test_beta_mkt3(i)), n_months-K3
));
pvalue_beta_SMB3(i)=2*(1-tcdf( abs(t_test_beta_SMB3(i)), n_months-K3
));
pvalue_beta_HML3(i)=2*(1-tcdf( abs(t_test_beta_HML3(i)), n_months-K3
));
end

% Rsquared_adjusted for each fund
Rsquared_adj3=zeros(45,1);
for i=1:n_funds
Rsquared_adj3(i)=1-[(1-Rsquared3(i))*(n_funds-1)./(n_funds-1-1)];
end
%% Fama-French 3 factor models with FTSE_MIB_INDEX benchmark

alphas4=zeros(n_funds,1);
beta_mkt4=zeros(n_funds,1);
beta_SMB4=zeros(n_funds,1);
beta_HML4=zeros(n_funds,1);
var_error4=zeros(n_funds,1);
Rsquared4=zeros(n_funds,1);

X4= [ones(n_months,1),exc_ret_FTSE_MIB_INDEX,SMB,HML];

for i=1:n_funds

[b4,bint4,r4,rint4,stats4] = regress(exc_ret_funds(:,i),X4);
alphas4(i)=b4(1);
beta_mkt4(i)=b4(2);
beta_SMB4(i)=b4(3);
beta_HML4(i)=b4(4);
var_error4(i)=stats4(4);
Rsquared4(i)=stats4(1);
end
```

```
mean_alphas4=mean(alphas4);
std_dev_alphas4=std(alphas4);
median_alphas4=median(alphas4);

mean_beta_mkt4=mean(beta_mkt4);
std_dev_beta_mkt4=std(beta_mkt4);
median_beta_mkt4=median(beta_mkt4);

mean_beta_SMB4=mean(beta_SMB4);
std_dev_beta_SMB4=std(beta_SMB4);
median_beta_SMB4=median(beta_SMB4);

mean_beta_HML4=mean(beta_HML4);
std_dev_beta_HML4=std(beta_HML4);
median_beta_HML4=median(beta_HML4);

% variance-covariance matrix of beta|X and standard error for each
fund

Vx4=zeros(180,4);
STD4=zeros(45,4);

for i=1:n_funds
Vx4(i*4-3:i*4,:)=var_error4(i,1)*inv(X4'*X4);
STD4(i,:)=sqrt((diag(Vx4(i*4-3:i*4,:)))');
end

% t-test statistic
t_test_alpha4=zeros(45,1);
t_test_beta_mkt4=zeros(45,1);
t_test_beta_SMB4=zeros(45,1);
t_test_beta_HML4=zeros(45,1);

for i=1:n_funds
t_test_alpha4(i)=(alphas4(i,:))./STD4(i,1);
t_test_beta_mkt4(i)=(beta_mkt4(i,:))./STD4(i,2);
t_test_beta_SMB4(i)=(beta_SMB4(i,:))./STD4(i,3);
t_test_beta_HML4(i)=(beta_HML4(i,:))./STD4(i,4);
end

% number of regressors (including the intercept)
K4=size(X4,2);

% p-value (two sided test)
for i=1:n_funds
pvalue_alpha4(i)=2*(1-tcdf( abs(t_test_alpha4(i)), n_months-K4 ));
```

```
pvalue_beta_mkt4(i)=2*(1-tcdf( abs(t_test_beta_mkt4(i)), n_months-K4
));
pvalue_beta_SMB4(i)=2*(1-tcdf( abs(t_test_beta_SMB4(i)), n_months-K4
));
pvalue_beta_HML4(i)=2*(1-tcdf( abs(t_test_beta_HML4(i)), n_months-K4
));
end

% Rsquared_adjusted for each fund
Rsquared_adj4=zeros(45,1);
for i=1:n_funds
Rsquared_adj4(i)=1-[(1-Rsquared4(i))*(n_funds-1)./(n_funds-1-1)];
end
%% Carhart 4-factor model with MSCI_ITALY benchmarkk

alphas5=zeros(n_funds,1);
beta_mkt5=zeros(n_funds,1);
beta_SMB5=zeros(n_funds,1);
beta_HML5=zeros(n_funds,1);
beta_WML5=zeros(n_funds,1);
var_error5=zeros(n_funds,1);
Rsquared5=zeros(n_funds,1);

X5= [ones(n_months,1),exc_ret_MSCI_ITALY,SMB,HML,WML];

for i=1:n_funds

[b5,bint5,r5,rint5,stats5] = regress(exc_ret_funds(:,i),X5);
alphas5(i)=b5(1);
beta_mkt5(i)=b5(2);
beta_SMB5(i)=b5(3);
beta_HML5(i)=b5(4);
beta_WML5(i)=b5(5);
var_error5(i)=stats5(4);
Rsquared5(i)=stats5(1);
end

mean_alphas5=mean(alphas5);
std_dev_alphas5=std(alphas5);
median_alphas5=median(alphas5);

mean_beta_mkt5=mean(beta_mkt5);
std_dev_beta_mkt5=std(beta_mkt5);
median_beta_mkt5=median(beta_mkt5);

mean_beta_SMB5=mean(beta_SMB5);
std_dev_beta_SMB5=std(beta_SMB5);
```

```
median_beta_SMB5=median(beta_SMB5);

mean_beta_HML5=mean(beta_HML5);
std_dev_beta_HML5=std(beta_HML5);
median_beta_HML5=median(beta_HML5);

mean_beta_WML5=mean(beta_WML5);
std_dev_beta_WML5=std(beta_WML5);
median_beta_WML5=median(beta_WML5);

% variance-covariance matrix of beta|X and standard error for each
fund

Vx5=zeros(225,5);
STD5=zeros(45,5);

for i=1:n_funds
Vx5(i*5-4:i*5,:)=var_error5(i,1)*inv(X5'*X5);
STD5(i,:)=sqrt((diag(Vx5(i*5-4:i*5,:)))');
end

% t-test statistic
t_test_alpha5=zeros(45,1);
t_test_beta_mkt5=zeros(45,1);
t_test_beta_SMB5=zeros(45,1);
t_test_beta_HML5=zeros(45,1);
t_test_beta_WML5=zeros(45,1);

for i=1:n_funds
t_test_alpha5(i)=(alphas5(i,:))./STD5(i,1);
t_test_beta_mkt5(i)=(beta_mkt5(i,:))./STD5(i,2);
t_test_beta_SMB5(i)=(beta_SMB5(i,:))./STD5(i,3);
t_test_beta_HML5(i)=(beta_HML5(i,:))./STD5(i,4);
t_test_beta_WML5(i)=(beta_WML5(i,:))./STD5(i,5);
end

% number of regressors (including the intercept)
K5=size(X5,2);

