LUISS Guido Carli
LIBERA UNIVERSITÀ INTERNAZIONALE DEGLI STUDI SOCIALI

Department of Economics and Finance

Chair of Financial Markets and Institutions

Performance Comparison of Actively-Managed Equity Funds and Index Funds: Evidence from the US Financial Market

Supervisor
Chiar.mo Prof. Gianni Nicolini

Student
Simone M. Manzocchi
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Introduction

At the end of 2016, U.S. actively-managed equity mutual funds accounted for a total asset value of $6.36 trillion[1], more than one-third of the entire United States GDP. This figure offers a clear perception of the enormous relevance that this class of investment company has in the asset management industry and the whole financial system. Although a noticeable shift of assets from active to passive investment vehicles has occurred in the last decades, allocating capital into equity mutual funds with an active asset allocation approach, remains the preferred option for the majority of American households. The purpose of this thesis is to understand if the ambition of numerous investors to obtain returns higher than the market is justified by performances of actively-managed equity mutual funds in the long term. It is crucial, given the extent of assets under management of these funds, to verify the consistency of their performance for 15 years (2002-2016) and to implement the empirical assessment in a risk-adjusted framework. Several studies on the issue have been realized since the 1960s: this one attempts to provide the reader with a contemporary overview of the functioning, characteristics and performance results of actively-managed equity mutual funds along with index funds and exchange-traded funds, focusing on the largest market in the world, the U.S..

In order to accomplish its aim, the research is divided into three main parts. The first chapter begins with a theoretical introduction to the concept of investing in contraposition with the one of speculation. Then, it provides an analysis of long-term returns and volatility of different financial asset classes in the U.S. financial markets. The chapter follows with a presentation of investment companies, highlighting their objective and their functioning, and it focuses on the two typologies considered in this thesis: equity mutual funds and ETFs. In evaluating the performance of an investment, risk must be taken into account: therefore, paragraph 1.5 presents the main risk-adjusted measures of performance that are subsequently used in the implementation of the

[1] Investment Company Institute (2017), Fact Book

empirical analysis. The chapter ends specifying the relevance of funds' style and fees and describing how they affect returns.

In the second chapter, an analysis of the asset management industry, in the period studied in the thesis, is carried out. The chapter is divided into two main parts: the first describes movements of the stock market from 2002 to 2016, explaining the causes of bear and bull markets and their effects on the financial system, and it serves as preamble for the second part, which outlines the essential trends in mutual fund industry between 2002 and 2016, accounting for flows of capital, liquidated and merged funds, evolution of fees, and implications of managers' incentive structure.

The final chapter is devoted to the empirical analysis of the performance of actively-managed equity mutual funds, index funds, and ETFs in the U.S. during the 15 years considered. The analysis starts from an examination of funds' performance under the essential conventional measures, and it follows describing results from two statistical tests. Two regressions are built in order to evaluate the statistical significance of additional return from fund managers' security selection and market-timing abilities. Finally, the chapter studies the relation between performance and measures of replication of the benchmark index.

Chapter 1 - Investment Companies and Performance Evaluation

The purpose of this chapter is to serve as guidance for the thesis. Throughout the paragraphs, the reader encounters preliminary definitions and explanations of the most relevant concepts for the purpose of this research. The chapter begins with the definition of the investment process, in opposition to the act of speculation. Subsequently, it presents long-term trends in the financial markets in order to provide the reader with an analysis of the returns and risks of different investment vehicles. Formerly, it defines different typologies of investment companies along with standard measures of portfolio performance evaluation. Finally, it outlines the most common forms of mutual fund's fees.

1.1 Investment and Speculation

"*Investing is an act of faith, a willingness to postpone present consumption and save for the future*"[2]. Benjamin Graham defines speculation as an act not meeting the fundamental principles of investing: to guarantee the safety of the principal and to generate a satisfactory return in the long-run. "*The most realistic distinction between the investor and the speculator is found in their attitude towards stock market movements. The speculator's primary interest lies in anticipating and profiting from market fluctuations. The investor's primary interest lies in acquiring and holding suitable securities at suitable prices.*" (Graham B. et al. (1973). *The Intelligent Investor*). Speculators, therefore, aim to predict the fluctuations in the market and exploit them in their favor. The final objective of this strategy is to obtain abnormal returns in the shortest possible time frame: anticipating the minimum of a bear market – the moment in which equity securities reach their lowest periodical price – and predicting the peak of a bull market – when stocks are priced at their maximum periodical level. The equivalent but opposed reasoning is done in fixed income

[2] Bogle, J. and Swensen, D. (2010). *Common Sense on Mutual Funds*.

valuation: interest rates on bonds, generally, have an antithetical path to one of stocks.

Speculative behaviors, however, are signaled by repetitive actions that comprise the following: unjustified emphasis on quarterly results, purchase of securities without a previous meticulous analysis, emotional involvement in market fluctuations and consequent distortion of the market timing approach.[3] Investing, on the other end, has a fundamental characteristic: time. Only throughout long-time spans, investors can observe the appreciation of their capital, benefit from the effect of compound interest, and obtain the highest possible real returns – not due to pure chance.

These concepts have been handed down throughout the last century by distinguished economists the likes of John M. Keynes, Benjamin Graham, John C. Bogle, and Warren E. Buffett.

1.2 Long Term Returns

Various asset classes can serve as a mean of investment. The first main distinction can be made between real assets and financial assets. Investments in the latter will be the object of this thesis.

Jeremy J. Siegel, professor of Finance at Wharton School of the University of Pennsylvania, has examined the long-term inflation-adjusted returns for distinct financial assets in the U.S. for the period 1802-1997.[4] The vast period of time he considered comprises three sub-periods: in the first one, from 1802 to 1871, the U.S. economy experienced a significant shift from agrarian to industrialized; in the second, from 1872 to 1925, the U.S. became the foremost political and economic power in the world; in the last sub-period, 1926-1997, the U.S. went through the stock market crash of 1929 and the subsequent Great Depression, and through the WWII followed by the postwar expansion. Figure 1.1 illustrates the total real returns[5] during this heterogeneous time span: it is

[3] Graham, B., and Zweig J. (1973). *The Intelligent Investor*.

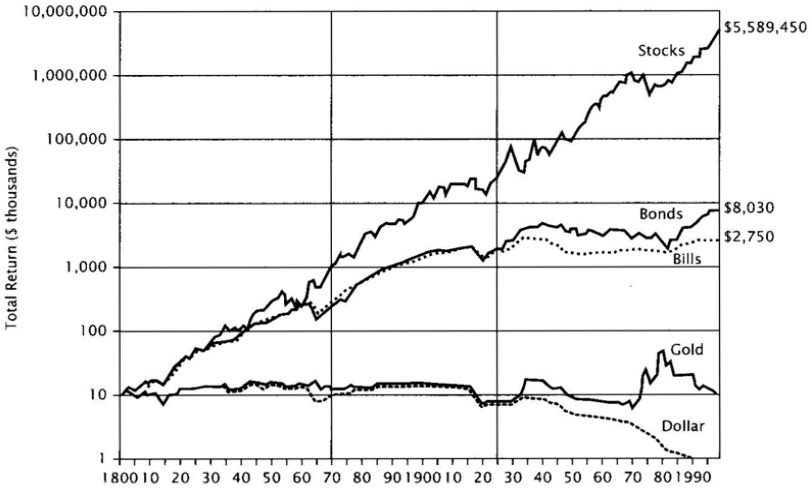
[4] Siegel, J., (1994). *Stocks for the Long Run*

[5] In the calculation of total returns, all returns – i.e., dividends, interests, and capital gains – are reinvested in the asset.

clear that stocks have outperformed all other asset classes, averaging a yield between 6.6 and 7.2 percent per year after inflation in the three sub-periods.

When looking at stock returns in this long-term perspective, market fluctuations become less significant; on the other hand, the primary consideration should be given to the long-term stability of the returns. This remarkable feature gains further importance if one considers the radical transformations of U.S. society during these two centuries. The economy changed from agricultural to industrialized in the 19th century and to post-industrial, service-oriented economy in the 20th century; the monetary system has undergone the transition from gold-based standard to paper-based standard; finally, technology has revolutionized the world and the financial markets in particular. However, stock market returns have maintained a constant rate of growth during long holding periods.

Figure 1.1 Total Real Return on $10.000 Initial Investment (1802-1997)



Source: Siegel J. (1994). Stocks for the Long Run

1.3 Risk and Return in Investment Planning

In the process of developing an investment strategy, investors take into account not only the total return on their assets but also the risk associated with the possibility of a loss.

All investments implicate risk. Financial risk involves the degree of uncertainty and the potential financial loss inherent in an investment decision. The return is strictly related to risk as, in general, investors demand a higher return in order to be compensated for taking a higher degree of risk.[6]

Every investment asset class has distinct risks and returns. As previously shown, stocks generally have a higher level of return with respect to all other financial assets: this reward is complementary to a particular type of financial risk, the volatility risk.

In finance, the concept of risk is considerably complicated, and there are different categories of risk. Default risk is the risk that the borrower – government or corporation – fails to repay a loan or to meet a contractual obligation. Lenders and investors are exposed to default risk in all forms of credit extensions.[7] Therefore, this typology of risk affects investments in both equity and debt assets. Inflation risk is a long-term financial risk related to the increase in the price level over time. Inflation erodes purchasing power and therefore it causes a discrepancy between real and nominal returns on investments. Asset classes with the lowest nominal returns are the most exposed to this sort of risk. Volatility risk is a severe form of risk that implies the possibility of a loss in the value of the asset due to downward fluctuations in its price. Volatility is measured as the standard deviation of the rate of return of that particular asset over a given period of time. This value measures the dispersion of possible outcomes around the expected value.[8]

According to the conventional theory of risk and return, asset returns over a given period are uncertain and are given by:

$$\tilde{r} = \frac{\widetilde{P_1} + \widetilde{D_1} - P_0}{P_0} \tag{1.1}$$

Where P_0 is the price of the asset at the beginning of the period, $\widetilde{P_1}$ is the uncertain price at the end of the period and $\widetilde{D_1}$ is the uncertain income/dividend

[6] Investor.got. *What is Risk? | Investor.gov*. [online] Available at: https://www.investor.gov/introduction-investing/basics/what-risk

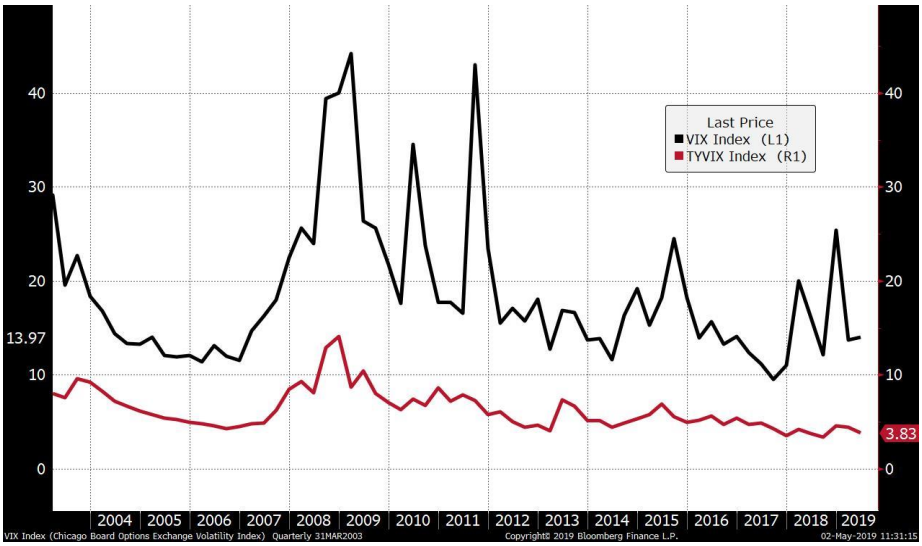
[7] Investopedia. *Default Risk*. [online] Available at: https://www.investopedia.com/terms/d/defaultrisk.asp [Accessed 4 May 2019].

[8] Bodie, Z., Kane, A., and Marcus, A. (2018). *Investments*. New York: McGraw-Hill Education.

paid out by the asset. The return on the asset is a random variable with *n* possible outcomes and p_n probabilities attached to each outcome. The expected rate of return on a risky asset is estimated by analyzing historical prices over a certain period, based on the assumption that past information is indicative of future outcomes.[9]

The most widely accepted indicators of volatility are the CBOE[10] Volatility Indexes. Figure 1.2 displays the CBOE Volatility Index or VIX, which is a "calculation designed to produce a measure of constant, 30-day expected volatility of the U.S. stock market, derived from real-time, mid-quote prices of S&P 500® Index (SPXSM) call and put options" (www.cboe.com/vix) and the CBOE/CBOT 10-year U.S. Treasury Note Volatility Index or TYVIX which, with the same methodology of the VIX, "*measures a constant 30-day expected volatility of 10-year Treasury Note futures prices, and is calculated based on transparent pricing from CBOT's actively traded options on the T-Note futures*"(www.cboe.com/tyvix). The values of the indexes are displayed from March 31st, 2003, the date in which the TYVIX was implemented.

Figure 1.2 VIX and TYVIX Indexes Values



Source: Bloomberg

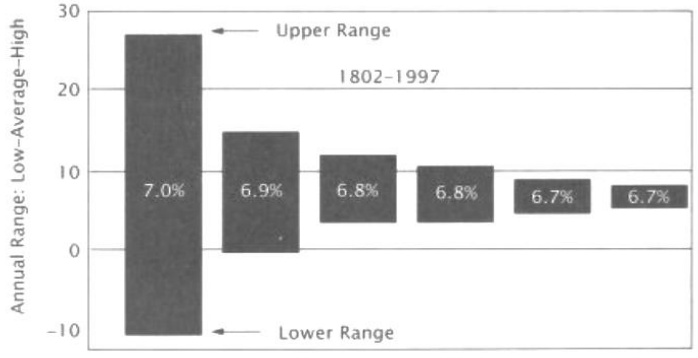
[9] Bodie, Z., Kane, A., and Marcus, A. (2018). *Investments*. New York: McGraw-Hill Education.

[10] Chicago Board Options Exchange.

It is clear that the volatility of bonds is constantly lower than the volatility of stocks. This implies minor swings in the yield of the former and greater swings in the price of the latter. The evidence of the volatility of stocks and bonds is coherent with historical data about the returns of the two assets.

Although stocks present modest volatility in the short-term, John C. Bogle found evidence that the stock market returns tend to stabilize over time.[11] This phenomenon entails diminishing volatility of stocks in the long run along with a constant mean of the returns.

Figure 1.3 Range of Stock Market Annual Returns



Standard Deviation of Returns (%)						
Upper Range	25.1	14.4	11.2	10.3	8.7	7.7
Lower Range	-11.1	-0.6	2.4	3.4	4.7	5.7
Standard Deviation	18.1	7.5	4.4	3.3	2.0	1.0

Source: Bogle, J. and Swensen, D. (2010). Common Sense on Mutual Funds.

1.4 Investment Companies

Investment companies are intermediaries that pool funds from individual investors and allocate those funds into securities or other assets. Investors have the claim to the established portfolio proportionally to the invested capital. The primary reason for allocating funds into this mechanism is to benefit from large-scale investing. Investment companies perform a vast range of functions that leads investors to prefer this particular investment strategy rather than

[11] Bogle, J. and Swensen, D. (2010). *Common Sense on Mutual Funds*.

allocate their funds individually.[12] First, these financial intermediaries are able to diversify the risk by investing in a large number of different securities: investors benefit from the possibility of holding fractional shares of the securities. Moreover, financially uneducated individuals, as well as a financially educated individual unable to spend the necessary amount of time performing securities analysis, may exploit the professionalism of fund managers. The investment company management performs different functions such as securities selection, portfolio management, record keeping, and administration. Finally, because these companies trade large amounts of securities, investors benefit from reduced transaction costs – i.e., brokerage fees and commissions.[13]

There exist two broad categories of investment companies: unit investment trusts and managed investment companies.

