

MASTER THESIS

Master in International Finance

"Is active management a charade? The shift to passive management and the abolition of an industry"

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ABSTRACT

There is a long-lasting debate about if active management offers better results than passive management (or just "follow the market"). This master thesis aims to take a representative sample of the market and study the performance of the Mutual Fund industry and the performance of the Standard & Poor's 500 over a period of 10 years, analyzing the results of the comparison and explaining them with the objective of opening the eyes of common investors with real data, and ultimately, changing the mindset of the investors.

Knowing that the American mutual fund industry and American ETF industry are the biggest and more efficient worldwide, our work study selects 142 American mutual funds and 145 American ETFs with significant correlation with the Standard & Poor's 500, and the return of the Standard & Poor's 500 from 2008 to 2017, comparing the returns to analyze which one offers a higher return, the Mutual Fund industry or the benchmark.

The analysis focuses on several comparisons, comparing the results of Mutual Funds excluding fees (gross) and including fees (net), and comparing them with the return of the Standard & Poor's 500 (not including dividends) and the Standard & Poor's 500 Total Return (including dividends).

The analysis makes 3 comparisons. The first one compares the average return of the Mutual Funds on a yearly basis, the second one the top performers at the end of the period (2017), and the third one the consistent outperformers on the long term (considering only the ones outperforming the index on a yearly basis).

After the results, our work-study forecasts 5 years the Standard & Poor's 500 in 2 different periods of time (from 2008 to 2012 and from 2013 to 2017) and compare the results with the mutual fund industry returns, with the main objective to see if mutual funds that have beaten the benchmark can be explained statistically.

Once we have all the results, the work-study focuses on explaining if there are psychological factors that might impact investor choices and the rationale or irrationality behind the mindset of the investors, trying to explain their objectives, motivations, behavioral biases, and at the end, their rational or irrational economic and financial behavior.

Finally, our work-study analyzes the decrease in relative terms of the mutual fund industry and the increase in relative terms of the ETF industry (in absolute terms both industries are growing), as well as the possible effects of the impact of robo-advisors and fintechs on the nearer future to this industry.

Lastly, we try to solve the everlasting question, is active management a charade?

And if so, should we abolish it?

CHAPTER 1. WHAT IS ACTIVE MANAGEMENT

Active management is the use of a manager or a team of managers to actively manage funds through qualitative and quantitative research, forecasts, and their own judgment and experience. Active managers try to beat the inflation plus a certain return or to beat the benchmark (for example, the Standard & Poor's 500 index). Unfortunately, it is difficult to achieve for a large majority of active managers.

Fund manager's expertise, experience and skills are very important for this industry. For example, a fund manager that's has extensive experience in the food industry might lead him to invest in undervalued stocks, and as a result, the fund may be able to beat the benchmark returns. By not being compelled to follow specific indexes, active fund managers can obtain better or worse returns than the benchmark, as they have the ability to reduce, increase or terminate exposure to certain stocks, while an ETF just follows the market. Active managers can also mitigate risk by using hedging strategies such as short selling and using derivatives to protect their portfolios.

As a summary, portfolio managers who believe in active management do not follow the efficient market hypothesis. As said by Burton G. Malkiel, "efficient capital markets fully and correctly reflect all relevant information in determining security prices". They believe that is possible to outperform the market and obtain higher returns through strategies that aim to identify mispriced securities.

1.1. MUTUAL FUNDS

A mutual fund is an investment vehicle that consists on a pool of money collected from individual investors for the purpose of investing it in different securities such as stocks, bonds, money market instruments or other assets. Value of the fund can be measured by the net asset value per share (NAVPS), that is calculated by dividing the total value of the securities in the portfolio by the total amount of shares outstanding.

As a general rule, mutual funds have few employees. Analysts help to pick investments and make market research, accountants calculate the fund's net asset value, and the portfolio manager decides in which securities to invest.

Among many others, the main advantages of mutual funds are the diversification (in order to reduce the risk exposure), the economies of scale (the bigger the fund is the lower the relative costs are, such as transaction costs, relative weight of salaries and general costs), the easiness to access the mutual funds (as they are quoted and can be bought and sold easily), and finally, mutual funds are under professional management. The main disadvantages of mutual funds are that mutual

funds pool the money from investors, so every day people are depositing and withdrawing it (to avoid illiquidity, mutual funds need to have enough cash), the fees, the lack of transparency (a certain percentage of investments is not disclosed), and the asymmetric information, as portfolio managers have more information than mutual fund investors, that might lead to manipulate information (for example, comparing the returns of the mutual fund against the Standard & Poor's 500 instead of the Standard & Poor's 500 Total Return).

According to the different typology of securities that mutual fund managers invest in, mutual funds are divided into several categories:

- Fixed income: focuses on investments that pay a fixed rate of return, such as government bonds, corporate bonds or other debt instruments.
- Index funds: fund manager simply buys stocks that correspond with market indexes such as the Standard & Poor's 500 or the Dow Jones.
- Balanced funds: they are also known as "asset allocation funds". Managers in this area invest in both stocks and bonds with the aim of reducing the risk.
- Other categories: money market funds, sector funds, equity funds, alternative funds, smart-beta funds, target-date funds and even funds of funds (buy shares of other funds), among many others.

Investment horizon for the mutual funds can be classified as the short-term, long-term, and medium-term:

- Short-Term Mutual Funds. These funds usually have an investment horizon of 1-3 years.
- Medium Term Mutual Funds. These funds have a longer investment horizon of more than 3 years, typically 5-7 years. Typically, the share of equities in long-term investment horizon portfolios is around 30-70%.
 - 1-5 years for debt funds
 - 3-7 years for equity funds.
- Long-Term Mutual Funds. These funds have the longest investment horizon that can last up to 10-20 years or more. Typically, the share of equities in long-term investment horizon portfolios is around 70-100%.
 - 5-20 years for debt funds
 - 7-20 years for equity funds.

1.1.2. Investment style and strategies

There are different investment styles that a fund manager can follow. Some of them are:

- Active: tries to outperform the market by actively picking out the stocks.
- Growth: seeks out growth stocks with high PE ratios.
- Value: buys "cheap" stocks with low PE ratios and with moat.
- Small Cap: prefers small-cap stocks for their higher growth potential.
- Middle Cap: seeks a trade-off between volatility and return.
- Large Cap: invests only in large cap companies.

Mutual fund managers can follow different investment strategies. Some of them are:

- Top-down investing: fund managers focus on the whole economic situation instead of just one industry. If a fund manager anticipates that the economy will grow sharply, he might buy company stocks of a particular economic sector, and vice versa.
- Fundamental analysis: managers analyze financial information and get the intrinsic value of the company.
- Technical analysis: involves the study of price movement and trading activity by using charts.
- Contrarian investing: chooses assets that are out of favor.
- Dividend investing: managers buy stocks with a strong record of earnings and dividends.

On the other hand, normally mutual fund managers follow the strategic asset allocation & tactical asset allocation. This means that the portfolio is rebalanced to the original allocations when they deviate significantly from the initial settings.

1.2. HEDGE FUNDS

Hedge funds are alternative investment instruments that use investor's money for aggressive strategies to obtain higher returns than the benchmark or to have an absolute return. Managers often use derivatives and leverage in both domestic and international markets in an aggressive way and invest in exotic financial products.

Hedge Funds normally have a higher standard deviation than the benchmark, high salaries of employees and managers, high costs related to fancy financial tools, dependence on the portfolio manager and its sense of the market, as an average hedge funds are more illiquid and riskier.

Depending on the style of each hedge fund manager, the investment horizon can be classified as short-term, long-term, and medium-term funds. Because fewer rules limit the hedge fund managers, and their only goal is to maximize returns, the investment horizon is more flexible, they can take their own decision of holding or selling, or to be long or short according to their own judgement.

1.2.1. Investment style and strategies

Among many others, the main hedge fund strategies are:

- Equity market neutral: merger arbitrage, discretionary thematic, fixed income and convertible arbitrage.
- Fundamental growth: special situations, systematic diversified, fixed income and asset backed.
- Quantitative discretional: multi-strategy.

- Convertible arbitrage: managers will be long on the convertible bond and short the common stock of the same company. Profits will come from the fixed income as well as the short sale of stock.
- Fixed income arbitrage: managers use leverage to buy bonds and fixed income derivatives. This category includes interest rate swap arbitrage, forward yield curve arbitrage and mortgage-backed securities arbitrage.
- Aggressive Growth: most invest in smaller and micro-cap stocks that belongs to technology or bio-tech sectors.
- Emerging Markets: invests in equity or debt of emerging economies that tend to have high inflation and volatility.
- Event-Driven: invests in equities in order to capture price movement generated by anticipated corporate events.
- Global Macro: aims to profit from changes in global economies, for example, shifts in government policies that might impact on the interest rates, currencies, stock or bonds.
- Other ones are risk arbitrage, invest in distressed securities, invest under the speculation of regulation or deregulation, market timing, or invest in high yield securities.

1.3. MUTUAL FUNDS VS HEDGE FUNDS

1.3.1. Tools that Mutual Funds and Hedge Funds use

There are several tools that might be used by portfolio managers. Mutual funds managers use methodologies such as modern portfolio theory, capital market line, discounted cash flows, and forecasting method, among many others. Additionally, hedge funds use special tools, satellites, internal information, and other sophisticated analysis techniques.

Modern Portfolio Theory (MPT): it was introduced by Harry Markowitz in 1952. Until now, it remains as one of the most useful models due to its simplicity. According to the theory, it is possible to draw an "efficient frontier" of optimal portfolios and every different choice that is in this frontier could offer the maximum expected return with a given level of risk, so investor can benefit from diversification by lowering the risk and improving the return. Anything below the efficient frontier will represent lower returns for the same risk or vice versa.

Capital Market Line (CML): it appears in the Capital Asset Pricing Model (CAPM) to depict the rates of return for efficient portfolios subject to the risk level (standard deviation) for a market portfolio and the risk-free rate (it is the tangential point to the risk-free rate).

Discounted cash flows (DCF): it estimates the value of any company or stock by estimating the future cash flows that the company is going to generate, and finally

discounting them. It takes into consideration the revenues growth, costs, margins, industry trends, economic data, company's competitive advantages and costs, among many other variables. DCF can use the WACC methodology, the PV methodology, or any other.

Forecasting method: requires to have a view on future returns, volatility and correlations, as this method is built on expectations. Normally takes into consideration past data and extrapolates it into the future. Statistical techniques allow analysts to place more weight on recent observations, de-emphasize or overemphasize extreme events, and capture the tendency and volatility over the time.

Satellites: hedge fund managers are particularly interested in satellite imagery in order to see activity around mines, ports or plantations before making an investment.

1.3.2. Comparison between Mutual Funds and Hedge Funds

The similarities between mutual funds and hedge funds are several. Some of them are that both are investment vehicles which pool money from various investors with the objective of maximizing returns while being managed by a professional fund manager.

Some of the differences between mutual funds and hedge funds are:

- Paperwork: mutual fund is required to be registered with the regulator, most hedge funds are not.
- Availability: hedge funds are only available to a specific group of qualified investors with certain characteristics (annual income that exceeds 200,000 USD for the past two years or a net worth exceeding 1 million USD), while mutual funds are open to everyone.
- Transparency: mutual funds have to publish their reports. Hedge funds do not have obligation to do any public disclosure of information.
- Fee structure: hedge funds normally charge the "Two and Twenty". In mutual funds fees are normally up to 3%.
- Flexibility: hedge funds are managed much more aggressively than mutual funds, taking speculative positions, using derivatives, short selling of stocks, and leverage. Mutual funds are limited to do so.
- Risk: is higher in hedge funds.
- Self-Investment: the manager of the hedge fund is expected to put some of his own capital in the hedge fund, while in mutual funds is not necessary.
- Liquidity: mutual funds investors can withdraw the money at any time. Hedge fund usually have a "lock-up" provision.

CHAPTER 2: WHAT IS PASSIVE MANAGEMENT

Passive management is a style of management where a fund mirrors a market index. Best example is exchange traded funds (ETF). Followers of passive management believe in the efficient market hypothesis or simply that it is a better option to obtain returns rather than other investment vehicles such us Mutual Funds or Hedge funds. The efficient markets hypothesis maintains that market prices fully reflect all available information, so current stock prices are the best approximation of a company's intrinsic value, and that if there is a misprice, there is no way to identify it.

2.1. EXCHANGE TRADED FUNDS (ETF)

An ETF owns securities such as stocks, bonds, oil futures, gold bars or foreign currency, and divides the ownership of those assets into shares. ETF shareholders have the right to obtain a proportion of interest or dividends, and investors can get the residual value in case the fund gets liquidated or they want to sell the ETF. It can be traded like a common stock, so it tends to be liquid. One of the best characteristics of ETFs is that some of them track the index, and our work-study will be focusing on this specific kind of ETFs. The main benefit is that as there is no active management involved, fees are very low.

Some ETFs are inverse or leveraged. Inverse ETFs track the opposite return of the underlying security, and leveraged ETFs seek to multiply the return of the underlying security.

2.1.1. Understanding the ETFs

Tracking error is the difference between the ETF performance and the index performance. Normally ETF deviate in a certain percentage, because managers do not buy or sell all the securities to track the index, they only buy the ones that represents the index the most in order to avoid excessive costs. The tracking error can be calculated as the annualized standard deviation of the daily return differences between the total return of the fund and the total return of the underlying index. It is produced by the total expense ratio, the rebalance cost, the sampling, the cash delay, the securities lending, and the timing of adjustment its components.

The information ratio shows the outperformance of the portfolio against the returns of the benchmark. It measures a portfolio manager's ability to generate excess returns. The higher the information ratio the better performance. It standardizes the returns by dividing the difference by the standard deviation. It is calculated using the return of the portfolio, the return of the benchmark, and the tracking error. The creation and dissolution of the ETFs is regulated through a mechanism known as creation and redemption. Authorized participants are financial institutions that can create or redeem units of an ETF. They assemble the required portfolio of underlying assets and turns that basket to the fund in exchange for newly created ETF shares. For redemptions, authorized participants return ETF shares to the fund and receive the basket of underlying securities (the value in monetary units).

Among many others, some of the advantages of ETF are that the investors are diversified, that there are no taxes realized until final liquidation (ETF gains can be reinvested in another ETF without the need of paying taxes), or that the fees are very low.

Among many others, some of the disadvantages of ETF are the market risk (as the ETF moves with the market), the high number of ETFs available in the market (causing decision paralysis), the risk of not knowing the tracking error of the ETF, the regular trading that adds costs and reduces the final return, and the liquidity risk (as some ETFs are not as liquid as the biggest ones).

CHAPTER 3: COSTS / FEES

3.1. COSTS OF MUTUAL FUNDS

In mutual funds, fees are classified into two categories: annual operating fees, known as expense ratio, and shareholder fees. The annual fund operating fees are charged as an annual percentage of funds under management, usually ranging from 0,5% to 3%. This fee includes advisory fee, management fee and its administrative costs. The shareholder fees, which come in the form of commissions and redemption fees, are paid directly by shareholders when purchasing or selling the funds. This part is also known as front-end or back-end, the load of a mutual fund. When a mutual fund has a front-end load, fees are assessed when shares are purchased. For a back-end load, mutual fund fees are assessed when an investor sells his shares. Sometimes, however, an investment company offers a no-load mutual fund, which doesn't carry any commission or sales charge.

As our work-study is going to take a sample of the market, we decided to do it as representative as possible. In this sense, the market sample considers only the American Mutual Fund industry, as it is the biggest and more developed worldwide. All data are from 2017.

152 funds will be analyzed (all data has been gathered from the fund information from Morningstar Premium subscription), considering only the ones that fulfills the following restrictions:

- Funds that invest, at least, 50% or more in American stock listed companies
- Funds that invest, at least, 50% or more in the SP500

More reasons for this selection will be stated afterwards. In this specific point, we decided to include both restrictions because if a mutual funds invests worldwide, its fees are going to be likely higher than a mutual fund that invest in SP500 companies. As we want to minimize the distortion of the study, we have deleted those funds that do not fulfil the restrictions.

List of 152 Mutual funds with their annual expense ratio are stated on the Annex I.

As shown in table 1, the average fee is 0,71%, which is in a sense surprising, as conventional wisdom believes that mutual funds fees are normally over 1%. This is very important data, as we will use the average fund fee in order to compare all returns versus the Standard & Poor's 500 returns (instead of going one by one, we will use this average).

	Data
Mode	0,66%
Average	0,71%
Median	0,74%
Low	0,02%
High	2,04%

Table 1: Statistics of Mutual Funds fees, 2017. Source: Own preparation. Data from Morningstar Premium subscription.

The lowest fee is 0,02% and the highest is 2,04%. In table 2 is shown the number of mutual funds and its distribution. Most of the funds (27%) have fees in between 0,8% and 0,99% (which is in line with market perception). It's also interesting to see that only 1,97% of the funds have fees higher than 1,50%.

	Funds	Percentage
0 to 0,19	24	15%
0,2 to 0,29	8	5%
0,3 to 0,39	5	3%
0,4 to 0,49	6	4%
0,5 to 0,59	6	4%
0,6 to 0,69	23	14%
0,7 to 0,79	13	8%
0,8 to 0,99	43	27%
1 to 1,49	28	18%
1,5 to 1,99	2	1%
2 to 2,5	1	1%
TOTAL	159	100%

 Table 2: Distribution of Mutual Funds fees, 2017.

 Source: Own preparation. Data from Morningstar Premium subscription.

In graph 1 is shown the distribution of Mutual Funds fees in 2017, showing a negative skewness (heavier on the right side) and a leptokurtic behavior (positive kurtosis).



Graph 1: Distribution of Mutual Funds fees, 2017. Source: preparation. Data from Morningstar Premium subscription.

Interestingly on the "2017 Investment Company Factbook", written by The Investment Company Institute, it is stated that, literally quoted "Average expenses paid by equity mutual fund investors have fallen substantially over time. For example, on an asset-weighted basis, average expense ratios for equity mutual funds fell from 0.99% in 2000 to 0.63% in 2016", which is very close to the 0,71% we obtain in our work-study, validating the market sample.

In graph 2 is stated the decrease of the fees from 2000 to 2016.



There are different types of mutual funds with different fees. In this sense, and according to a study performed by the "2017 Investment Company Factbook", written by The Investment Company Institute. Results of this study are shown on graph 3, showing

the breakdown of 2016 Mutual Funds fees by category. This is even closer to the result of 0,71% average fee that we have obtained in our work-study, with a difference of just 0,03%.

Equity mutual funds ¹	0.68
Growth	0.71
Sector	0.77
Value	0.70
Blend	0.41
World	0.83

Graph 3: Fees of Mutual Funds. Source: 2017 Investment Company Factbook, ICI.

Why have the fees been steadily reducing since 2000? One of the main reasons is that expense ratios are normally inversely correlated with the assets under management. As the costs of the Mutual funds are fees, accounting, auditing, and salaries, the higher the amount of assets under management, the lesser the fee. As we will analyze later on, the mutual fund industry is a growing industry in terms of numbers of participants and in terms of size. Also, fees have declined due to economies of scale and competition, as investor demand of mutual fund have been steadily increasing for the last 17 years.

3.1.1. The salaries of Mutual Fund's managers

The structure of a mutual fund manager's salary is typically a base salary plus a performance bonus. A 2012 study compiled by Ma, Tang and Gomez reached the conclusion that 75% of mutual fund advisers explicitly receive compensation from fund performance. The top fund managers in the industry have been known to earn between 10 and 25 million USD per year.

There is a significant disparity in the average annual income of mutual fund managers. A survey conducted by Russell Reynolds Associates revealed that fund managers at banks make an average of 140,000 USD, while mutual fund managers at insurance companies make 175,000 USD. Fund managers at brokerage firms make 222,000 USD, and mutual fund companies' mutual fund managers make an average of 436,500 USD. Managers working for large funds make significantly more. However, mutual fund's prospectus often does not state the amounts paid to the fund managers.

3.2. COSTS OF HEDGE FUNDS

Hedge funds differ radically from mutual funds in their fee-structure. Fees paid by investors are higher than in mutual funds. This is one of the reasons why talented money managers decide to open their own hedge funds.