% p-value (two sided test)
for i=1:n_funds
pvalue_alpha5(i)=2*(1-tcdf( abs(t_test_alpha5(i)), n_months-K5 ));
pvalue_beta_mkt5(i)=2*(1-tcdf( abs(t_test_beta_mkt5(i)), n_months-K5
));
pvalue_beta_SMB5(i)=2*(1-tcdf( abs(t_test_beta_SMB5(i)), n_months-K5
));
```

```
pvalue_beta_HML5(i)=2*(1-tcdf( abs(t_test_beta_HML5(i)), n_months-K5
));
pvalue_beta_WML5(i)=2*(1-tcdf( abs(t_test_beta_WML5(i)), n_months-K5
));
end

% Rsquared_adjusted for each fund
Rsquared_adj5=zeros(45,1);
for i=1:n_funds
Rsquared_adj5(i)=1-[(1-Rsquared5(i))*(n_funds-1)./(n_funds-1-1)];
end
%% Carhart 4-factor model with FTSE_MIB_INDEX benchmark

alphas6=zeros(n_funds,1);
beta_mkt6=zeros(n_funds,1);
beta_SMB6=zeros(n_funds,1);
beta_HML6=zeros(n_funds,1);
beta_WML6=zeros(n_funds,1);
var_error6=zeros(n_funds,1);
Rsquared6=zeros(n_funds,1);

X6= [ones(n_months,1),exc_ret_FTSE_MIB_INDEX,SMB,HML,WML];

for i=1:n_funds

[b6,bint6,r6,rint6,stats6] = regress(exc_ret_funds(:,i),X6);
alphas6(i)=b6(1);
beta_mkt6(i)=b6(2);
beta_SMB6(i)=b6(3);
beta_HML6(i)=b6(4);
beta_WML6(i)=b6(5);
var_error6(i)=stats6(4);
Rsquared6(i)=stats6(1);
end

mean_alphas6=mean(alphas6);
std_dev_alphas6=std(alphas6);
median_alphas6=median(alphas6);

mean_beta_mkt6=mean(beta_mkt6);
std_dev_beta_mkt6=std(beta_mkt6);
median_beta_mkt6=median(beta_mkt6);

mean_beta_SMB6=mean(beta_SMB6);
std_dev_beta_SMB6=std(beta_SMB6);
median_beta_SMB6=median(beta_SMB6);
```

```
mean_beta_HML6=mean(beta_HML6);
std_dev_beta_HML6=std(beta_HML6);
median_beta_HML6=median(beta_HML6);

mean_beta_WML6=mean(beta_WML6);
std_dev_beta_WML6=std(beta_WML6);
median_beta_WML6=median(beta_WML6);

% variance-covariance matrix of beta|X and standard error for each
fund

Vx6=zeros(225,5);
STD6=zeros(45,5);

for i=1:n_funds
Vx6(i*5-4:i*5,:)=var_error6(i,1)*inv(X6'*X6);
STD6(i,:)=sqrt((diag(Vx6(i*5-4:i*5,:)))');
end

% t-test statistic
t_test_alpha6=zeros(45,1);
t_test_beta_mkt6=zeros(45,1);
t_test_beta_SMB6=zeros(45,1);
t_test_beta_HML6=zeros(45,1);
t_test_beta_WML6=zeros(45,1);

for i=1:n_funds
t_test_alpha6(i)=(alphas6(i,:))./STD6(i,1);
t_test_beta_mkt6(i)=(beta_mkt6(i,:))./STD6(i,2);
t_test_beta_SMB6(i)=(beta_SMB6(i,:))./STD6(i,3);
t_test_beta_HML6(i)=(beta_HML6(i,:))./STD6(i,4);
t_test_beta_WML6(i)=(beta_WML6(i,:))./STD6(i,5);
end

% number of regressors (including the intercept)
K6=size(X6,2);

% p-value (two sided test)
for i=1:n_funds
pvalue_alpha6(i)=2*(1-tcdf( abs(t_test_alpha6(i)), n_months-K6 ));
pvalue_beta_mkt6(i)=2*(1-tcdf( abs(t_test_beta_mkt6(i)), n_months-K6
));
pvalue_beta_SMB6(i)=2*(1-tcdf( abs(t_test_beta_SMB6(i)), n_months-K6
));
pvalue_beta_HML6(i)=2*(1-tcdf( abs(t_test_beta_HML6(i)), n_months-K6
));
```

```
pvalue_beta_WML6(i)=2*(1-tcdf( abs(t_test_beta_WML6(i)), n_months-K6
));
end

% Rsquared_adjusted for each fund
Rsquared_adj6=zeros(45,1);
for i=1:n_funds
Rsquared_adj6(i)=1-[(1-Rsquared6(i))*(n_funds-1)./(n_funds-1-1)];
end

%% Performance persistence test

%ret_a is the cumulative 1-year return

ret_a=zeros(10,45);

for t=1:10
    for i=1:n_funds
ret_a(t,i)=(prod(1+rets_funds(t*12-11:t*12,i)))-1;
    end
end;

ret_a_2y=zeros(5,45);
for t=1:5
    for i=1:n_funds
ret_a_2y(t,i)=(prod(1+rets_funds(t*24-23:t*24,i)))-1;
    end
end;

%% graphs of the estimated alphas by means of the single index
model (figure 1), three-factor model (figure 2) and four-factor
model (figure 3)

figure(1)
title('Single index model alpha');
x=[1:1:45];
y=alphas;
y1=alphas2;
plot(x,y,'*');
xlabel('open-end equity mutual funds');
hold on
plot(x,y1,'*');
hold off
legend('Single index model alpha, MSCI Index','Single index
model alpha, FTSE MIB Index');
```

```
figure(2)
title('three-factor model alpha');
x=[1:1:45];
y=alphas3;
y1=alphas4;
plot(x,y,'*');
xlabel('open-end equity mutual funds');
hold on
plot(x,y1,'*');
hold off
legend('three-factor model alpha, MSCI Index','three-factor
model alpha, FTSE MIB Index');