1.4.1 Unit Investment Trusts

This first type of investment company consists of a pool of money invested in a portfolio that is fixed for the entire duration of the funds. The trustee buys the portfolio of securities deposited into a trust and, subsequently, sells the shares, or units, to investors at a premium to their net asset value (NAV) – i.e., the difference between the market value of the assets of the fund and the liabilities divided by the outstanding shares. Since the composition of the portfolio remains the same over time, this type of fund is referred to as unmanaged. Units cannot be traded on the financial markets, therefore, investors willing to liquidate their position may sell the shares to the trustee.

1.4.2 Managed Investment Companies

[12] Bodie, Z., Kane, A., and Marcus, A. (2018). *Investments*. New York: McGraw-Hill Education.

[13] Mishkin, Frederic, S., and Stanley Eakins G. (2018) *Financial Markets and Institutions, Global Edition*.

Managed investment companies can, in turn, be divided into closed-end funds and open-end funds, commonly referred to as mutual funds.

Closed-end funds offer a limited number of non-redeemable shares to the public. Shares of closed-end funds are traded in the over-the-counter market at a price different from NAV.[14] Investors cannot directly withdraw their money from the fund; they can, however, sell their shares to other investors. Closed-end funds comprise private equity and hedge funds.

This thesis will focus on the second category of managed investment companies: open-end funds. These funds may redeem or issue shares at NAV: this implies that investors can contribute to an open-end fund after the initial offering and can withdraw the invested capital at any point in time – this action is generally disincentivized by back-end load fees.[15] Open-end funds comprise mutual and exchange-traded funds.[16]

1.4.2.1 Equity Mutual Funds

Four primary classes of mutual funds are available to investors: equity funds, bond funds, hybrid funds, and money market funds. Equity funds invest primarily in the stock market and generally maintain a minor position – between 4% and 5% – in money market instruments, in order to have the necessary liquidity to guarantee the redemption of shares. Equity funds are classified with respect to their strategy and to the size of the market capitalization of companies they purchase shares of.[17] Paragraph 1.6 presents a type of funds' performance analysis devoted to investigating how the strategy of a fund impacts its performance. The evolution of the U.S. asset management industry, discussed in Chapter 2, brought to the following distribution of assets among different types of mutual funds. The Investment Company Institute[18]

[14] Mishkin, Frederic, S., and Stanley Eakins G. (2018) *Financial Markets and Institutions, Global Edition*

[15] Mutual funds fees are discussed in Paragraph 1.7.1

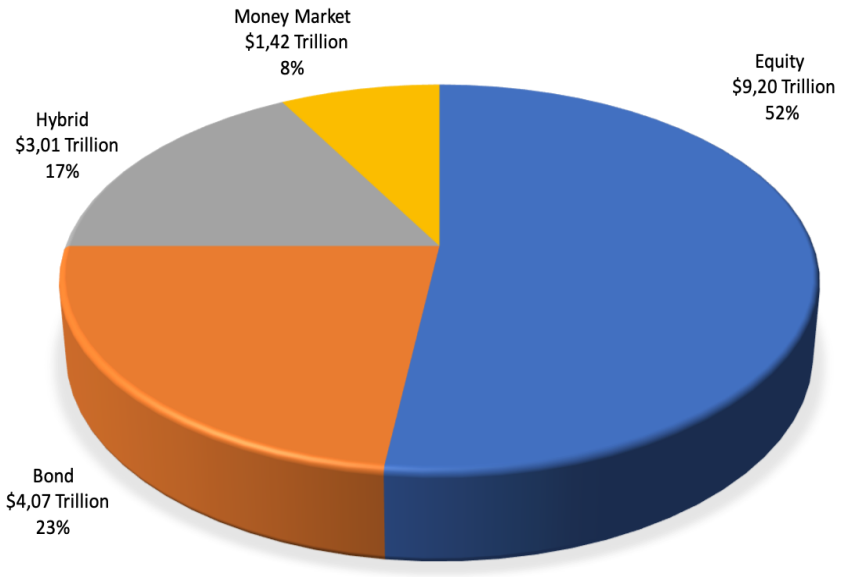
[16] Bodie, Z., Kane, A., and Marcus, A. (2018). *Investments*. New York: McGraw-Hill Education.

[17] Mishkin, Frederic, S., and Stanley Eakins G. (2018) *Financial Markets and Institutions, Global Edition*

[18] Investment Company Institute (2019). *INVESTMENT COMPANY FACT BOOK, A Review of Trends and Activities in the Investment Company Industry*

provides data concerning the size of asset under management of mutual funds in the U.S. at the end of 2018. "*With $17.7 trillion in total net assets, the US mutual fund industry remained the largest in the world at year-end 2018. The majority of US mutual fund net assets at year-end 2018 were in long-term mutual funds, with equity funds alone making up 52 percent of US mutual fund net assets (Figure 1.2). Bond mutual funds were the second-largest category, with 23 percent of net assets. Money market funds (17 percent) and hybrid funds (8 percent) held the remainder.*" (Investment Company Institute (2019)).

Figure 1.2 Distribution of Mutual Fund Total Net Asset



Source: Investment Company Institute, 2019, Investment Company Fact Book.

The main distinction of equity mutual funds can be made between actively-managed funds and index funds: the former aim to outperform a benchmark while the latter aim to replicate the performance of that benchmark. The comparison of the two types of funds is the main objective of this thesis: in Chapter 2 the two are compared in terms of management and turnover of assets, fees, and recent developments; in Chapter 3 an analysis of the risk-adjusted performances of a sample of the two categories is presented.

1.4.2.2 Exchange Traded Funds

Exchange Traded Funds or ETFs were introduced in 1993 to allow investors to trade index portfolios as they did with common stocks. The first ETF was the so-called "spider": it was a unit investment trust holding a portfolio that matched the Standard & Poor's 500 Index. ETFs, like index funds, present small management fees. Since 1993 ETFs have grown in asset under management and in range of asset classes they are linked to. A detailed analysis of the evolution of the ETFs market is presented in Chapter 2.

1.5 Conventional Theory of Portfolio Performance Evaluation

To analyze the performance of mutual funds it is necessary to determine the proper measurements of returns. The conventional theory[19] provides several different risk-adjusted performance measurements for a portfolio, this paragraph is devoted to the illustration of the most commonly used measurements. First, it is necessary to define the concept of the time-weighted rate of return or geometric average. This is the constant rate of return for a period t that would provide the same cumulative rate of return over the investment period. Denoting by v_t the overall NAV of the fund in period t and by x_t the number of outstanding shares, the value of one share of the mutual fund is the ratio $q_t = v_t / x_t$. The time-weighted rate of return (TWRR) of the fund is given by:

$$r_t = \frac{q_t}{q_{t-1}} - 1 \qquad (1.2)$$

The NAV of a mutual fund can change as a consequence of two distinct situations: the variation of the value of underlying assets in the portfolio or the change in the number of shares of the fund. The TWRR, however, is not affected by changes in the number of shares hence, it is a proper indicator of performance.

[19] Bodie, Z., Kane, A. and Marcus, A. (2018). *Investments*. New York: McGraw-Hill Education.

Before defining the different risk-adjusted measurements, it is important to highlight three statistical concepts that will be exploited in the analysis of performance. The first concept is the semi-variance. The standard deviation is a symmetric measure of dispersion, and it is a proper indicator of risk if considering symmetric distributions. Since returns tend to be asymmetric[20] and the actual source of risk is given by the lower tail of the distribution of returns, the semi-variance is a more valid measure of risk. It is defined as:

$$sv_r = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(\min(0; r_t - \tilde{r}])^2} \tag{1.3}$$

Investors may not be interested in the deviation from the mean of returns, but in comparing the performance of the fund with a target return. Hence, the downside risk measure (1.4) may be more appropriate than the semi-variance.

$$DD = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(\min(0; r_t - \tilde{r_{TRT}}])^2} \tag{1.4}$$

The objective of a mutual fund manager is to provide a certain return to investors. The return of the fund is generally compared with the return of a benchmark index. The tracking error volatility (1.5) measures the average distance of the return of a fund r_t in a given period of time with the return of the benchmark $r_{B,t}$ in the same period.

$$TEV = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(r_t - \tilde{r_{B,t}})^2} \tag{1.5}$$

As previously discussed, investors are interested in the risk-return tradeoff, rather than the absolute return. Therefore, to the extent of evaluating the

[20] Bodie, Z., Kane, A., and Marcus, A. (2018). *Investments*. New York: McGraw-Hill Education.

performance of mutual funds, risk factors must be introduced in the measurements. The relevant risk-adjusted measures of performance to the extent of this thesis are four: the Sharpe ratio, the Information ratio, the Treynor ratio, and the Jensen's alpha.

1.5.1 The Sharpe Ratio

The Sharpe ratio was introduced by the American economist William F. Sharpe in an article for the *Journal of Business* in 1966. The economist called it the reward to variability ratio of a particular fund *p* since it is defined as the expected excess return over a risk-free asset divided by the standard deviation of the returns (1.6).

$$S_p = \frac{\widetilde{r_p} - r_f}{\sigma_p} \tag{1.6}$$

The higher the Sharpe ratio the better the trade-off between risk and return. The measure allows a simple and immediate comparison of mutual fund performances; however, it considers both systematic and unsystematic risk, this implies that the Sharpe ratio is an accurate measure of performance in the instance in which the investor allocates the entire capital in a single fund.

1.5.2 The Information Ratio

The information ratio is another measure of the risk-adjusted return of a mutual fund. It is defined as the expected active return, the positive deviation of the return of the actively-managed fund from the return of a selected benchmark index, divided by tracking error volatility (1.7).

$$ir_p = \frac{\widetilde{r_p} - \widetilde{r_b}}{\sigma_p} \tag{1.7}$$

This ratio allows assessing the skills of fund managers as it measures the active return of the portfolio over the amount of risk the manager takes relative

to the benchmark (TEV). The higher the information ratio, the better the performance of a fund taking risk into consideration. Several funds use this ratio for calculating the performance fees.[21]

1.5.3 The Treynor Ratio

The Sharpe ratio considered the entire risk of a portfolio, including the diversifiable one. To overcome this imperfection, Jack L. Treynor presented the Treynor ratio in the article *"How to Rate Management Investment Funds"* published in 1966 on the *Harvard Business Review*[22]. This measure is derived from the Capital Asset Pricing Model[23] [24] formulated by Treynor and Sharpe, among others, and considers purely the systematic component of risk. It is defined as follows:

$$tr_p = \frac{\tilde{r_p} - r_f}{\beta_p} \tag{1.8}$$

Like the Sharpe ratio, the Treynor ratio does not evaluate the value added of active portfolio management, it solely ranks the funds based on a systematic risk criterion.

1.5.4 Jensen's Alpha

The Capital Asset Pricing Model may be expressed by the following linear relation:

$$\tilde{r_j} - r_f = a_J + \beta_{j,m}(\tilde{r_m} - r_f) + \tilde{\varepsilon_j} \tag{1.9}$$

[21] Richard C. Grinold and Ronald N. Kahn, *Active Portfolio Management*, Second Edition
[22] Jack L. Treynor "How to Rate Management Investment Funds" Harvard Business Review 43 (Jan- Feb 1966).
[23] Sharpe, William F. (1964). *Capital asset prices: A theory of market equilibrium under conditions of risk*. Journal of Finance. 19 (3): 425–442.
[24] Treynor, Jack L. (1961). *Market Value, Time, and Risk*. Unpublished manuscript.

Equation 1.9 is known as the single-index model: it is a pricing model that measure the risk and return of a security. It determines the expected return on asset *j* given the premium on the market portfolio $(\widetilde{r_m} - r_{\square})$, the risk-free rate r_f – i.e., the rate on treasury bills, the asset's beta $\beta_{j,m}$ – i.e., the responsiveness of the asset to the market return, the asset's alpha α_j or abnormal return, and the error term $\tilde{\varepsilon}_j$ with zero expected value and σ standard deviation. This simplified model assumes only a single factor of systematic risk that affects the stock return: the rate of return on a market index. $\tilde{\varepsilon}_{\square}$ represents the asset-specific or non-systematic risk that can be diversified.

The single-index model may be applied to the returns of a fund *p* over period t = 1, …, T. In this case the linear regression has this formulation:

$$\widetilde{r_{p,t}} - r_{f,t} = \alpha_p + \beta_p\left(\widetilde{r_{m,t}} - r_{\square,t}\right) + \widetilde{\varepsilon_{p,t}} \qquad (1.10)$$

Jensen's alpha of the fund *p* is the intercept α_p of the linear regression. It represents the average return on the portfolio over and above the one predicted by the CAPM through the fund's beta and the average market return. Jensen's alpha evaluates the ability of the fund manager in the selection of stocks with superior performance.

Conventional measures of performance evaluation provide investors with an assessment mechanism for mutual funds that prioritize the concepts of risk and return. However, the index model can serve as the pillar of another remarkable evaluator of the determinants of fund performance: the style analysis.

1.6 Style Analysis

The Nobel Prize William F. Sharpe introduced the concept of style analysis in 1992.[25] The idea at the basis of this alternative portfolio performance evaluation was to regress funds returns with respect to individual asset classes

[25] Sharpe William F. (1992). *Asset Allocation: Management Style and Performance Evaluation.* Journal of Portfolio Management

in order to measure the fund "style" – i.e., the asset allocation. The linear regression has the following form:

$$\mathbf{R_{p,t}} = \sum_{k=1}^{K} \beta_{p,k} R_{k,t} + \varepsilon_{p,t} \qquad (1.11)$$

$R_{k,t}$ is the excess return of a particular asset class *k* over the risk-free asset. The $\beta_{p,k}$ coefficients may assume only value between 0 and 1, as funds are precluded from taking short positions on any asset class. The R-square of the regression measures the percentage of return variability attributable to style or asset allocation. The residual of return variability will either be attributable to security selection or to market timing – periodical readjustments of the allocation in each asset class.

While the performance evaluation measures based on the SML provide a mechanism based on the comparison with a single benchmark portfolio, the style analysis constructs a tracking portfolio from several specialized indexes. The R-squared of the regression with a single factor is greater than the one of the style regression, which used different indexes: the reason lies in the fact that the style analysis linear regression imposes strong restrictions on the βs.

It is difficult to conclude which methodology is the proper indicator of fund performance in a given period. Conventional risk-adjusted measures based on the SML are a better representation of the comparison between the performances of the fund and the benchmark index. Nonetheless, style analysis allows to identify the closer asset allocation strategy to the one employed by the fund manager and subsequently assess the performance of the fund relative to that particular strategy.

1.7 The Role of Funds' Costs

Investors choosing the investment vehicle of mutual funds should be concerned about the performance of the fund in the previous years as well as the fee structure. As John C. Bogle stated: "In the mutual fund field, costs assume tremendous importance for the long-term investor. Other things held

equal, lower costs mean higher returns." (John Bogle, "Bogle on Mutual Funds: New Perspectives for the Intelligent Investor" (1994))

1.7.1 Loads and Management Fees

The U.S. Security and Exchange Commission (SEC)[26] divides fees in the U.S. mutual fund industry into two broad categories. The first and most relevant comprises annual fund operating expenses, also known as the expense ratio. This category includes operating expenses such as management fees and administrative costs, and the 12b - 1 fee, which comprises costs related to distribution, advertising, and disclosure (annual reports and prospectuses). The expense ratio is generally expressed as a percentage of the asset under management (AUM) and deducted from the asset of the fund, therefore it is included in the calculation of the NAV and consequently, it affects funds returns. It may range from 0.2% to 2%: passive index funds exhibit the lowest fees as opposed to actively-managed funds. The second type of fees are loads. Loads are sales charge or commission that the investor pays to compensate an intermediary – i.e., broker or financial advisor. They may exist in the form of front-end loads, which are fees paid at the moment of the purchase of the shares, or back-end load, paid simultaneously with the redemption of shares. Back-end load may be characterized by a fee-structure that decreases with the passage of time. In Chapter 2 an analysis of the impact of funds' cost over time is provided.