Hedge funds charge an expense ratio and a performance fee, known as "Two and Twenty", a 2% asset management fee and a 20% on the gains generated. Even if the hedge fund manager loses money, he still gets the 2% fee. In some cases, hedge funds can go as far as charging a 50% fee on their performance.

However, there are mechanisms put in place to protect the investors. For example, fee limitations are employed to prevent portfolio managers from getting paid on the same returns twice and taking excess risk. A manager only collects the incentive fee for profits exceeding the fund's previous high. This is called the high-water mark. This means that if a fund looses 5% from its previous high, the manager will not collect the performance fee until he has first made up the 5% loss. As most of the hedge funds do not disclose full fees, and due to the lack of size of the sample, we were not able to analyze significant data to make an average of the costs of hedge funds.

3.2.1. The salaries of Hedge Fund's managers

A hedge fund manager gets paid basically depending on how well he performs (bonuses are explicitly tied to the fund's performance). On the other hand, it is not uncommon for a hedge fund manager with 5 to 10 years of experience to have salaries close to 1 million USD per year. People just starting at a small hedge fund can earn around 70,000 USD plus bonuses based on their performance. As they start to get more senior, salaries and bonuses increase. Compared to mutual fund managers, hedge fund managers earn exorbitant amounts of money.

3.3. COSTS OF ETFS

As our work-study is going to be just a sample of the market, we decided to do it as representative as possible. In this sense, the market sample considers only the American ETF industry, as it is the biggest and more developed worldwide. As shown in graph 4, the American ETF industry represent 73% of total net assets in 2017.



Graph 4: Percentage of ETF. Total worldwide ETF assets: 3,5 trillion. Source: 2017 Investment Company Factbook, ICI.

For our study, 145 ETF will be analyzed (all data has been gathered from the ETF information from Morningstar Premium subscription), considering only the ones that fulfills the following restrictions:

- ETFs that invest, at least, 50% or more in American Stock listed companies
- ETFs that invest, at least, 50% or more in the SP500

List of 145 ETF with their annual expense ratio and the percentage of SP500 correlation are stated on the **Annex II**.

As shown in table 3, the average ETF fee is 0,37%, which confirms that ETFs fees are far away cheaper then Mutual funds fees (almost a 50% in average).

	Data
Mode	0,60%
Average	0,37%
Median	0,38%
Low	0,05%
High	0,76%

Table 3: Statistics of ETF fees, 2017.

Source: Own preparation. Data from Morningstar Premium subscription.

The lowest fee we can find is 0,05% and the highest is 0,76% (which is just a bit higher than the average of the fund fees). The median is almost the same as the average. As shown in table 4, most of the funds (24%) have fees in between 0,05% and 0,19%, and then another 23% of the funds with fees between 0,6% and 0,79%. (which is in line of market perception). 69% of the funds have fees lower than 0,50%, which is in line of the common perception that ETF fees are cheap.

	Funds	Percentage
0 to 0,19	35	24,14%
0,2 to 0,29	21	14,48%
0,3 to 0,39	20	13,79%
0,4 to 0,49	24	16,55%
0,5 to 0,59	7	4,83%
0,6 to 0,69	34	23,45%
0,7 to 0,79	4	2,76%
TOTAL	145	100,00%

Table 4: Distribution of ETF fees, 2017. Source: Own preparation. Data from Morningstar Premium subscription.

In graph 5 is shown the distribution of ETF fees in 2017. Interestingly, there is not a clear distribution pattern, so kurtosis and skewness cannot be studied as easily as in the mutual fund distribution.



Graph 5: Distribution ETF fees, 2017. Source: Own preparation. Data from Morningstar Premium subscription.

According to the "2017 Investment Company Factbook", written by The Investment Company Institute, the expense ratios incurred in ETF investors were 0,52% as the simple average. In our sample the average cost we obtained was 0,37%, which is in between 0,23% and 0,52%. Our data is not as accurate as the previous one of the Mutual Funds, but still in range of other market studies. In any case, both studies indicate that ETF fees are basically and significantly lower than Mutual funds fees.



Graph 6: ETF fees. Source: 2017 Investment Company Factbook, ICI.

3.3.1. The salaries of ETF's managers

ETFs' performance depends on the Tracking error. The lower difference between the market index and ETFs performance prove that the management of this ETF is successful, so the salary of the managers is normally a part of the fund fee.

3.4. IMPACT OF THE COSTS ON LONG TERM RETURNS

At this point is obvious that fees deteriorate investor's return, but we will analyze the effect on the long run. Investment costs in the short time might not seem like a big deal, but on the long term have a huge effect due to the compound effect.

Imagine an investment of 100,000 USD. If the investment has a 6% annual yield with no fees for the next 25 years, investor would have ended up with 430,000 USD. If, on the other hand, there is an annual fee of 2%, investor would have ended up with 260,000 USD. The 2% annual fee would wipe out almost 40% of the value. In graph 7 are shown both scenarios:

Costs can eat away at your investments



Graph 7: Costs and investments.

Different researches on mutual funds have shown that higher-cost funds generally underperform lower-cost funds. This is because the fund managers that are charging these costs have more difficulties at adding enough value to overcome the additional expense. Graph 8 compares the annualized returns of an investment of 10 years, 25% with the cheapest fees and the 25% with the highest fees. Both returns are net of expenses:



Graph 8: Funds with lower costs have outperformed more expensive ones.

Active funds' performance tends to suffer more versus lower-cost funds' performance due to the higher costs. This is according to the study that Sharpe performed. He assumed that, as a whole, this is not because there is something inherently wrong in their financial strategies, but simply because of the laws of arithmetic. For active managers to outperform the market, they have to achieve a return that can overcome their fund expenses, which are much higher than passive funds due to higher management fees, higher trading costs and higher turnover. When passive management is employed, there is no need to expend time or resources on stock selection or market timing.

CHAPTER 4: COMPARISSON BETWEEN ACTIVE AND PASSIVE MANAGEMENT RETURNS

4.1. INTRODUCTION

For this study, we have selected the Standard & Poor's 500 as the benchmark in order to make all comparisons. The Standard & Poor's 500 is an American index quoted in the United States of America composed by the 500 largest companies stock listed on the NYSE or NASDAQ. Public companies such as 3M, Alphabet, American Express or Facebook are part of the Standard & Poor's 500.

On Annex III we can find all Standard & Poor's 500 listed companies as of 2018.

The market capitalization of the index is 23,9 USD trillion (as of December 29th, 2017). The operator of the index is the S&P Dow Jones Indexes. Our study will compare the returns of the funds versus the returns of the Standard & Poor's 500 and the Standard & Poor's 500 Total return (including dividends). For this study, we will use 2 different data:

- Standard & Poor's 500. It only considers the close price of each season.
- SP500 Total Return. It includes the dividend yield.

In graph 9, we can see the evolution of the Standard & Poor's 500 index since the very first data entry, in 1891.

All the data and the close price of each season from 1871 to 2017 is stated on the **Annex IV**.



Graph 9: S&P500 price from 1871 to 2017.

Source: Own preparation. Data from Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated. We will use the Standard & Poor's 500 as we understand that is one of the most efficient indexes worldwide, if not the most one. On the other hand, there are enough funds in order to have a statistically significant market sample and extract valuable information as a proxy of the market.

For the study purpose, we have limited the number of mutual funds of the study (we gather the fund information from Morningstar Premium subscription), so we only have taken the ones that fulfills the following restrictions:

- Funds that invest, at least, 50% or more in American Stock listed companies.
- Funds that invest, at least, 50% or more in the Standard & Poor's 500.

Both restrictions have been chosen due to the following reasons:

- As we want to compare active management versus passive management, and our passive management proxy is the Standard & Poor's 500, we cannot take funds that have most of their investments in other regions such as Asia or Africa, as the results would be completely uncorrelated due to different economic cycle, currency impact, or development of the country or area.
- In this sense, we want to find out if active management can create value to the investor in a sustainable way by investing at least 50% in the Standard & Poor's 500, realizing if the fund managers can find and create value or not.

Once we apply both filters, we have a list of 146 funds, and our study will be focused on the results of those funds.

All the list of the selected funds is attached as Annex VIII, for reference.

Also, all the selected funds are rated by Morningstar from 1 to 5 stars. A brief explanation about this, quoting Morningstar as it is stated on their website:

- Morningstar rates mutual funds and ETFs from 1 to 5 stars based on how well they've performed (after adjusting for risk and accounting for sales charges) in comparison to similar funds and ETFs.
- Within each Morningstar Category, the top 10% of funds and ETFs receive 5 stars and the bottom 10% receive 1 star. Funds and ETFs are rated for up to three time periods-three-, five-, and 10-years and these ratings are combined to produce an overall rating. Funds and ETFs with less than three years of history are not rated.
- Ratings are objective, based entirely on a mathematical evaluation of past performance. They're a useful tool for identifying funds and ETFs worthy of further research but shouldn't be considered buy or sell signals.

Funds are ranked by their Morningstar Risk-Adjusted Return scores and stars are assigned using the following scale:



Graph 10: Distribution of Morningstar stars. Source: Morningstar premium subscription.

4.2. RETURNS FROM 2008 TO 2017

4.2.1. Standard & Poor's 500 return

Our study will be focusing on the returns of the market from 2008 to 2017. The annual returns of those years of the Standard & Poor's 500 are stated in table 5. The average return is 10,39%. We can see in here the impact of the global financial crisis, with a fall of the market of 37% in 2008. The rest of the years the Standard & Poor's 500 had a positive return, all of them double digit, except for the years 2011 and 2015:

	SP500 returns
2008	-37,00%
2009	26,46%
2010	15,06%
2011	2,11%
2012	16,00%
2013	32,39%
2014	13,69%
2015	1,38%
2016	11,96%
2017	21,83%

Table 5: Annual Standard & Poor's 500 returns from 2008 to 2017.

Source: Own preparation. Data from Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

For the study purposes, we will simulate how our investment will behave considering an initial investment of 100 USD. In this sense, it is like using 2008 as the proxy year with a base of a 100. If we consider the initial investment and final result, we will have a return of 125,99%. If we annualize it, we will have a compounded annual return of 9,48%. In this sense, if we consider the initial investment in the Standard & Poor's 500, evolution of our 100 USD investment will be as shown in table 6:

	SP500 100 base
2008	63,00
2009	79,67
2010	91,67
2011	93,60
2012	108,58
2013	143,75
2014	163,43
2015	165,68
2016	185,50
2017	225,99

Table 6: 100 USD invested in the Standard & Poor's 500 evolution from 2008 to 2017.

 Source: Own preparation.

4.2.2. Standard & Poor's 500 total return

The other proxy we will be comparing the results of the funds is the Standard & Poor's 500 Total Return, that includes the dividends. We think that comparing the results of the funds with only the Standard & Poor's 500 will not be accurate, as funds are collecting the dividends from their investments. In this sense, and as the funds are including the dividends collected, the proxy that does the same is the Standard & Poor's 500 Total Return.

Interestingly, most mutual funds compare themselves with the benchmark, but most of them "forget" to include the dividend yield. This is the main reason we are including the Standard & Poor's 500 Total Return in our work-study. The dividend yield of the Standard & Poor's 500 since inception has an average of 4,38%. In this sense, we can see that the dividend yield can highly impact the final return of the investment. All data is shown in Graph 11 (from 1871 to 2015):



Graph 11: Dividend yield of S&P500 from 1871 to 2015. Source: Own preparation. Data from Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

All the dividend annual return data is stated on the Annex V.

As we have analyzed, for the last 20 years dividend yield has been lower than the historical average, and it is nowadays stable around 2%, which is consistent with the increase of the prices. We can easily compare the returns of the Standard & Poor's 500 versus the returns of the Standard & Poor's 500 Total Return. In graph 12 are shown the Standard & Poor's 500 Total Return annual returns from 1970 to 2017. We can see how the return is always greater (as there is impossible to have a negative dividend yield. It can be zero, but never negative), and that, even in some cases, even if the Standard & Poor's 500 Total Return of the Standard & Poor's 500 return was negative, due to the effect of the dividend, the return of the Standard & Poor's 500 Total Return is positive.

All the total annual return data is stated on the Annex VI, for reference.

From 1970 to 2017, the total annual return is shown in graph 12:



Source: Own preparation. Data from Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

In graph 13 is stated the final price of the Standard & Poor's 500 Total Return considering the dividends. We can see that the value is far away higher, due as well to the effect of the compounded return. In 2017 is over 5.000 points, multiplying by more than 2 times from 2007, and almost 4 times since 2008 (impact on the financial markets of the global financial crisis). The Total return quotes from 2008 to 2017 (period of our study) are shown in graph 13:



All the return close prices from 2008 to 2017 are stated on the Annex VII, for reference.

For our study, we will only consider the periods between 2008 and 2017. In this sense, the dividend Yield of the Standard & Poor's 500 for those years are shown in table 7, having an average 2,13% of dividend yield (lower than the historic average of 4,38%).

	SP500 Dividend Yield
2008	3,23%
2009	2,02%
2010	1,83%
2011	2,13%
2012	2,20%
2013	1,94%
2014	1,92%
2015	2,11%
2016	2,03%
2017	1,84%

Table 7: Annual Standard & Poor's 500 dividend yield from 2008 to 2017.

Source: Own preparation. Data from Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

The return of the Standard & Poor's 500 Total Return is shown in table 8, having an average return of 12,51%, higher than the 10,39% average return of the Standard & Poor's 500, which is in line with the aforementioned average of dividend yield of the period:

	SP500 Total Return
2008	-33,77%
2009	28,48%
2010	16,89%
2011	4,24%
2012	18,20%
2013	34,33%
2014	15,61%
2015	3,49%
2016	13,99%
2017	23,67%

Table 8: Annual Standard & Poor's 500 Total Return from 2008 to 2017.

Source: Own preparation. Data from Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

For the study purposes, we will simulate how our investment will behave considering an initial investment of 100 USD. In this sense, it is like using 2018 as the

proxy year with a base of a 100. If we consider initial investment and final result, we will have a return of 177,66%. If annualize it, we will have a compounded annual return of 12,02% (lower than the average return, as it is annualized). Results are stated on table 9.

	SP500 Total Return 100 base
2008	66,23
2009	85,09
2010	99,46
2011	103,68
2012	122,55
2013	164,62
2014	190,32
2015	196,96
2016	224,52
2017	277,66

 Table 9: 100 USD invested in the Standard & Poor's 500 Total Return evolution from 2008 to 2017.

 Source: Own preparation.

As we can clearly see, there is a mayor difference between both calculations. So, as mentioned before, we will compare both with all the results of mutual funds, so we can have a wider range of results and interpretations.

4.2.3. Gross Mutual Funds return (no fees discounted)

For the first part of this work-study, we will consider the average gross return of all mutual funds. This means that we are not deducting the fees they charge on a yearly basis. As shown in table 10, the average return of mutual funds was negative on 2008 and on 2011, meanwhile the remaining years they obtained a positive return, double digit for all years except for 2015.

	AVERAGE
2008	-38,34%
2009	33,32%
2010	15,68%
2011	-0,24%
2012	17,15%
2013	34,81%
2014	11,62%
2015	1,46%
2016	10,48%
2017	23,03%

Table 10: Annual average of Mutual Fund returns from 2008 to 2017. Source: Own preparation. Data from Morningstar Premium subscription. As shown in graph 14, returns of 2009 and 2013 were above 30% return, which is impressive. Later on, we will compare these results with the Standard & Poor's 500 and see if they are as impressive as they seem.



Graph 14: Gross Mutual Funds return average from 2008 to 2017. Source: Own preparation. Data from Morningstar Premium Subscription.

The statistics of all the mutual funds under analysis are stated in table 11. It is important to see the standard deviation, in any case higher than 10%, which means that they are highly correlated and that there is not a huge dispersion, which makes total sense considering the restrictions of our study (focused on the American market and specifically, on the Standard & Poor's 500). On the other hand, we can see extreme values (differences from high and low), due to the different investment philosophies or assets selected. These differences range up to 4.000 basic points (or a 40% difference on the return). But we have to be clear, these are just the extremes, and in most cases, isolated and extravagant returns in both sides of the distribution table, that does not represent the sample at all.

	STD, DEVIATION	MODE	AVERAGE	MEDIAN	HIGH	LOW
2008	4,46%	-41,96%	-38,34%	-37,61%	-22,79%	-50,89%
2009	9,52%	43,25%	33,32%	31,12%	65,96%	12,91%
2010	3,69%	14,45%	15,68%	14,99%	34,80%	9,29%
2011	3,67%	0,32%	-0,24%	0,32%	21,15%	-11,31%
2012	2,94%	15,66%	17,15%	16,83%	29,56%	10,50%
2013	5,21%	32,33%	34,81%	34,45%	48,60%	0,90%
2014	4,06%	8,72%	11,62%	11,51%	34,23%	-7,44%
2015	4.73%	-2.58%	1.46%	1.11%	11.91%	-9.10%
2016	6.21%	15.60%	10.48%	11.88%	29.04%	-2.16%
2017	7,32%	21,79%	23,03%	21,37%	43,83%	4,22%

Table 11: Statistics of Mutual Fund returns from 2008 to 2017.

Source: Own preparation. Data from Morningstar Premium subscription.

For the study purposes, we will simulate how our investment will behave considering an initial investment of 100 USD. In this sense, it is like using 2008 as the proxy year with a base of a 100. If we consider the initial investment and final result, we will have a return of 130,64%. If we annualize it, we will have a compounded annual return of 9,73%. In table 12 are shown the results considering an initial investment of 100 USD in the mutual funds.

	MUTUAL FUNDS100 base
2008	61,66
2009	82,21
2010	95,10
2011	94,87
2012	111,14
2013	149,83
2014	167,24
2015	169,68
2016	187,46
2017	230,64

 Table 12: 100 USD invested in average Mutual Fund return from 2008 to 2017.
 Source: Own preparation. Data from Morningstar Premium subscription.

4.2.4. Net Mutual Funds return (fees discounted)

For the second part of this work-study, we will consider the average net return of all mutual funds. This means that we are deducting the fees they charge on a yearly basis (we decided to deduct the average fee of mutual funds, a 0,71%). Obviously, this will reduce the final return of the mutual funds, and thus, its average. As shown in table 13, average return of mutual funds was negative in 2008 and in 2011, meanwhile the remaining years they obtained a positive return, double digit for all years except for 2015 and 2016, this last one due to the deduction of the fees.

	AVERAGE
2008	-39,04%
2009	32,61%
2010	14,97%
2011	-0,94%
2012	16,44%
2013	34,10%
2014	10,91%
2015	0,75%
2016	9,77%
2017	22,32%

Table 13: Statistics of Net Mutual Fund returns (fees discounted) from 2008 to 2017. Source: Own preparation. Data from Morningstar Premium subscription. In graph 15 we can see the annual return more clearly. Returns of 2009 and 2013 were above 30% return, which is impressive. Later on, we will compare these results with the Standard & Poor's 500 and see if they are so impressive as they seem.



Graph 15: Net Mutual Funds return average from 2008 to 2017. Source: Own preparation. Source from Morningstar Premium Subscription.

In table 14 are stated all statistics of all the mutual funds under analysis. Interpretation is basically the same, what changes is only the impact of the fees (no impact at all on the standard deviation).

	STD, DEVIATION	MODE	AVERAGE	MEDIAN	HIGH	LOW
2008	4,46%	-42,22%	-39,04%	-38,32%	-23,50%	-51,60%
2009	9,52%	25,76%	32,61%	30,41%	65,25%	12,20%
2010	3,69%	13,74%	14,97%	14,28%	34,09%	8,58%
2011	3,67%	-6,89%	-0,94%	-0,39%	20,44%	-12,02%
2012	2,94%	14,95%	16,44%	16,12%	28,85%	9,79%
2013	5,21%	31,62%	34,10%	33,74%	47,89%	0,19%
2014	4,06%	8,01%	10,91%	10,80%	33,52%	-8,15%
2015	4,73%	-3,29%	0,75%	0,40%	11,20%	-9,81%
2016	6,21%	14,89%	9,77%	11,17%	28,33%	-2,87%
2017	7,32%	21,08%	22,32%	20,66%	43,12%	3,51%

 Table 14: Annual average of Net Mutual Fund returns (fees discounted) from 2008 to 2017.