figure(3)
title('four-factor model alpha');
x=[1:1:45];
y=alphas5;
y1=alphas6;
plot(x,y,'*');
xlabel('open-end equity mutual funds');
hold on
plot(x,y1,'*');
hold off
legend('four-factor model alpha alpha, MSCI Index','four-factor
model alpha alpha, FTSE MIB Index');
```

Bibliography

Statista Research Department. (2019, November 25). *Investment fund shares' value of Italian households from 2010 to 2018*. Retrieved June 5, 2020, from Statista: https://www.statista.com/statistics/1073585/households-investment-fund-shares-value-in-italy/

Banca d'Italia. Relazione Annuale, anno 2019. (2020, May 29). Retrieved June 3, 2020, from bancaditalia: https://www.bancaditalia.it/pubblicazioni/relazione-annuale/2019/rel_2019.pdf

Banegas, A., Gillen, B., Timmermann, A., & Wermers, R. (2013). The cross section of conditional mutual fund perfomance in European stock markets. *Journal of Financial Economics, 108*, 699-726.

Bauer, R., Koedijk, K., & Otten, R. (2005). International evidence on ethical mutual fund performance and investment style. *Journal of Banking & Finance, 29*, 1751–1767.

Berk, J. B., & Green, R. C. (2002). *Mutual Fund Flows and Performance in Rational Market.*

Best, M., & Grauer, R. (1990). The Efficient Set Mathematics when MeanVariance Problems are Subject to General Linear Constraints. *Journal of Economics and Business, 42*, 105-120.

Capon, N., Fitzsimons, G., & and Prince, R. (1996). An individual Level Analysis of the Mutual Fund Investment Decision. *Journal of Financial Services Research, 10*, 59-82.

Carhart, M. M. (1997, March). On Persistence in Mutual Fund Performance. *The Journal of Finance, LII*(1).

Choi, J. J., & Zhao, K. (2020, January 22). Carhart (1997) Mutual Fund Performance Persistence Disappears Out of Sample.

Distribution of domestic open-end investment funds on the Italian asset management market as of December 2017, by asset class . (2020, May 28). Retrieved June 5, 2020, from Statista: https://www.statista.com/statistics/796605/domestic-open-end-investment-funds-by-asset-class-the-italian-asset-management-market/

Euro short-term rate (€STR): il risk-free rate per l'area dell'euro. (n.d.). Retrieved 4 25, 2020, from Banca d'Italia: https://www.bancaditalia.it/compiti/sispaga-mercati/riforma-tassi-riferimento/estr/index.html

European Banking Federation - EURIBOR. (2013, March). *Eonia Code of Conduct.* Retrieved May 15, 2020, from European Money Market Institute: https://www.emmi-benchmarks.eu/assets/files/eonia_code_conduct.pdf

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics, 116*, 1-22.

Goetzmann, W. N., & Ibbotson, R. G. (1994). Do winners repeat? Patterns in Mutual Fund Return Behavior. *Journal of portfolio management, 20*(2), 9-17.

Green, R. (1986). Benchmark Portfolio Inefficiency and Deviations from the Security Market Line. *Journal of Finance*(41), 295-312 .

Investment Company Institute. (2019). *INVESTMENT COMPANY FACT BOOK, A Review of Trends and Activities in the Investment Company Industry 2019.* Retrieved March 18, 2020, from ICI: https://www.ici.org/pdf/2019_factbook.pdf

Jong, F. d. (2011). *Do Firm Characteristics Influence Mutual Fund Performance? An Empirical Study for European Mutual Funds.* Tilburg University, Department of Finance.

Lawrence, M. (1998). How Well Does Your Super Grow? *Business Review Weekly, June 15*.

Lee, S. L. (2003). *The Persistence of Real Estate Fund Performance.*

M., S. (2019, August 9). *Finance, Insurance & Real Estate;Banks & Financial Services*. Retrieved March 16, 2020, from Statista: https://www.statista.com/statistics/255590/number-of-mutual-fund-companies-in-the-united-states/

Mateus, I. B., Mateus, C., & Todorovicc, N. (2019). Review of new trends in the literature on factor models and mutual fund performance. *International Review of Financial Analysis, 63,* 344-354.

Morningstar Equity Style Box. (n.d.). Retrieved April 16, 2020, from Morningstar: https://www.morningstar.co.uk/uk/glossary/98212/morningstar-equity-style-box.aspx

Otten, R. (2002). A Comparison Between the European and the U.S. Mutual Fund Industry. *Managerial Finance, 28*(1), 29.

Otten, R., & Bams, D. (2002). European Mutual Fund Performance. *European Financial Management, 8*(1).

Pozen, R., & Hamacher, T. (2011). *The Fund Industry. How Your Money Is Managed* (third ed.). John Wiley & Sons, Inc., Hoboken, New Jersey.

PWC. (2017). *Asset & Wealth Management Revolution: Embracing Exponential Change' report.* Retrieved from https://www.pwc.com/gx/en/asset-management/asset-management-insights/assets/awm-revolution-full-report-final.pdf accessed 16 March 2020

REFINITIV LIPPER GLOBAL CLASSIFICATION, Category Definitions. (2019, February 15). Retrieved April 29, 2020, from REFINITIV: https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/lipper-global-fund-classification-methodology.pdf

Revol, T. (2015). Mutual Funds in Europe and in the United States. A Comparison Analysis of Performance. *IESEG School of Management, Department of Finance* . France.

Roll, R. (1978). Ambiguity when Performance is Measured by the Security market Line. *Journal of Finance, 33*, 1051-1069.

Sensoy, B. A. (2009). Performance evaluation and self-designated benchmark indexes in the mutual fund industry. *Journal of Financial Economics, 92*, 25-39.

Stambaugh, R. F., & Yuan, Y. (2017, April). Mispricing factors. *Review of Financial Studies, 30*, 1270-1315.

Thune, K. (2020, May 29). *What Is a Mutual Fund's Beta? Beta Definition: What You Should Know & How to Use it for Mutual Funds*. Retrieved April 15, 2020, from the balance: https://www.thebalance.com/what-is-a-mutual-fund-s-beta-2466643

Vidal-García, J. (2013). The persistence of European mutual fund performance. *Research in International Business and Finance*, *28*, 45-67.

West, S., & Leonard-Chambers, V. (2006). *Understanding Investor Preferences for Mutual Fund Information.* Investment Company Institute (ICI). Retrieved April 3, 2020, from Investment Company Institute (ICI): https://www.ici.org/pdf/rpt_06_inv_prefs_full.pdf

Summary

At the end of 2018, approximately 101.6 million of individuals in the United States invested a portion of their money through a fund. Particular attention goes to the term ‘through’ rather than ‘in’ a fund. This precise terminology is adopted because a mutual fund is not an investment itself but it is a financial intermediary. The word ‘mutual’ in front of ‘fund’ highlights its main characteristic that all expenses and all returns, for instance interests, dividends, and capital gains, are shared among the fund’s investors. Mutual funds are financial vehicles pulling investors’ capital to buy a diversified portfolio of financial instruments. These invest money in different asset classes, representing the kinds of securities they invest in, such as stocks, bonds or money market instruments, depending on its investment fund strategy and on the type of returns they seek. Although investing in mutual funds still presents a certain degree of risk, its practice is becoming more and more common around the world. Fund assets are managed by professionals, whose task is eliminating part of the risk involved in investments of individual stocks and bonds through the diversification of assets. These funds provide an easy, relatively safe investment option that presents modest returns, appealing especially to long-term investors, willing to grow their wealth and save for retirement. Purchasing a share, traders in the marketplace do not establish the fund’s share price, which is equal to the fund’s net asset value (NAV) and, if present, pay the sales load. When selling, they gain back the NAV, reduced by any redemption fees. By law, every day the New York Stock Exchange is open, a mutual fund must buy back, or redeem, its shares according to its investors’ willingness. An exception is made for money market funds, which are allowed to stop redemptions. The ability to sell almost instantaneously a mutual fund position is a major benefit for investors, but not for the fund itself. Daily redemptions imply that investment portfolios must be structured in a way that enables the funds to raise cash rapidly, in order to meet any level of withdrawal requests. In order to accomplish this, the Investment Company Act (1940) imposed rules regarding portfolio structure, limiting the portfolio holdings in two ways by shrinking borrowings and setting standards for diversification. In practice, the majority of diversified mutual funds hold more than 50 positions and rarely more than 10 percent of their assets are invested in any one issuer. Smaller positions are easier to sell than larger ones, so diversified funds are better positioned to accommodate redemption requests. Funds provide investors numerous advantages over buying and selling securities directly. First, investors have the possibility to own more securities than they would if they were acting just for themselves and to diversify even further by acquiring more than one fund. Investing in a fund assures the benefits of a high level expertise of a professional money manager to buy and sell securities on their behalf, as well as the oversighting of an independent board of directors.