1.7.2 Performance Fees

This paragraph focuses on management fees. In March 2005, the SEC imposed an additional requirement for mutual funds that forced them to disclose the compensation structure of fund managers in the Statement of Additional Information (SAI).[27] In addition to management fees as a percentage of AUM, investment companies' managers may receive

[26] Sec.gov. *SEC.gov | Mutual Fund Fees and Expenses*. [online] Available at: https://www.sec.gov/fast-answers/answersmffeeshtm.html

[27] SEC Rule S7-12-04, Disclosure Regarding Portfolio Managers of Registered Management Investment Companies, http://www.sec.gov/rules/final/33-8458.htm.

performance fees. Although this remuneration typology is more common in alternative investment vehicles – i.e., hedge funds, it may be present in mutual funds as well. In 2018 a substantial fraction of mutual fund managers earned performance fees.[28] Managers of funds adopting the incentive fee structure are required to outperform a selected benchmark index in order to benefit from performance fees: the mechanism should align incentives of the fund manager with incentives of fund's shareholders, notwithstanding it could be a stimulus for the management to take excessive risk. To impose limits on this behavior the U.S. Congress[29] restrained the use of asymmetric performance fees that rewarded managers for outperforming the benchmark but did not include penalties for underperforming. Paragraph 2.2.4 is devoted to investigating the implication of performance fees in the U.S. mutual fund industry.

[28] Servaer H. and Sigurdsson K. (2018). *The Costs and Benefits of Performance Fees in Mutual Funds.* Ecgi.

[29] Investment Company Amendments Act of 1970, amended Section 205 (effective December 14, 1971)

Chapter 2 - The Asset Management Industry in 2002-2016

This chapter serves as a guideline to identify the context in which the empirical analysis of Chapter 3 is performed. At first, it presents the trends in the U.S. stock market in the 2002-2016 span, analyzing the causes and consequences of the movements in the main indices. Secondly, it displays the evolution of investment companies, showing flows of assets among different types of funds, describing the increasing importance of the passive side of asset management and determining the influence of funds' costs and management fees' structure.

2.1 The U.S. Stock Market Trends

As discussed in Chapter 1, stocks are considerably volatile: their prices are subject to substantial swings which entail speculative factors. This paragraph analyzes the behavior of the U.S. stock market[30] during the 2002-2016 period in order to provide a framework to study trends in the asset management industry during the same period.

2.1.1 The Burst of the Dot-com Bubble

The period begins with the final segment of the burst of the dot-com bubble. The dot-com speculative bubble was a period of excessive speculation that occurred primarily in the United States from 1994 to 2000. The great public enthusiasm towards the extreme growth in the usage and adoption of the Internet brought to a massive overvaluation of several internet-based companies. [31] To the extent of analyzing the developments of the dot-com bubble, the Nasdaq Composite Index[32] is used as a reference for the stock

[30] The S&P 500, Nasdaq and Dow Jones Indices are taken as reference for the stock market
[31] Wollscheid, Christian (July 11, 2012). Rise and Burst of the Dotcom Bubble: Causes, Characteristics, Examples. GRIN Verlag. p. 1.
[32] The Nasdaq Composite Index is a stock market index launched in 1971 with a value of 100. It is heavily oriented towards IT companies that accounted for almost 50% in early 2000.

market. The Nasdaq reached its maximum on March 10th, 2000 peaking at 5048.62 and from that date, it lost almost 78% of its value reaching the low on October 9th, 2002.[33] The stock market downturn of 2002 is, therefore, only a small part of the bear market that started in 2000. From the relative maximum of January 4th, 2002 (March 12th, 2002 for the DJIA) to the minimum of October 9th, 2002, the Nasdaq, the DJIA and the S&P 500 lost respectively 45.7, 31.5 and 33.7 percent of their values. Stock markets slightly recovered after the minimum of October and reach a final minimum in mid-March 2003, which was the starting point of a 4-year bull market, examined in the following paragraph.

Figure 2.1 The Three Main U.S. Stock Market Indices

Graph Normalized by Factor (100) as of 02 January 2002 (02/01/2002 to 31/03/2003)

Source: Bloomberg

2.1.2 The 2003-2007 Bull Market and the Great Recession

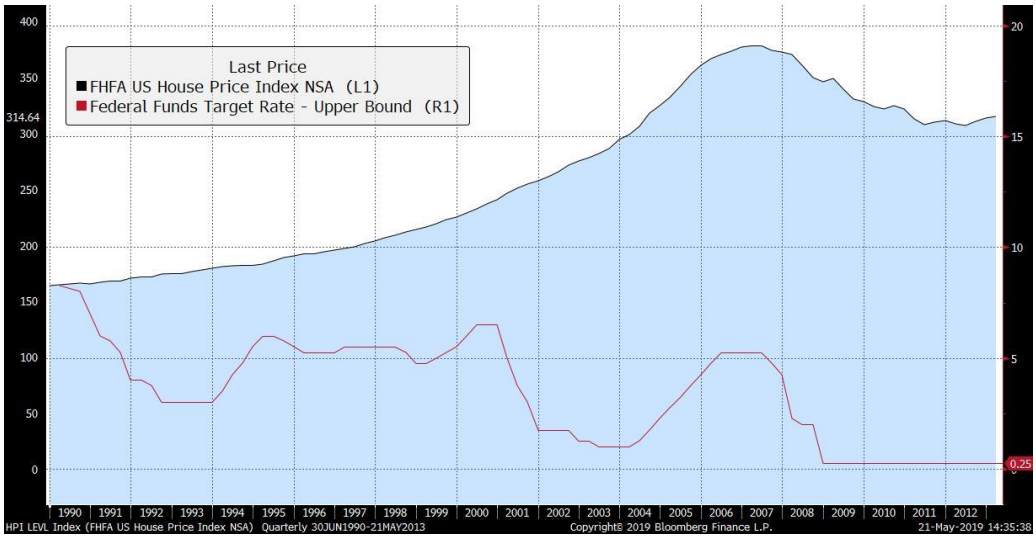
The severe stock market downturn ended at the beginning of 2003, paving the way to a period of expansion supported by loose monetary policy and by the credit boom. During the bull market of 2003-2007, the S&P 500 grew at a pace of 15.56% annually. This period, however, has been subsequently

[33] Data retrieved from Bloomberg Professional

considered as the genesis of the 2007-2009 financial crisis. Two fundamental elements gave birth to the longest recession since 1929: financial innovation in the mortgage markets and low interest rates.[34] The securitization process, which took off in the early 2000s, allowed banks to bundle several loans into standardized debt securities called asset-backed securities (ABSs). Moreover, developments in financial engineering led to the creation of structured credit products – the most notable are collateralized debt obligations (CDOs) – that pay out streams of income for underlying assets and divide those cash flows into tranches with different risk. ABSs along with CDOs allowed banks to offer subprime mortgages to low-FICO[35] score customers and created a principal-agent problem in the mortgage markets. Brokers that originated the loan did not accurately evaluate the financial soundness of borrowers resulting in a large volume of subprime mortgages in the market.[36] The low interest rates charged by the Federal Reserve, on the one hand, facilitated expansion of the economy and the stock market, on the other, they harmed the profitability of the banking sector and of pension funds, which, as a result, found in ABSs and CDOs a favorable compromise between risk and return. Nonetheless, the risk was enormous as there was another bubble expanding: the housing bubble.

Figure 2.2 House Price Index Level and Federal Funds Target Rate

HPI (left axis) and FFTR in percent (right axis) 1990-2014



[34] Mishkin, Frederic, S., and Stanley Eakins G. (2018) *Financial Markets and Institutions, Global Edition*.

[35] A FICO score is a type of credit score created by the Fair Isaac Corporation.

[36] Mishkin, Frederic, S., and Stanley Eakins G. (2018) *Financial Markets and Institutions, Global Edition*.

Source: Bloomberg

The housing bubble was the fuel for the subprime mortgages market and as soon as the bubble collapsed, thousands of mortgages simultaneously defaulted and the balance sheet of the main financial institutions deteriorated, forcing them to deleverage, selling assets off and crunching credit extension to household and firms. On Monday, September 15th, 2008, the investment bank Lehman Brothers filed for bankruptcy. In a few days, the Standard & Poor's 500 lost 28.35% of its value. From the peak of October, the 9th 2007 to the minimum of March 9th, 2009 the main U.S. stock market index lost 56.70% of its value.

Figure 2.3 The Standard & Poor's 500 Index

2003-2010

Source: Bloomberg

2.1.3 Post 2008 Recovery and Expansion

The U.S. stock market started its recovery in early March 2009, after one and a half years of crisis. Since 2009 it experienced a flourish expansion (the longest in history at the date of writing) during which the S&P 500 gained a 230.93% (+16.54% annually).[37] Investors reacquired the confidence in investment companies, as shown in the next paragraph, and the U.S. economy grew. There have been only two relevant slowdowns during this long positive

[37] These numbers consider the period from 06/03/2009 to 31/12/2016 - which is the end of the period considered in the research.

trend. The first occurred in the second semester of 2011 in conjunction with the peak of the European sovereign debt crisis, which affected global stock markets. The second was the stock market sell-off of 2015-2016, a period of decline in value of stocks mainly due to turmoil in the Chinese and European stock markets. During the former, the S&P 500 went down by 17.81% between July and October[38]; in the latter, it lost 13.90% between July 2015 and February 2016.[39]

2.2 The Evolution of the Market: from Mutual Funds to ETFs

During the period considered in this research, the mutual fund industry has undergone a relevant transformation. This paragraph analyzes the primary trends concerning mutual funds and serves as a preamble for chapter 3, which provides empirical evidence on the performance of mutual funds during the same period.

2.2.1 Trends in the Mutual Funds Industry

As previously mentioned, the interval considered had been subject to contrasting macroeconomic trends which reflected in the propensity of households (who hold 89% of mutual funds' assets[40]) and institutional investors to allocate funds in capital and money markets. The general trend is, however, a positive increase in the AUM of all types of investment companies, nonetheless in different proportions, as shown in Table 2.1. ETF is the type of managed investment company which has experienced the largest growth: assets allocated in ETFs went from $102 billion in 2002 to $2.54 trillion in 2016, accounting for an impressive 2,374% increase[41]. Mutual funds follow ETFs with a rate of growth of 156% and they hold solid supremacy in terms of net assets absolute value. The important increase of mutual funds' net assets may be a consequence of two distinct facts: the appreciation of the value of assets in the funds' portfolios or the increase in the number of outstanding

[38] Precisely 25/07 and 03/07

[39] 16/07 and 11/02

[40] ICI Fact book 2017 p. 30

[41] Investment Company Institute

shares (which in turn may be due to the issuance of new shares by existing funds or the establishment of new mutual funds). Figure 2.4 displays the annual net cash flow to mutual funds in the period 2002-2016. Comparing the total absolute increase in mutual funds' net assets during this period with the net cash flows, it is possible to observe how the appreciation of the value of assets contributed the most to the positive trend in mutual funds' net assets.

Table 2.1 Investment Companies Total Net Assets

In Billions of Dollars (2002-2016)

	Mutual Funds[1]	Closed-end funds[2]	ETFs[3]	UITs	Total
2002	6,383	159	102	36	6,680
2003	7,402	214	151	36	7,803
2004	8,096	253	228	37	8,614
2005	8,891	276	301	41	9,509
2006	10,398	297	423	50	11,168
2007	12,000	312	608	53	12,974
2008	9,621	184	531	29	10,365
2009	11,113	223	777	38	12,151
2010	11,834	238	992	51	13,114
2011	11,633	242	1,048	60	12,983
2012	13,054	264	1,337	72	14,727
2013	15,049	279	1,675	87	17,090
2014	15,873	289	1,975	101	18,238
2015	15,650	261	2,101	94	18,106
2016	16,344	262	2,524	85	19,215

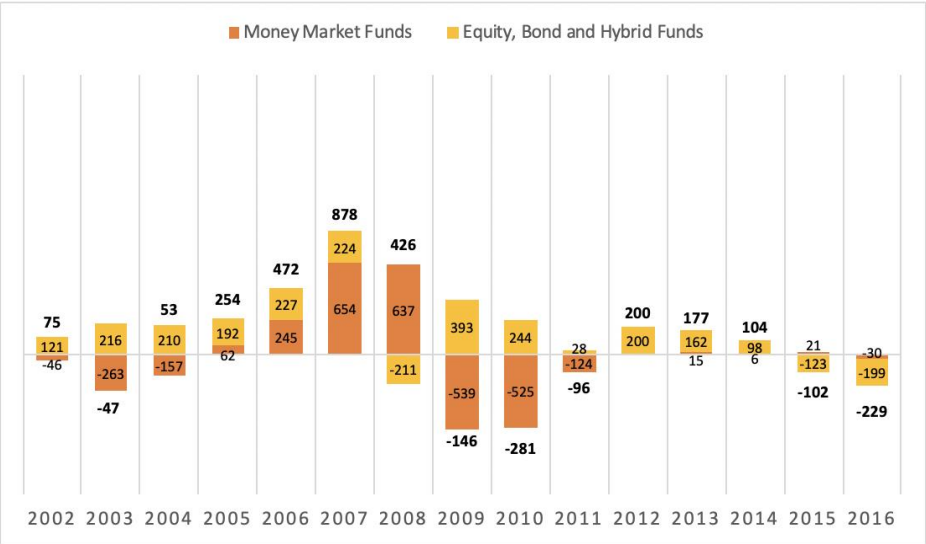
[1]Mutual fund data exclude mutual funds that invest primarily in other mutual funds.
[2]Closed-end fund data include preferred share classes.
[3]ETF data prior to 2001 were provided by Strategic Insight Simfund. ETF data include ETFs not registered under the Investment Company Act of 1940 and exclude ETFs that primarily invest in other ETFs.
[4]Total investment company assets include mutual fund holdings of closed-end funds and ETFs.

Note: Data are for investment companies that report statistical information to the Investment Company Institute. Assets of these companies comprise 98 percent of investor assets. Components may not add to the total because of rounding.

Source: Investment Company Institute

Figure 2.4 Annual Net Cash Flow to Mutual Funds

In Billions of Dollars (2002-2016)



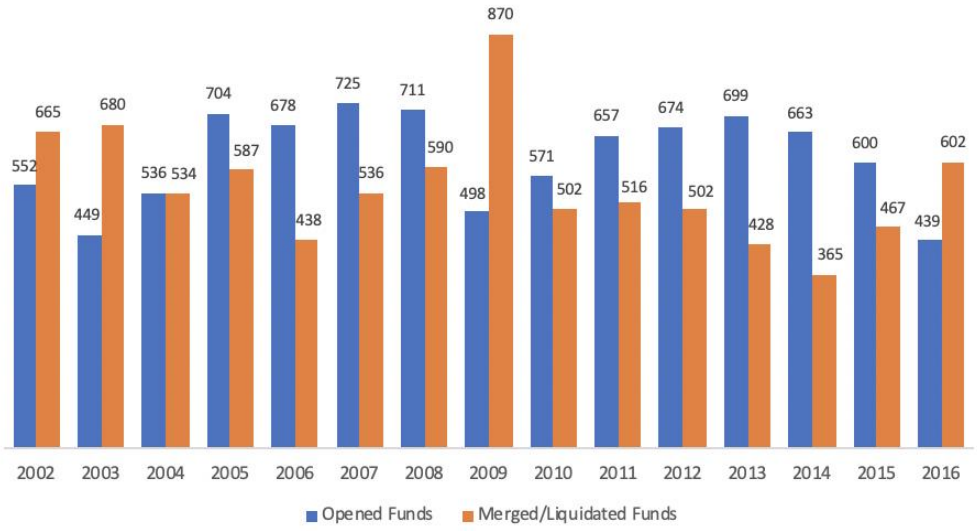
Source: Investment Company Institute

Competitive dynamics in the mutual fund industry, as well as the impact of macroeconomic cycles, led to significant variation in the market participants.[42] Investment companies may decide to open a new fund, liquidate an existing fund or merge two or more funds. From 2002 the establishment or liquidation/merger of mutual funds and ETFs has followed market trends. Figure 2.5 shows that the totality of mutual funds and ETFs increased in the period 2002-2016, with three main periods of decrease (2002-2003, 2009, 2016) which are subsequent to market slowdowns – respectively the burst of the dot-com bubble, the 2008-2009 recession, and the 2015-2016 stock market selloff.