 Source: Own preparation. Data from Morningstar Premium subscription.

For the study purposes, we will simulate how our investment will behave considering an initial investment of 100 USD. In this sense, it is like using 2008 as the proxy year with a base of a 100. If we consider the initial investment and final result, we will have a return of 115,71%. If we annualize it, we will have a compounded annual return of 8,92%. In table 15 are shown the results if we consider an initial investment of 100 USD in Mutual Funds from 2008 to 2017:

	MUTUAL FUNDS100 base
2008	60,96
2009	80,84
2010	92,94
2011	92,06
2012	107,20
2013	143,76
2014	159,45
2015	160,65
2016	176,35
2017	215,71

Table 15: 100 USD invested in average Net Mutual Fund return (fees discounted) from 2008 to 2017. Source: Own preparation. Data from Morningstar Premium subscription.

As we can see, the impact of the fees over this period of time is of around 15 USD at 2017, which compared to the 100 USD investment, represents around a 15% of the total investment.

4.3. METHODOLOGY: AVERAGES

4.3.1. Gross Mutual Fund return VS Standard & Poor's 500 return

First of all, we will analyze the gross return of the mutual funds on a yearly basis and taking the number of funds that have outperformed the market benchmark (Standard & Poor's 500) and the ones that have had a worse performance. In the table 16, the outperformers are stated as "higher return", and the underperformers as "lower return". The first comparison will be comparing the gross results of the mutual funds versus Standard & Poor's 500 (no dividends considered).

As shown in table 16, as the average of all years, only a 46,44% of the funds have outperformed the index. This is less than half. Also, we have detected that in extremely bullish years funds tend to outperform the market, but in bearish markets the funds have a worse performance.

	Lower return	Higher return
2008	63,01%	36,99%
2009	21,92%	78,08%
2010	53,42%	46,58%
2011	85,62%	14,38%
2012	34,93%	65,07%
2013	24,66%	75,34%
2014	81,51%	18,49%
2015	58,22%	41,78%
2016	53,42%	46,58%
2017	58,90%	41,10%
AVERAGE	53,56%	46,44%

Table 16: Comparison of returns between Mutual Funds return and Standard & Poor's 500 from 2008 to 2017. Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

4.3.2. Gross Mutual Fund return VS Standard & Poor's 500 total return

Secondly, we will analyze the gross return of the mutual funds on a yearly basis and taking the number of funds that have outperformed the market benchmark (Standard & Poor's 500 Total Return) and the ones that have had a worse performance. On the table the outperformers are stated as "higher return", and the underperformers as "lower return". In this case, obviously, the number of funds that will outperform the market will be lower, as the Standard & Poor's 500 Total Return is higher than the returns of the Standard & Poor's 500, due to the effect of the dividend yield.

As shown in table 17, as an average of all years, only a 28,84% of the cases the funds have outperformed the index, which is a bit more than 1 out of 4 funds. But there is no doubt that some mutual fund managers can beat the market benchmark. On the following pages we will go deeper into the analysis.

	Lower return	Higher return
2008	89,04%	10,96%
2009	38,36%	61,64%
2010	71,92%	28,08%
2011	95,21%	4,79%
2012	71,23%	28,77%
2013	48,63%	51,37%
2014	92,47%	7,53%
2015	70,55%	29,45%
2016	69,86%	30,14%
2017	64,38%	35,62%
AVERAGE	71,16%	28,84%

Table 17: Comparison of returns between Mutual Funds return and Standard & Poor's 500 Total Return from 2008 to 2017. Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

In the data already shown, we have already detected that less than half of the funds can beat the market not even considering the dividends, and if we consider the dividends, then the amount of fund's managers that can beat the market benchmark is reduced by almost a 50%, to a total of 1 out of 4. But this data has been processed not taking into consideration the fund's fees, that will be deducted from the gross return of the fund. Investor will be charged a specific percentage over his investment, as active management so far is not free. So, if we deduct the fee of the fund, will the number of outperformers change? A priori, answer is as easy as it seems, yes. As the fees will reduce the final return, it will probably reduce the number of funds beating the market. On the following pages we will state, over the period of time of the work-study, the exact number.

4.3.3. Net Mutual Fund return VS Standard & Poor's 500

Methodology will be the same as before, comparing the results of the funds versus the Standard & Poor's 500 and the Standard & Poor's 500 Total Return. But in this case, we will deduct the fee of the fund out of the gross return. We will start with the Standard & Poor's 500, considering fund fees, and thus, reducing annual returns. As shown in table 18, only a 39,32% of the funds now outperform the market (reduced from 46,44% of outperformers when fees were not considered).
	Lower return	Higher return
2008	71,23%	28,77%
2009	30,82%	69,18%
2010	60,96%	39,04%
2011	92,47%	7,53%
2012	48,63%	51,37%
2013	31,51%	68,49%
2014	86,30%	13,70%
2015	62,33%	37,67%
2016	60,27%	39,73%
2017	62,33%	37,67%
AVERAGE	60,68%	39,32%

 Table 18: Comparison of returns between Net Mutual Funds return (fees discounted) and Standard & Poor's 500 from 2008 to 2017.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

4.3.4. Net Mutual Fund return VS Standard & Poor's 500 total return

What if we compare the net mutual fund return against Standard & Poor's 500 Total return? Remember that before, not including fees, outperformers were 28,84%. In table 19 are shown the results when comparing versus the Standard & Poor's 500 Total Return. In this case the average of funds that outperforms the market is 24,52% (from the previous 28,84% of the funds), which is again close to 1 out of 4 funds. Again, we can see how in bearish markets normally mutual funds tend to outperform poorly, and in extremely bullish markets a higher percentage of mutual funds tend to beat the market (at least compared to bearish markets). It is also interesting to see that only in 2009 more than 50% of the mutual funds have a higher return than the benchmark. This means that, after deducting the fees, there are managers that can create real value.

	Lower return	Higher return
2008	93,15%	6,85%
2009	43,15%	56,85%
2010	78,77%	21,23%
2011	97,26%	2,74%
2012	79,45%	20,55%
2013	53,42%	46,58%
2014	94,52%	5,48%
2015	74,66%	25,34%
2016	72,60%	27,40%
2017	67,81%	32,19%
AVERAGE	75,48%	24,52%

 Table 19: Comparison of returns between Net Mutual Funds return (fees discounted) and Standard & Poor's 500 Total Return from 2008 to 2017.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated. But of course, we have been using averages. So, we will continue to study the data and get valuable conclusions about the active management and the passive management

4.4. METHODOLOGY: TOP PERFORMERS

The second methodology that we will use in this work-study is considering which funds have outperformed the market at the end of the period of the study (from year 2008 to year 2017, considering the final value/performance at the end of the period). So instead of working with averages, we will imagine that we are investors that have the option to invest from 2008 to 2017 in a fund (active management), or just in the index (passive management), and see how our investment would mature over those years. And with the final results, we will see in which one we make more money.

In this case, we do not look for consistency (if they beat year by year the Index, but rather if at the end of the period the funds have had made more money than the Index), but only for the final result. As an example, imagine a fund that have been losing money (compared to the index) by -3% in every year, but last year it outperforms the index in a 200%. As long as the final value is higher than the final value of the Standard & Poor's 500 at the end of 2017, it will be considered as an outperformer. Results are shown in table 20, stating the number of funds that have outperformed the benchmark at the end of 2017:

	S&P 500	S&P 500 Total Return
NET - FEES	42/142	5/142
GROSS - NO FEES	78/142	11/142

 Table 20: Comparison of number of Mutual Funds and Net Mutual funds (fees discounted) outperforming the Standard & Poor's

 500 and the Standard & Poor's 500 Total Return at the end of 2017.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

In table 21 are shown the same results, but as percentages of the total number of mutual funds.

	S&P 500	S&P 500 Total Return
NET - FEES	28,77%	3,42%
GROSS - NO FEES	53,42%	7,53%

 Table 21: Percentage of the total number of Mutual Funds and Net Mutual funds (fees discounted) outperforming the Standard & Poor's 500 Total Return at the end of 2017.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated. Let's see the data:

- If we consider gross mutual fund return and Standard & Poor's 500, we see that 53,42% of the funds that outperform the Standard & Poor's 500, which a priori does not make sense with all the previous data. But we have to consider the effect of the dividend compounded from 2008 to 2017. This makes a huge difference. And even taking into consideration this, we realize that only half of the funds obtain better results.
- If we deduct the fees and take the net mutual fund return and compare it with the Standard & Poor's 500, then we can see that the effect of the money paid for active management reduces the investor profitability, and from 78 funds, now only 42 out of 146 outperforms the market, which is a 28,77%.
- If now we consider the effect of the dividends and compare the mutual fund return with the Standard & Poor's 500 Total Return (when compared to the Standard & Poor's 500, as the price of the fund always takes into account the dividend effect in the liquidation value), now only 7,53% outperform the market. And again, without considering the effect of the fees of the funds (gross mutual fund return). If we consider the fee and deduct it, the number of total funds that outperforms the market drops to a total of 5, or a 3,42% of the total (net mutual fund return).



Graph 16: Mutual Funds outperformers return average from 2008 to 2017. Source: Own preparation. Source from Morningstar Premium Subscription.

Now, if we take a closer look to the data, we can see that there are 2 major impacts that reduces the profitability of the funds, or that reduces the number of funds that outperform the Standard & Poor's 500 (at the end of the day, less money for the investors), which are:

- The effect of considering the dividends or not in the Standard & Poor's 500
- The effect of the fees of the mutual funds (gross or net mutual fund return)

So, which one has a greater impact? According to this data, the effect of considering or not considering the fees is around a 50% (so it reduces a 50% the number of funds that outperform the market), and the effect of considering or not the dividend effect of the Standard & Poor's 500 is around 85% (so it reduces 85% the number of funds that outperform the market). As these numbers are shocking, it makes total sense for the funds to always compare with the Standard & Poor's 500, instead of the Standard & Poor's 500 Total Return, that will be the one that they should compare to. But of course, if they compare their returns against the Standard & Poor's 500 Total Return they will show more mediocre results (either less outperformance or greater losses). In this sense, we recommend the fund industry to stop taking advantage of asymmetric information and be completely honest comparing their results with the more transparent system they can find (in this case, the Standard & Poor's 500 Total Return).

List of the fund names in a yearly basis is stated for reference in the Annex IX.

4.5. METHODOLOGY: CONSISTENCY ON THE LONG TERM

The third and last phase of the work-study is to compare the funds that systematically outperform the Standard & Poor's 500 on a yearly basis. In this sense, we compare year by year, starting in 2008. Only the ones that outperform in 2008 will be taken in consideration for the next year. Then, we do the same thing for 2009, 2010, and on until 2017. If a fund does not outperform in one year will not be taken into consideration for the next one. In this sense, accumulated results will be decreasing.

List of the fund names in a yearly basis is stated for reference in the Annex X.

We will also follow the same strategy, first, we will run the study without considering the gross mutual fund return (no fees included), the net result of mutual funds (fees included) versus the Standard & Poor's 500 (with no dividend impact) and with the Standard & Poor's 500 Total Return (with dividend impact).

4.5.1. Gross Mutual Fund return VS Standard & Poor's 500 return & Standard & Poor's 500 total return

In table 22 is shown the comparison both the Standard & Poor's 500 and the Standard & Poor's 500 Total Return against the gross mutual fund return (without considering the fees):

	S&P 500	S&P 500 Total Return
2008	54	16
2009	44	10
2010	38	7
2011	33	5
2012	32	3
2013	32	3
2014	32	1
2015	27	1
2016	26	1
2017	24	1

 Table 22: Total number of Mutual Funds outperforming the Standard & Poor's 500 and the Standard & Poor's 500 Total Return on

 a yearly basis from 2008 to 2017.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

In graph 17 are shown the same results. We can clearly appreciate the difference between the ability of fund managers to create value when compared to the Standard & Poor's and the ability of the fund managers to create value when compared to the when compared to the Standard & Poor's Total Return.



Graph 17: Gross Mutual Funds consistent outperformers from 2008 to 2017. Source: Own preparation. Source from Morningstar Premium Subscription.

As we have analyzed, if we compare both benchmarks with the gross mutual fund return, results are mediocre. First, we would like to analyze the trend and try to explain why this happens, and then we will analyze the total number of funds that systematically outperformed the market all the years (we are fully aware that our study covers a lot of years, and that it is extremely difficult to beat the market for all those years without making mistakes that can lead to a single year of non-performance).

Comparing the fund performance versus the Standard & Poor's 500:

- The trend: we can see during the first 2 years that around a 60% of the funds do not outperform the market. It doesn't matter the year of beginning, this is an effect that keeps happening. After giving great thought about the possible explanation of this effect, only conclusion is that, in general, fund industry is an industry that doesn't work in general terms, and that the immense majority of the funds destroy value for the final investor
- But, if we see from year 3 onwards, number tends to stabilize with minor changes. As we can see, over 5 years in a row, the number of funds that outperform the market falls from 38 to 32, only 6 funds (only a 4,10% of the total funds). In this case the conclusion is clear, this fund managers are the ones that generates real value to the final investor. They have a system that systematically beat the market. Consistently. This 21,9% of the fund managers know what they do. Not considering the fees, they know how to outperform the market. Later on, we will see what happens after they collect their fees. But at this point we can clearly say that there is a reduced number of managers that can find value in securities.

Comparing the fund performance versus the Standard & Poor's 500 Total Return:

- The trend: we can see during the first 2 years that around a 90% of the funds do not outperform the market. Same effect as aforementioned.
- But, if we see from year 3 onwards, same effect happens, with the same conclusion. It just stabilizes.
- But we can see an even more interesting effect, at some point, the number of funds that outperform systematically the market is just 1. This will represent a 0,68% of our study, an extremely low percentage of the total. This also lead us to an extremely important conclusion: the fund managers that can outperform the market on the long term is statistically insignificant.

4.5.1. Net Mutual Fund return versus Standard & Poor's 500 return & Standard & Poor's Total Return

As shown in table 23, results change when we compare both the Standard & Poor's 500 and the Standard & Poor's 500 Total Return but considering the net mutual fund return (considering the impact of the fees of the funds).

	S&P 500	S&P 500 Total Return
2008	42	10
2009	28	9
2010	25	6
2011	22	2
2012	20	2
2013	20	2
2014	19	1
2015	17	1
2016	16	1
2017	14	1

 Table 23: Total number of Net Mutual Funds (fees discounted) outperforming the Standard & Poor's 500 and the Standard & Poor's 500 Total Return on a yearly basis from 2008 to 2017.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

In graph 18 are shown the same results. We can clearly appreciate the difference between the ability of fund managers to create value (beating the benchmark performance) and the ability of the fund managers to create real value for the final investor (beating the benchmark after deducting the fees).



Graph 18: Net Mutual Funds consistent outperformers from 2008 to 2017. Source: Own preparation. Source from Morningstar Premium Subscription.

Now if we also consider the fees, obviously the returns and the number of funds that outperform the market are even lower. It's interesting to see the same effects all over again. The only effect will be the effect of the costs/fees of the funds. As stated below, it impacts around a 50% of the total, which completely matches in this case (down from 24 to 14). This also has a different way of reading: after applying their fees, only 50% of the managers prove that they can actually deliver real value to the final investor. The other 50% can outperform the market, but at a cost that it is just simply not profitable. So as the cost is higher than the benefit, investors would be better off just by buying the Standard & Poor's 500, as those 50% of the managers doesn't create enough benefits to cover their own costs.

And of course, if we include the dividend effect, we have the same conclusion: yes, you can find fund managers that outperform the market in a consistent way, creating real value after costs to the final investors, but those managers are a far cry of the fund industry, and they are around a 0,5% of the total amount of the fund manager industry.

This part of the study is also stated on "Passive Investment Strategies and Efficient Markets", by Burton G. Malkiel, 2003. On it, Malkiel states that after expenses, active managers underperform the market average. After costs, passive managers will outperform most active managers, not because they do not know how to create value (which only some of them know how to create value over the time), but because of the fees.



Graph 19: Distribution of returns after expenses (Passive investment strategies). Source: Passive Investment Strategies and Efficient Markets, Burton G. Malkiel, 2003.

CHAPTER 5: CAN OUTPERFORMANCE BE EXPLAINED STATISTICALLY? SIMULATING THE INDEX

5.1. INTRODUCTION

Now, the next question is obvious: are those top performers real top performers, or are they just lucky enough to have those great results? And if so, can they obtain those higher results in a consistent way on a medium/long period of time? We all have heard about the most incredible investing systems that outperforms the market from time to time. Also, we all have heard about cherry-picking stocks by throwing darts into a bullseye with the stock page of the newspaper open in the middle of it, and just invest in those where the dart hits. And yes, maybe the portfolio of this "dart-system" can outperform the market for a year. Or two. But consistently?

The objective of this study is to compare if out of the managers that outperform the market in a 5 years horizon, it is because they are good managers, or maybe because they're lucky. We will try to figure it out, by comparing their results with Standard & Por's 500 forecasts.

On the other hand, we will not be forecasting on the long run, as we have seen that the managers that create value to the investor on the long run are around:

- A 24,54% under the average methodology
- A 3,42% under the top performers methodology
- A 0,68% under the consistency on the long-term methodology

We are pretty sure that for a certain year a certain percentage can be explained by statistical luck, rather than personal skills. But on a 3-5-year horizon, things might change a lot. There are several ways to forecast the Standard & Por's 500, but we have considered 2 of them:

- ETS (Error, Trend, Seasonality)
- GBM (Geometric Brownian Motion)

The main problem of the ETS is that, as the stock market over the studied years does not have any seasonality, the only thing that captures is the trend, obtaining a forecast that is close to useless. In this sense, all our forecasts will be using the Geometric Brownian Motion applying the Montecarlo methodology. Also, we will analyze statistically as many data entry points as we can.

Enclosed the ETS forecast taking into consideration the period of 1980 to 2007 as **Annex XI** for reference.

5.2. SIMULATION: FROM 2008 TO 2012

5.2.1. Graph Analysis

As shown in graph 20, from 1981 the trend of the Standard & Poor's 500 is absolutely exponential, specially from the 80s. Also, we can see the 2000 crisis and the 2007 global financial crisis. We can also see that from 2009 to 2017 Standard & Poor's 500 has almost tripled its value.



5.2.1. Data analysis from 1980 to 2007

R studio code for ETS and for GBM enclosed as Annex XII for reference.

As part of the study, we will forecast the Standard & Poor's 500 taking all data from 1980 to 2007, and then forecasting from 2008 to 2012, using the GBM and compare those results to the returns of the funds during that period. Before anything, we will perform a graphic and a data analysis of the prices of the Standard & Poor's 500 from 1980 to 2007, as BGM will take the last close price and forecast/simulate on a daily basis. Then, we will take the last value at the end of the forecast (end of 2012) and compare it to the mutual funds' performance.



Source: Own preparation. Data from Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

The Standard & Poor's 500 have had changes on the trend, but the difference between last value and first value is positive, and the general trend is positive. Even at this stage we can clearly see that the average is going to be positive. In graph 22 are shown the daily returns. We can see some extreme values, the highest one a drop of over a 20% in the 80s.



Graph 22: S&P500 daily returns from 1980 to 2017.



In graph 23 are shown the yearly returns of the Standard & Poor's 500. It's interesting to see the drop of the market of 2002, but most of the years have had positive returns, some of them even over 20%.



For additional information, all the yearly returns from 1980 to 2007 are stated below:

> dARContS	P500Annual
	yearly.returns
1980-12-31	NA
1981-12-31	-0.10236945
1982-12-31	0.13768429
1983-12-30	0.15931767
1984-12-31	0.01390884
1985-12-31	0.23375433
1986-12-31	0.13645569
1987-12-31	0.02007223
1988-12-30	0.11690124
1989-12-29	0.24098713
1990-12-31	-0.06784144
1991-12-31	0.23354291
1992-12-31	0.04367485
1993-12-31	0.06817400
1994-12-30	-0.01551261
1995-12-29	0.29349506
1996-12-31	0.18451636
1997-12-31	0.27008959
1998-12-31	0.23640395
1999-12-31	0.17836413
2000-12-29	-0.10690821
2001-12-31	-0.13975291
2002-12-31	-0.26612887
2003-12-31	0.23412622
2004-12-31	0.08611762
2005-12-30	0.02956873
2006-12-29	0.12768436
2007-12-28	0.04156228

5.2.3. Geometric Brownian Model

For the forecast, we have done 10.000 simulations. The values that feed the model are shown in table 24:

Mu	Sigma	Delta	Initial Value
9,33%	16,34%	0,40%	1.478,49

Table 24: Mu, Sigma, Delta and Initial Value data used for GBM forecast using data from 1980 to 2007.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

In graph 24 are shown the simulations using the GMB methodology. Please note that simulations have been done on a daily basis, so 5 years of simulations equals to 1.250 daily simulations (250 days of trade per year).