Furthermore, it gives access to investment strategies that otherwise might not be accessible to smaller investors. Lastly, crucial for investors is also the ability to easily compare different funds, thanks to a regular full reporting of their holdings and investment strategy in a standardized format. However, all these benefits come at a cost for investors. Investors pay an annual fee, known as expense ratio, corresponding to a small percentage of the total value of the shares, typically ranging between 1% and 3%. These fees cover the costs of the ongoing expenses, such as management services, fund administration and operating costs. An ulterior disadvantage for the investor is that mutual funds do not allow to control the timing of capital gains. Mutual funds' managers decide when to sell the securities the fund holds and, that same year, taxes on the net capital gain are charged to investors. Due to the frequent buying and selling of bonds, mutual funds' income varies a lot more, depending on the specific combination of securities owned on any given date. Final drawback to mutual funds is that they do not allow for any customization. Every fund investor gets exactly the same deal.

There are three distinct types of funds, outlined in the Investment Company Act: open-end funds, closed-end funds and exchange-traded funds. These differ from each other in the way share sales and redemptions are handled. Open-end funds are the only ones that enable investors to redeem their shares every business day. All the buying and selling characteristics of funds illustrated so far are typical of these types of funds. Open-end funds do not present any limit to the number of investors or shares. Closed-end funds issue new shares only once, in the moment they collect money from investors at their creation. Distinguishable is their limited number of shares offered during an Initial Public Offering (IPO). These mutual investment instruments can be subscribed only in a certain lapse of time and the return of the capital can be requested only at the expiry date of the fund or after a certain number of years. Therefore, shareholders who desire to convert their investment into cash beyond the regulated time period must first find a buyer on the open market. The price earned from the share sale is determined by supply and demand, which often results to be lower than the NAV. At the outset of the industry, investment managers preferred closed-end funds; however, through the years their popularity declined sharply, due to the investor's preference for the open-end funds.

Successfully introduced in the United States only in 1992, the exchange-traded funds (ETF) combine features of both open-end and closed-end funds. ETF shares are traded on a stock exchange, so investors purchase and sell throughout the day on the open market, as it is for the closed-end funds. ETFs resemble also the open-end funds for their ability to adjust the number of shares outstanding and for the tax regime applied. These funds often adopt a passive investment management approach, generating in this way little capital gains then reflected in low tax bills; they are well known for being very tax-efficient. A further categorization of mutual funds is based on the nature of their principal investments: stock or equity, bond or fixed income funds, hybrid or balanced funds and money market funds. These correspond to different investors' return expectations and levels of risk. Equity funds are one of the most aggressive forms of investment funds, they carry the greatest risk along with the greatest potential returns. By the fourth quarter of 2019, 45% of worldwide regulated open-end fund assets were held in equity funds. Bond funds provide a safer choice to investors. The resources are invested in fixed income securities of maturity over one year, like treasury bills, municipal bonds or corporate bonds. The asset share of bond funds accounted for 21% at the end of 2019. Hybrid or mixed funds invest part of a fund portfolio in equities and part in debt instruments, therefore they are also called asset allocation funds. Balanced funds are often a "fund of funds" since they invest in a group of other mutual funds. The asset share of balanced funds amounted to 12% in the fourth quarter of 2019. Money market funds offer the lowest returns. As an offset, they carry the lowest risk, affording a high degree of safety. Money market fund assets constitute 13% of the worldwide total open-end fund assets.

The six main European mutual fund markets, based on total assets, are France, Italy, United Kingdom, Spain, Germany and the Netherlands, which together account for almost 90% of total mutual fund assets in Europe. While their total assets account for less than half of the US one, the total number of European funds exceeds the US ones. The number of mutual funds in the US increased considerably, from 6,778 in 1997 to 9,599 in 2018. Accordingly, the total net assets of US mutual funds throughout the same period, 1998-2018, faced a remarkable increment. A noteworthy difference consists in the prevalence of equity-oriented funds in the United States, while investors in Europe put money consistently into bond funds, revealing their preference for fixed income mutual funds. By examining the lapse of time from 1990 till 1998, it emerges that the asset allocation of European mutual funds dealt with a transition caused by the dramatic rise in the percentage of assets invested in equity mutual funds, mainly at the expense of money market funds.

Studies focused on the US market since long-term data is available. Most academic studies reach the conclusion that mutual funds' net performance, after expenses, is significantly inferior to that of a comparable passive market proxy. Thus, investing in a low cost index fund is preferred to choosing an actively managed fund. In the late 1980s and early 1990s this thesis was undermined by some studies.

Grinblatt and Titman (1992)[94] and Ippolito (1989)[95] sustain that mutual funds possessed enough private information to offset the expenses. Whereas Carhart (1997)[96] states that persistence in mutual fund performance over short-term horizons is mainly explained by simple momentum strategies and not by superior fund management. Few studies examined the performance of equity funds investing in the main European financial markets, this may be due to the fact that it lags the US market for both size and market importance. Nonetheless, during the last 20 years the European mutual funds experienced large inflows, encouraging studies on the evaluation of performance for such funds. Otten and Bams (2002)[97] carry out a study on the performance of five European countries' funds, including both dead and surviving ones, investing only in the domestic market, for the period 1991 to 1998. Considering before-cost alpha, most European countries exhibit significant out-performance at an aggregate level. The risk-adjusted performance of a fund is influenced by its characteristics, negatively related to the expense ratio and age and positively related to the fund assets.