Figure 2.5[43] Number of Opened and Merged/Liquidated Mutual Funds and ETFs (2002-2016)

[42] Investment Company Institute

[43] Data include mutual funds that do not report statistical information to the Investment Company Institute and mutual funds that invest primarily in other mutual funds. ETF data include ETFs not registered under the Investment Company Act of 1940 but exclude ETFs that invest primarily in other ETFs.



Source: Statista

The recurrent operations of merger and liquidation of funds, as well as less evident changes in funds' name, create a relevant inclination towards evidence of positive performance of actively-managed funds over their benchmarks. The survivorship bias, of which an in-depth analysis is presented in chapter 3, is the tendency to consider the performance of funds present in the market as representative of the totality of funds' performance, without accounting for negative performances of those funds that left the market in previous periods. This bias causes an overvaluation of performance as the probability of outperforming the market increases for the remaining funds.

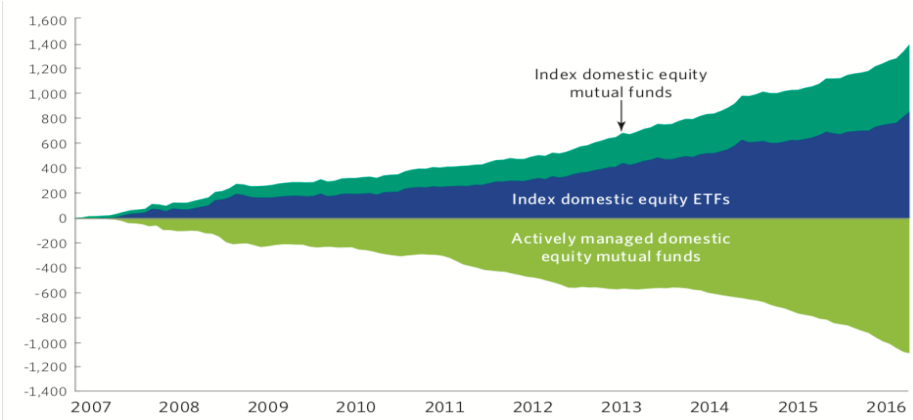
2.2.2 The Rise of Index Funds and ETFs

In the analysis of the mutual fund industry, the main distinction has to be made between active and passive portfolio management. An active strategy gives portfolio managers discretion to select individual securities and is associated with the final objective of outperforming a previously defined benchmark index. On the other hand, passive (or "index") strategies are concerned with tracking a predetermined index, by holding in the portfolio all of the securities of the index or an automatically selected representative sample

of those assets and by adjusting the composition of the portfolio over time, in accordance with the variation of the securities in the index.[44]

Figure 2.6 Outflows from U.S. Equity Mutual Funds to U.S. Index ETFs

Monthly cumulative flows to and net share issuance of domestic equity mutual funds (active and passive) and index ETFs in billions of dollars (2007-2016).



Note: Equity mutual fund data include net cash flow and reinvested dividends. Data exclude funds that invest primarily in other funds.

Source: Investment Company Institute

During the 15 years period considered, there has been a shift from active to passive investing signaled by changes in net cash flows of mutual funds and ETFs operating in the two different fields.

Figure 2.6 shows that in the period 2007-2016 a considerable part of monthly outflows from actively managed U.S. equity mutual funds was a corresponding inflow for index U.S. equity mutual funds and ETFs. The shift, however, dates back to the early 1990s when the concept of indexing started to spread in the asset management industry. John C. Bogle foresaw the trend and argued in favor of indexing when the majority of professionals in the industry sided against his theory.[45] In fact, in 1975 the first index fund was established by Bogle's company: the Vanguard Group, which today represents the largest

[44] Anadu, Kenechukwu et al. *The Shift from Active to Passive Investing: Potential Risks to Financial Stability?* Federal Reserve Bank of Boston, Risk and Policy Analysis Unit, August 2018

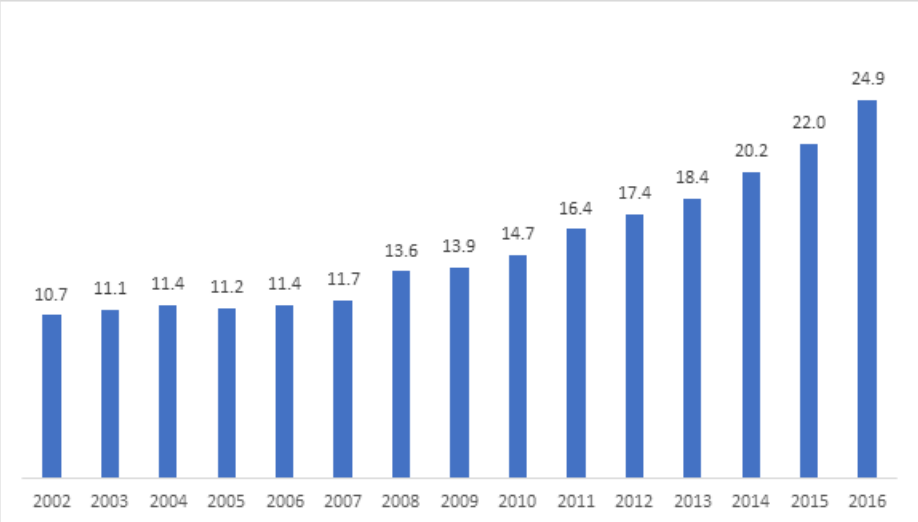
[45] Bogle J., (1997). *The First Index Mutual Fund: A History of Vanguard Index Trust and the Vanguard Index Strategy. Vanguard.com*

mutual funds' provider and the second largest ETFs' provider in the world, with $5.3 trillion in global asset under management.[46]

Figure 2.7 displays the increase of asset under management of index equity mutual funds as a percentage of total equity mutual funds' asset from 2002 to 2016.

Figure 2.7 Index Equity Mutual Fund's Share 2002-2016

Percentage of equity mutual funds' total net asset.



Source: Investment Company Institute

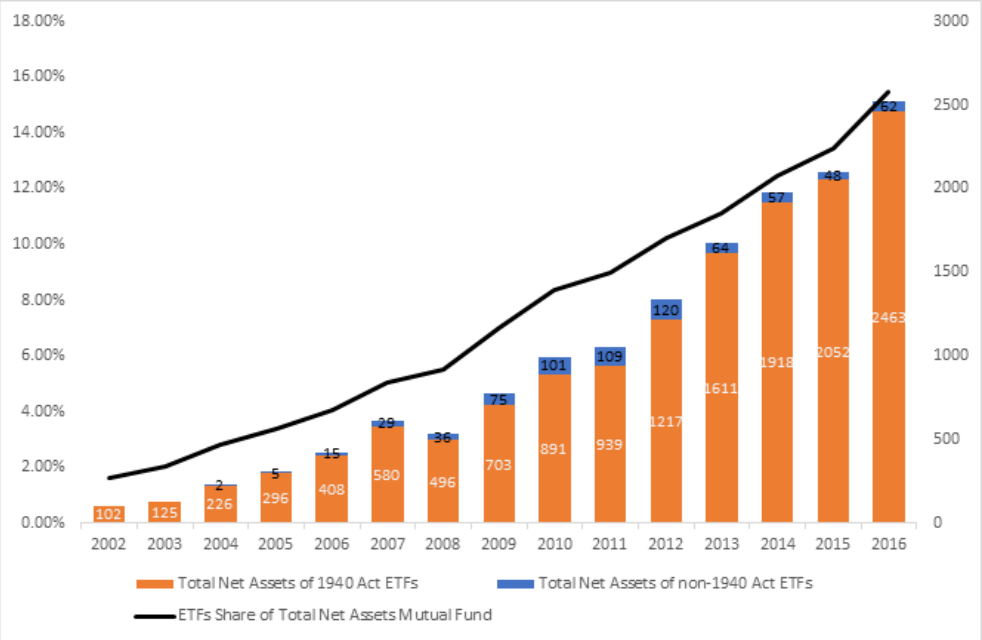
While index mutual funds share of the total experienced a massive increase in the 1990s[47] and was already modest in 2002, ETFs net asset expansion has been remarkable in 2002-2016 as attested by Figure 2.8. The percentage of assets allocated in ETFs compared to assets in mutual funds rose from 1.53% to 15.44%.

Figure 2.8 ETFs Total Net Assets and Share of Mutual Funds' Total Net Assets

Total Net Assets in Billions of Dollars (left side); Share of MFs Total Net Assets in % (right side). (2002-2016)

[46] Bloomberg

[47] Equity index mutual fund assets percentage of equity mutual fund assets in 1990 was below 3% as reported by ICI factbook 2007.



Note: Funds under the non-1940 Act category are not registered under the Investment Company Act of 1940[48] *and invest primarily in commodities, currencies, and futures.*

Source: ICI fact book 2007, 2013, 2017.

2.2.3 Fees and Costs

As discussed in paragraph 1.7, expenses play a crucial role in the mutual fund industry. Investors may incur fees related to ongoing expenses (management, administration, and 12b-1) or sales charges (front-end and back-end loads). While the first category is paid out from the fund's assets, the second is directly charged to investors. The costs of investing in a mutual fund are of primary importance for investors, and despite the massive increase in households demand for mutual funds (which has more than doubled from 1990 to 2016[49]), expense ratio has fallen in the period 2002-2016. This paragraph examines the main elements behind this paradox – as an increase in demand generally drives prices up – and provides a detailed breakdown of the trend.

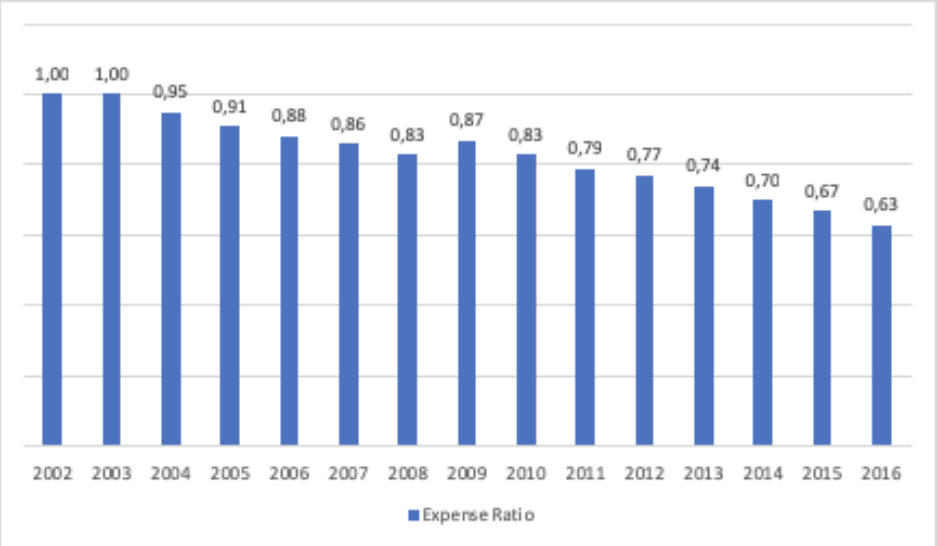
[48] The Investment Company Act of 1940 was created through an act of Congress. "This Act regulates the organization of companies, including mutual funds, that engage primarily in investing, reinvesting, and trading in securities, and whose own securities are offered to the investing public. The focus of this Act is on disclosure to the investing public of information about the fund and its investment objectives, as well as on investment company structure and operations." (https://www.sec.gov/)

[49] Investment Company Institute

In figure 2.9, the reader may observe the variation of equity mutual funds expense ratio from 2002 to 2016.

Figure 2.9 Asset-Weighted Expense Ratios for U.S. Equity Mutual Funds

Expenses as a percentage of net assets of the fund; (2002-2016)



Source: Statista

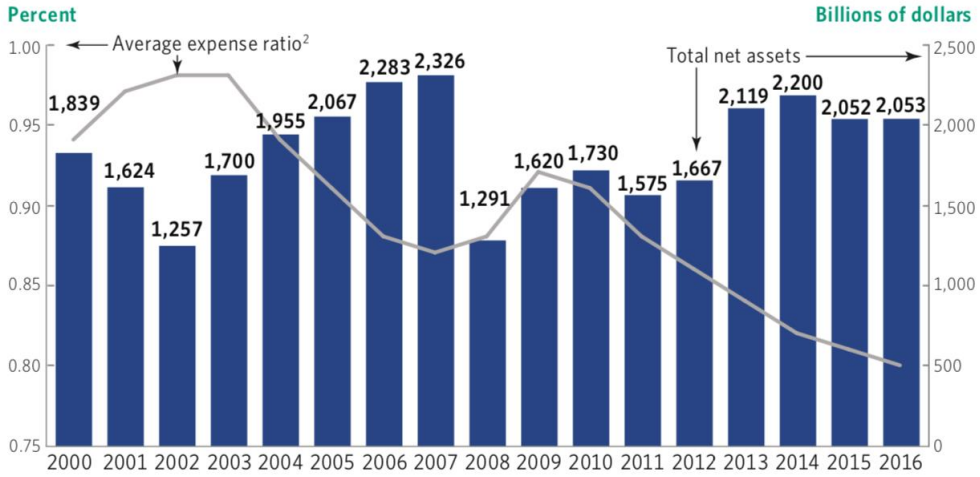
The downward trend in the expense ratio is attributable to three primary factors. First, there is evidence that the expense ratio varies inversely with the assets of the fund: this is explained by the fact that the majority of costs included in the expense ratio is fixed. Second, the shift of several mutual funds towards no-load share classes. This fee structure presents neither front-end loads nor back-end loads: funds are distributed[50] directly by the investment company without any intermediary. Third, the increasing competition, mainly due to the rise of ETFs and index funds, inside the asset management industry contributed to driving expenses down. A fourth explanatory fact that contributes to the downward trend, and is particularly related to the methodology used in the calculation of average expense ratio, is the tendency of investors to allocate capital in mutual funds with below-average expenses ratios: this inclination increases the assets and therefore the weight of funds with the lowest expense ratios.[51]

[50] The distribution is financed by a 12b-1 fee of 0.25%.

[51] Investment Company Institute

Figure 2.8 Mutual Fund Expense Ratio Inverse Correlation with Fund Assets

2000-2016



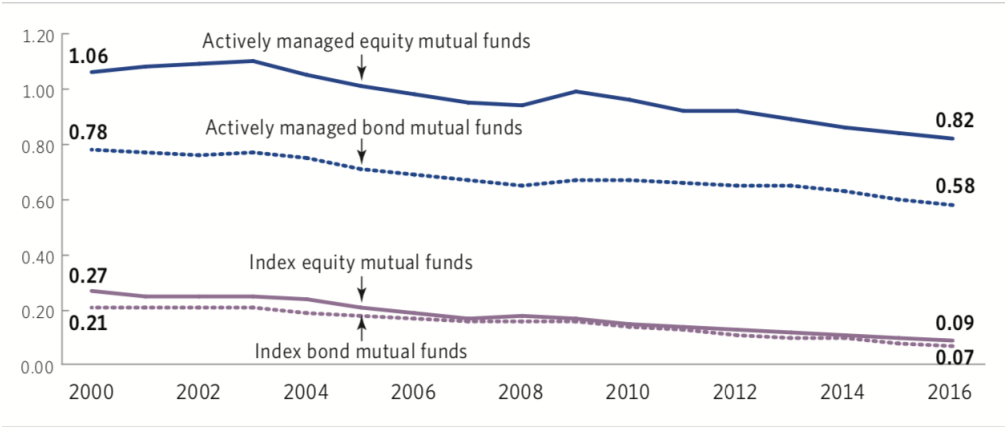
Note: Calculations are based on a fixed sample of share classes. Data exclude mutual funds available as investment choices in variable annuities, index mutual funds, and mutual funds that invest primarily in other mutual funds. Expense ratios are measured as asset-weighted averages.

Sources: ICI, Lipper, and Morningstar

The principle at the basis of passive management is the replication of the return on a specified index. Under this approach, portfolio managers do not undertake extensive research about securities, markets, and geographical sectors, resulting in a particularly small expense ratio for index funds compared to those of actively managed funds. Index funds' expense ratios declined in the period 2002-2016 as a consequence of the factors previously mentioned. The disparity between the expense ratio of actively managed mutual funds and index funds has slightly narrowed, however, it remains substantial.