Results of the simulations are as follow:

-	Average final result of all simulations:	2.378,60
-	Average return at the end of the simulation:	60,88%
-	Probability of having a positive profitability/yield:	86%

Now we will compare the GBM forecast with all the data. The Standard & Poor's 500 has had a return at the end of the period of 8,58%. This is mainly due that during our period of forecasting (2008 to 2012), in 2008 the market dropped heavily, and as GBM takes into consideration data from 1980 to 2007 it does not reflect the effect of the 2008 drop, just simulates according the data from 1980 to 2007. Interpretation of the results are:

- The Standard & Poor's 500 at the end of the period had a return of 8,58%, far away lower than the average GBM return of 60,88%. Taking this into consideration, 81,70% of the times the GBM simulation was better off of the Index results
- Then, we will compare the GBM results with the average of only the funds that outperform the market during this period. Those funds outperformed the market, having an average return of 17,4%. If we compare it with the GBM simulation, 76,60% of the simulations outperformed that 17,4%.
- Lastly, if we compare the best fund performance (the fund obtained a 61,73% return) versus the GBM simulation, we will see that in 42,80% of the cases the GBM simulations were above that 61,73% performance.

	Model Methodology	S&P 500	S&P 500 Total Return	GBM Average
2008 to 2012	GMB	8,58%	22,55%	60,88%

Table 25: 2008 to 2012 returns of GMB simulations, Standard & Poor's 500 return, and Standard & Poor's 500 Total Return, using data from 1980 to 2007.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

	Below 8,58%	Above 8,58%	Above 17,4%	Above 61,73%
	S&P 500 return	(8,58%)		
2008 to 2012	18,30%	81,70%	76,60%	42,80%

Table 26: Comparison between Standard & Poor's 500 return, Standard & Poor's 500 Total Return, average of the Mutual Funds that outperform the benchmark (17,4%), the Mutual Fund top performer return (61,73%) and the results from the GMB simulation from 2008 to 2012, using data from 1980 to 2007.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

Lastly, in graph 25 is stated the histogram showing the distribution of the Standard & Poor's 500 obtained with the GBM simulation:



As a summary, we can conclude that the GBM simulations outperformed by far not only the Index, but also the best fund in 42,80% of the cases. But, on the other hand, the GBM simulation did not take into account the drop of the market in 2008, or if do so, in an extremely low percentage of the cases, that did not affect the average of returns.

5.3. SIMULATION: 2013 TO 2017

5.3.1. Graph Analysis

Enclosed the ETS forecast taking into consideration the period of 1980 to 2012 as **Annex XIII** for reference.

As we have done before, we will forecast the Standard & Poor's 500, but now taking all data from 1980 to 2012, and then forecasting from 2013 to 2017, using the GBM and compare those results to the returns of the funds during that period. So, we will, before everything, graphic the prices of the Standard & Poor's 500 from 1980 to 2012, as BGM will take the last close price and forecast/simulate on a daily basis. Then, we will take the last value at the end of the forecast (end of 2017) and compare it to the funds' performance.



5.3.2. Data analysis from 1980 to 2012

Before the forecast we will analyze all the data. The Standard & Poor's 500 have had changes on the tendency, but the difference between last value and first value is positive, so the trend is positive. Even at this stage we can clearly see that the average is going to be positive. Also, in this case there are two mayor drops in the market, one around the 2000, and the other one in 2008, so in this case, for the simulation, we will not have the prior problem, but rather the opposite. If we convert the data into daily returns, we can add a graph. We can see some extreme values, the highest one a drop of over a 20% in the 80s, and some mayor ones during 2008, several ones, as shown in graph 27.



In graph 28 are stated the yearly returns. It's interesting see the drop of the market of 2002, but most of the years have had positive returns, some of them even over 20%. The mayor impact comes in 2008, with a drop of over a 40%. Then the market seems to

The mayor impact comes in 2008, with a drop of over a 40%. Then the market seems to recover and go back to positive returns until the end of the period (2012).



Graph 28: S&P500 yearly returns from 1980 to 2012. Source: Own preparation. Data from Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

5.3.3. Geometric Brownian Model

Fort he forecast, we have done 10.000 simulations. The values that the model uses are shown in table 27. We can see that the mu is lower than the previous GBM simulation, due to the drop of the market in 2008 (most probably).

Mu	Sigma	Delta	Initial Value
7,76%	18,18%	0,40%	1.402,43

Table 27: Mu, Sigma, Delta and Initial Value data used for GBM forecast using data from 1980 to 2012. Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

In graph 29 are shown some of the simulations. Please note that simulations have been done on a daily basis, so 5 years of simulations equals to 1.250 daily simulations (250 days of trade per year).



Source: Own preparation. Data from Yahoo Finance.

Results of the simulations are as follow:

-	Average final result of all simulations:	2.097,58
-	Average return at the end of the simulation:	49,56%
_	Probability of having a positive profitability/vield:	78.2%

It's interesting to see that in this simulation, at the end of the period, the final value (2.097,58) is lower than in the previous study (2.378,60), as well as the average return and the probability of having a positive return/yield.

Now we will compare the GBM forecast with all the data. The Standard & Poor's 500 has had a return at the end of the period of 208,13% (this period has been on the real market extremely bullish). And at this point we can see that our GBM simulation is going to be in general terms going to be a far cry from that 208,13% return. This is because the GBM model is taking in consideration the fall of 2008 and that it was damping (the Standard & Poor's 500 over the last periods), so the simulations would be on that line. The data analysis is as follow:

- The Standard & Poor's 500 at the end of the period had a return of 208,13%, far away higher than the average GBM return of 49,56%. Taking this into consideration, only a 16,10% of the times the GBM simulation was better off of the Index results
- Then, we will compare the GBM results with the average of only the funds that outperform the market during this period. Those funds outperformed the market, having an average return of 223,98%. If we compare it with the GBM simulation, 11,30% of the simulations outperformed that 223,98%.
- Lastly, if we compare the best fund performance (the fund obtained an incredible 242,32% return) versus the GBM simulation, we will see that in 7,60% of the cases the GBM simulations were above that 242,32% performance.

This data is very valuable, because even in bad scenarios, we can see how random simulations can obtain extremely good results. So, we can state that:

- At the level of a performance of 233,78%, it is statistically possible to have those returns in 8,80% of the cases.
- At the level of a performance of 242,32%, it is statistically possible to have those returns in 7,60% of the cases.

So, the funds, at least, should beat those percentages. But as we will see:

- What percentage of funds beat a 233,78% of return? In 9,58% of the cases. As this is higher than the 8,80% of the simulations, we can state that at least some of them beat the market due to the Active Management
- What percentage of funds beat a 242,32% of return? In 0,68% of the cases. As this is lower than the 7,60% of the simulations, we can state that at least some of them beat the market due to the Active Management, or maybe due to luck, but it is below a random simulation, something to think about.

	Model	S&P 500	S&P 500 Total Return	GBM Average	
	Methodology				
2013 to 2017	GMB	208,13%	226,56%	49,56%	
Table 28: 2013 to 2017	returns of GMB simulations,	Standard & Poor's S	500 return, and Standard & Poor's 500) Total Return, using	
		data from 1980 to 2	2012.		

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational

Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

	Below 208,13%	Above 208,13%	
	S&P 500	return (208,13%)	
2013 to 2017	83,90%	16,10%	

Table 29: Comparison between the 2013 to 2017 returns of the GMB simulation using data from 1980 to 2012 and the Standard & Poor's 500 return.

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

Model		Above 223,98%	Above 226,56%	
	Methodology	Average performers over S&P500	S&P 500 Total Return	
2013 to 2017	GMB	11,30%	10,30%	

Table 30: Comparison between the 2013 to 2017 returns of the GMB simulation using data from 1980 to 2012, the average of the Mutual Funds that outperform the Standard & Poor's 500 (223,98%), and the average of the Mutual Funds that outperform the Standard & Poor's 500 Total Return (226,56%).

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

	Above 233,78%	Above 242,32%
	Average performers over S&P500 Total return	Best performer (242,32%)
2013 to 2017	8,80%	7,60%

Table 31: Comparison between the 2013 to 2017 returns of the GMB simulation using data from 1980 to 2012, the average of the Mutual Funds that outperform the Standard & Poor's 500 Total Return (233,78%), and the Mutual Fund top performer return (242,32%).

Source: Own preparation. Data from Morningstar Premium subscription and Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated.

Lastly, in graph 30 is shown the histogram with the distribution of the Standard & Poor's 500 obtained with the GBM simulation.

Histogram of sim.dataSP500t[ndays,]



5.4. CONCLUSIONS

As a summary, we can conclude that the GBM simulations did not outperformed the Index nor the funds in general terms on the second simulation, but when it comes to the top performers, we have 2 main conclusions:

- At a certain level of outperformance, there is real value in Active Management
- For the best performer, it might be explained statistically as a matter of random simulations

R studio code for SP500 Total Return enclosed as **Annex XV** for reference (for both periods, 1980 to 2007 and for 1980 to 2012).

Finally, we need to take into consideration as well that we have done the simulations considering the Standard & Poor's 500 instead of the Standard & Poor's 500 Total Return. Regarding the results above, we believe that there is no need to compare the fund results with the Standard & Poor's 500 Total Return, as it will show what we all think at this point, as funds outperformance might be statistically explained by randomly simulating the Standard & Poor's 500 around 10.000 times

CHAPTER 6: BEHAVIORAL ANALYSIS OF INVESTORS IN MUTUAL FUNDS

6.1. RESONS FOR HIRING ACTIVE MANAGEMENT

Normally, there are a lot of reasons to hire an asset manager or to conduct investments thru professional advice. But first we need to understand why people invest. The main answers are pursuing wealth/return or maintaining it, provide security, provide stability, and enjoy life.

But an individual can invest by himself, so, the question is why people hire a professional to conduct or to advise over possible investments. What are the main reasons behind it? The most important ones are:

- Investors do not have enough expertise nor knowledge
- To secure better returns
- Time saving
- Access to investment expertise and new/exotic products
- Investors have anxieties that might lead to irrational decisions
- Investors need to feel supported by trusted support and advice, especially when related to losing money
- Paying for advice makes investor feel that their investments are under control
- Around 65% of the investor trusts and rely on the professional advise. It is the highest in the market

On the study conducted by PwC "PwC Strategy & Global Wealth Management Survey 2016", the most required service as a percentage of the total of people who invest and save seek advice of professionals, surpassing 65% of total investors. In graph 31 are shown the percentages of professional advice received.



Graph 31: Professional advice received. Source: PwC Strategy & Global Wealth Management Survey 2016.

6.2. MUTUAL FUND'S INVESTOR PROFILE

First thing in order to understand the psychology of the investor of mutual funds is to frame them, trying to analyze the average American investor in mutual funds. According to the "2017 Investment Company Factbook", written by The Investment Company Institute, in 2016, 94 million individuals and 54,9 million US household ownership of mutual funds invested directly or indirectly (i.e. pension funds, company pension funds, etc). This means that around a 50% of the American population is an investor in mutual funds.



Graph 32: millions of US household owning Mutual Funds from 1980 to 2016.

Source: Investment Company Institute and US Census Bureau, ICI Research Perspective, Ownership of Mutual Funds, Shareholder Sentiment, and Use of the Internet, 2016.

Basic characteristics of mutual funds holders are:

- 74% married
- 50% college graduates
- 76% employed (full or part-time)
- Generation distribution:
- 11% are Silent or GI Generation (born 1904 to 1945)
- 38% are Baby Boomers (born 1946 to 1964)
- 33% are Generation X (born 1965 to 1980)
- o 18% are Millennial Generation (born 1981 to 2004)
- 94,300 USD is the median household income
- 200,000 USD is the median household financial assets
- 64% hold more than half of their financial assets in mutual funds
- 85% own retirement plan accounts
- 4 mutual funds are the median number owned
- 67% purchased their first mutual fund through an employer-sponsored retirement plan
- 92% of the investors are saving for retirement

6.3. DOES PSYCHOLOGY IMPACT FINANCIAL DECISIONS?

Finance assumes that economic agents are rational and that we process relevant information in such an efficient way that we always maximize our utility (*homo economicus*). Psychology is the science of mind and behavior. Our brain is a combination of our rational brain (conscious) and our emotional brain (unconscious), and millions of neuronal links among them. So, it's not a big surprise that behavioral finance is the combination of finance and psychology. It tries to explain as much as possible why people make irrational decisions when they consume, buy, sell, invest, etc.

Behavioral finance is based on the alternative notion that economic agents are subject to biases that mean their financial decisions can be less than fully rational. We can find a lot of categories for the biases: Behavioral biases, cognitive biases, heuristic, irrational, emotional biases, information biases, etc. These biases tend to sit deep within our psyche. We will mention what we consider the most important biases and go deeper in the ones we think that might have a greater impact for our work-study.

6.1. Behavior Biases

Loss Aversion: because investors don't want to admit that the loss has gone from a computer screen to real money, they hold on and hope that it will, one day, recover at least its original price. Also, psychologically, losses produce more pain than gains.



Graph 33: Psychological gain and psychological loss. Source: SAGE Business Researcher, May 9, 2016.

Disposition effect: this produces investors to sell the assets that have a gain and holding the ones that are losing money hoping one day they will at least recover their original acquisition price. The result is to pay taxes over the benefits, not recognize the loses, and probably loose the opportunity to make more money as the asset they sold could produce higher returns.

Choice Paralysis: intuitively, the more choices we have the better. However, the truth is that too many choices can lead to decision paralysis due to information overload.

Trust and control: for mutual funds, trust is essential. Interestingly, people dedicate little time to deposit their money and invest it in a Mutual Fund having spent no time investigating the fund nor the portfolio manager, its professional experience and its track record. People spend entire months comparing cars, for example, and only few minutes to invest 20,000 USD. But they trust the portfolio manager, they think "he is a professional, he knows better", which lead as well to asymmetric information.

Familiarity bias, risk, and return: individuals often prefer to invest in familiar assets. This is especially important for us, as the American market is already used to Mutual Funds. They are everywhere and have been there for a long time. So, people invest on them, leaving little space to new instruments. This also applies to the type of Mutual Fund they invest, Americans will likely invest in Mutual Funds that invest in American companies as they are more familiar with them.

Anchoring. The form of presentation of information can affect the decision made. People anchor on the first information they are exposed to (for example, the price of a stock, or the revenue of a specific company, and thus find modifying their initial perception might be difficult). Investors can anchor on the bad experience of the bear market of 2008 or on the great experience of investing in Amazon or Apple.

Mental Accounting: money is fungible, but people treat it in a different way depending on its origin, where is it kept, how is it spent, etc. Individuals allocate wealth to separate mental compartments and ignore fungibility and correlation effects.

Others ones such as herding ("monkey see, monkey do") or hot hand (if you win you're going to win next time. And as more you win, more people think they have a "hot hand") might apply as well.

As we have seen before, psychology can affect investment decisions. Not only the biases, but also personality, demographic and socioeconomic factors, and many others, probably even religion (for example, Muslims cannot conduct all kinds of investments as some of them are forbidden by the Coran).



As a summary: emotions impact on financial decisions. So, investors in mutual funds sometimes take irrational decisions.

6.2. Is investing psychology of regular people like wealthy people?

Wealthy people take decisions in a different way from not wealthy people. Differences are the following ones:

1. Wealthy people consult and take professional advice (bankers, financial planners) before taking any decision.

- 2. Wealthy people avoid common mistakes:
- Being optimistic about the future all time. Normally people tend to think that, for example, stocks will rise. This does not happen always, but there is a common feel that any investment will tend to generate money all time. So, wealthy people consider as well bad scenarios, and depend less on luck and more in real data.
- Think that the stock market can make them rich with incredible returns a year, multiplying their money. Wealthy people know that they can expect a return of around 8% a year, meaning, if they invest 35,000 USD they can get a return from 2,000 USD to 3,000. Regular people expect to double or triple their money within a year, taking substantial risks that might end up by losing most of their investment.
- Wealth management is not all about status. They provide a service, you pay them. Normal people think getting accepted is a status per se, like buying a Ferrari.

- Forget about currency and exchange rate. Regular people tend to think as unique investment, wealthy people know that currency can impact severely their investment, and that they should treat investment and currency independently. So, they cover/hedge the currency.
- Jump from fad to fad and from fraud to fraud. Wealthy people know that penny for a dollar rarely exist and will invest their money for an extra 2-3% of return.
- Trust in their instincts. Wealthy people tend to hire and pay a professional, instead of just their guts. On the chart below, we can see the percentage of wealthy people share information with their managers:



Graph 35: Information shared with financial manager / advisor. Source: PwC Strategy & Global Wealth Management Survey 2016.

- Wealthy people are committed of being rich, with all the effort it has. Normal people just want to be rich but not putting all the effort it requires. Wealthy people know that they have to put 100% of their time and/or their money. Normal people break at some point and thus fail.
- Wealthy people are more opportunity oriented and thus, solution oriented, meanwhile regular people are more problem oriented. First ones see opportunities and value creation, second ones all the problems that might arise.

3. On the other hand, there are certain advantages of being already wealthy, that ease the generation of money. Among many, we would like to point some of them:

- They have access to investments that regular people do not or are not able to invest in (i.e. hedge funds).
- If they lose part of their money, it really does not matter, as they do not need it for a living.
- Some investments will mature in 20 years or more.
- Private equity is normally for wealthy people.

6.3.3. Why active management still attracts investors even if returns are poor?

So far, we have seen the average American investor profile on Mutual Funds, how psychology affects its investment decisions, and how is different to invest if you are a normal folk or a wealthy person. In this question, we will try to see then how it is possible for these people to keep investing in Mutual Funds even if they know that the returns are poor, or at least, lower than the benchmark, because obviously this is not a rational financial behavior, thus, it must be an irrational behavior. Some of the possible reasons are:

- Investors are not fully aware of the poor results of the mutual funds, as the mutual funds compare their results against the benchmark, instead of comparing themselves with the benchmark total return. So mutual funds eliminate the effect of the dividends, that can be easily between 2 to 3% every year.
- Investors are not fully aware on how the mutual fund fees affect their long-term investments. In some cases, it is not even clear if it is deducted or not from the return they tell the investor.
- They tend to think that professionals will know better, so they put the money in investment funds. This is a huge mistake, as this is purely psychological, and not related in any way to reality. And normally, they tend to think that as higher the salary of the manager or as higher the fee the better performance, as these fund managers must be exceptional to get those incredible salaries, so their work has to be extraordinary as well, and as they manage the Mutual Fund they are investing in, the higher return will be for me. Again, this is a biased way of thinking.
- It's far away cooler to say that your banker and financial planner or advisor is JP Morgan or Goldman Sachs rather than buying a boring ETF on the Standard & Poor's 500 by yourself. Again, irrational behavior, looking for status rather than for financial results.

CHAPTER 7: THE INDUSTRY AS OF TODAY

7.1. THE AMERICAN MARKET

According to the "2017 Investment Company Factbook", written by The Investment Company Institute, in 2016 the United States of America had the largest ETF Market (percentage of total net assets, year-end 2016), amounting to a 73% of the total share.



Graph 36: Percentage of total net assets, year-end 2016. Source: Investment Company Institute and ETFGI.

By the same study, in 2016 the United States of America had the world's largest Regulated Open-End Fund Market (percentage of total net assets, year-end 2016), amounting to a 47% of the total share.



Graph 37: Open-End Fund Market (percentage of total net assets, year-end 2016. Source: Investment Company Institute and International Investment Funds Association.