The CAPM, Fama-French and Carhart models have become widely accepted in the academic field for evaluating mutual fund performance and persistence in performance. When anomalies in asset pricing occur, a notable branch of literature seeks to add "missing" factors to the standard models, thus beyond size, value and momentum, in order to explain such anomalies. A wide range of potential factors were identified, however none of them is fully successful to explain all anomalies or constitute the best fit for all stocks. In their studies, based on US and UK evidence, I. B. Mateus, C. Mateus and Todorovic (2018)[98] publish modifications of the standard factor models aiming to a less biased mutual fund performance evaluation. A bias in the construction of Fama-French risk factors occurs since standard models provide alphas that do not account for the ones embedded in the passive indices assumed as benchmarks. In fact, there will be skills conferred to a manager if he merely replicates the benchmark, making no active bets on it. The authors concentrate on models that account for non-zero benchmark alphas. Fama and French (2015)[99] leave their mark in the asset pricing literature presenting the five-factor model, which includes investment and profitability factors besides the standard three-factor model. Juxtaposing the three-factor

[94] Grinblatt, M. & Titman, S., (1992). The persistence of mutual fund performance, Journal of Finance, 47, 1997-1984

[95] Ippolito, R., (1989). Efficiency with costly information: a study of mutual fund performance, Quarterly Journal of Economics, 104, 1-23

[96] Carhart, M., (1997). On persistence in mutual fund performance. Journal of Finance 52, 57–82

[97] *Otten, R. & Bams, D., (2002). European mutual fund performance.* European Financial Management 8*, 75–101*

[98] Mateus, I. B., Mateus, C., & Todorovicc, N. (2019). Review of new trends in the literature on factor models and mutual fund performance. International Review of Financial Analysis, 63, 344-354

[99] Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics, 116*, 1-22.

and five-factor model regressions highlights that alphas for small-growth portfolios remain significantly negative while significantly positive for small-value portfolios and large-growth portfolios. However, this model presents some limitations when it comes to anomalies that remain unexplained, like net share issues and volatility anomalies. Stambaugh and Yuan (2017)[100] introduce two 'mispricing' factors, by averaging anomaly rankings within the set of 11 anomalies, with the aim to address the 'no model fits all', arguing that anomalies reflect general mispricing with common components across stocks. A more recent study of Hou et al. (2017)[101] evinces that the q-factor model encompassing the market, size, investment-to-assets, and profitability (i.e. return on equity) factors outperforms the multiple standard models, pricing a higher number of anomalies. Evidence with the application of new models still points towards mutual fund underperformance, as earlier documented by the standard three- and four-factor models.

In the past literature, there has been a wide discussion on the topic of performance persistence. Its economic importance for investment management is fundamental, since if previous return performance could be used to forecast future returns, then market efficiency would face an important challenge, along with the value-increasing opportunities that will be created for investors. There is high disagreement on whether and to what degree persistence is present. Various authors sustain the hypothesis of predictability in fund performance even after accounting for momentum. In contrast, Carhart (1997)[102], based on a sample of survivorship-free US equity funds, supports that persistence shrinks after accounting for momentum in stock returns. Vidal-García (2012)[103] considers European mutual funds from 1988 to 2010. His goal is to determine whether an investor can follow a determined successful investment strategy by actively selecting European mutual funds with a persistent performance objective, accounting for European risk factors. The analyses of fund performance persistence report different results depending on the type of returns employed. The use of raw returns often reveals performance reversals, while risk-adjusted returns indicates the existence of performance persistence. In order to account for consistency due to management skills, the author considers the benchmark-adjusted alphas: the one year horizon shows resilient aggregate persistence in overall performance. The author rejects, at 5% level, the hypothesis of

[100] Stambaugh, R. F., & Yuan, Y. (2017, April). Mispricing factors. *Review of Financial Studies, 30*, 1270-1315
[101] Hou, K., Xue, C., & Zhang, L. (2017). Replicating anomalies (no.w23394). Working paper. National Bureau of Economic Research, https://www.nber.org/papers/ w23394
[102] Carhart, M. M. (1997, March). On Persistence in Mutual Fund Performance. *The Journal of Finance, LII*(1)
[103] Vidal-García, J. (2013). The persistence of European mutual fund performance. *Research in International Business and Finance, 28*, 45-67

no persistence for all fund portfolios in each European country, unveiling the usefulness of previous fund performance information for potential investment strategies to achieve higher returns.

Performance evaluation is carried out by less sophisticated principals, not fully able to distinguish which are the useful benchmarks. Agents are sequentially incentivized to figure out a way to strategically influence the benchmark used. The most accurate performance can be predicted when the chosen reference benchmark is based on the fund's holdings and objectives. In practice it is not uncommon that mutual funds in the same peer-group, expound a number of different passive indices. Funds do not deviate all into higher risk objectives. This tendency cannot be explained by gaming behavior. Though, the results do not permit to merely conclude that some funds have suboptimal benchmarks, for instance despite significant typical differences, it may still be the closest match possible and it may be able to capture the fund’s exposure to common factors in returns. The benchmark whose style matches the fund’s Morningstar style is defined as the fund’s candidate corrected benchmark. Performance relative to a mismatched self-designated benchmark has determinant explanatory power for fund flows and overcoming the benchmark is associated with higher flows. Fund investors have a high influence on the fund agents’ compensation through cash inflows and outflows, since fees are usually a fixed percentage of assets under management. The fund companies’ aspiration for higher compensation is a great incentive for them to increase flows by maximizing risk-adjusted returns. It can be concluded that the incremental responses of flows to performance relative to mismatched self-designated benchmarks are probably not rational responses to abnormal returns, but they are actually a reflection of a behavioral element to the composition of mutual fund flows. As for self-designated benchmark-adjusted return, the coefficients in the regressions imply that funds are rewarded for overcoming a mismatched benchmark, but are barely penalized for trailing it. From a fund investor’s viewpoint, purchasing a fund with a mismatched self-designated benchmark offers on average a worse risk-return trade-off than a fund whose benchmark is corrected. Sensoy (2009)[104] sustains that, if the benchmark of a fund drifted away through time from being suitable to mismatched, due to a changing of fund styles, then not necessarily this behavior can be identified as strategic. On the contrary, if from the beginning a fund’s benchmark was recognized to be mismatched, then this might indicate that it has been strategically chosen. Since flows improve fund profits through fees and a change in flows as a percentage of assets is a bigger capital for funds with more assets under management, funds with these characteristics have a higher probability to have mismatched benchmarks. Numerous studies

[104] Sensoy, B. A. (2009). Performance evaluation and self-designated benchmark indexes in the mutual fund industry. *Journal of Financial Economics, 92,* 25-39

advance solutions to the problem of mismatched benchmarks. Chan et al. (2009)[105] debate that, instead of augmenting the standard models with a number of factors, there should be only one factor added to the Carhart model, the Active Peer Benchmark (APB). The purpose of the inclusion of the APB is to facilitate and improve the choice of performing funds for the investor within a comparable peer group of funds and to identify managerial skills that outperform the average group's skill. For relative performance evaluation of funds, investors have to assess it compared to the peer group, as a fund may report a positive Carhart alpha but actually perform worse than the average in its same group. Hence, it is highly relevant the selection of the comparable peer group, which should be based on broadly accepted standards.