Figure 2.10 Expense Ratio of Actively Managed and Index Mutual Funds

Expenses as a percentage of net assets of the fund; (2000-2016)



Sources: Investment Company Institute, Lipper, and Morningstar

In 1986, Brinson, Hood and Beebower published an article on the Financial Analyst Journal stating that: "*Investment policy*[52] *dominates investment strategy (market timing and security selection), explaining on average 93.6 percent of the variation in total plan return*".[53] This concept was widely misunderstood in the industry[54] and in 1997 William Jahnke published an article where he explained the misinterpretation.[55] He pointed out that the theory "*focused on the wrong thing*": in fact, investors are not affected by short-term variations in the returns as they are by long-term returns, and using the same data, investment policy explained only 14.6 percent of the long-term total returns Additionally, Jahnke noted that the word "cost" was never mentioned in Brinson's, Hood and Beebower article and concluded his study with a powerful statement: "*[...] for many individual investors, cost is the most important determinant of portfolio performance, not asset allocation policy, market timing or security selection.*" (Jahnke W. (1997)). To give an example of the central role fund's costs have in determining long term returns, consider a net 10 percent return on an equity mutual fund in the 90th percentile for expense ratio, that at 2016 was 2.04%[56], and consider how the return would change if the fund was in the 10th percentile (0.68%). The 10 percent annual return would transform into an 11.36 percent annual return. Table 2.2 shows the cumulative impact of the expense ratio.

[52] With investment policy authors mean asset allocation.
[53] Brinson G, et al. (1986) "Determinants of Portfolio Performance" Financial Analyst Journal
[54] Bogle, J. and Swensen, D. (2010). *Common Sense on Mutual Funds*.
[55] Jahnke W. (1997) "The Asset Allocation Hoax" Financial Analyst Journal
[56] Investment Company Institute

Table 2.2 Cumulative Impact of Fund's Costs on $10.000 Initial Investment

Years	High Cost; 10% Return	Low Cost; 11.36% Return	Difference
10	$ 25.937	$ 29.329	**$ 3.391**
20	$ 67.275	$ 86.017	**$ 18.742**
25	$ 108.347	$ 147.309	**$ 38.962**
30	$ 174.494	$ 252.276	**$ 77.782**
40	$ 452.593	$ 739.893	**$ 287.300**
50	$ 1.173.909	$ 2.170.007	**$ 996.098**

Source: Investment Company Institute

2.2.4 Implication of Incentive Structure in Asset Management

As extensively discussed throughout the chapter, the asset management industry has experienced a profound transformation and has increased in size and complexity. This trend has implications on the agency relationships involved in the delegation of asset management decisions.[57] There are relevant consequences related to the structure of compensation schemes. Paragraph 1.7.2 discussed incentives for fund managers to bear excessive risks when compensated by performance fees; however, these compensations are less frequent in mutual funds than they are in closed-end funds.[58] Indeed, even without performance-related fees, the prevalence of AUM-based fees and the reliance on the performance of the fund relative to a benchmark index, entail incentive for fund managers to continually react to previous fund's performances. Fear of underperforming the benchmark with a negative consequence on cash flows or dismissal from the position, incentivize managers to avoid large deviations from the benchmark. Empirical studies[59] have found evidence concerning two distinct behavioral phenomena: fee waiving and benchmark gaming. The first is the voluntary waive of fees in order to boost the fund net performance and attract investors. The second is the

[57] B.I.S. *Incentive structures in institutional asset management and their implications for the financial market*. March 2003
[58] Bodie, Zvi et al., *Investments*, McGraw-Hill Education, 2018
[59] B.I.S. Incentive structures in institutional asset management and their implications for the financial market. March 2003

tendency of underperforming funds to increase risk as they approach the end of the evaluation period and the opposite tendency, for outperforming fund managers to reduce volatility in the attempt to lock the returns. A further shortcoming of AUM-based fees is that it does not consider diseconomies of scale: performance of funds may decline with the increment of asset under management.[60] Fund manager obtaining compensations proportional to the AUM may have incentives to increase their funds over the efficient amount in terms of returns, acting against the interests of investors.

Using John C. Bogle words: "*Active fund management is theoretically a zero-sum game (for every winner, there must be a loser), and after the substantial costs of investing are deducted, it becomes a loser's game.*" (Bogle, J. and Swensen, D. (2010). *Common Sense on Mutual Funds*). The tendency to deviate the least from the benchmark along with substantial costs of active-management, explains why active funds tend to underperform indexes.

2.3 Smart-Beta ETFs

The ETFs market has evolved in the last decade, increasing the size of asset under management and the variety of products available to investors. A remarkable innovation is the smart-beta ETF, which, differently from standard ETF, apply more active management of the underlying.[61] This type of ETF uses a rules-based system in order to select assets to include in the portfolio. It is a blend of active and passive investing as it tracks a benchmark index but selects only some companies from it based on different factors. The smart beta is an intelligent coefficient that inserts other factors different from market capitalization in the weighting of benchmark indices. There exist several typologies of smart-beta ETF, the main of which are four. The equally-weighted ETF gives the same weight to all stocks in an index, regardless of market capitalization or price. The fundamentally weighted ETF selects, and weights stocks based on companies' fundamentals. The factor-based ETF weights stocks based on specific factors such as balance sheet components,

[60] Beckers, S, and Vaughn, G (2001), Small is beautiful, Journal of Portfolio Management, vol. 27(4), pp 9-17.
[61] Borsa Italiana, Cosa sono gli ETF Smart Beta

underpriced valuations, or smaller companies that are growing.[62] Finally, low volatility ETF takes into account the historic price fluctuations of stock and select only those with low volatility. Smart beta ETFs are more expensive than common ETFs but still much cheaper than an actively-managed fund.

These investment vehicles may be a revolution in the asset management industry: they guarantee a certain degree of flexibility while choosing assets and their volatility including risk-based approaches and they cost less than a normal active fund. However, they are not free from negative aspects including the possibility of underperforming the benchmark as they are continuously traded, the possible presence of high liquidity risk due to low trading volumes and the higher than average fees that some smart-beta ETFs may have as a consequence of the transaction costs incurred in the frequent trading of securities necessary to guarantee the compliance of the fund with its specific rules.

[62] Investopedia. Smart Beta ETF [online] Available at: https://www.investopedia.com/terms/s/smart-beta-etf.asp.

Chapter 3 - Empirical Analysis of Mutual Funds' Performance

3.1 Introduction

A fundamental problem in portfolio management is related to the attempt of predicting future performances of investment companies based on performances over a given period of time. As previously mentioned, the concept of performance cannot be uniquely identified in the mean of the returns over a time span, but it has to concern their distribution i.e. the volatility. Performance measurements should quantify the increase in the fund's asset value and the amount of risk the fund manager has taken in order to provide investors with a given rate of return. Developments in the theory of capital asset pricing[63] occurred during the 1960s, provided a basis to formulate portfolio's performance measures which consider dimensions of risk and return. This chapter presents an empirical analysis of the risk-adjusted performances of 48 actively-managed mutual funds in a 15-years period between 2002 and 2016. The performance of mutual funds is compared with benchmark indices and with 6 corresponding index funds and ETFs in order to provide an empirical insight into the active-passive debate. Paragraph 3.2 outlines the funds' sample, listing all funds by their names and tickers, defining their size category and strategy. Paragraph 3.3 is dedicated to explaining the methodology through which the empirical assessment of performance is carried out. Finally, paragraph 3.4 presents the outcome of the research, describing and evaluating the findings. The final aim of the research is to find the necessary evidence to be able to give an answer to the fundamental problem at the basis of this thesis: whether U.S. actively-managed equity mutual funds are able, in the long run, to outperform passive funds tracking their benchmark indices. Furthermore, the research evaluates important features of outperforming funds and tries to extrapolate factors contributing to their success.

[63] In particular the formulation of the Capital Asset Pricing Model by Sharpe, Lintner and Treynor

3.2 Data Description

The analysis is based on a statistical sample of 48 actively-managed U.S. equity mutual funds, 3 index funds and 3 ETFs, whose data related to net asset value and dividends were retrieved from Bloomberg Professional. The performance of these funds is analyzed in the period 2002-2016, which comprises the end of the dot-com bear market, the 2008 financial crisis and two bull markets, the second (in chronological order - i.e., 2009-2016) of which has been the longest in history at the time of writing. Equity mutual funds may be characterized with respect to two distinct features: the market capitalization of the companies they hold shares of, and the strategy the employ. The first category generally divides equity mutual funds into small-cap funds, mid-cap funds and large-cap funds. The second category divides the strategies of funds into value investing[64], growth investing[65] and a blend of the previous two. The 48 actively-managed equity mutual funds considered in this research are divided as shown in table 3.1.

Table 3.1 Distribution of the Sample of Mutual Funds into the Categories of Size and Strategy.

	Value	Blend	Growth
Small-Cap	1	6	8
Mid-Cap	1	1	7
Large-Cap	2	8	14

The number of small, mid and large-cap funds is chosen with respect to data from S&P Global[66] concerning the total number of U.S. equity mutual funds

[64] Value investing is an investment strategy in which stocks are selected if they are priced at less than their intrinsic, or book, values, which is determined by fundamental analysis. Stocks are bought at a significant margin of safety - the difference between price and intrinsic value.
[65] Growth investing is an investment strategy that seeks to invest in companies with growth potential. It is conceived as the opposite of value investing as managers generally pay more than the value of the company due to its great potentials.
[66] SPIVA Report 2017

into the three size categories, maintaining the same percentages; on the other hand, the distribution of value, blend and growth funds among the size categories is randomly determined. Each size category is matched with an appropriate benchmark index, used for the measurement of performance. Small-cap funds are compared to the Standard and Poor's Small Cap 600 Index (SML); mid-cap funds are compared with the Russell Midcap Index (RMCC); large-cap funds are compared with the Standard and Poor's 500 Index (SPX). In addition, data from actively-managed funds are compared with the proper index fund and ETF.[67]

Table A.1, in the appendix, summarizes actively-managed funds employed in the analysis and matches them with their reference index.

Additionally, the research provides data from 3 index funds: the Principal SmallCap S&P 600 Index Fund, the Vanguard Mid-cap Index Fund and the Vanguard 500 Index Fund. It also presents data concerning 3 ETFs: the iShares Core S&P Small-Cap ETF, the iShares Russell Mid-Cap ETF, and the iShares Core S&P 500 ETF. Each of these funds is examined in terms of risk-adjusted performance, as it is done for active funds. In table A.1.1 in the Appendix, a detailed summary of passive funds is provided.

3.3 Methodology

The empirical analysis of the performance of mutual funds is carried out through the assessment of results concerning the conventional measures of portfolio performance mentioned in par. 1.5 and through an econometric analysis of "active factors" of mutual funds, performed using the model of linear regression developed by Michael C. Jensen in 1968 and the model of non-linear regression by Treynor and Mazuy (1966). The empirical evaluation will be mainly devoted to shaping trends in performances of mutual funds and the relation of those with funds' expense ratios, with the coefficient of correlation with the benchmark index, and with other relevant characteristics of funds affecting their risk-adjusted returns.

[67] One index fund and one ETF for every benchmark index.

The purpose of the analysis is not an absolute evaluation of funds' performances but a comparative assessment of the totality of risk- measures with benchmarks and passive funds. In the case of Sharpe ratio, the values of active mutual funds are compared with values from their benchmark indices and of their respective index funds and ETFs. On the other hand, Treynor and information ratios already include the relevant data of benchmarks, therefore they are assessed in absolute terms. In addition to the comparison of risk-adjusted performance measures, the chapter presents two models built to test the statistical significance of the additional return provided by the fund manager thought his active strategy. Data from regression analysis are outlined and results are inspected.

In Chapter 1 a description of the functioning and the significance of the most widely-used risk-adjusted measures are presented; the following two paragraphs introduce the theoretical framework behind the two statistical studies that will be performed later in the chapter.

3.3.1 Jensen's Model

In an article on the Journal of Finance in 1968, Michael Jensen introduced the concept of alpha, starting from the Capital Asset Pricing Model, developed a few years before by Treynor, Sharpe and Lintner. The pricing model was constructed on several assumptions: investors are risk-averse, they have identical decision horizons and homogeneous expectations on investment opportunities, they can only choose among portfolios based only on expected returns and the variance of returns, there are no transactions costs or taxes and assets are infinitely divisible.[68] Considering the additional assumption of equilibrium in capital markets, the model predicts the expected return for portfolio *p* with the following equation:

$$E(\widetilde{R_{p,t}}) = R_{f,t} + \beta_p \left[E\left(\widetilde{R_{M,t}} - R_{f,t}\right)\right] \qquad (3.1)$$

[68] Jensen M. (1968) The Performance of Mutual Funds in the Period 1945-1964. The Journal of Finance.

where the tilde denotes the variable is random, $R_{f,t}$ is the risk-free rate, considered constant, β_p is the regression coefficient indicating the systematic risk of the portfolio and is calculated as $\frac{cov\ (\widetilde{R_p}, \widetilde{R_M})}{\sigma^2\ (\widetilde{R_M})}$ and $E(\widetilde{R_{M,t}})$ is the expected return on a market portfolio or benchmark index.

Jensen considers $\widetilde{R_{p,t}} = E(\widetilde{R_{p,t}}) + \beta_p \widetilde{\pi_t} + \widetilde{e_{p,t}}$ and $\widetilde{R_{M,t}} = E(\widetilde{R_{M,t}}) + \widetilde{\pi_t}$ in which $\widetilde{\pi_t}$ is an unobservable market factor that affects the return of the portfolio and $\widetilde{e_{p,t}}$ is a random error term; both variables are independently normally distributed variables with zero expected value and zero covariance. Elaborating the CAPM following the previously mentioned assumptions, Jensen formulated an ultimate model, which includes an additional consideration: fund managers may have abnormal forecasting abilities that enable them to select overperforming securities. In order to adapt the model to this characteristic, Jensen do not constrain the estimated linear regression to pass through the origin, generating an intercept, defined as the Jensen's α, whose positive sign indicates the incremental return above the one predicted by the asset pricing model, purely generated by the stock selection ability of the manager. A negative Jensen's alpha, on the other hand, indicated the manager poorly performed in the stock picking process.

$$\widetilde{R_{p,t}} - R_{f,t} = \alpha_p + \beta_p \left[\widetilde{R_{M,t}} - R_{f,t} \right] + \widetilde{u_{p,t}} \qquad (3.2)$$

3.3.2 Treynor and Mazuy Model

In the first paragraph of this thesis, the market-timing strategy is defined as speculative. In fact, it relies on the prediction of future trends in the stock market, which depends on an enormous number of variables. Fund managers, however, often perform market-timing strategies, in the attempt to choose the right moment to invest. The structure of the fund's portfolio is influenced by predictions about the stock market movements: the aim of this strategy is to have a β_p greater than 1 – an aggressive portfolio – in periods of bull market, and a β_p smaller than 1 – a cautious portfolio – when the stock market is

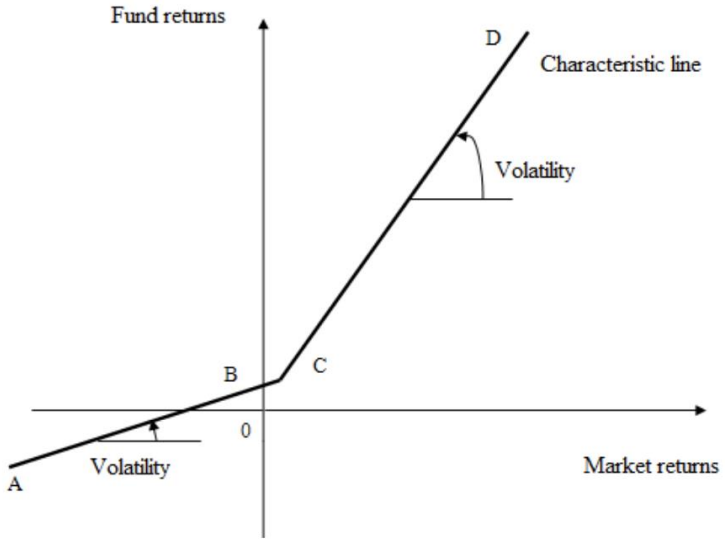
bearish.[69] In 1966, economists Jack L. Treynor and Kay K. Mazuy, published an article[70] in which they outlined a model to evaluate the ability of funds' managers in market-timing. The paper by Treynor and Mazuy discussed the methodology for testing the presence of market-timing ability in an investment fund, but did not formulate a quantitative model, which was later developed by other researchers on the basis of the CAPM.[71] The derived equation has the following form:

$$\widetilde{R_{p,t}} - R_{f,t} = \alpha_p + \beta_p \left[\widetilde{R_{M,t}} - R_{f,t} \right] + \gamma_p \left[\widetilde{R_{M,t}} - R_{f,t} \right]^2 + \widetilde{u_{p,t}} \qquad (3.3)$$

Variables and coefficients are the same as those in Jensen's model, the additional part, $\gamma_p \left[\widetilde{R_{M,t}} - R_{f,t} \right]^2$, defines the market-timing ability. The inclusion of the squared market premium functions as an indicator of the convexity of the regression curve. If the coefficient γ_p has a positive sign, the curve is convex, and the manager adopted a low β_p strategy in periods of negative returns and high β_p in periods of positive returns. If the coefficient γ_p has a negative sign, the curve is concave and the manager failed to perform an efficient market-timing strategy, consuming the returns of the fund. In their article, Treynor and Mazuy provided an illustration that clarifies the functioning of the model. (Figure 3.1) It displays how the slope β_p of the characteristic line should vary relatively to changes in market returns, in order to construct an efficient market-timing strategy. The figure considers only two distinct situations, generating a kinked curve, with two different slopes; however, the more the graph is segmented, the more changes in portfolio aggressiveness are done to adapt to stock market movements and the more the graph resembles a curve.