Total worldwide assets invested in regulated open-end funds*	\$40.4 trillion
Americas	\$21.1 trillion
Europe	\$14.1 trillion
Africa and Asia-Pacific	\$5.2 trillion
US-registered investment company total net assets	\$19.2 trillion
Mutual funds	\$16.3 trillion
Exchange-traded funds	\$2.5 trillion
Closed-end funds	\$262 billion
Unit investment trusts	\$85 billion

Graph 41: Total worldwide assets in regulated open-end funds, year-end 2016. Source: "2017 Investment Company Factbook", by the Investment Company Institute.

In graph 38 and graph 39 are shown the market share of mutual funds and ETFs by number of them and the market by net assets under management. We can see that both industries are growing in terms of size and volume. The mutual fund industry controls almost 85% of the market (both number and net assets under management).



Graph 38: Mutual Fund and ETFs net assets under management from 2010 to 2016. Source: Own preparation. Data from "2017 Investment Company Factbook", by the Investment Company Institute.

7.1.1. Increase of Mutual Funds

As we have explained before, in 2016, the American Mutual Fund industry is by far the largest one worldwide with \$16.34 trillion in assets. In table 32 are shown the total number of mutual funds and the net assets under management.

Graph 39: Number of Mutual Funds and number of ETFs from 2010 to 2016. Source: Own preparation. Data from "2017 Investment Company Factbook", by the Investment Company Institute.

Mutual Funds (US Only)	2010	2011	2012	2013
Number of Mutual Funds (US)	8.535,00	8.673,00	8.744,00	8.972,00
%	0,00 %	1,62 %	0,82 %	2,61 %
MF Net Assets Under Manag. (Trillion USD)	11,83	11,63	13,06	15,05
%	0,00 %	-1,69 %	12,30 %	15,24 %

Mutual Funds (US Only)	2014	2015	2016	2010-2016	Annualized
Number of Mutual Funds (US)	9.258,00	9.517,00	9.511,00		
%	3,19 %	2,80 %	-0,06 %	11,44 %	1,82 %
MF Net Assets Under Manag. (Trillion USD)	15,87	15,65	16,34		
%	5,45 %	-1,39 %	4,41 %	38,12 %	5,53 %

Table 32: Number of Mutual Funds in the USA and Mutual Funds Net Assets Under Management (in trillion USD). Source: Own preparation. Data from The Investment Company Institute, 2017 Investment Company Factbook.

As shown in graph 40 and graph 41, in absolute terms the mutual fund industry keeps growing not only in terms of number of mutual funds but also in terms of size.



Graph 40: Number of mutual Funds from 2010 to 2016. Source: Own preparation. Data from "2017 Investment Company Factbook", by the Investment Company Institute.

Graph 41: Net assets under management of mutual funds from 2010 to 2016. Source: Own preparation. Data from "2017 Investment Company Factbook", by the Investment Company Institute.

As a further explanation of the data showed before, we can see the opened mutual funds, the merged and the liquidated ones:



Graph 42: Number of Mutual Funds entering and exiting the industry, from 2007 to 2016. Source: 2017 Investment Company Factbook, by the Investment Company Institute.

7.1.2. Increase of ETFs

As stated before, the American ETF industry is by far the largest one worldwide, and the demand of ETFs has grown rapidly over the past 6 years. In table 33 is shown the evolution of the number of ETFs and the evolution of the net assets under management of the ETF industry.

ETF Funds (US Only)	2010	2011	2012	2013
Number of ETFS (US)	923,00	1.135,00	1.195,00	1.295,00
%	0,00 %	22,97 %	5,29 %	8,37 %
ETF Net Assets Under Manag. (Trillion USD)	0,99	1,05	1,34	1,68
%	0,00 %	5,65 %	27,58 %	25,28 %

ETF Funds (US Only)	2014	2015	2016	2010-2016	Annualized
Number of ETFS (US)	1.412,00	1.595,00	1.716,00		
%	9,03 %	12,96 %	7,59 %	85,92 %	10,89 %
ETF Net Assets Under Manag. (Trillion USD)	1,98	2,10	2,52		
%	17,91 %	6,38 %	20,13 %	154,44 %	16,84 %

 Table 33: Number of ETF in the USA and ETF Net Assets Under Management (in trillion USD).

 Source: Own preparation. Data from The Investment Company Institute, 2017 Investment Company Factbook.





Graph 44: Net assets under management of ETFs from 2010 to 2016. Source: Own preparation. Data from 2017 Investment Company Factbook, by the Investment Company Institute.

The following chart reflects the market share of ETFs issuers. It is interesting to see that as of 2016, the market is controlled (71,4% of the market) by 3 main companies that issue ETF, all American, which are BlackRock, Vanguard and State Street.



Graph 45: market share of the largest ETF owners, year-end 2016. Source: Market share of largest Exchange Traded Fund (ETF) providers worldwide in 2016, The Statistic portal, Statista Gmbh.

Among some reasons of rapid ETFs industry growth, we can say that it is a convenient vehicle for participating in the market, is more cost-efficient and simple than mutual funds, and it can be used to invest or to hedge against movements in the stock market. And as ETF become more popular, more investors request these kind of investment vehicles. As of 2016, 13,38% of the total assets under management are ETF. We can also see that the net issuance of ETF is in most of the years increasing, contrasting with the slower net issuance of Mutual Funds. As a further explanation of the data showed before, in graph 46 is shown the breakdown of net issuance of ETFs shares:





ETFs have been available for nearly 25 years but have become more popular on the last few years. We believe that this trend will continue, increasing the number of ETFs and its weight on the market, on detraction of Mutual Funds.

7.2. ROBO-ADVISORS AND FINTECHS

There is no doubt that a digital revolution is happening today. Robo-advisor offers automated, algorithm-driven financial planning services with little to no human supervision at all. This results in lower costs and more scalable solutions, threatening traditional businesses. In this industry, we believe that robo-advisors should better be a complement to the traditional financial advisory, instead of replacing it, creating a hybrid service that combine features of both robo-advice and traditional financial advice, and as robo-advisors become more efficient, managers will be able to focus less on data entry and more time on building client relationships or investing on high value adding activities.

On the other hand, and according to the study conducted by PwC "PwC Strategy & Global Wealth Management Survey 2016", 66% of relationship managers do not consider robo-advisors a threat to their business, as they believe it is a limited market. We are talking about an extremely traditional and atomized industry, in which human factor still have a very relevant importance. Furthermore, user experience by investors revelas that only 14% of people uses robo-advisors, and less than 50% of them do not like it at all. At

the end, only a 6% of the people decide to conduct their investments thru robo-advisors. This can lead to some conclusions:

- Investors feel that robo-advisors are not appropriate for asset management advise.
- Asset managers are right and thus should not worry about robo-advisors, at the end, their relation with investors is based on trust.

Contradicting previous points, 33% of non-users of robo-advisors feel that in the nearer future the percentage of investor using robo-advisors will increase to 47%, and that once those investors have a relation with the robo-advisor it is unlikely that they will shift to traditional asset management.



Graph 47: Usage, awareness and consideration of robo-advisors. Source: PwC Strategy & Global Wealth Management Survey 2016.

There is a medium term, automation with human supervision, that will give prestige and exclusivity. Benefits of this system will be:

- Lower costs and thus, lower fees for the investor.
- Bigger volume and larger assets under management, thus, lower fees for the investor.
- Wider palette of investment ideas and products.
- Automatized selection of investments.
- Predictive changes on goals and objectives of the investor.
- More dynamic portfolio management.
- All information available and updated.
- More personalized advice.

7.3. IS THERE A REAL SHIFT TO PASSIVE MANAGEMENT?

As we can see on the charts below, there is no doubt that Mutual Funds are reducing their market share by number and their market share by assets under managements. In less than 6 years they have lost between a 5-6% of all the assets under management of the market, mainly because ETF has gained that market. We believe that, as awareness of ETFs by investors increases, and more transparent comparisons between the returns of the Mutual Funds, the total return of the benchmark and the impact of the commissions/fees of the mutual funds, more and more investors will stop investing in Mutual Funds and shift to ETFs.

So right know the shift to passive management is not a question, is a reality, as shown on graph 48 and graph 49. The question at this point is how the market is going to be split between Mutual Funds and ETFs in the next 10 to 20 years, and how this will impact the Asset Management industry worldwide.



Graph 49: ETF market share by number / assets, from 2010 to 2016. Source: Own preparation. Data from 2017 Investment Company Factbook, by the Investment Company Institute.

Interestingly, Mutual Fund industry keeps growing, not only in the number of mutual funds, but as well in the size of assets under management. So, in absolute terms the Mutual Fund industry keeps growing and expanding.

- Number of mutual funds: we can see that from 2010 to 2016, 2016 was the only year in which the number of mutual funds was reduced, and only by a 0,06%. The trend continues to be positive. The accumulated increase from 2010 to 2016 is 11,44%, and if we annualize it, we have an annual increment of 1,82%
- Net assets under management of mutual funds: in this case, and as this data depends on ow the market and the investors behave, we have a mixed result, but overall, from 2010 to 2016 assets under management have increased a 38,12%,
and if we annualize it, we have an annual increase od 5,33%, which represents how the industry keeps growing.

- Number of ETFs: we can see that from 2010 to 2016, all years have an increase, and in some of them, growths of double digit. The trend is not only positive, it's starting to be exponential. The accumulated increase from 2010 to 2016 is 85,92%, and if we annualize it, we have an annual increment of 10,89 %, which is six times the growth of mutual funds.
- Net assets under management of ETF: in this case, and as this data depends on ow the market and the investors behave, we have positive growth every year, from 2010 to 2016 assets under management have increased a 154,44%, and if we annualize it, we have an annual increase od 16,84%, which represents how the industry keeps growing 3 times faster than the mutual funds industry

We can extract valuable conclusions out of this, number of ETFs is growing 6 times faster than Mutual funds, but net assets under management are only growing 3 times faster, which means that companies are issuing lots of ETFs, but they do not take net assets under management at the same pace. One worry is that market will be overload of ETFs with low net assets under management, causing decision paralysis to the investor due to the extremely high number of choices available, if this is not happening already with the Mutual Fund industry, and the ETF industry as well, even if it's far away smaller than the previous one.

Mutual Funds (US Only)	2010	2011	2012	2013
Number of Mutual Funds (US)	8.535,00	8.673,00	8.744,00	8.972,00
%	0,00 %	1,62 %	0,82 %	2,61 %
MF Net Assets Under Manag. (Trillion USD)	11,83	11,63	13,06	15,05
%	0,00 %	-1,69 %	12,30 %	15,24 %
MF Market share by number (MF + ETF)	90,24 %	88,43 %	87,98 %	87,39 %
MF Market share by Assets (MF + ETF)	92,26 %	91,73 %	90,71 %	89,99 %
Number of ETFS (US)	923,00	1.135,00	1.195,00	1.295,00
%	0,00 %	22,97 %	5,29 %	8,37 %
ETF Net Assets Under Manag. (Trillion USD)	0,99	1,05	1,34	1,68
%	0,00 %	5,65 %	27,58 %	25,28 %
ETF Market share by number (MF + ETF)	9,76 %	11,57 %	12,02 %	12,61 %
ETF Market share by Assets (MF + ETF)	7,74 %	8,27 %	9,29 %	10,01 %

Mutual Funds (US Only)	2014	2015	2016	2010-2016	Annualized
Number of Mutual Funds (US)	9.258,00	9.517,00	9.511,00		
%	3,19 %	2,80 %	-0,06 %	11,44 %	1,82 %
MF Net Assets Under Manag. (Trillion USD)	15,87	15,65	16,34		
%	5,45 %	-1,39 %	4,41 %	38,12 %	5,53 %
MF Market share by number (MF + ETF)	86,77 %	85,65 %	84,72 %		
MF Market share by Assets (MF + ETF)	88,93 %	88,16 %	86,62 %		
Number of ETFS (US)	1.412,00	1.595,00	1.716,00		
%	9,03 %	12,96 %	7,59 %	85,92 %	10,89 %
ETF Net Assets Under Manag. (Trillion USD)	1,98	2,10	2,52		
%	17,91 %	6,38 %	20,13 %	154,44 %	16,84 %
ETF Market share by number (MF + ETF)	13,23 %	14,35 %	15,28 %	85,92 %	
ETF Market share by Assets (MF + ETF)	11,07 %	11,84 %	13,38 %		

Table 34: Comparison between number of Mutual Funds and ETF in the USA and Mutual Funds Net Assets Under Management and ETF Net Assets Under Management (in trillion USD). Source: Own preparation. Data from The Investment Company Institute, 2017 Investment Company Factbook.

If we analyze what is happening in relative terms, comparing both industries, we can clearly see that the Mutual Fund industry is losing importance, and that ETF industry is gaining importance almost at the same rhythm, so we can deduct that Mutual Fund investors are shifting to ETF industry. But as we have seen above, the gap still very big, and mutual fund industry controls around 86,62% of the market, compared to the ETF industry that controls only a 13,38%.

CHAPTER 8: IS ACTIVE MANAGEMENT A CHARADE?

8.1. CAN A SMALL PERCENTAGE OF OUTPERFORMERS SUSTAIN AN ENTIRE INDUSTRY?

After all the data we have analyzed, there is no doubt that Mutual Funds are in general terms destroying value to the investor, but people keep using them as the main investment vehicle. Also, we can see that the lack of information is huge, even for sophisticated investors. On the other hand, investment behavior impacts greatly the investor in benefit of Mutual Funds versus ETFs.

There is no doubt that some Mutual Funds and Mutual Funds managers create real value for the final investor, but data shows that it only represents around a 0,6% of all industry. Thus, the rational thing to do is to keep and maintain those funds and remove the rest of them from the market (market discipline will do that), creating a more efficient, profitable, bigger and cost-effective mutual fund industry. So, the questions at the end of the day are:

- Should a small percentage of incredible out-performers support an entire industry? The answer is absolutely NO
- Can a small percentage of incredible out-performers support an entire industry? The answer is apparently YES, even do this is mainly because of lack of information and behavioral biases, but what we see in real life is that they are supporting the entire industry, even if the very investors do not realize it
- Will a small percentage of incredible out-performers support an entire industry? The answer on the short term is probably yes, on the long term it will be impacted by the development of the ETF market and the impact of fintechs and robo-advisors, which is close to impossible to measure

8.2. WILL ACTIVE MANAGEMENT DISSAPEAR AS WE KNOW IT TODAY?

It is very difficult to forecast the future, especially in the high changing environment we are living today, were technology can completely change the way we work, live and behave in less than 20 years. We are subject to technological revolutions such as internet, and we do not know how new technologies such blockchain might develop or impact the way we live today. But there are some basic trends that we can analyze and will show the path. Maybe we will not be able to measure all impacts, but we know where we are heading. So, trying to answer the aforementioned question, the main conclusion is that it is impossible to answer. Here are some factors that shows the path, and that we have concluded during all over this work-study:

- The ETF industry (passive management) will continue to grow faster than the mutual fund industry (active management) in terms of size and volume in relative terms.
- Passive management industry will continue to steal market share in terms of size and volume from the active management industry.

- Investors will be more informed, thus reducing information asymmetry and reducing behavioral biases. They will be able to compare in better terms mutual funds returns, fees and its effects against the return, fees and effects of the ETFs.
- Robo-advisors might help to reduce both mutual fund and ETF industries, thus reducing the fees of both industries, making more competitive mutual fund industry as we know it today, and finally, being able to create real value to the final investor (so more mutual funds will be able to beat the benchmark, reducing the utility of ETFs).
- Mutual funds and active management will continue to exist, and with a market share of probably more than 50%. It is a powerful industry that will not disappear on the short, medium, nor long term. Also, due to the trust of investors, they will keep investing in mutual funds with the hope to obtain better returns
- Behavioral biases will continue to exist, it's intrinsic to human beings

As a summary, we do not forecast an abolition of active management, nor its disappearance. But surely it will reduce its market share in terms of number of mutual funds and in terms of net assets under management, while ETF industry will probably be more and more important. A 60%-40% will be the most likely scenario we will face, but as said before, nothing is certain. There is the trend, but to measure it is close to impossible.

THE TFM IN FIGURES

On the thesis:

- 81 pages of TFM
- 49 graphs
- 34 tables
- 15 Annexes
- More than 400 hours of work (believe it or not)

Excel:

- More than 120.000 data cells in excel All funds (Morningstar), S&P500 data
- More than 35.000 excel formulas Mutual Funds return data, S&P500 return data, return comparison
- More than 68 Tabs in excel 3 different methodologies
- 11 excel spreadsheets Annexes and main work spreadsheet

R Studio:

- More than 1.000 coding lines (R studio) GMB forecast, ETS forecast, statistics
- More than 125.000.000 data generated (GMB forecast)

Bibliography:

- More than 20 books consulted
- More than 100 websites consulted

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ANNEX I

Number	Fund Name	Annual Expense Ratio
1	Vanguard Instl Ttl Stk Mkt Idx InstlPls	0,02
2	Vanguard 500 Index Admiral	0,04
3	Vanguard Institutional Index I	0,04
4	Vanguard Total Stock Mkt Idx Adm	0,04
5	Fidelity® 500 Index Premium	0,05
6	Fidelity® Total Market Index Premium	0,05
7	Schwab Total Stock Market Index	0,05
8	Vanguard Growth Index Admiral	0,06
9	Vanguard Large Cap Index Admiral	0,06
10	Vanguard Mega Cap Index Institutional	0,06
11	Vanguard Value Index Adm	0,06
12	DFA US Large Company I	0,08
13	Fidelity® Total Market Index Investor	0,09
14	Vanguard Tax-Managed Capital App Adm	0,09
15	Fidelity® 500 Index Investor	0,1
16	Vanguard FTSE Social Index I	0,12
17	Vanguard 500 Index Investor	0,14
18	Bridgeway Blue Chip 35 Index	0,15
19	Vanguard Total Stock Mkt Idx Inv	0,15
20	Vanguard Growth Index Investor	0,18
21	Vanguard Large Cap Index Investor	0,18
22	Vanguard Value Index Inv	0,18
23	DFA US Core Equity 1 I	0,19
24	TIAA-CREF Social Choice Eq Instl	0,19
25	Columbia Large Cap Index Inst	0,2
26	JPMorgan Equity Index I	0,2
27	Vanguard FTSE Social Index Inv	0,22
28	Wells Fargo Index Admin	0,25
29	T, Rowe Price Equity Index 500	0,26
30	Vanguard US Value Inv	0,26
31	DFA US Large Cap Value I	0,27
32	JPMorgan US Research Enhanced Equity R6	0,28
33	T, Rowe Price Total Equity Market Idx	0,3
34	Vanguard Growth & Income Inv	0,34

35	Schwab Fundamental US Large Company Idx	0,35
36	iShares S&P 500 Index Investor A	0,36
37	TIAA-CREF Large-Cap Value Instl	0,39
38	Vanguard PRIMECAP Inv	0,4
39	JPMorgan Intrepid Growth R6	0,43
40	JPMorgan US Research Enhanced Equity I	0,43
41	AQR Large Cap Multi-Style I	0,45
42	Vanguard Capital Opportunity Inv	0,45
43	Wells Fargo Index A	0,45
44	PIMCO StocksPLUS® Instl	0,5
45	Dodge & Cox Stock	0,52
46	Fidelity® New Millennium	0,54
47	T, Rowe Price Instl Large Cap Growth	0,56
48	T, Rowe Price Instl Large Cap Core Gr	0,57
49	Fidelity Advisor® Capital Development O	0,59
50	American Beacon Large Cap Value Instl	0,6
51	ClearBridge Large Cap Value I	0,6
52	American Funds Fundamental Invs A	0,61
53	JPMorgan US Equity L	0,61
54	MFS® Value I	0,61
55	Fidelity® Equity-Income	0,62
56	Fidelity® Large Cap Stock	0,62
57	Morgan Stanley Inst Growth I	0,63
58	Principal LargeCap Growth I Instl	0,63
59	Fidelity Advisor® Large Cap I	0,64
60	Fidelity® Growth & Income	0,64
61	Harbor Capital Appreciation Instl	0,64
62	Selected American Shares D	0,64
63	LSV Value Equity	0,65
64	PRIMECAP Odyssey Stock	0,65
65	BlackRock Capital Appreciation K	0,66
66	Loomis Sayles Growth Y	0,66
67	Mairs & Power Growth Inv	0,66
68	PRIMECAP Odyssey Growth	0,66
69	T, Rowe Price Equity Income	0,66
70	JPMorgan Intrepid Growth I	0,68
71	T, Rowe Price Growth Stock	0,68
72	Loomis Sayles Value Y	0,69