Ethical investing is deeply rooted more than a century ago, but the modern concepts date back to the 1960s, characterized by a political climate that increased social awareness on specific issues such as environment, civil rights and nuclear energy. During the last 30 years, the ethical mutual fund market witnessed an unprecedented growth in assets, although still representing a small fraction of the entire retail market. The US industry rose from US$ 12 billion in 1995 to US$ 153 billion at the end of 2000. Whereas, the European market is still in an early stage of development, ethical funds in most countries do not even account for 1% of the total domestic market of mutual funds. Among European countries, the United Kingdom and Sweden are characterized by the highest number of ethical mutual funds, each corresponding to 1.35% and 1.46% of total assets at the end of 2000, which relevance however corresponds to only half of the one in the USA. These values are evidence of the fact that the ethical mutual fund industry plays a marginal role with respect to the conventional market. Due to the increasing spread of this movement, the financial consequences in investing in ethical funds became of great relevance and object of studies. Socially responsible mutual funds draw attention to investing in companies that apply predetermined ethical standards in the running of their business or on the final product. What can be defined as ethical varies widely across fields as environmental, social, moral and religious. When determining the stocks to include in the ethical funds, managers have to undergo a detailed screening process to decide which values to assume in order to attract the largest possible number of investors. Managers' additional ethical research is compensated by the attribution of higher fees with respect to the ones imposed to regular funds. The literature on mutual funds is mainly focused on US and British retail markets. After controlling for investment style, the results suggest there are no significant differences in risk-adjusted returns between ethical and conventional funds for the decade 1990-2001. It

---

[105] Chan, L. K. C., Dimmock, S. G., & Lakonishok, J. (2009). Benchmarking money manager performance: Issues and evidence. The Review of Financial Studies, 22(11), 4553–4599

has been registered a relative development of increasing performance through time as a consequence of the undergoing changes of the ethical fund sector. However, ethical mutual funds went through a catching-up phase before actually reaching similar financial returns to that of conventional mutual funds.

In this dissertation, it is analyzed a dataset constituted by 45 open-end equity mutual funds. The funds are all actively managed and only the primary class is included. The funds are registered to sell in Italy, even though a part of those not exclusively there, and are domiciled mainly in Italy and in Luxembourg. The sample is survivorship-bias free, since no fund has ceased to exist during this sample period. The reference period of the data goes from January 2009 to December 2019. According to the Lipper Global Classification (LGC), the funds encompassed in the sample are classified for the majority as Equity Italy and four as Equity Italy Sm&Mid Cap. The risk free rate adopted in the analysis is the Euro OverNight Index Average (EONIA). The Eonia rate denotes the 1-day interbank interest rate undertaken by the Panel Banks for the whole Euro zone. As for the benchmarks, my study considers two distinct ones: MSCI Italy Index and FTSE MIB Index. All the data are collected from Thomson Reuters Datastream.

Attention is devoted to the Sharpe ratio, an important financial tool for investors since it permits to compare the return of an investment relative to its risk. The ratio is the average return of a security or a fund earned in excess of the risk-free rate per unit of total risk or volatility. It is not significant in short periods. In order to be analyzed it must be calculated over a medium or long period of time, to integrate multiple aspects of the strategy to a higher confidence interval. It can be noticed that the Sharpe ratio of FTSE MIB Index is higher than the MSCI Italy index. All Sharpe ratios are positive, with the exception of one, which exhibits general low or negative values for the excess returns and the highest standard deviation of the whole sample. The positive array varies widely from 0.37% to 16.71%. With respect to both market indices, nearly 78% of funds present a better risk-adjusted performance. Analogous conclusion can be evinced also by examining the mean of the funds' Sharpe ratio, equaling 10.08%, which is higher than the values of both benchmarks. On average Italian open-end equity mutual funds offer a better risk-adjusted performance than the MSCI Italy index by 2.41% and the FTSE MIB index by 1.86%.

In my study, I carried out multiple analyses, by regressing the funds' excess returns with respect to two different benchmark indexes. The mutual fund investment vehicle generates returns by two means: capital appreciation and dividend payouts. The first refers to the increase or decrease in the market price, corresponding to the NAV, of the security. With the purpose of studying the performance of Italian funds, I adopted three distinct models: the single factor Capital Asset Pricing Model, the Fama-French three-factor model and the Carhart four-factor model.

The Capital Asset Pricing Model (CAPM) is the most common model used to determine the rate of return of an asset or a fund. This risk-adjusted performance measure was introduced to examine the stock picking ability of a fund manager. It takes into account the asset's sensitivity to market risk or systematic risk, indicated by the quantity beta (β), which represents a non-diversifiable type of risk. It is the only risk rewarded, since non-systematic risk can be eliminated through diversification. In fact, mutual funds should bear systematic risk only since one of the main characteristics of this type of instrument is that it is diversified. Beta measures how much the securities' values move in synchrony with the market. The single index model uses realized returns and a market index as benchmark, and not the market portfolio as in the CAPM. In the first analysis, I regress the fund excess returns against the market MSCI Italy index excess returns. From the results, it can be evinced that 13 funds out of 45 have a significantly positive alpha coefficient, at the 10% level. Whereas at the 5% significance level, 8 funds out of 45 have alphas that are significantly different from zero, all of which are positive. All the individual fund market beta estimates are significant at the 1% significance level and are less than one, indicating that all funds are less volatile than the market MSCI Italy index benchmark. By examining the average adjusted R^2, the MSCI Italy index is able to explain on average 85.94% of the total variation of mutual fund returns. In the second analysis, I apply the CAPM to the same sample, but using the FTSE MIB Index as benchmark. Analyzing the results, 10 of 45 funds have alphas whose values are significantly positive at 10% significance level; reducing the significance level to 5%, the number of funds diminishes to 6. In this case, the number of funds that are significant both at the 10% and 5% significance level decreased compared to the regression examined in the previous case, accounting that the same sample and period are considered. The funds' alpha mean is 0.1135%. This value is slightly smaller than the one in the previous case by approximately 0.03%. The funds' betas are all less volatile than the market FTSE MIB Index, being every coefficient inferior to 1, with a 1% significance level. The result that both the intercept alpha and the coefficient beta in this second case, regressing the funds' excess return to the FTSE MIB Index, are lower than in the previous one, regressing the funds' excess return to the MSCI Italy index, is in line with the fact that the FTSE MIB Index present a higher Sharpe ratio. The average adjusted R^2 value corresponds to 86.52%. This average is higher than the one calculated in the previous model, indicating that the FTSE MIB Index can explain better the total variation of mutual fund returns.