[69] Prigent, J-L. (2007), Portfolio Optimization and Performance Analysis, Chapman & Hall/CRC, Financial Mathematics Series.
[70] Treynor, J. L. and Mazuy, K. K. (1966), Can Mutual Funds Outguess the Market?, Harvard Business Review, 45, pp. 131-136.
[71] Škrinjarić, T. (2013), Market Timing Ability of Mutual Funds with Tests Applied on Several Croatian Funds.

Figure 3.1 The characteristic line of a fund with an efficient market-timing



Source: Treynor and Mazuy (1966)

Considering the linear regression (3.2) and the nonlinear regression (3.3), to understand the meaning of alphas, it is necessary to construct a two-tailed test. The test is formulated with the following configuration:

$$H_0 : \alpha_p = \mathbf{0}$$
$$H_1 : \alpha_p \neq \mathbf{0}$$

If H_0 it is rejected, the test proved the statistical significance of α_p with a 95% level of confidence. The crucial phase is the identification of the t-statistic which is defined as $t_p = \frac{(\bar{\alpha}_p - \alpha_{H_0})}{SE\ (\bar{\alpha}_p)}$ and whose critical value for the two tailed test, with 14 degrees of freedom and 95% level of significance is $t_c = 2.\mathbf{145}$. If the $|t_p| > t_c$ the null hypothesis is rejected which means the fund either present a statistically significant positive alpha or a statistically significant negative alpha. The identical procedure is done to verify the statistical significance of gammas in regression 3.3.

3.4 Empirical Evidence and Results

Table 3.2 Summary Statistics of Actively-Managed Mutual Funds

Fund	Mean Return Fund*	Mean Return Index*	St. Deviation Fund	St. Deviation Index	Sharpe Fund	Sharpe Index
ACEHX US	0.0583	0.0669	0.1797	0.1816	0.2553	0.3003
ALMRX US	0.0549	0.0948	0.2829	0.2153	0.1503	0.3828
AMCGX US	0.0414	0.0948	0.2788	0.2153	0.1042	0.3828
AMCIX US	0.0636	0.1013	0.3070	0.1966	0.1669	0.4522
BUFEX US	0.0624	0.0669	0.2194	0.1816	0.2278	0.3003
CCAFX US	0.0507	0.0948	0.1999	0.2153	0.1915	0.3828
CFIMX US	0.0551	0.0669	0.1988	0.1816	0.2150	0.3003
CMSCX US	0.0804	0.1013	0.2409	0.1966	0.2823	0.4522
DGAGX US	0.0692	0.0669	0.1621	0.1816	0.3507	0.3003
DRIPX US	0.0503	0.0669	0.1457	0.1816	0.2603	0.3003
DRMCX US	0.0675	0.0948	0.2274	0.2153	0.2421	0.3828
DTGRX US	0.0526	0.0669	0.2742	0.1816	0.1466	0.3003
DTLGX US	0.0551	0.0669	0.1929	0.1816	0.2212	0.3003
DTMGX US	0.0459	0.0669	0.1432	0.1816	0.2340	0.3003
EGWAX US	0.0628	0.1013	0.2367	0.1966	0.2129	0.4522
EILGX US	0.0744	0.0669	0.1707	0.1816	0.3631	0.3003
ETEGX US	0.0602	0.1013	0.2253	0.1966	0.2124	0.4522
FDCPX US	0.0610	0.0669	0.3389	0.1816	0.1435	0.3003
FDFAX US	0.0932	0.0669	0.1218	0.1816	0.6633	0.3003
FMAGX US	0.0461	0.0669	0.2252	0.1816	0.1497	0.3003
FMCSX US	0.0719	0.0948	0.2418	0.2153	0.2460	0.3828
FNPIX US	-0.0081	0.0669	0.3247	0.1816	-0.0632	0.3003
FSCHX US	0.1265	0.0669	0.2545	0.1816	0.4485	0.3003
FSLCX US	0.0808	0.1013	0.2504	0.1966	0.2733	0.4522
FSNGX US	0.0613	0.0669	0.3302	0.1816	0.1482	0.3003
FSPTX US	0.0747	0.0669	0.3403	0.1816	0.1831	0.3003
GGEYX US	0.0542	0.0669	0.2151	0.1816	0.1941	0.3003
GPSCX US	0.0889	0.1013	0.2229	0.1966	0.3431	0.4522
GVEQX US	0.0546	0.0669	0.1744	0.1816	0.2418	0.3003
GWETX US	0.0678	0.1013	0.2154	0.1966	0.2572	0.4522
HAGAX US	0.0885	0.0948	0.2098	0.2153	0.3629	0.3828
JAMEX US	0.0503	0.0669	0.1691	0.1816	0.2239	0.3003
JPDEX US	0.0656	0.0669	0.1912	0.1816	0.2783	0.3003
KTCAX US	0.0434	0.0669	0.2681	0.1816	0.1157	0.3003
NCGFX US	0.0523	0.0669	0.1828	0.1816	0.2182	0.3003
NOSGX US	0.1033	0.1013	0.1810	0.1966	0.5022	0.4522
OPOCX US	0.0669	0.1013	0.2240	0.1966	0.2431	0.4522
OTCAX US	0.0272	0.0948	0.2706	0.2153	0.0547	0.3828
PBFDX US	0.0483	0.0669	0.1660	0.1816	0.2164	0.3003
PDFDX US	0.0598	0.1013	0.3277	0.1966	0.1448	0.4522
RSEGX US	0.0602	0.1013	0.2766	0.1966	0.1729	0.4522
RYVPX US	0.1003	0.0948	0.2753	0.2153	0.3193	0.3828
SSCTX US	0.0678	0.1013	0.2318	0.1966	0.2389	0.4522
TRSSX US	0.1010	0.1013	0.2058	0.1966	0.4304	0.4522
UMLGX US	0.0563	0.0669	0.2490	0.1816	0.1761	0.3003
VLIFX US	0.0407	0.0948	0.1984	0.2153	0.1426	0.3828
WAAEX US	0.0686	0.1013	0.2271	0.1966	0.2473	0.4522
WMICX US	0.0750	0.1013	0.2545	0.1966	0.2459	0.4522
MEAN	0.0636	0.0829	0.2302	0.1926	0.2375	0.3632
MEDIAN	0.0612	0.0809	0.2252	0.1891	0.2258	0.3415
HIGHEST	0.1265	0.1013	0.3403	0.2153	0.6633	0.4522
LOWEST	-0.0081	0.0669	0.1218	0.1816	-0.0632	0.3003

* Geometric average of the annual rate of return.

Note: the Sharpe Ratio is calculated as $S_p = \frac{r_p - r_f}{\sigma_p}$ and the risk-free rate is the average annualized rate of the U.S. 3 months Treasury bill in the period 2002-2016 (1.24%).

Source: Bloomberg

Table 3.2 presents the statistics related to the sample of actively-managed funds. In particular, it displays the geometric average of returns and the

standard deviation of returns for funds and their benchmark indices, as well as the Sharpe ratios. The first and most important consideration to be made is related to the percentage of actively-managed mutual funds that have outperformed the benchmark index in terms of absolute return: only 7 funds out of 48 – equivalent to the 14.6 percent – present an average rate of return, for the period 2002-2016, higher than the one of the benchmark. The average difference of returns between funds and indices is a negative 193 basis points. Considering the comparison of the most relevant measure of risk-adjusted return – the Sharpe ratio – between funds and indices, the previous percentage becomes even smaller. Among the 7 funds outperforming the benchmark in terms of average rate of return, two present a particularly large standard deviation of returns: the Fidelity ® Select Technology Portfolio, which yielded a mean annual return of 7.47%, shows a volatility of 34.03% (almost the double of the standard deviation of the S&P 500 index) and the Royce Smaller-Companies Growth Fund, whose NAV grew at an average of 55 basis points more than its reference index, has a higher volatility than the index and a lower Sharpe ratio – 31.93% against 38.28%. The Carillon Eagle Mid Cap Growth Fund, on the other hand, although averaging a rate of return lower than its benchmark, has a higher Sharpe ratio. The percentage of actively-managed mutual funds outperforming their benchmarks, therefore, drops to 12.5 percent if the risk is included in measurements. The relevance of the adjustment for risk is evident also if one looks at the best fund of the sample in terms of performance. Considering the pure rate of return, the Fidelity ® Select Chemical Portfolio holds the record with a 12.65% average annual return between 2002 and 2016; however the Fidelity ® Select Consumer Staples Portfolio presents a higher Sharpe ratio (66.33% versus 44.85%) due to an impressively low standard deviation.

These results highlight the general underperformance of actively-managed funds and relate to the description of the evolution of the asset management industry carried out in the previous chapter. Passive investing is becoming more popular in recent decades, and the outcome of this research gives an explanation of this phenomenon. Next table (3.3) summarizes the main statistics for passive funds – i.e. index and exchange-traded – in the same period in which actively-managed funds are analyzed. These funds closely

replicate the performance of the market index, yielding an average return slightly lower than the benchmark, but in some cases (iShares Core S&P 500 ETF) presenting a higher Sharpe ratio due to lower volatility. ETFs show higher returns than index funds in all three size categories as a result of lower expense ratios. The outcome from the comparison between actively-managed funds and benchmarks is confirmed in the case of a direct contraposition of active and passive funds, the only exception concerns the T. Rowe Price Institutional Small-Cap Stock Fund, which averaged a return lower than the benchmark but higher than the corresponding index fund, however, its Sharpe ratio is lower than the one of the Principal SmallCap S&P 600 Index Fund.

Table 3.3 Summary Statistics of Index Funds and ETFs

Fund	Mean Return Fund*	Mean Return Index*	St. Deviation Fund	St. Deviation Index	Sharpe Fund	Sharpe Index
PSSIX US	0.0985	0.1013	0.1954	0.1966	0.4407	0.4522
IJR US	0.1012	0.1013	0.1971	0.1966	0.4503	0.4522
VMCIX US	0.0925	0.0948	0.2092	0.2153	0.3828	0.3828
IWR US	0.0935	0.0948	0.2153	0.2153	0.3765	0.3828
VFINX US	0.0657	0.0669	0.1813	0.1816	0.2941	0.3002
IVV US	0.0668	0.0669	0.1806	0.1816	0.3011	0.3002
MEAN	0.0864	0.0877	0.1965	0.1979	0.3743	0.3784
MEDIAN	0.0930	0.0948	0.1962	0.1966	0.3796	0.3828
HIGHEST	0.1012	0.1013	0.1013	0.2153	0.2153	0.2153
LOWEST	0.0657	0.0669	0.1806	0.1816	0.2941	0.3002

* Geometric average of the annual rate of return.

Note: funds are paired by size category in ascending order. The first of the pair is an index fund and the second is an ETF. The Sharpe Ratio is calculated as $S_p = \frac{r_p - r_f}{\sigma_p}$ and the risk-free rate is the average annualized rate of the U.S. 3 months Treasury bill in the period 2002-2016. (1.24%)

Source: Bloomberg

Further confirmation of the achieved results is provided by the analysis of two relevant risk-adjusted measures of portfolio performance: the Treynor ratio and the information ratio. As said in chapter 1, the Treynor ratio ranks the performance of mutual funds based on a systematic risk criterion, dividing the mean excess return of the fund over a risk-free asset by the systematic risk of the portfolio (β_p); on the other hand, the information ratio measures the active return of the fund adjusting it by the risk taken, considered as the deviation from the benchmark (TEV). Therefore, the Treynor ratio of a fund must be

compared to the excess return of its reference index over the risk-free rate, while the information ratio is assessed with an ordering criterion and more importantly looking at the sign of the ratio.

Table 3.4 Treynor Ratio and Information Ratio

Fund	Information Ratio	Treynor Ratio	Fund	Information Ratio	Treynor Ratio
ACEHX US	-0.1406	0.0491	FSNGX US	-0.0216	0.0419
ALMRX US	-0.3501	0.0347	FSPTX US	0.0371	0.0385
AMCGX US	-0.4803	0.0239	GGEYX US	-0.1728	0.0373
AMCIX US	-0.2323	0.0370	GPSCX US	-0.1423	0.0732
BUFEX US	-0.0604	0.0436	GVEQX US	-0.3778	0.0445
CCAFX US	-0.5402	0.0433	GWETX US	-0.5324	0.0523
CFIMX US	-0.1540	0.0423	HAGAX US	-0.0826	0.0834
CMSCX US	-0.1976	0.0614	JAMEX US	-0.3319	0.0420
DGAGX US	0.0760	0.0725	JPDEX US	-0.0625	0.0508
DRIPX US	-0.3277	0.0430	KTCAX US	-0.1843	0.0231
DRMCX US	-1.0392	0.0544	NCGFX US	-0.5155	0.0400
DTGRX US	-0.1076	0.0293	NOSGX US	0.0408	0.1019
DTLGX US	-0.1961	0.0422	OPOCX US	-0.2938	0.0554
DTMGX US	-0.3316	0.0440	OTCAX US	-0.6350	0.0124
EGWAX US	-0.4254	0.0446	PBFDX US	-0.3187	0.0411
EILGX US	0.1420	0.0636	PDFDX US	-0.2432	0.0313
ETEGX US	-0.3789	0.0469	RSEGX US	-0.3069	0.0379
FDCPX US	-0.0287	0.0298	RYVPX US	0.0470	0.0749
FDFAX US	0.2793	0.1356	SSCTX US	-0.3905	0.0500
FMAGX US	-0.2582	0.0288	TRSSX US	-0.0072	0.0872
FMCSX US	-0.3813	0.0544	UMLGX US	-0.0940	0.0352
FNPIX US	-0.4027	-0.0130	VLIFX US	-0.4323	0.0359
FSCHX US	0.3835	0.0949	WAAEX US	-0.3129	0.0543
FSLCX US	-0.1586	0.0624	WMICX US	-0.2626	0.0517

Source: Bloomberg

Information ratios yield similar results as those given by the average return assessment: 7 funds present a positive ratio, meaning they outperformed their benchmark in terms of pure returns, however, given that the ratio accounts for the excess return of the fund, funds' ranking changes if considering information ratios rather than average returns. The Treynor ratio corrects the imperfection of the Sharpe ratio and adjusts the excess return over the risk-free rate by systematic risk only. To have an overview of the performance of funds using the Treynor ratio, results should be compared with the excess return of indices over the risk-free rate. The Standard and Poor's Small Cap 600 Index presents an 8.89% excess return, the Russell Midcap Index an 8.24% excess return and the Standard and Poor's 500 Index a 5.45% excess return. 7 funds out of 48 outperformed the benchmark according to the Treynor measure.