73	Diamond Hill Large Cap I	0,7
74	Fidelity Advisor® Growth & Income I	0,7
75	Clipper	0,72
76	T, Rowe Price Blue Chip Growth	0,72
77	American Beacon Bridgeway Lg Cp Val Inst	0,73
78	Neuberger Berman Multi-Cap Opp Inst	0,73
79	Prudential Jennison Growth Z	0,73
80	MFS® Blended Research Core Equity A	0,74
81	JPMorgan Value Advantage L	0,75
82	Laudus US Large Cap Growth	0,75
83	JPMorgan US Equity I	0,76
84	Boston Partners All Cap Value Instl	0,77
85	American Funds New Economy A	0,78
86	JHancock Disciplined Value I	0,8
87	T, Rowe Price New America Growth	0,8
88	Fidelity® Blue Chip Growth	0,82
89	MFS® Research A	0,82
90	T, Rowe Price Value	0,82
91	JHancock Blue Chip Growth 1	0,83
92	Parnassus	0,84
93	Fidelity® Growth Company	0,85
94	Neuberger Berman Socially Rspns Inv	0,85
95	Fidelity® Value Discovery	0,86
96	Glenmede Large Cap Core Port	0,86
97	Glenmede Large Cap Growth	0,86
98	MFS® Value A	0,86
99	ClearBridge Large Cap Value A	0,89
100	Davis NY Venture A	0,89
101	Fidelity Advisor® Capital Development A	0,89
102	JPMorgan Large Cap Growth I	0,89
103	Oakmark Investor	0,89
104	Fidelity Advisor® Large Cap A	0,9
105	PIMCO StocksPLUS® D	0,9
106	Sound Shore Investor	0,91
107	American Beacon Large Cap Value Inv	0,92
108	Ave Maria Rising Dividend	0,92
109	Columbia Select Large Cap Equity Inst	0,92
110	Loomis Sayles Growth A	0,92

111	Putnam Equity Income A	0,92
112	MFS® Growth A	0,93
113	Oppenheimer Main Street A	0,93
114	Touchstone Focused Y	0,93
115	JPMorgan US Equity A	0,94
116	Loomis Sayles Value A	0,94
117	Davis Opportunity A	0,95
118	Artisan Value Investor	0,96
119	Fidelity Advisor® Growth & Income A	0,97
120	Selected American Shares S	0,97
121	American Century Ultra® Inv	0,98
122	American Century Value Inv	0,98
123	Dreyfus Strategic Value A	0,98
124	Oakmark Select Investor	0,98
125	AllianzGI NFJ Dividend Value A	0,99
126	American Century Select Inv	0,99
127	Diamond Hill Large Cap A	0,99
128	Hotchkis & Wiley Value Opps Instl	0,99
129	JPMorgan Growth Advantage I	1
130	Poplar Forest Partners Institutional	1
131	Boston Partners All Cap Value Inv	1,02
132	JPMorgan Growth And Income A	1,03
133	Lazard US Equity Concentrated Open	1,03
134	Prudential Jennison Growth A	1,03
135	Columbia Disciplined Core A	1,04
136	JPMorgan Large Cap Growth A	1,05
137	JHancock Disciplined Value A	1,06
138	Transamerica Large Cap Value A	1,06
139	Vulcan Value Partners	1,07
140	BlackRock Capital Appreciation Inv A	1,08
141	Columbia Contrarian Core A	1,09
142	Janus Henderson Forty A	1,1
143	Alger Capital Appreciation Instl I	1,14
144	ClearBridge Aggressive Growth A	1,14
145	Ivy Large Cap Growth A	1,15
146	JHancock US Global Leaders Growth A	1,16
147	Columbia Select Large Cap Equity A	1,17
148	Fidelity Advisor® Large Cap M	1,17

149	Natixis Oakmark A	1,18
150	Alger Spectra A	1,21
151	Janus Henderson Forty S	1,21
152	Alger Capital Appreciation A	1,22
153	Fidelity Advisor® Growth & Income M	1,22
154	Natixis US Equity Opportunities A	1,23
155	JPMorgan Growth Advantage A	1,24
156	Akre Focus Retail	1,34
157	MFS® Growth B	1,68
158	BlackRock Capital Appreciation Inv C	1,89
159	Alger Capital Appreciation B	2,04

ANNEX II

		Annual Expense	SP500
Number	ETF Name	Ratio	Corr.
1	Vanguard Small-Cap ETF	0,05	96,28
2	Vanguard Mid-Cap ETF	0,05	96,8
3	Vanguard Value ETF	0,05	97,06
4	Vanguard Growth ETF	0,05	98,32
5	Vanguard Large-Cap ETF	0,05	99,95
6	iShares Core S&P 500 ETF	0,05	99,98
7	Vanguard Mid-Cap Growth ETF	0,07	95,77
8	Vanguard Mid-Cap Value ETF	0,07	95,78
9	Vanguard Small-Cap Growth ETF	0,07	96,02
10	Vanguard Mega Cap Value ETF	0,07	96,37
11	Vanguard Mega Cap Growth ETF	0,07	97,54
12	Vanguard Mega Cap ETF	0,07	99,83
13	Vanguard Extended Market ETF	0,08	96,64
14	Vanguard Dividend Appreciation ETF	0,08	98,59
15	iShares Core S&P Mid-Cap ETF	0,09	97
16	iShares Core S&P Small-Cap ETF	0,09	97,15
17	SPDR® S&P 500 ETF	0,09	99,97
18	Vanguard Total World Stock ETF	0,1	80,62
19	Vanguard Health Care ETF	0,1	90,44
20	Vanguard Consumer Discretionary ETF	0,1	94,83
21	Vanguard Industrials ETF	0,1	96,01
22	Vanguard Information Technology ETF	0,1	96,7
23	Health Care Select Sector SPDR® ETF	0,14	87,18
24	Consumer Discret Sel Sect SPDR® ETF	0,14	94,46
25	Technology Select Sector SPDR® ETF	0,14	95,41
26	Industrial Select Sector SPDR® ETF	0,14	95,86
27	SPDR® S&P 600 Small Cap Value ETF	0,15	95,34
28	SPDR® S&P 600 Small Cap Growth ETF	0,15	95,54
29	SPDR® S&P 400 Mid Cap Growth ETF	0,15	96,3
30	SPDR® S&P 600 Small Cap ETF	0,15	97,42
31	SPDR® Portfolio S&P 500 Growth ETF	0,15	97,64
32	SPDR® Dow Jones Industrial Average ETF	0,15	98,27
33	iShares Russell 1000 ETF	0,15	99,91

34	iShares Core Aggressive Allocation ETF	0,16	97,55
35	iShares S&P 500 Growth ETF	0,18	97,68
36	PowerShares QQQ ETF	0,2	93,9
37	iShares Russell 2000 ETF	0,2	95,07
38	Guggenheim S&P 500® Top 50 ETF	0,2	96,55
39	iShares Russell Mid-Cap ETF	0,2	97,14
40	iShares Russell 1000 Growth ETF	0,2	98,48
41	iShares S&P 100 ETF	0,2	99,13
42	iShares Morningstar Large-Cap ETF	0,2	99,15
43	iShares Russell 3000 ETF	0,2	99,8
44	iShares Dow Jones US ETF	0,2	99,87
45	Fidelity® NASDAQ Composite Tr Stk ETF	0,21	98,34
46	iShares Russell 2000 Growth ETF	0,24	95,41
47	SPDR® S&P MidCap 400 ETF	0,24	97,11
48	iShares MSCI Kokusai ETF	0,25	88,8
49	iShares S&P Small-Cap 600 Growth ETF	0,25	95,4
50	iShares S&P Mid-Cap 400 Growth ETF	0,25	95,54
51	iShares S&P Small-Cap 600 Value ETF	0,25	96,27
52	iShares Morningstar Large-Cap Growth ETF	0,25	96,64
53	iShares Russell Mid-Cap Growth ETF	0,25	96,9
54	WisdomTree US Earnings 500 ETF	0,28	99,46
55	WisdomTree US Total Earnings ETF	0,28	99,64
56	PowerShares S&P 500® Quality ETF	0,29	94,19
57	iShares Morningstar Mid-Cap Value ETF	0,3	92,1
58	iShares Morningstar Small-Cap Growth ETF	0,3	94,74
59	iShares Morningstar Mid-Cap Growth ETF	0,3	94,97
60	iShares MSCI ACWI ETF	0,32	81,13
61	Guggenheim S&P 500® Equal Weight ETF	0,33	98,07
62	SPDR® S&P Regional Banking ETF	0,35	64,06
63	SPDR® S&P Insurance ETF	0,35	65,7
64	SPDR® S&P Semiconductor ETF	0,35	67,7
65	SPDR® S&P Biotech ETF	0,35	81,91
66	SPDR® S&P Retail ETF	0,35	91,01
67	Guggenheim S&P MidCap 400® Pure Gr ETF	0,35	93,38
68	VanEck Vectors Retail ETF	0,35	94,6
	Guggenheim S&P SmallCap 600® Pure Gr		
69	ETF	0,35	94,8
70	Guggenheim S&P 500® Pure Value ETF	0,35	95,03
71	Guggenheim S&P 500® Pure Growth ETF	0,35	95,13

73WisdomTree US SmallCap Earnings ETF0,38	96,6
74PowerShares Russell 2000 Pure Growth ETF0,39	91,61
75 PowerShares Russell Midcap Pure Gr ETF 0,39	93,55
PowerShares FTSE RAFI US 1500 Sm-Mid	
76 ETF 0,39	94,1
77SPDR® Blmbg Barclays Convert Secs ETF0,4	64,07
78 iShares Global 100 ETF 0,4 6	54,51
79Guggenheim S&P 500® Eq Weight Fincl ETF0,4	76,72
80Guggenheim S&P 500® Eq Weight HC ETF0,4	94,27
Guggenheim S&P 500® Eq Wt Technology	
81 EIF 0,4 9	94,78
82 Guggenheim S&P 500® Eq Wt Indls ETF 0,4 9	95,75
83 FTF 04	96 1
84 Oppenheimer Large Cap Revenue ETE 0.42	$\frac{90,1}{90,02}$
85 iShares US Basic Materials ETE 0.44	79 7 <u>4</u>
86 iShares US Healthcare ETE 0.44	20/1
87 iShares US Medical Devices ETE 0.44	37,41
87 IShares US Healthcare Providers ETE 0.44	$\frac{1,1}{2}$
80 IShares US Consumer Services ETE 0.44	0,55 0/ 77
90 iShares US Technology ETE 0.44	05 8
91 iShares US Aerospace & Defense ETE 0.44)5.81
92 iShares US Industrials ETE 0.44)7 30
92 IShares OS Industriais ETF 0,44 93 iShares Nasdag Biotechnology ETE 0.47	22 77
94 iShares North Amer Tech-Multimd Ntwk ETE 0.48	56.28
94 IShares Notul Ameri Tech-Muthind Ntwk ETT 0,46 95 iShares PHLY Semiconductor ETE 0.48	26 20
95 IShares Clobal Healthcare ETE 0.48	86.33
90 IShares Olobal Healtheart ETF 0,48 97 iShares North American Tech Software ETF 0.48	30,33 34 48
98 iShares Global Tech ETE 0.48)4,40)5 5/
90 iShares Global Consumer Discr ETE 0.48)6.87
100 iShares North American Tech FTE 0.48	0,82 07 74
100Ishares North American Teen LTT0,40101iShares MSCI KI D 400 Social FTF0.5)8.88
101 Ishares Wiser KED 400 Social ETT 0,5 102 VanEck Vectors Agribusiness ETE 0.53	27 Q/
102 Function of the second s)1 51
105 1131 105 1131 0,54 5 104 PowerShares Dynamic Pharmaceuticals FTF 0.56 5	87.84
101 For a construction of the function of the fu	83.07
105 105 105 105 105 0,50 0 106 PowerShares Dynamic Large Cap Growth FTF 0.57	98 5
100 PowerShares Dynamic Biotech & Genome FTF 0.58	<u>90,5</u>

108	PowerShares DWA Financial Momentum ETF	0,6	84,82
	PowerShares DWA Consumer Staples Mom		
109	ETF	0,6	89,67
110	iShares Micro-Cap ETF	0,6	89,71
111	PowerShares NASDAQ Internet ETF	0,6	90,87
112	PowerShares DWA Industrials Momentum ETF	0,6	91,4
112	PowerShares DWA Technology Momentum	0.7	01.0
113		0,6	91,8
114	PowerShares Dynamic Market ETF	0,6	93,23
115	ETF	0.6	93 75
116	PowerShares DWA Cnsmr Cyclicals Mom ETF	0,6	94 46
117	First Trust NASDAO-100-Tech Sector ETF	0.6	95.43
118	First Trust NASDAO-100 ex-Tech Sect ETF	0.6	95.9
119	First Trust US Equity Opportunities ETF	0.6	97.17
120	First Trust NASDAO-100 Equal Wtd ETF	0.6	97.53
121	PowerShares Aerospace & Defense ETF	0.61	88.8
122	Guggenheim Defensive Equity ETF	0.61	89.11
123	PowerShares Dynamic Leisure & Entmnt ETF	0.61	91.97
124	Guggenheim Insider Sentiment ETF	0.61	94.26
125	First Trust Large Cap Core AlphaDEX® ETF	0.61	97.19
126	First Trust Health Care AlphaDEX® ETF	0.62	94.35
127	First Trust Large Cap Gr AlphaDEX® ETF	0.62	94,49
128	PowerShares Dynamic Semiconductors ETF	0.63	76.7
129	First Trust Financials AlphaDEX® ETF	0,63	85,94
130	First Trust Technology AlphaDEX® ETF	0,63	90,31
131	PowerShares Dynamic Networking ETF	0,63	90,76
132	PowerShares Dynamic Media ETF	0,63	92,47
133	PowerShares Dynamic Software ETF	0,63	94,36
134	PowerShares Buyback Achievers ETF	0,63	95,31
135	PowerShares DWA Momentum ETF	0,63	95,67
136	First Trust Cnsmr Discret AlphaDEX® ETF	0,63	95,85
137	First Trust Small Cap Core AlphaDEX® ETF	0,63	96,85
138	First Trust Mid Cap Core AlphaDEX® ETF	0,63	97,22
139	Guggenheim S&P Spin-Off ETF	0,64	96,21
140	First Trust Materials AlphaDEX® ETF	0,65	92,94
141	Guggenheim Mid-Cap Core ETF	0,65	96,15
142	First Trust Value Line® 100 ETF ETF	0,7	88,81
143	First Trust Multi Cap Gr AlphaDEX® ETF	0,7	95,72

144	Guggenheim Raymond James SB-1 Equity ETF	0,75	97,49
145	IQ Hedge Multi-Strategy Tracker ETF	0,76	52,21

ANNEX V

	Dividend
Date	Yield
Dec 31, 1871	5%
Dec 31, 1872	5,92%
Dec 31, 1873	7,47%
Dec 31, 1874	7,27%
Dec 31, 1875	6,86%
Dec 31, 1876	8,38%
Dec 31, 1877	5,85%
Dec 31, 1878	5,22%
Dec 31, 1879	4,07%
Dec 31, 1880	4,45%
Dec 31, 1881	5,32%
Dec 31, 1882	5,48%
Dec 31, 1883	6,18%
Dec 31, 1884	7,14%
Dec 31, 1885	4,62%
Dec 31, 1886	3,90%
Dec 31, 1887	4,74%
Dec 31, 1888	4,47%
Dec 31, 1889	4,14%
Dec 31, 1890	4,78%
Dec 31, 1891	4,07%
Dec 31, 1892	4,36%
Dec 31, 1893	5,67%
Dec 31, 1894	4,88%
Dec 31, 1895	4,40%
Dec 31, 1896	4,27%
Dec 31, 1897	3,79%
Dec 31, 1898	3,54%
Dec 31, 1899	3,49%
Dec 31, 1900	4,37%
Dec 31, 1901	4,03%
Dec 31, 1902	4,10%
Dec 31, 1903	5,33%

Dec 31, 1904	3,76%
Dec 31, 1905	3,46%
Dec 31, 1906	4,07%
Dec 31, 1907	6,70%
Dec 31, 1908	4,43%
Dec 31, 1909	4,27%
Dec 31, 1910	5,19%
Dec 31, 1911	5,16%
Dec 31, 1912	5,12%
Dec 31, 1913	5,97%
Dec 31, 1914	5,71%
Dec 31, 1915	4,54%
Dec 31, 1916	5,71%
Dec 31, 1917	10,15%
Dec 31, 1918	7,22%
Dec 31, 1919	5,94%
Dec 31, 1920	7,49%
Dec 31, 1921	6,29%
Dec 31, 1922	5,81%
Dec 31, 1923	6,20%
Dec 31, 1924	5,41%
Dec 31, 1925	4,82%
Dec 31, 1926	5,11%
Dec 31, 1927	4,41%
Dec 31, 1928	3,67%
Dec 31, 1929	4,53%
Dec 31, 1930	6,32%
Dec 31, 1931	9,72%
Dec 31, 1932	7,33%
Dec 31, 1933	4,41%
Dec 31, 1934	4,86%
Dec 31, 1935	3,60%
Dec 31, 1936	4,22%
Dec 31, 1937	7,26%
Dec 31, 1938	4,02%
Dec 31, 1939	5,01%
Dec 31, 1940	6,36%
Dec 31, 1941	8,11%

Dec 31, 1942	6,20%
Dec 31, 1943	5,31%
Dec 31, 1944	4,89%
Dec 31, 1945	3,81%
Dec 31, 1946	4,69%
Dec 31, 1947	5,59%
Dec 31, 1948	6,12%
Dec 31, 1949	6,89%
Dec 31, 1950	7,44%
Dec 31, 1951	6,02%
Dec 31, 1952	5,41%
Dec 31, 1953	5,84%
Dec 31, 1954	4,40%
Dec 31, 1955	3,61%
Dec 31, 1956	3,75%
Dec 31, 1957	4,44%
Dec 31, 1958	3,27%
Dec 31, 1959	3,10%
Dec 31, 1960	3,43%
Dec 31, 1961	2,82%
Dec 31, 1962	3,40%
Dec 31, 1963	3,07%
Dec 31, 1964	2,98%
Dec 31, 1965	2,97%
Dec 31, 1966	3,53%
Dec 31, 1967	3,06%
Dec 31, 1968	2,88%
Dec 31, 1969	3,47%
Dec 31, 1970	3,49%
Dec 31, 1971	3,10%
Dec 31, 1972	2,68%
Dec 31, 1973	3,57%
Dec 31, 1974	5,37%
Dec 31, 1975	4,15%
Dec 31, 1976	3,87%
Dec 31, 1977	4,98%
Dec 31, 1978	5,28%
Dec 31, 1979	5,24%

Dec 31, 1980	4,61%
Dec 31, 1981	5,36%
Dec 31, 1982	4,93%
Dec 31, 1983	4,31%
Dec 31, 1984	4,58%
Dec 31, 1985	3,81%
Dec 31, 1986	3,33%
Dec 31, 1987	3,66%
Dec 31, 1988	3,53%
Dec 31, 1989	3,17%
Dec 31, 1990	3,68%
Dec 31, 1991	3,14%
Dec 31, 1992	2,84%
Dec 31, 1993	2,70%
Dec 31, 1994	2,89%
Dec 31, 1995	2,24%
Dec 31, 1996	2,00%
Dec 31, 1997	1,61%
Dec 31, 1998	1,36%
Dec 31, 1999	1,17%
Dec 31, 2000	1,22%
Dec 31, 2001	1,37%
Dec 31, 2002	1,79%
Dec 31, 2003	1,61%
Dec 31, 2004	1,62%
Dec 31, 2005	1,76%
Dec 31, 2006	1,76%
Dec 31, 2007	1,87%
Dec 31, 2008	3,23%
Dec 31, 2009	2,02%
Dec 31, 2010	1,83%
Dec 31, 2011	2,13%
Dec 31, 2012	2,20%
Dec 31, 2013	1,94%
Dec 31, 2014	1,92%
Dec 31, 2015	2,11%
Dec 31, 2016	2,03%
Dec 31, 2017	1,84%