Numerous empirical studies suggest that multiple variables are needed in order to explain securities' expected returns. A general theory of asset pricing is the Arbitrage Pricing Theory (APT), where the several risk factors are not explicitly outlined, assigning however a key role to variables as GDP, unemployment and inflation. Differently, models like Fama-French or Carhart specify such fundamental factors, as market capitalization, book value and momentum. The theory evolved with the observation that small cap stocks and high book-to-market ratio stocks (value stocks) tended to outperform the market as a whole. The following analysis applies the Fama-French model to the sample, regressing the 45 funds' excess returns on three factors: market MSCI Italy index factor, size factor (SMB) and value factor (HML). 33 funds' alphas out of 45 are positive, 10 significant at 10% level and 7 at the 5% significance level. The alphas' mean equals 0.000997, meaning that the average investment's return of a fund was nearly 0.10% better than the market during that same sample period. Similarly to the regressions obtained applying the CAPM, also in this case all the beta coefficients relative to the market MSCI Italy and, as for the next analysis, to the market FTSE MIB index are significant at the 1% significance level. Highlighting that all the funds in the sample undergo a lower risk compared to the market, considering either MSCI Italy or FTSE MIB index as benchmark. Regarding the SMB beta coefficient the number of funds whose values are significant is high. In particular, the funds significant at 10% level are 38 out of 45; the number does not reduce much when lowering the significance level, at 5% level there are 32 funds. All the positive coefficients' values signal that the funds are weighted toward owning small-cap stocks, known for granting higher returns. 27 out of 45 funds' HML betas are negative, of these 5 are significant at 10% level, and the remaining 18 are positive, although of these only 1 is significant at 10% level. The HML beta average and median are both negative, indicating more sensitivity to low book-to-market stocks, implying positive weights on growth stocks. The mean of the adjusted R^2 equals 0.866355, implying that the model accounts for 86.64% of the variability of the dependent variable, the funds' excess returns. The successive analysis regresses the funds' excess returns by means of the three-factor model, using the FTSE MIB Index as market benchmark. Considering all 45 funds, 9 have a positive alpha significant at 10% level and 5 significant at 5% level. Important to underline that the mean value of alpha resultant from the regression using FTSE MIB index as benchmark is lower than the one obtained from using the MSCI Italy index as benchmark. The conclusion drawn by the comparison between the average alphas determined using the two different benchmark indexes but the same model, is the same as the one drawn for the CAPM model. The coefficients relative to the SMB factor are all positive, of these 32 out of 45 funds are significant at 10% level, 28 at 5% level. The HML beta coefficients are for the majority negative, in particular 37 funds out of 45, of which 13 significant at 10% level, 8 significant at 5% level. In this analysis, there is an even higher number of funds that are characterized by a negative HML beta with respect to the previous analysis, suggesting once more the tendency to own growth stocks. Regarding the coefficient of determination, the resulting values are not particularly dissimilar respect to the previous case. The average explanatory power of the regression accounts for 87.17%. Comparing the last two analyses based on the same reference period and sample of funds applying the Fama-French model, being the choice of the market benchmark the only difference, it emerges that the average values of the intercepts alpha and of all the three beta coefficients are higher when adopting the MSCI Italy index than the FTSE MIB Index. Whereas, the goodness-of-fit for the two regression models is relatively similar; in particular, the mean adjusted R^2 is slightly higher for the regressions based on the FTSE MIB Index relative to the MSCI Italy index by 0.53%.

By applying the four-factor model with MSCI Italy as benchmark for the market factor, it results that 33 funds out of 45 have positive alphas, although only 8 with 10% significance level and 6 with 5% significance level. All the funds' market beta are positively significant at 1% level. The SMB beta coefficients are all relatively small positive numbers, of these 34 at 5% level and broadening the significance level at 10% adds 4 more funds. By analyzing the values of the HML beta coefficient, it appears that 25 funds out of 45 have positive values, however only one of these is significant at the 5% level. In this case, since only one value is significant, due to its p-value inferior to 1%, it can be stated that the empirical evidence is not sufficiently adverse to the null hypothesis that HML beta equals 0, and therefore it cannot be rejected. The values the WML beta coefficients undertake are positive for 41 funds out of 45, of these 11 are significant at 10% level and when narrowing the significance level to 5% the number of funds reduces to 4. Of the other 4 funds that present a negative coefficient, only one is significant at 5%. The average adjusted R^2 is 86.78%. In particular, only two funds of the sample have adjusted R^2 values inferior to 50%, more than 82% of funds have values superior to 80%. The last analysis examines the regressions run applying the four-factor model and adopting the FTSE MIB Index as market benchmark. It can be observed that 28 funds out of 45 have positive alphas, of these 6 significant at 10% level and 4 significant at 5% level. Once more, the funds' market betas are all positively significant at 1% level. The SMB beta coefficients of the funds are also in this case characterized by the positivity of the values. 32 SMB beta values out of 45 present a significance level of 10%. This is a relatively high percentage of funds, 71.11%, indicating that the values are for the majority relatively small but significantly different from zero. Lowering the significance levels to 5% still includes a high number of funds, i.e. 28. Regarding the HML beta coefficients, 25 values out of 45 are negative and 20 are positive. However, with the exception of one positive value significant at 5% level, no one else is significant. In this case, since only one coefficient has a significant value, it is hard to draw any conclusion concerning the influence of the HML factor. The WML beta coefficients are all positive except for one, significant at 10% level. The total number of funds whose coefficient is significant at 10% level is 18 and 14 at 5% level. Concerning the adjusted coefficient of determination, the average value corresponds to 87.37%. To be noted that, as it was verified applying the previous two models, also in these last two analyses the mean value of the intercept alpha in the first case, adopting MSCI Italy index, is higher than in the second case, where FTSE MIB Index is used as market benchmark. Furthermore, the mean values for market beta, SMB beta and the HML beta are lower for the second analysis.