An important phenomenon that must be mentioned when discussing funds' performance is the survivorship bias. This concept was studied and presented by Stephen J. Brown, among others, in 1992.[72] The bias is the tendency to view the performance of "survived" funds as representative for the whole population, not accounting for liquidated/merged funds. Brown demonstrated that survivorship bias is a "*force that can lead to persistence in performance rankings.*" (Brown et al., 1992). Running 20,000 Monte Carlo simulations, Brown concluded that the bias gives rise to spurious evidence of persistence. Brown assumed that managers have equal skills, and therefore, the probability of being in the 50% best funds or in the 50% worst funds is the same. Considering two consequent periods, he estimated the probability of being a "winner" in the first and in the second period: when there are no cut-offs, the frequency of distribution is almost equal to a randomly generated one, but with 10 or 20 percent cut-off, the probability of persistence rises respectively by 3.5% and 7.35%.[73]

The SPIVA U.S. Year-end 2017 Scorecard provides an overview of equity mutual funds results in a 15-year period accounting for the survivorship bias. According to the research, the percentage of large-cap, mid-cap and small-cap that outperformed their benchmark indices were respectively: 7.67%, 5.19% and 4.27%.[74]

The table below (3.5) presents the summary statistics of the frequency of distribution of regression coefficients of Jensen's model (equation 3.2). The risk-free rate is considered constant and its value is the average of the annualized 3-month U.S. Treasury bill rate in the period 2002-2016. The estimated $\hat{\alpha}$ has a mean value of -0.0213, reaching a minimum of -0.1202 and a maximum of 0.0584. The discussion about the meaning of these values is presented later in the paragraph. $\hat{\beta}$ indicates the estimated systematic risk of a fund: it is the ratio between the covariance of the return of the fund with the market return to the variance of the market return. The sample presents an average $\hat{\beta}$ greater than 1, which signifies that, on average, actively-managed funds tend to hold portfolios that are more volatile than the market portfolio

[72] Brown S, et al., Survivorship Bias in Performance Studies, Oxford University Press, 1992.
[73] Data from Table 5 p. 568.
[74] SPIVA U.S. Year-end 2017 Scorecard

(benchmark index). The average $\widehat{r^2}$ is 0.8567, this value implies that generally the regression line (3.2) fits data of most funds reasonably well.

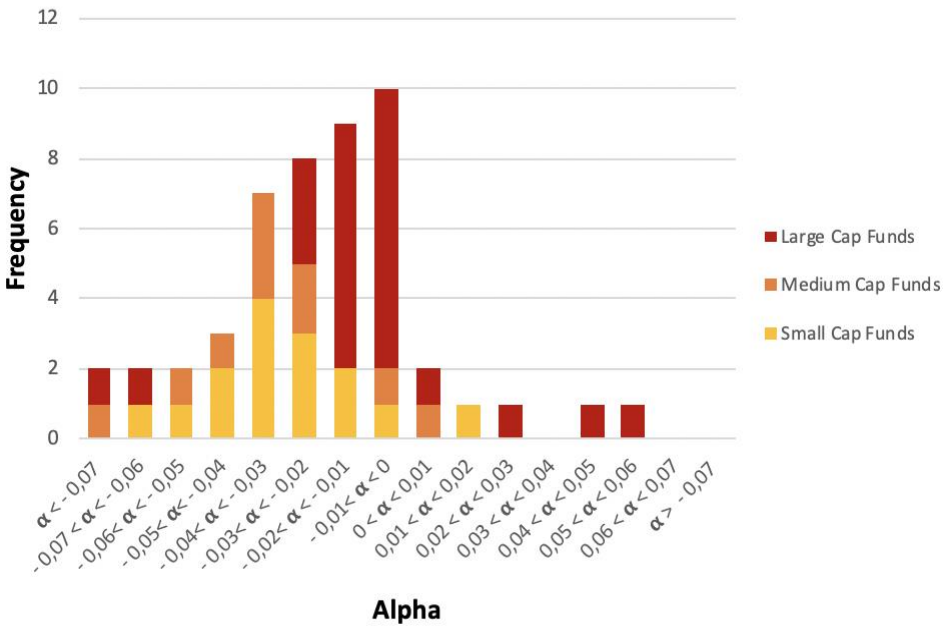
Table 3.5 Summary of Estimated Regression Statistics

			Extreme Values	
Item	**Mean Value**	**Median Value**	**Minimum**	**Maxiumum**
Alpha	-0.0213	-0.0178	-0.1202	0.0584
T-statistic	-0.7650	-0.8796	2.7958	-2.7984
Beta	1.0978	1.0773	0.5953	1.6303
R-squared	0.8567	0.8796	0.9903	0.4122

Source: Bloomberg, Excel Analysis ToolPak

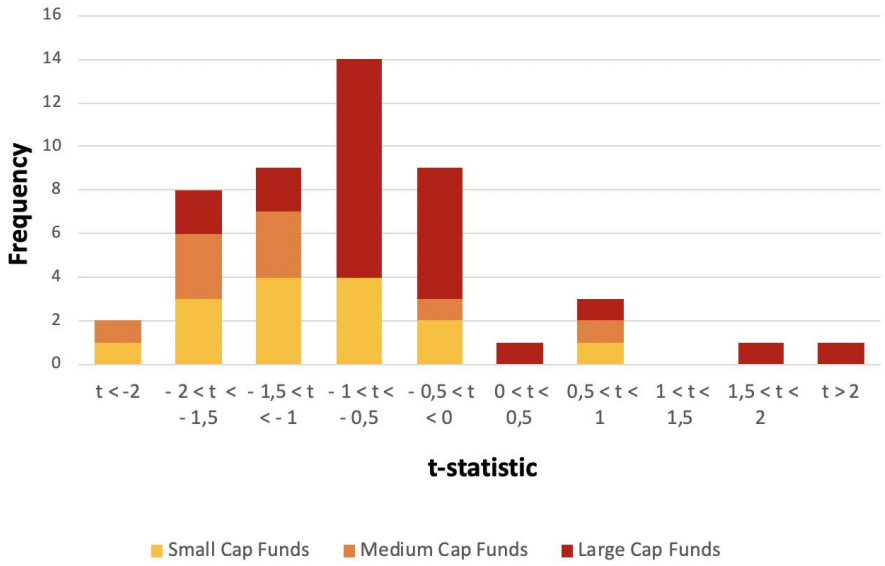
The primary concern with this model is, however, the estimation of funds' Jensen's alphas and their statistical significance. It is important to give an interpretation to the intercept as they provide evidence fund managers ability in stock picking. Table A.2 in the appendix shows the α_p values for the 48 actively-managed mutual funds along with the t-statistic of the $\widehat{\alpha_p}$. The results are summarized in the following graphs.

Figure 3.1 Frequency Distribution of Funds Alphas



Source: Bloomberg, Excel Analysis ToolPak

Figure 3.2 Frequency Distribution of Alphas' T-statistics



Source: Bloomberg, Excel Analysis ToolPak

Funds' alphas are predominantly negative and only 7 funds have a positive intercept. The majority (70.8%) present an $\widehat{\alpha_p}$ between -0,04 and 0. The most remarkable fact is, however, displayed in figure 3.2: only 2 funds present a t-statistic whose absolute value is greater than 2.145, the MFS Mid Cap Growth Fund has a t-statistic of - 2.798, while the Fidelity ® Select Consumer Staples Portfolio has a t-statistic of 2.796. Therefore, the conclusion of this first regression analysis is coherent with what Michael Jensen found in 1968: evidence on actively-managed equity mutual fund performance discussed above shows that the majority of funds in the sample was not able to properly predict security prices in order to outperform the buy-and-hold strategy. Furthermore, there is very little statistical evidence that any individual mutual fund was able to perform significantly better than the market: for 46 funds out of 48 the null hypothesis is not rejected.

The non-linear regression of Treynor and Mazuy model confirms the results obtained by Jensen's model with respect to fund managers security selection ability and includes another regression coefficient that measures the market-timing ability of the mutual fund. The method used to test the significance of regression Table A.3 in the appendix displays the statistics of the regressions

of the 48 actively-managed funds and table 3.6 below exhibits the summary of the frequency of regression coefficients and relevant values.

Table 3.6 Summary of Estimated Regression Statistics (2)

			Extreme Values	
Item	**Mean Value**	**Median Value**	**Minimum**	**Maxiumum**
Alpha T&M	-0.0197	-0.0174	-0.1032	0.0684
T-statistic Alpha	-0.5620	-0.6811	-2.8919	3.3007
Beta T&M	1.1053	1.1005	0.5615	1.7119
Gamma	0.0127	-0.0062	-1.1563	1.3896
T-statistic Gamma	0.0890	0.0906	-3.4415	3.3668
R-squared T&M	0.8661	0.8805	0.4311	0.9950

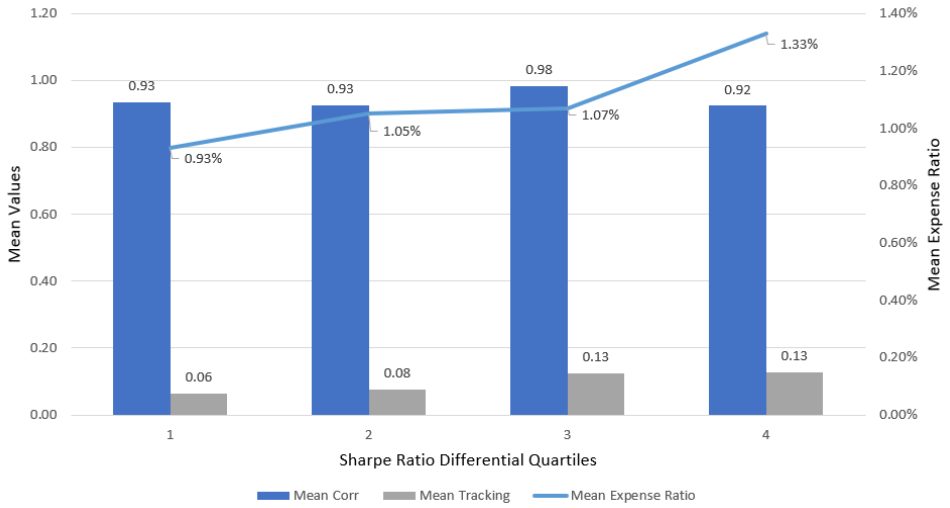
Source: Bloomberg, Excel Analysis ToolPak

The R-squared of the non-linear regression is, as expected, higher than the one of the linear regression, since the polynomial equation fits observed data more precisely. The model confirms the average negative sign of intercepts and their non statistical significance, although values are slightly different, furthermore it reinforces the previous consideration about the higher systematic risk that actively-managed mutual funds, on average, take with respect to the market portfolio. Treynor and Mazuy regression model adds the γ_p term whose sign indicates the convexity of the curve and thus the market-timing ability of the fund manager; the average γ_p has a positive value (0.0127), however, only two funds show statistical significance with respect to their gammas and they correspond to the minimum and maximum values reported in table 3.6. Hence, it can be affirmed that there is no statistical evidence of ability by actively-managed funds to add excess returns through market-timing.

In the figure below, funds are ranked by Sharpe ratio differentials – i.e., the difference between the fund's ratio and the benchmark index ratio.

Figure 3.3 Mean Correlation, TEV and Expense Ratio

Average Values per Sharpe Ratio Differential Quartiles



Source: Bloomberg

Examining the graph two shreds of evidence emerge: firstly, fees play a crucial role in mutual funds' risk-adjusted performance, as theoretically discussed in chapter 1 and 2, and secondly, funds showing a Sharpe ratio differential ranked in the first quartile are those with the lowest average deviation from market returns and with the lowest fees. The exceptions in the orientation of the first quartile are exactly the first two funds – the Fidelity ® Select Consumer Staples Portfolio and the Fidelity ® Select Chemical Portfolio. These funds present characteristics which deviate from the average of their quartile: a β_p largely differing from 1 and a lower than average correlation. The third quartile, on the other hand, has a particular feature: it presents the highest average correlation of returns with the benchmark (0.982) but an especially wide TEV, coherent with the large divergence of funds' β_p from 1. Summarizing, it is notable that, with the exception of the very first two, funds belonging to the first quartile of Sharpe ratio differentials present a performance similar to the one of the benchmarks, slightly worse for the majority of funds. This has two implications: funds do not considerably deviate from the market index – confirmed by an average TEV of 5.4 percent, an average correlation of almost 94 percent and an average β_p of 0.96 – and their minimal overperformance or underperformance is dictated by expenses. In general, as the Sharpe ratio differential decreases, mutual funds present an increment in their "active share" and in the expense ratio. The greater a mutual

fund's active characteristics, the worse its performance (with few, previously mentioned, exceptions). This trend explains the tendency, mentioned in par. 1.7.2, of fund managers to deviate the least from the benchmark index.

Furthermore, when looking at the portfolio composition of the best performing fund of the sample under every performance measurement except for the information ratio – Fidelity ® Select Consumer Staples Portfolio – it can be seen that it is widely oriented towards consumer defensive stocks.

Table 3.7 Fidelity ® Select Consumer Staples Portfolio Composition

	% Stocks	Benchmark*
Cyclical		
Basic Materials	0.35	0.12
Consumer Cyclical	4.37	0.09
Sensitive		
Industrials	0.58	0.18
Technology	0.4	0.15
Defensive		
Consumer Defensive	94.3	99.47

* Morningstar Consumer Defensive Index

Source: morningstar.com

If comparing the performance of the Fidelity ® Select Consumer Staples Portfolio fund with a special category index of consumer defensive, created by Morningstar, the value added by the fund's abilities in stock selection and market timing, along with other actions of portfolio management, is relatively lower than one emerging from a performance comparison with the benchmark index (S&P 500). Therefore, an important factor behind the fund's outperformance has been the industry growth in the same period.

Figure 3.4 Growth of $10.000 Invested at January 1, 2002 in 15 years

Note: the green line is the S&P 500, the orange line is the consumer defensive index and the blue line is the Fidelity ® Select Consumer Staples Portfolio.

Source: morningstar.com

Conclusion

Throughout this thesis, the central point guiding the organization of the analysis was the attempt to determine if, in the long term, U.S. actively-managed mutual funds are able to outperform their passive counterparts and how often does it happen. In order to give an answer to this question, the thesis presented an overview of investment companies, focusing on mutual funds and ETFs, along with conventional measures of risk-adjusted performance in the first chapter. The second chapter described the main trends in the U.S. stock market and in the asset management industry, highlighting the increasing inflow of capital into passive investment vehicles. The final chapter presented an empirical study on a sample of 48 actively-managed equity mutual funds and 6 index funds and ETFs, whose purpose was to give an empirical answer to the research question.

In the research developed in the last chapter, several significant evidences emerged. The first, and most important, shows that only 14.6 percent of the active funds considered in the sample were able to outperform their benchmark indices considering measures of average annual return, information ratio and Treynor ratio; while using the Sharpe ratio measure, this number reduces to 10.4 percent. It is a remarkable result, considering the relevance and popularity of this investment vehicle in the U.S.. The empirical analysis also found no evidence of superior abilities by fund managers to select securities with above-average returns or to apply an efficient market-timing strategy to the turnover of their portfolios: these conclusions emerged from two distinct t-statistic tests applied to a linear regression (Jensen model) and to a nonlinear regression (Treynor and Mazuy model). Two funds presented a performance impressively better than the benchmark index, but it was shown that for best fund of the sample, the abnormal performance had been strongly due to the growth of the sector the fund invests in (consumer defensive). The thesis demonstrated the crucial role that fees have in long-term funds' performances: in particular how a slight increase of expense ratio may weight on fund's returns and how sample funds positioned in the highest quartile of Sharpe ratio differential presented

the lowest average expenses. Furthermore, active management of mutual funds in the U.S. is undergoing a phenomenon of *benchmark gaming,* in which managers tend to deviate the least from the benchmark, as confirmed by measures of correlation and tracking error volatility in the empirical analysis.