ANNEX VI

Year	Total Annual Return
1970	4,01%
1971	14,31%
1972	18,98%
1973	-14,66%
1974	-26,47%
1975	37,20%
1976	23,84%
1977	-7,18%
1978	6,56%
1979	18,44%
1980	32,50%
1981	-4,92%
1982	21,55%
1983	22,56%
1984	6,27%
1985	31,73%
1986	18,67%
1987	5,25%
1988	16,61%
1989	31,69%
1990	-3,10%
1991	30,47%
1992	7,62%
1993	10,08%
1994	1,32%
1995	37,58%
1996	22,96%
1997	33,36%
1998	28,58%
1999	21,04%
2000	-9,10%
2001	-11,89%
2002	-22,10%
2003	28,68%

2004	10,88%
2005	4,91%
2006	15,79%
2007	5,49%
2008	-37,00%
2009	26,46%
2010	15,06%
2011	2,11%
2012	16,00%
2013	32,39%
2014	13,69%
2015	1,38%
2016	11,96%
2017	21,83%

ANNEX VIIII

Number	Fund Name	2008	2009	2010	2011	2012	urn per Year 2013	2014	2015	2016	2017	100 Bse
1	Vanguard Instl Ttl Stk Mkt Idx InstlPls Vanguard 500 Index Admiral	-36,89%	28,92%	17,25%	1,11%	16,53%	33,63%	12,64%	0,48%	12,77%	21,13%	232,21
3	Vanguard 1900 mack Admiral Vanguard Institutional Index I	-36,95%	26,63%	15,05%	2,08%	15,98%	32,35%	13,65%	1,37%	11,93%	21,79%	226,07
4	Vanguard Total Stock Mkt Idx Adm	-36,99%	28,83%	17,26%	1,08%	16,38%	33,52%	12,56%	0,39%	12,66%	21,17%	230,62
5	Fidelity® 500 Index Premium Fidelity® Total Market Index Premium	-37,01%	26,55%	15,01%	2,06%	15,97%	32,33%	13,62%	1,35%	11,92%	21,79%	225,39
7	Schwab Total Stock Market Index	-36,58%	28,29%	17,23%	1,32%	16,30%	33,36%	12,39%	0,41%	12,58%	21,06%	230,53
8	Vanguard Growth Index Admiral	-38,22%	36,42%	17,12%	1,87%	17,01%	32,40%	13,63%	3,30%	6,12%	27,80%	247,99
10	Vanguard Mega Cap Index Admiral Vanguard Mega Cap Index Institutional	-36,06%	25,46%	13,81%	2,34%	16,13%	32,00%	13,32%	1,56%	11,03%	22,03%	226,16
11	Vanguard Value Index Adm	-35,90%	19,72%	14,45%	1,14%	15,18%	33,05%	13,18%	-0,86%	16,86%	17,13%	209,08
12	DFA US Large Company I Fidelity® Total Market Index Investor	-36,76%	26,62%	15,00%	2,10%	15,82%	32,33%	13,53%	1,38%	11,90%	21,73%	225,92
14	Vanguard Tax-Managed Capital App Adm	-37,58%	29,11%	16,02%	1,38%	16,35%	33,67%	12,52%	1,68%	12,01%	22,40%	231,25
15	Fidelity® 500 Index Investor	-37,03%	26,51%	14,98%	2,03%	15,93%	32,25%	13,59%	1,31%	11,87%	21,72%	224,53
16	Vanguard 500 Index Investor	-42,33%	35,27% 26,49%	14,58%	-0,52%	17,84%	37,09% 32.18%	15,85%	1,27%	10,34%	24,19%	230,94
18	Bridgeway Blue Chip 35 Index	-33,30%	26,61%	10,60%	3,17%	15,20%	31,67%	11,51%	2,17%	13,18%	18,43%	223,21
19	Vanguard Total Stock Mkt Idx Inv Vanguard Growth Index Invector	-37,04%	28,70%	17,09%	0,96%	16,25%	33,35%	12,43%	0,29%	12,53%	21,05%	228,07
20	Vanguard Large Cap Index Investor	-37,08%	27,60%	15,63%	1,44%	15,94%	32,45%	13,24%	0,93%	11,50%	21,89%	224,63
22	Vanguard Value Index Inv	-35,97%	19,58%	14,28%	1,00%	15,00%	32,85%	13,05%	-1,03%	16,75%	16,99%	206,33
23	DFA US Core Equity 1 I TIAA-CREF Social Choice Ed Instl	-36,53%	29,84%	20,11%	-0,64%	16,91%	36,60%	10,52%	-1,35%	14,80%	20,89%	237,65
25	Columbia Large Cap Index Inst	-37,22%	26,03%	14,62%	1,73%	15,51%	31,77%	13,16%	0,96%	11,47%	21,30%	216,92
26	JPMorgan Equity Index I	-37,05%	26,42%	14,82%	1,96%	15,76%	32,10%	13,40%	1,19%	11,71%	21,61%	222,09
27	Wells Fargo Index Admin	-42,39%	35,12%	14,43%	-0,78%	17,84%	36,84%	15,75%	1,17%	10,24%	24,11%	220,34
29	T, Rowe Price Equity Index 500	-37,06%	26,33%	14,71%	1,87%	15,68%	32,02%	13,40%	1,15%	11,87%	21,73%	221,65
30	Vanguard US Value Inv DEA US Large Cap Value I	-34,79%	15,29%	13,82%	3,23%	19,12%	33,98%	14,68%	-1,65%	16,36%	12,97%	209,02
32	JPMorgan US Research Enhanced Equity R6	-42,24%	32,39%	28,22%	10,80%	16,74%	0,90%	31,09%	3,02%	4,53%	4,22%	188,27
33	T, Rowe Price Total Equity Market Idx	-37,16%	28,76%	16,80%	0,61%	16,32%	33,70%	12,29%	0,33%	12,69%	20,80%	226,78
34	Schwab Fundamental US Large Company Idx	-37,72%	42.14%	14,62%	-0.21%	16,92%	32,59%	14,04%	-2.96%	16.31%	20,68%	235.63
36	TIAA-CREF Large-Cap Value Instl	-39,85%	30,88%	18,18%	-5,67%	19,68%	34,43%	9,16%	-4,69%	18,60%	12,52%	196,04
37	Vanguard PRIMECAP Inv	-32,41%	34,45%	12,89%	-1,84%	15,27%	39,73%	18,72%	2,58%	10,63%	29,51%	283,01
39	Vanguard Capital Opportunity Inv	-39,23%	48,91%	11,06%	-6,18%	18,37%	42,69%	18,88%	2,15%	5,97%	29,10%	247,79
40	Wells Fargo Index A	-37,35%	25,91%	14,49%	1,59%	15,41%	31,65%	13,03%	0,87%	11,48%	21,29%	214,90
41	PIMCO StocksPLUS® Instl Dodge & Cox Stock	-40,26%	46,83%	15,42%	-10,57%	28,16%	22,62%	5,64%	1,17%	9,24%	18,84%	197,42
43	Fidelity® New Millennium	-40,23%	40,24%	18,93%	2,52%	15,66%	37,19%	6,96%	-3,17%	14,92%	20,06%	231,73
44	T, Rowe Price Instl Large Cap Growth	-40,86%	53,40%	16,29%	-1,40%	17,55%	44,44%	8,72%	10,08%	2,85%	37,82%	299,62
45	T, Rowe Price InstI Large Cap Core Gr Fidelity Advisor® Capital Development O	-42,61%	42,99%	16,37%	1,47%	18,48%	41,44%	9,30%	11,34%	1,12%	36,50%	272,76
47	American Beacon Large Cap Value Instl	-39,39%	27,52%	14,56%	-2,34%	19,07%	34,93%	10,56%	-6,05%	15,98%	17,07%	195,93
48	ClearBridge Large Cap Value I	-35,23%	24,04%	9,57%	4,79%	16,57%	32,17%	11,79%	-2,71%	13,13%	14,44%	200,12
49 50	JPMorgan US Equity L	-39,70%	33,36%	14,05%	-1,89%	17,14%	31,50%	8,96%	3,38%	12,54%	23,37%	216,77
51	Fidelity® Equity-Income	-41,64%	29,54%	15,13%	-4,68%	17,23%	27,68%	8,68%	-3,52%	17,38%	13,36%	173,26
52	Fidelity® Large Cap Stock	-47,46%	50,45%	18,22%	-1,62%	20,71%	39,24%	10,13%	-3,17%	16,70%	18,15%	227,20
54	Principal LargeCap Growth I Instl	-40,60%	52,16%	19,91%	-0,31%	16,52%	36,68%	8,65%	8,17%	0,98%	43,83%	273,03
55	Fidelity Advisor® Large Cap I	-47,37%	50,72%	18,23%	-1,47%	20,81%	39,59%	10,27%	-3,41%	16,92%	18,50%	229,96
56	Fidelity® Growth & Income Harbor Capital Appreciation Instl	-50,89%	23,05%	14,57%	1,39%	19,10%	33,40%	9.93%	-2,28%	16,06%	16,88% 36.59%	163,19 263.00
58	Selected American Shares D	-39,24%	32,06%	12,90%	-4,02%	13,19%	33,62%	5,96%	3,96%	12,83%	22,18%	199,70
59	LSV Value Equity	-39,21%	23,53%	13,25%	-1,90%	20,31%	42,88%	12,15%	-2,58%	17,60%	18,30%	217,98
60	BlackRock Capital Appreciation K	-33,27%	36,87%	11,82%	-8,78%	13,62%	34,39%	8,72%	7,29%	0,03%	33,19%	200,40
62	Loomis Sayles Growth Y	-49,81%	32,65%	15,70%	0,72%	18,75%	35,36%	11,27%	10,02%	5,87%	32,64%	214,39
63 64	Mairs & Power Growth Inv PRIMECAP Odyssey Growth	-28,51%	22,52%	17,40%	0,74%	21,91%	35,64%	8,12%	-3,07% 6.18%	15,38%	16,52%	241,35
65	T, Rowe Price Equity Income	-35,50%	25,28%	15,23%	-0,63%	17,44%	30,02%	7,79%	-6,65%	19,07%	16,47%	197,15
66	JPMorgan Intrepid Growth I	-39,37%	33,46%	15,61%	1,10%	15,66%	33,93%	16,14%	1,87%	5,45%	31,55%	240,44
67	Loomis Savles Value Y	-42,26%	43,25% 20.16%	16,93%	-0,97%	18,92%	39,20%	8,83%	-4.19%	1,41%	33,63%	259,20
69	Diamond Hill Large Cap I	-33,82%	30,71%	9,72%	2,60%	12,62%	36,60%	10,74%	-0,85%	14,63%	20,30%	226,83
70	Fidelity Advisor® Growth & Income I	-41,33%	26,88%	14,85%	1,59%	18,49%	33,51%	10,32%	-2,35%	15,95%	16,85%	200,55
72	T, Rowe Price Blue Chip Growth	-42,62%	42,57%	16,42%	1,50%	18,41%	41,57%	9,28%	11,15%	1,14%	36,71%	272,15
73	American Beacon Bridgeway Lg Cp Val Inst	-36,83%	24,92%	14,51%	2,33%	18,06%	37,77%	14,17%	-1,24%	16,24%	15,89%	228,44
74	Prudential Jennison Growth Z	-35,97%	43.25%	13,72%	0,20%	19,95%	43,04%	6,73% 9.96%	-0,64%	-1.19%	24,82%	263.59
76	MFS® Blended Research Core Equity A	-36,57%	25,16%	16,11%	1,71%	14,97%	35,70%	11,84%	0,66%	8,12%	20,34%	214,25
77	JPMorgan Value Advantage L Laudus US Large Can Growth	-35,41%	35,87%	20,72%	1,62%	18,92%	32,27%	13,87%	-4,24%	17,03%	14,23%	246,85
79	JPMorgan US Equity I	-37,74%	33,27%	14,50%	-1,53%	17,35%	36,04%	13,83%	0,28%	10,88%	21,52%	242,41
80	Boston Partners All Cap Value Instl	-27,26%	30,97%	13,42%	-1,38%	15,83%	39,12%	12,23%	0,95%	14,82%	17,85%	263,25
81	American Funds New Economy A T. Rowe Price New America Growth	-41,86% -38,47%	45,16% 48,98%	13,40%	-5,65%	24,02%	43,36%	4,59%	3,80% 8,52%	2,19%	34,38%	239,35
83	Fidelity® Blue Chip Growth	-38,60%	44,96%	19,61%	-2,72%	17,77%	39,84%	14,60%	6,28%	1,59%	36,06%	287,14
84	MFS® Research A	-42,47%	30,30%	10,50%	-11,31%	16,40%	18,40%	-7,44%	-2,50%	-1,56%	28,33%	115,43
86	JHancock Blue Chip Growth 1	-33,76%	42,69%	16,25%	-2,00%	19,46%	41,23%	9,10%	-1,74%	0,84%	36,24%	267,94
87	Parnassus	-34,13%	47,93%	16,70%	-5,01%	26,06%	34,21%	14,67%	0,27%	13,45%	16,08%	276,72
88 89	Pidenty® Growth Company Neuberger Berman Socially Rsnns Inv	-40,90% -38,77%	41,15% 30,61%	20,55%	-2.90%	18,52%	37,61%	14,44%	7,83% -0,41%	6,01% 10.10%	36,76%	295,39
90	Fidelity® Value Discovery	-42,32%	27,68%	15,37%	-2,28%	16,97%	35,51%	14,78%	-3,02%	13,24%	14,17%	189,40
91	Glenmede Large Cap Core Port	-37,64%	27,55%	17,85%	2,82%	17,65%	37,52%	16,35%	1,67%	11,06%	24,76%	255,59
92	MFS® Value A	-39,58% -32,85%	55,19% 20,48%	22,00% 11,41%	-0,21%	16,13%	57,42% 35,48%	20,01%	4,10% -0,79%	13,86%	28,08% 17,45%	201,09
94	ClearBridge Large Cap Value A	-35,52%	23,73%	9,42%	4,41%	16,24%	31,70%	11,44%	-3,01%	12,78%	14,13%	194,12
95	Davis NY Venture A	-40,03%	32,06%	12,11%	-4,78%	12,73%	34,56%	6,55%	2,97%	12,25%	22,15%	192,92
90	Oakmark Investor	-++3,44% -32,61%	44,77%	12,18%	-4,50%	20,97%	37,29%	3,80% 11,51%	-3,01%	18,35%	21,14%	284,19
98	Fidelity Advisor® Large Cap A	-47,53%	50,22%	17,84%	-1,86%	20,50%	39,15%	9,96%	-3,65%	16,64%	18,18%	223,22
99 100	PIMCO StocksPLUS® D Sound Shore Investor	-33,13%	27,13%	27,60%	21,15%	27,22%	18,86%	34,23%	-3,19%	20,42%	32,87%	413,18 204 90
101	American Beacon Large Cap Value Inv	-39,58%	20,04%	14,11%	-2,72%	13,52%	34,46%	10,19%	-6,38%	15,60%	16,70%	189,40
102	Ave Maria Rising Dividend	-22,79%	25,29%	17,90%	4,63%	13,89%	33,85%	9,28%	-5,89%	15,33%	16,82%	252,06
103	Loomis Sayles Growth A	-35,89%	24,00% 32,16%	15,34%	-2,25%	17,28%	30,51% 35,09%	11,56%	3,61%	9,83% 5,67%	24,18% 32,29%	213,31 208,14
105	Putnam Equity Income A	-31,28%	27,20%	12,37%	1,77%	19,02%	31,63%	12,44%	-3,18%	13,55%	18,69%	229,77
106	MFS® Growth A	-37,61%	38,19%	15,65%	-0,60%	17,10%	36,28%	8,52%	7,11%	2,25%	30,53%	245,37
107	Touchstone Focused Y	-30,74%	32,68%	9,55%	-0,22%	22,13%	39,24%	6,76%	3,29%	11,42%	10,74%	232,49
109	JPMorgan US Equity A	-34,90%	32,77%	14,02%	-1,81%	16,92%	35,57%	13,44%	0,45%	10,49%	21,13%	233,92
110	Loomis Savles Value A	-33,59%	19,81%	11,63%	-3,03%	19,41%	35,22%	10,49%	-4,43%	11,34%	14,44%	187,11
111	Davis Opportunity A	-44.71%	44.81%	13,47%	-3,64%	1 1.2			A DECISION OF A DECISIONO OF A		×	22.3

113	Fidelity Advisor® Growth & Income A	-41,51%	26,47%	14,45%	1,27%	18,05%	33,01%	9,95%	-2,58%	15,60%	16,58%	194,33
114	Selected American Shares S	-39,44%	31,64%	12,53%	-4,35%	12,82%	33,16%	5,60%	3,59%	12,50%	21,77%	193,18
115	American Century Ultra® Inv	-41,74%	35,36%	16,56%	1,19%	14,18%	36,91%	9,91%	6,16%	4,38%	31,90%	233,58
116	American Century Value Inv	-26,70%	19,43%	13,41%	0,59%	14,55%	31,10%	12,89%	-4,34%	20,22%	8,47%	211,20
117	Dreyfus Strategic Value A	-36,01%	24,83%	15,01%	-6,23%	17,99%	37,66%	10,43%	-2,30%	18,26%	14,85%	205,04
118	Oakmark Select Investor	-36,22%	52,46%	13,24%	2,15%	21,74%	36,52%	15,39%	-3,58%	15,31%	15,72%	277,54
119	AllianzGI NFJ Dividend Value A	-36,25%	12,91%	13,08%	3,09%	13,93%	28,64%	9,65%	-8,63%	15,87%	15,70%	165,18
120	American Century Select Inv	-39,67%	34,79%	14,58%	1,42%	14,74%	30,21%	10,52%	7,69%	5,48%	28,93%	228,52
121	Diamond Hill Large Cap A	-34,06%	30,21%	9,29%	2,35%	12,29%	36,33%	10,42%	-1,10%	14,26%	19,95%	220,06
122	Hotchkis & Wiley Value Opps Instl	-42,12%	65,96%	34,80%	-7,07%	29,56%	37,73%	10,09%	-3,33%	19,42%	13,85%	310,69
123	JPMorgan Growth Advantage I	-41,96%	36,62%	21,11%	-1,72%	15,88%	44,36%	9,54%	8,54%	1,07%	35,19%	256,49
124	Boston Partners All Cap Value Inv	-27,56%	30,77%	13,19%	-1,62%	15,61%	38,91%	11,98%	0,69%	14,52%	17,63%	257,31
125	JPMorgan Growth And Income A	-37,03%	22,05%	14,98%	0,32%	19,53%	33,96%	14,10%	-2,53%	14,78%	17,14%	212,26
126	Lazard US Equity Concentrated Open	-36,43%	24,49%	11,62%	-1,77%	16,51%	29,21%	18,28%	6,67%	7,06%	15,22%	203,30
127	Prudential Jennison Growth A	-37,79%	42,81%	11,28%	0,17%	15,49%	37,06%	9,61%	10,80%	-1,50%	36,37%	255,73
128	Columbia Disciplined Core A	-38,74%	21,42%	15,14%	5,51%	15,50%	33,53%	14,98%	0,87%	7,68%	24,07%	215,94
129	JPMorgan Large Cap Growth A	-39,72%	34,51%	22,31%	2,72%	11,86%	32,53%	10,64%	7,45%	-2,16%	37,71%	241,90
130	JHancock Disciplined Value A	-33,24%	26,05%	12,78%	0,00%	19,53%	35,51%	10,60%	-5,20%	13,64%	18,92%	217,82
131	BlackRock Capital Appreciation Inv A	-36,56%	36,18%	19,13%	-9,13%	13,93%	33,80%	8,35%	6,86%	-0,36%	32,59%	218,07
132	Columbia Contrarian Core A	-35,61%	37,02%	15,91%	-1,19%	18,33%	35,41%	12,66%	2,78%	8,35%	21,43%	246,66
133	Alger Capital Appreciation Instl I	-43,89%	49,12%	13,48%	-1,03%	18,11%	34,81%	13,30%	6,23%	0,46%	31,02%	237,04
134	ClearBridge Aggressive Growth A	-42,40%	32,69%	23,92%	1,41%	18,53%	44,62%	14,55%	-4,40%	5,71%	14,28%	217,81
135	Ivy Large Cap Growth A	-38,14%	24,58%	14,07%	1,85%	10,50%	35,57%	11,32%	6,76%	1,17%	29,04%	208,10
136	JHancock US Global Leaders Growth A	-34,77%	44,32%	12,16%	3,85%	19,32%	26,15%	8,55%	8,07%	0,71%	25,32%	244,37
137	Columbia Select Large Cap Equity A	-35,89%	24,00%	13,76%	-2,25%	17,28%	30,51%	11,56%	3,61%	9,83%	24,18%	213,31
138	Natixis Oakmark A	-40,45%	44,03%	13,08%	-1,56%	17,03%	37,82%	10,43%	-4,41%	18,37%	20,75%	232,34
139	Alger Spectra A	-43,19%	56,52%	16,67%	-0,63%	18,79%	35,07%	12,28%	7,08%	-0,18%	31,03%	260,10
140	Alger Capital Appreciation A	-44,44%	50,00%	13,11%	-0,97%	17,84%	34,89%	13,12%	6,25%	0,33%	31,22%	234,80
141	Fidelity Advisor® Growth & Income M	-41,51%	26,47%	14,45%	1,27%	18,05%	33,01%	9,95%	-2,58%	15,60%	16,58%	194,33
142	Natixis US Equity Opportunities A	-40,05%	36,41%	21,90%	-2,79%	17,79%	35,75%	12,94%	5,86%	11,86%	26,28%	261,69
143	JPMorgan Growth Advantage A	-41,96%	36,62%	21,11%	-1,72%	15,88%	44,36%	9,54%	8,54%	1,07%	35,19%	256,49
144	MFS® Growth B	-38,07%	37,09%	14,82%	-1,36%	16,25%	35,26%	7,69%	6,30%	1,51%	29,55%	227,61
145	BlackRock Capital Appreciation Inv C	-36,92%	35,22%	18,17%	-9,84%	12,93%	32,79%	7,52%	5,99%	-1,18%	31,51%	201,83
146	Alger Capital Appreciation B	-44.85%	48.45%	12.15%	-1.86%	16.96%	33.83%	12.21%	5.42%	-0.51%	30.33%	216.34