A common test for performance persistence is the non-parametric test, which makes use of the two-way contingency tables to examine the frequency with which funds are identified as winners and losers over successive time periods. Performance persistence is calculated in 1-year interval, short-term persistence, and 2-year interval, long-term performance persistence. Funds are classified according to either raw returns or risk-adjusted returns, Jensen's alpha. In particular, in the first case, annual cumulative returns have to be calculated by compounding mutual funds' monthly returns. There is an intense debate on whether raw returns are more appropriate when adjusted for risk and in what form the potential risk-adjustment should be made. In my analysis, I considered raw returns in classifying mutual funds' performance. The funds examined in the sample belong all to the same category, open-end equity mutual funds, and have similar organizational structure, thus they can be considered to have all the same level of risk. Furthermore, investors refer mostly to performance rankings which are based on raw returns, reported by consultants and in periodicals. Hence, for investors the consistency of raw returns is the most important criteria for testing persistence, since their decisions are based on this measure rather than on risk-adjusted returns. Therefore, mutual funds are ranked every year or every couple of years relative to their compound raw returns and the median is computed. The mutual funds that manifest a performance equal to or higher than the median are classified as winners (W), while the ones below the median as losers (L). The performance of mutual funds is defined to be persistent if these are either winners (WW) or losers (LL) in two consecutive periods. The null hypothesis sustains the existence of performance persistence if there is evidence of a significantly larger number of observations in the WW or LL categories than in the other two. The alternative hypothesis states that performance persistence does not exist. The test statistic adopted is the cross product ratio (CPR), the ratio of all funds which present performance persistence over the ones that do not. The Z-statistic is used for verifying the statistical significance of the CPR test. The Z-statistic is normally distributed and it is evaluated by dividing the natural logarithm of the CPR by its standard error. The non-parametric test on performance persistence is executed at the 5% significance level. The test for the short-term persistence is carried out in 9 different sub-periods, from 2009-2010 to 2017-2018. By analyzing the results, it emerges that in three lapses of times out of nine the estimated CPR is greater than 1 and in two cases the values are significant at 5% level, since the Z-statistic critical values are above 1.645. The overall CPR, accounting for the total of the repeat and non-repeat performers of all the period considered, is close to but does not reach 1, i.e. 0.9878 and its Z-statistic is -0.0613. Thus, in only a third of the periods considered, all of which before 2013, the number of repeat performers is higher than the number of reversal performers. Therefore, the null hypothesis sustaining the existence of general performance persistence is rejected. The fact that the results from the 1-year interval based on raw return are not statistically significant, with the exception of two periods, may be due to the small sample size. Furthermore, non-persistence of mutual funds' performance can also be a consequence of the generally unstable Italian stock market from 2009 to 2018. Successively, in order to evaluate the equity mutual fund's performance in the long term, monthly raw returns are compounded to generate 2-year raw returns for the period 2009-2018, resulting in five sub-periods. In this second analysis, the CPR values are greater than 1 for all the years. In two cases out of four they are statistically significant at 5% level. The overall result, obtained by combining all the values in the whole sample period considered, highlights that the number of repeat performers is considerably higher than the number of non-repeat performers. Moreover, evidence reveals that persistence is slightly more pronounced for the top performers than the bottom ones. It can be concluded that the long-term performance persistence based on raw returns exists and is statistically significant at 5% significance level. The results show that equity open-end mutual funds in Italy can present persistence in their performance in the long-term, maintaining their ranking positions through the years.

In conclusion, three distinct models are used in order to identify the exposure to traditional factors, the funds portfolio's "style". The analyses of multiple models are crucial to understand how the interpretation of regression loadings might be affected by the inclusion of different mimicking portfolios. On average, by applying the single index model, a quarter of the funds present a positive alpha significant at the 10% level over an 11-year time period. When considering the three-factor and four-factor regression models, the number of funds that have positive alpha, significant at the 10% level, reduce at a slightly higher than a quintile in the first case and at approximately 15% in the second case. An average positive alpha, observable in all models, is a measure of performance indicating that the portfolio and the strategy undertaken have been well managed to beat the market return over the sample period. Thus, for these funds that present a significant positive alpha it can be evinced that there is a general good performance of the fund manager and part of the returns, not explained from the traditional factors, can be attributed to the manager's skill. In the Italian equity mutual fund market, the augmented value by active management is able to cover the fees incurred. The market beta is a relative risk measurement and it helps investors to recognize whether the mutual fund is appropriate for their risk tolerance. The values obtained in all regression models are all significant at 1% level, on average the beta are less than one, suggesting that the funds are less volatile than both indexes. Along with this, the corresponding adjusted R^2 is relatively high, indicating reliable and meaningful beta. The factor loadings reveal significant positive SMB coefficients for the majority of mutual funds, implying that the returns are being driven relatively more by smaller stocks. The HML coefficients, resulting from the two distinct three-factor model regression analyses, are significant at 5% and 10% level only in a small part, and these are characterized by a negative sign. This can be interpreted as evidence of exposure to growth companies. As for the momentum factor, the coefficients' values result positive and significant at 10% level for nearly a quarter of sample's funds in the regression model carried out using the MSCI Italy index as market benchmark and for 40% of funds using the FTSE MIB index. The positive sign of the momentum beta highlights that the funds are at large more sensitive to 'winners' mutual funds than 'losers'. In general, the fitting of the various regressions result to be high, due to the elevated values of the index adjusted R^2. Similarly for both benchmarks, the average adjusted coefficient of determination does not vary substantially when shifting from the single index model to the three-factor model, and even less extensively when switching from the three-factor to the four factor model. This suggests that the SMB and HML factors improve only in small part the fitting of the multiple regression equations for the mutual funds' sample data and analogously, the momentum factor explains a particularly small proportion of the variability of the excess returns on equity mutual funds. Furthermore, in all three regression models, the average adjusted R^2 is higher when FTSE MIB index is adopted as market benchmark, indicating that it is able to better explain the equity mutual fund performance. From the results obtained in this dissertation, it can be stated that performance persistence exists when increasing the period of historical data, from one to two years. There is strong evidence of significant long-term performance persistence for our equity mutual funds. These results highlight that past performance can pave the way for predicting future returns, and they may represent a reliable benchmark to future performance. Past fund performance information may be a tactical and pivotal tool for potential investment strategies for the achievement of higher returns. This is consistent with the study of Carhart (1997), arguing that assuming the existence of managerial skill, a 1-year return is probably a highly noisy measure. Thus, for reducing the noise in past-performance rankings, it is necessary to consider portfolios of mutual funds whose returns are lagged at least two years. The knowledge of long-term persistence represents a great deal of value for investors.

Besides the advantages of vast diversification and low transaction costs of mutual funds, the results suggest that open-end equity mutual funds in the Italian market deliver positive risk-adjusted performance, adding value for their investors. Contrary to US evidence, a relevant portion of Italian funds seems to be able to take advantage of their vast money capitals available, through which they are able to exploit specific investment strategies, and the high level of their managers' expertise to offset their expenses.