Passive equity funds should be considered, therefore, as a superior investment choice for long-term retail investors looking for a remarkable capital appreciation. As shown in the first chapter, stocks are the asset class which yields the higher return and whose volatility tend to decrease over time. However, investing in equity mutual funds in the attempt to outperform the market proves to be inefficient almost 90 percent of the times (95 percent considering the survivorship bias). The research has shown that managers struggle to add value to the portfolio, either by selecting securities or by choosing the right moment to invest the capital; in addition, actively-managed mutual funds present front-end or back-end loads 1 time out of 4[75], another detrimental factor to long-term returns, which is not accounted for in net returns calculations previously made. Among passive alternatives it can be said the right choice depends on investor's preferences: index funds generally present higher fees than ETFs, which, in turn, allowing for the possibility to be traded like common stocks, could incentivize emotion-guided actions such as continuous trading leading to reduced returns by means of transaction costs.

The underperformance of actively-managed mutual funds, along with a tendency to reduce their active approach has paved the way to innovative typologies of investment vehicles. Smart Beta ETFs, for instance, track a benchmark index but allows for a certain degree of activeness in choosing the weights of securities based on certain factors. They constitute a hybrid option between active and passive management and their AUM is growing extremely rapidly[76]: they could represent the turning point in the active-passive debate, being a tailor-made passive investment able to meet the preferences of investors and to guarantee proper tracking of a reference index.

[75] Bloomberg Professional

[76] Morningstar UK. (2019). *What is a Smart Beta ETF?* [online] Available at: http://www.morningstar.co.uk/uk/news/182790/what-is-a-smart-beta-etf.aspx.

Appendix

Table A.1 Actively-Managed Mutual Funds Sample

FUND	TICKET	BENCHMARK	SIZE CATEGORY	STRATEGY CATEGORY
Alger Mid Cap Growth Fund	AMCGX US	RDG	Mid-Cap	Growth
Alger Mid Cap Growth Institutional Fund	ALMRX US	RDG	Mid-Cap	Growth
AllianzGI Micro Cap Fund	AMCIX US	SML	Small-Cap	Growth
AllianzGI Mid-Cap Fund	DRMCX US	RDG	Mid-Cap	Blend
AMG GW&K Small Cap Core Fund	GWETX US	SML	Small-Cap	Blend
Buffalo Large Cap Fund Inc	BUFEX US	SPX	Large-Cap	Value
Calvert Mid-Cap Fund	CCAFX US	RDG	Mid-Cap	Blend
Carillon Eagle Mid Cap Growth Fund	HAGAX US	RDG	Mid-Cap	Growth
Clipper Fund	CFIMX US	SPX	Large-Cap	Growth
Columbia Select Large Cap Growth Fund	UMLGX US	SPX	Large-Cap	Blend
Columbia Small Cap Growth Fund I	CMSCX US	SML	Small-Cap	Blend
Dreyfus Appreciation Fund Inc	DGAGX US	SPX	Large-Cap	Growth
Dreyfus Tax Managed Growth Fund	DTMGX US	SPX	Large-Cap	Value
Dreyfus Technology Growth Fund	DTGRX US	SPX	Large-Cap	Growth
DWS Science and Technology Fund	KTCAX US	SPX	Large-Cap	Growth
Eaton Vance Small-Cap Fund	ETEGX US	SML	Small-Cap	Growth
Eaton Vance-Atlanta Capital Focused Growth Fund	EILGX US	SPX	Large-Cap	Growth
Fidelity Magellan Fund	FMAGX US	SPX	Large-Cap	Blend
Fidelity Mid-Cap Stock Fund	FMCSX US	RDG	Mid-Cap	Blend
Fidelity Select Chemicals Portfolio Fund	FSCHX US	SPX	Large-Cap	Blend
Fidelity Select Computers Portfolio Fund	FDCPX US	SPX	Large-Cap	Blend
Fidelity Select Consumer Staples Portfolio	FDFAX US	SPX	Large-Cap	Growth
Fidelity Select Natural Gas Portfolio Fund	FSNGX US	SPX	Large-Cap	Value
Fidelity Select Technology Portfolio Fund	FSPTX US	SPX	Large-Cap	Growth
Fidelity Small Cap Stock Fund	FSLCX US	SML	Small-Cap	Blend
Government Street Equity Fund	GVEQX US	SPX	Large-Cap	Growth
GuideStone Growth Equity Fund	GGEYX US	SPX	Large-Cap	Growth
Invesco Exchange Fund	ACEHX US	SPX	Large-Cap	Growth
Invesco Oppenheimer Discovery Fund	OPOCX US	SML	Small-Cap	Growth
Jamestown Equity Fund	JAMEX US	SPX	Large-Cap	Growth
JPMorgan Tax Aware Equity Fund	JPDEX US	SPX	Large-Cap	Blend
MFS Mid Cap Growth Fund	OTCAX US	RDG	Mid-Cap	Growth
MP63 Fund	DRIPX US	SPX	Large-Cap	Growth
New Covenant Growth Fund	NCGFX US	SPX	Large-Cap	Growth
Northern Small Cap Value Fund	NOSGX US	SML	Small-Cap	Value
Payson Total Return Fund	PBFDX US	SPX	Large-Cap	Growth
Perkins Discovery Fund	PDFDX US	SML	Small-Cap	Growth
ProFunds Financials UltraSector Fund	FNPIX US	SPX	Large-Cap	Growth
Royce Smaller-Companies Growth Fund	RYVPX US	RDG	Mid-Cap	Blend
T Rowe Price Institutional Small-Cap Stock Fund	TRSSX US	SML	Small-Cap	Growth
Value Line Mid Cap Focused Fund	VLIFX US	RDG	Mid-Cap	Blend
Victory RS Small Cap Equity Fund	GPSCX US	SML	Small-Cap	Growth
Victory RS Small Cap Growth Fund	RSEGX US	SML	Small-Cap	Growth
Virtus Silvant Small-Cap Growth Stock Fund	SSCTX US	SML	Small-Cap	Growth
Wasatch Micro Cap Fund	WMICX US	SML	Small-Cap	Growth
Wasatch Small Cap Growth Fund	WAAEX US	SML	Small-Cap	Growth
Wells Fargo Traditional Small Cap Growth Fund	EGWAX US	SML	Small-Cap	Blend
Wilshire Large Company Growth Portfolio Fund	DTLGX US	SPX	Large-Cap	Blend

Source: Bloomberg

Table A.1.1 Index Funds and ETFs Sample

FUND	TICKER	BENCHMARK	SIZE CATEGORY
Principal SmallCap S&P 600 Index Fund	PSSIX US	SML	Small-Cap
iShares Core S&P Small-Cap ETF	IJR US	SML	Small-Cap
Vanguard 500 Index Fund	VFINX US	SPX	Large-Cap
iShares Core S&P 500 ETF	IVV US	SPX	Large-Cap
Vanguard Mid-Cap Index Fund	VMCIX US	RMC	Mid-Cap
iShares Russel Mid-Cap ETF	IWR US	RMC	Mid-Cap

Source: Bloomberg

Table A.2 Linear Regression Results

Fund	Benchmark	Estimated Alpha	T-Statistic	Estimated Beta	R-Squared
ACEHX US	SPX	-0.0045	-0.2608	0.9338	0.8905
ALMRX US	RMC	-0.0426	-1.4028	1.2270	0.8722
AMCGX US	RMC	-0.0560	-1.9668	1.2177	0.8844
AMCIX US	SML	-0.0579	-1.3214	1.3829	0.7844
BUFEX US	SPX	-0.0084	-0.4113	1.1452	0.8978
CCAFX US	RMC	-0.0350	-1.9181	0.8843	0.9078
CFIMX US	SPX	-0.0071	-0.3242	1.0117	0.8534
CMSCX US	SML	-0.0214	-0.6759	1.1073	0.8169
DGAGX US	SPX	-0.0071	-0.7983	0.7844	0.9551
DRIPX US	SPX	0.0066	0.9118	0.8819	0.9760
DRMCX US	RMC	-0.0262	-1.3342	1.0114	0.9173
DTGRX US	SPX	-0.0217	-0.6556	1.3719	0.8254
DTLGX US	SPX	-0.0099	-0.5758	1.0104	0.9045
DTMGX US	SPX	-0.0105	-0.9851	0.7623	0.9343
EGWAX US	SML	-0.0429	-1.7155	1.1303	0.8816
EILGX US	SPX	-0.0140	-0.8422	0.9750	0.9078
ETEGX US	SML	-0.0353	-1.1185	1.0196	0.7922
FDCPX US	SPX	-0.0160	-0.3345	1.6303	0.7629
FDFAX US	SPX	0.0453	2.7958	0.5953	0.7881
FMAGX US	SPX	-0.0225	-1.0600	1.1725	0.8936
FMCSX US	RMC	-0.0264	-1.6250	1.0946	0.9501
FNPIX US	SPX	-0.0670	-1.5326	1.5829	0.7834
FSCHX US	SPX	0.0584	1.5437	1.2021	0.7357
FSLCX US	SML	-0.0197	-0.5028	1.0967	0.7414
FSNGX US	SPX	0.0211	0.2880	1.1677	0.4122
FSPTX US	SPX	-0.0016	-0.0326	1.6184	0.7455
GGEYX US	SPX	-0.0143	-0.7017	1.1198	0.8932
GPSCX US	SML	-0.0126	-0.4740	1.0447	0.8492
GVEQX US	SPX	-0.0099	-1.2367	0.9480	0.9744
GWETX US	SML	-0.0350	-2.0999	1.0600	0.9365
HAGAX US	RMC	0.0011	0.0512	0.9127	0.8777
JAMEX US	SPX	-0.1202	-0.9767	0.9014	0.9367
JPDEX US	SPX	-0.0034	-0.6194	1.0480	0.9903
KTCAX US	SPX	-0.0295	-0.9179	1.3435	0.8280
NCGFX US	SPX	-0.0140	-1.9910	0.9981	0.9823
NOSGX US	SML	0.0101	0.7371	0.8925	0.9397
OPOCX US	SML	-0.0265	-0.7602	0.9822	0.7434
OTCAX US	RMC	-0.0701	-2.7984	1.1954	0.9050
PBFDX US	SPX	-0.0129	-0.9170	0.8744	0.9142
PDFDX US	SML	-0.0646	-1.5352	1.5134	0.8250
RSEGX US	SML	-0.0487	-1.3054	1.2636	0.8069
RYVPX US	RMC	-0.0040	-0.1204	1.1737	0.8427
SSCTX US	SML	-0.0371	-1.5317	1.1083	0.8841
TRSSX US	SML	-0.0003	-0.0207	1.0159	0.9427
UMLGX US	SPX	-0.0132	-0.4406	1.2468	0.8261
VLIFX US	RMC	-0.0318	-1.0350	0.7890	0.7336
WAAEX US	SML	-0.0291	-0.9381	1.0341	0.8019
WMICX US	SML	-0.0344	-1.2349	1.2098	0.8734

Source: Bloomberg, Excel Analysis Toolpak

Table A.3 Non-linear Regression Results

Fund	Benchmark	Estimated Alpha	T-Statistic	Estimated Beta	Estimated Gamma	T-Statistic2	R-Squared
ACEHX US	SPX	0.0011	0.0438	0.9257	-0.1385	-0.3378	0.8915
ALMRX US	RMC	-0.0351	-0.8886	1.2315	-0.1470	-0.3155	0.8732
AMCGX US	RMC	-0.0509	-1.3710	1.2208	-0.1006	-0.2300	0.8849
AMCIX US	SML	-0.1032	-2.0742	1.2290	1.3143	1.6297	0.8234
BUFEX US	SPX	-0.0255	-0.9161	1.1703	0.4272	0.9086	0.9043
CCAFX US	RMC	-0.0366	-1.5393	0.8833	0.0322	0.1148	0.9080
CFIMX US	SPX	0.0025	0.0815	0.9975	-0.2411	-0.4612	0.8560
CMSCX US	SML	-0.0053	-0.1353	1.1644	-0.4684	0.7435	0.8249
DGAGX US	SPX	0.0052	0.4566	0.7662	-0.3090	-1.5894	0.9629
DRIPX US	SPX	-0.0047	-0.5238	0.8986	0.2837	1.8506	0.9814
DRMCX US	RMC	-0.0338	-1.3323	1.0069	0.1488	0.4968	0.9189
DTGRX US	SPX	-0.0606	-1.3800	1.4289	0.9697	1.3059	0.8471
DTLGX US	SPX	-0.0017	-0.0717	0.9984	-0.2046	-0.5007	0.9065
DTMGX US	SPX	0.0001	0.0070	0.7468	-0.2635	-1.0866	0.9402
EGWAX US	SML	-0.0355	-1.1385	1.1566	-0.2159	-0.4271	0.8833
EILGX US	SPX	-0.0167	-0.7389	0.9788	0.0663	0.1837	0.9081
ETEGX US	SML	-0.0133	-0.3511	1.0972	-0.6373	-1.0362	0.8092
FDCPX US	SPX	-0.0716	1.3212	1.7119	1.3896	1.2981	0.7921
FDFAX US	SPX	0.0684	3.3007	0.5615	-0.5767	-1.6443	0.8271
FMAGX US	SPX	-0.0189	-0.6298	1.1672	-0.0900	-0.1772	0.8939
FMCSX US	RMC	-0.0298	-1.4122	1.0925	0.0675	0.2710	0.9504
FNPIX US	SPX	-0.0721	-1.1654	1.5904	0.1265	0.1209	0.7837
FSCHX US	SPX	0.0603	1.1255	1.1994	-0.0465	0.9600	0.7358
FSLCX US	SML	-0.0016	-0.0323	1.1607	-0.5254	-0.6724	0.7509
FSNGX US	SPX	0.0648	0.6351	1.1037	-1.0904	0.6319	0.4311
FSPTX US	SPX	-0.0467	-0.6903	1.6844	1.1251	0.9833	0.7644
GGEYX US	SPX	-0.0162	-0.5622	1.1226	0.0476	0.0977	0.8933
GPSCX US	SML	-0.0181	-0.5441	1.0245	0.1593	0.2954	0.8503
GVEQX US	SPX	-0.0108	-0.9474	0.9492	0.0209	0.1081	0.9744
GWETX US	SML	-0.0261	-1.2769	1.0915	-0.2597	-0.7848	0.9396
HAGAX US	RMC	0.0014	0.0471	0.9128	-0.0045	-0.0131	0.8777
JAMEX US	SPX	-0.0117	-0.6718	0.9010	-0.0079	-0.0269	0.9367
JPDEX US	SPX	-0.0160	-2.8919	1.0666	0.3156	3.3668	0.9950
KTCAX US	SPX	-0.0537	-1.2118	1.3790	0.6045	0.8058	0.8368
NCGFX US	SPX	-0.0134	-1.3453	0.9972	-0.0153	-0.0911	0.9823
NOSGX US	SML	-0.0014	-0.0856	0.8521	0.3321	1.2728	0.9469
OPOCX US	SML	-0.0222	-0.5085	0.9973	-0.1242	-0.1753	0.7441
OTCAX US	RMC	-0.0742	-2.2716	1.1930	0.0792	0.2058	0.9054
PBFDX US	SPX	-0.0140	-0.7046	0.8760	0.0281	0.0835	0.9142
PDFDX US	SML	-0.0692	-1.3110	1.4976	0.1326	0.1550	0.8254
RSEGX US	SML	-0.0398	-0.8525	1.2953	-0.2607	-0.3449	0.8088
RYVPX US	RMC	-0.0441	-1.1515	1.1497	0.7841	1.7367	0.8743
SSCTX US	SML	-0.0375	-1.2325	1.1070	0.0107	0.0217	0.8841
TRSSX US	SML	0.0069	0.3730	1.0416	-0.2105	-0.6975	0.9449
UMLGX US	SPX	-0.0181	-0.4269	1.2539	0.1222	0.1700	0.8266
VLIFX US	RMC	0.0273	0.9599	0.8243	-1.1563	-3.4415	0.8659
WAAEX US	SML	-0.0066	-0.1782	1.1136	-0.6528	-1.0824	0.8195
WMICX US	SML	-0.0264	-0.7610	1.2379	-0.2311	-0.4112	0.8752

Source: Bloomberg, Excel Analysis Toolpak

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