ANNEX IX

	NO FEES CONS	SIDERED	FEES CONSIDERED					
Number	SP base 100 NO DIVIDENDS	Number SP base 100 DIVIDENDS	Number SP base 100 NO DIVIDENDS Number SP base 100 DIVIDENDS					
1	Vanguard Instl Ttl Stk Mkt Idx InstlPls	1 Vanguard PRIMECAP Inv	1 Vanguard Growth Index Admiral 1 T, Rowe Price Instl Large Cap Growth					
2	Vanguard Institutional Index I	2 Vanguard Capital Opportunity Inv	2 Vanguard Growth Index Investor 2 PIMCO StocksPLUS® D					
3	Vanguard Total Stock Mkt Idx Adm	3 T, Rowe Price Instl Large Cap Growth	3 Vanguard PRIMECAP Inv 3 Hotchkis & Wiley Value Opps Instl					
4	Fidelity® Total Market Index Premium	4 Morgan Stanley Inst Growth I	4 JPMorgan Intrepid Growth R6 4 Ave Maria Rising Dividend					
5	Schwab Total Stock Market Index	5 PRIMECAP Odyssey Growth	5 Vanguard Capital Opportunity Inv 5 Oakmark Investor					
6	Vanguard Growth Index Admiral	6 Fidelity® Blue Chip Growth	6 T. Rowe Price Instl Large Cap Growth					
7	Vanguard Large Cap Index Admiral	7 Fidelity® Growth Company	7 T Rowe Price InstI Large Cap Core Gr					
8	Vanguard Mega Cap Index Institutional	8 Glenmede Large Cap Growth	8 JPMorgan US Equity L					
9	Fidelity® Total Market Index Investor	9 Oakmark Investor	9 Morgan Stanley Inst Growth I					
10	Vanguard Tax-Managed Capital App Adm	10 PIMCO StocksPLUS® D	10 Principal LargeCap Growth Linst					
11	Vanguard FTSE Social Index I	11 Hotchkis & Wiley Value Opps Instl	11 Harbor Capital Appreciation Inst					
12	Vanguard Total Stock Mkt Idx Inv		12 PRIMECAP Odyssey Stock					
13	Vanguard Growth Index Investor		13 PRIMECAP Odyssey Growth					
14	DFA US Core Equity 1 I		14 T Rowe Price Growth Stock					
15	Vanguard FTSE Social Index Inv		15 T. Rowe Price Blue Chip Growth					
16	DFA US Large Cap Value I		16 Prudential Jennison Growth Z					
17	T Rowe Price Total Equity Market Idx		17 JPMorgan Value Advantage L					
18	Schwab Fundamental US Large Company Idx		18 Laudus US Large Cap Growth					
19	Vanguard PRIMECAP Inv		19 IPMorgan US Equity I					
20	JPMorgan Intrepid Growth R6		20 Boston Partners All Cap Value Instl					
21	Vanguard Capital Opportunity Inv		21 T Rowe Price New America Growth					
22	Fidelity® New Millennium		22 Fidelity® Blue Chip Growth					
23	T Rowe Price Instl Large Can Growth		23 JHancock Blue Chip Growth 1					
24	T Rowe Price Inst Large Cap Core Gr		24 Parnassus					
25	JPMorgan US Equity L		25 Fidelity® Growth Company					
25	Fidelity® Large Can Stock		26 Glenmede Large Can Core Port					
20	Morgan Stanley Inst Growth I		27 Glenmede Large Cap Growth					
28	Principal LargeCan Growth LInst		27 Orienticule Large Cap Growth					
20	Fidelity Advisor® Large Can I		20 PIMCO StockePLUS® D					
20	Harbor Conital Approximation Instl		20 Ava Maria Dising Dividend					
21	DRIMECAR Odward Steel		21 MES® Crowth A					
22	Philippede Control American K		22 Orlevente Calent Investor					
32	Maine & Deren Canada Luca		32 Oakmark Select Investor					
24	DRIMECAR Odward Crowth		A IDMoreon Crowth Adventora I					
34	IDM array Intervid County I		34 JPMorgan Growin Advantage 1 25 Destars Destars All Cas Vision Inc.					
35	JPMorgan Intrepid Growth I		35 Boston Partners All Cap Value Inv					
36	I, Rowe Price Growth Stock		36 Prudential Jennison Growth A					
37	Diamond Hill Large Cap I		37 JP Morgan Large Cap Growin A					
38	1, Rowe Price Blue Chip Growth		38 Columbia Contrarian Core A					
39	American Beacon Bridgeway Lg Cp val Inst		39 JHancock US Global Leaders Growth A					
40	Neuberger Berman Multi-Cap Opp Inst		40 Alger Spectra A					
41	Prudential Jennison Growth Z		41 Natixis US Equity Opportunities A					
42	JPMorgan Value Advantage L		42 JPMorgan Growth Advantage A					
43	Laudus US Large Cap Growth							
44	JPMorgan US Equity I							
45	Boston Partners All Cap Value Insti							
46	American Funds New Economy A							
47	T, Rowe Price New America Growth							
48	Fidelity® Blue Chip Growth							
49	T, Rowe Price Value							
50	JHancock Blue Chip Growth 1							
51	Parnassus							
52	Fidelity® Growth Company							
53	Glenmede Large Cap Core Port							
54	Glenmede Large Cap Growth							
55	Oakmark Investor							
56	PIMCO StocksPLUS® D							
57	Ave Maria Rising Dividend							
58	Putnam Equity Income A							
59	MFS® Growth A							
60	Touchstone Focused Y							
61	JPMorgan US Equity A							
62	American Century Ultra® Inv							
63	Oakmark Select Investor							
64	American Century Select Inv							
65	Hotchkis & Wiley Value Opps Instl							
66	JPMorgan Growth Advantage I							
67	Boston Partners All Cap Value Inv							
68	Prudential Jennison Growth A							
69	JPMorgan Large Cap Growth A							
70	Columbia Contrarian Core A							
71	Alger Capital Appreciation Instl I							
72	JHancock US Global Leaders Growth A							
73	Natixis Oakmark A							
74	Alger Spectra A							
75	Alger Capital Appreciation A							
76	Natixis US Equity Opportunities A							
77	JPMorgan Growth Advantage A							
78	MFS® Growth B							
-								

ANNEX X



ANNEX XII

#Exclusive use by Ignacio de José Rincón and Ziwenxi Wang.
#Use of this code only if aforementioned names grant written permission.
#Code used for final thesis for the Master in International Finance - CUNEF.
#Final Thesis: ¿Is active management a charade? The shift to passive management and the abolition of an industry.
#Script Quantitative Finance - SP 500 model.
#Forecast Model - Analysis and forecast (Geometric Brownian Method).
#ETS Model (Error, Trend, Seasonality) and statistics.
#TFM - Ignacio de José Rincón & Ziwenxi Wang.

#Required packages for ETS (Error, Trend, Seasonality).
require(forecast)
require(xts)
require(ggplot2)
library(ggfortify) #Plot.

#For Geometric Brownian Method. library(pastecs) # For statistics. library(ggplot2) library(ggcorrplot) library (xts) #For quantmod. library (TTR) #For quantmod. library(quantmod) library(reshape) library("fOptions") #For Geometric Brownian Method.

#Data gathering, from .CSV file (Annex). newData <-read.csv("~/Desktop/R abril 18/Evolution SP500 quarter final 1980 to 2007.csv",sep=";",dec=".")

#Data is stated quarterly, so quarterly order is required. quarter=as.Date(as.yearqtr(newData\$Quarter,format="Q%q%Y"))

#Need to convert into a time serie, so we can produce graphics and forecast. #indexPrice data is ordered in the same format as quarters, #and its frequency is 4 as there are 4 quarters. indexPrice=xts((newData\$IndexPrice),order.by=as.POSIXct(format(quarter)),frequency =4) plot(indexPrice) barplot(indexPrice)

#We will work with the info in quarters. #So indexPrice should be per quarters instead of per dates. indexPrice=to.quarterly(indexPrice) #We transform the info to type zoo data to make it a time serie irregular or regular. #irregular o regular. We only want the close price, so we select it. indexPrice2=zoo(indexPrice\$indexPrice.Close) plot(indexPrice2) barplot(indexPrice2, col=4)

#Now we change the name so we can recognise it names(indexPrice2)="SP500IndexPrice"

#Quarter graph. In order to forecast we need seasonal component, #and to identify it we need to do a graph. #We do a graph of indexPrice2 with the name of SP500QuarterIndexPrice, #x axis will be quarters and y axis will be SP500QuarterIndexPrice. #Positive tendency and no apparent seasonability. autoplot(indexPrice2, col=4)+ggtitle("SP500IndexPrice")+xlab("Quarters")+ylab("SP500IndexPrice") autoplot.zoo(indexPrice2,col=(4))+ggtitle("SP500IndexPrice")+xlab("Quarters")+ylab("SP500IndexPrice")+ylab("SP500IndexPrice")

#Season graph. We compare 4 quarters in one graph, so we can detect seasonability. #It seems there is no seasonability. ggfreqplot(as.ts(indexPrice2),freq=4,nrow=1,facet.labeller=c())

```
##Plot Serie.
plot(indexPrice2,ylab="SP500IndexPrice",main="SP500IndexPrice",xlab="Quarters",c
ol.main="black",col=(4) )
grid()
```

```
#Seasonal Plot.
monthplot(indexPrice2,phase=cycle(indexPrice2),ylab="SP500IndexPrice",main="Seas
onal Component",xlab="Quarters",col.main="black",xaxt="n",col=(4))
axis(1, at=1:4, lab=c("1Q", "2Q", "3Q", "4Q"))
grid()
```

#Select number of observation to compare forecast (forecast VS reality). #as it is in quarters, 1 quarters = 0,25 year (minimum exposure as we will take prediction on a 0 base). cOmit=1

#Data Size.
nObs=length(indexPrice2)

#sub_sample for the forecast (eliminating number of quarters stated).
sampleIndexPrice2=indexPrice2[1:(nObs-cOmit),]

sampleIndexPrice2 window(indexPrice2,start=index(indexPrice2[1]),end=index(indexPrice2[nObscOmit])) plot(sampleIndexPrice2, col="blue")

#Fit Simple Exponential Smoothing Model. fit1 <- ses(sampleIndexPrice2) fit1\$model

#Fit Holt Model. fit2 <- holt(sampleIndexPrice2) fit2\$model

#Fit Holt- exponential Model. fit3 <- holt(sampleIndexPrice2,exponential=TRUE) fit3\$model

#Fit Holt - damped Model. fit4 <- holt(sampleIndexPrice2,damped=TRUE) fit4\$model

#Fit Holt - (exponential+damped) Model. #For years 1871 to 2018 (-2) it seems to be THIS MODEL. fit5 <- holt(sampleIndexPrice2,exponential=TRUE,damped=TRUE) fit5\$model

#Results for the selected model. fit5\$model

```
#Seasonal model Holt-winters Model.
fit6 <- hw(sampleIndexPrice2,seasonal="additive")
fit6$model
fit7 <- hw(sampleIndexPrice2,seasonal="multiplicative")
fit7$model
plot(sampleIndexPrice2)
```

<-

```
#Plot models.
plot(fit6,ylab="SP500IndexPrice",
  plot.conf=FALSE, type="o", fcol="white", xlab="Year")
lines(window(indexPrice2),type="o",col="blue")
lines(fitted(fit6), col="red", lty=2)
lines(fitted(fit7), col="green", lty=2)
lines(fit6$mean, type="o", col="red")
lines(fit7$mean, type="o", col="green")
legend("topleft",lty=1, pch=1, col=1:3,
    c("data", "Holt Winters' Additive", "Holt Winters' Multiplicative"))
#New With 0. Select number of observation to compare forecast.
cOmit=0
#Data Size. New With 0.
nObs=length(indexPrice2)
#sub_sample.New With 0.
sampleIndexPrice2=indexPrice2[1:(nObs-cOmit),]
sampleIndexPrice2
window(indexPrice2,start=index(indexPrice2[1]),end=index(indexPrice2[nObs-
cOmit]))
#Fit Simple Exponential Smoothing Model. New With 0.
fit1 <- ses(sampleIndexPrice2)
fit1$model
#Fit Holt Model. New With 0.
fit2 <- holt(sampleIndexPrice2)
fit2$model
#Fit Holt- exponential Model. New With 0.
fit3 <- holt(sampleIndexPrice2,exponential=TRUE)
fit3$model
#Fit Holt - damped Model. New With 0.
fit4 <- holt(sampleIndexPrice2,damped=TRUE)
fit4$model
#Fit Holt - (exponential+damped) Model. New With 0.
fit5 <- holt(sampleIndexPrice2,exponential=TRUE,damped=TRUE)
fit5$model
```

#Results for the selected model.

<-

fit5\$model

```
#Plot models fitted.
plot(fit1, type="o", ylab="SP500IndexPrice", flwd=1, plot.conf=FALSE)
lines(window(indexPrice2),type="o")
lines(fit1$mean,col=2)
lines(fit2$mean,col=3)
lines(fit4$mean,col=5)
lines(fit5$mean,col=6)
legend("topleft", lty=1, pch=1, col=1:6,
    c("Data", "SES", "Holt's", "Exponential",
     "Additive Damped", "Multiplicative Damped"))
#Seasonal model Holt-winters Model.
fit6 <- hw(sampleIndexPrice2, seasonal="additive")
fit6$model
fit6
fit7 <- hw(sampleIndexPrice2, seasonal="multiplicative")
fit7$model
fit7
#Plot models.
plot(fit6,ylab="SP500IndexPrice",
  plot.conf=FALSE, type="o", fcol="white", xlab="Year")
lines(window(indexPrice2),type="o",col="blue")
lines(fitted(fit6), col="red", lty=2)
lines(fitted(fit7), col="green", lty=2)
lines(fit6$mean, type="o", col="red")
lines(fit7$mean, type="o", col="green")
legend("topleft", lty=1, pch=1, col=1:3,
    c("data", "Holt Winters' Additive", "Holt Winters' Multiplicative"))
#Plot Multiplicative Model.
plot(fit7,ylab="SP500IndexPrice",
  plot.conf=FALSE, type="o", fcol="white", xlab="Year")
lines(window(indexPrice2),type="o",col="blue")
lines(fitted(fit6), col="red", lty=2)
lines(fitted(fit7), col="green", lty=2)
lines(fit6$mean, type="o", col="red")
lines(fit7$mean, type="o", col="green")
legend("topleft", pch=1, col=2:3,
    c("Holt Winters' Additive", "Holt Winters' Multiplicative"))
fit6
fit7
```

#Plot Two best Models and their data.

```
plot(fit5,ylab="SP500IndexPrice",
    plot.conf=FALSE, type="o", fcol="black", xlab="Year")
lines(window(indexPrice2),type="o",col="blue")
lines(fitted(fit3), col="red", lty=2)
lines(fitted(fit5), col="green", lty=2)
lines(fit3$mean, type="o", col="red")
lines(fit5$mean, type="o", col="green")
legend("topleft", pch=1, col=2:3,
    c("Holt Winters' Exponential+Damped","Holt Winters' Exponential"))
fit5
fit3
#Forecast model.
```

fventas.ets=forecast(indexPrice2)

#Summary of the results. summary(fventas.ets)

#Model for Montecarlo - Prediction 2

```
#Extract the data from SP500 from Yahoo.
#First available data from Yahoo are from Jan 3, 1950, so we start from there.
symbolSP500="^GSPC"
dataSP500<-getSymbols(symbolSP500, from="1980-01-01",to="2007-12-
31",auto.assign=FALSE)
dataSP500= dataSP500[complete.cases(dataSP500)]
```

#Define workdata. dataSP500t=Ad(dataSP500) plot(dataSP500t, col="blue", title("SP500")) #Grafico evolución IBEX stat.desc(dataSP500t)

#Calculate Daily Arithmetic Return Continuous (RENTABILITY). dARContSP500=dailyReturn(dataSP500t,type='log',leading=FALSE, row.names("SP500")) dARContSP500= dARContSP500[complete.cases(dARContSP500)]

#Graph stating the rentabilities and statistics (daily returns). plot(dARContSP500, col="blue") stat.desc(dARContSP500)
```
#Convert it to annual and make graphs and statistics (continuous).
dARContSP500Annual=annualReturn(dataSP500t,type='log',leading=FALSE,
row.names("SP500"))
dARContSP500Annual
```

```
#Graph stating the rentabilities and statistics (annual returns).
plot(dARContSP500Annual, col="blue")
stat.desc(dARContSP500Annual)
```

```
####Funcion to run - specific for Geometric Brwonian Method####
```

```
simGBM=function(S,mu,sigma,delta.t=1,T=250,num.sim=1000){
#S0 initial value of the SP500.
#mu= drift (annual).
#sigma= standard deviation (annual).
#delta.t= step (annual).
#T= number of steps that we are going to simulate.
#num.sim= number of simulations.
path=(mu-sigma*sigma/2)*delta.t + sigma*sqrt(delta.t)*rnorm(num.sim*T,0,1)
path=matrix(path,T,num.sim)
S*exp(apply(path,2,"cumsum"))
}
```

```
###Simulate/Forecast of SP500 (xx days = xx years).
#Adjusted data from Yahoo.
SP500Sim=Ad(dataSP500)
```

```
#Average/mean estimation.
mu=mean(ROC(SP500Sim,na.pad=FALSE))*250
mu
```

```
#Volatility estimation.
sigma=sd(ROC(SP500Sim,na.pad=FALSE))*sqrt(250)
sigma
```

```
#Daily simulation (that's why I divede between 250).
delta.t=1/250
delta.t
```

```
#Last index price day will be the initial value for the simulation/forecast.
S=as.numeric(coredata(last(SP500Sim)))
S
```

#numero de simulaciones. nSim=1000

#Days of simulation (1250 days = 5 years). ndays=1250

#Simulation/Forecast and graphs. sim.dataSP500t=simGBM(S,mu,sigma,delta.t,ndays,nSim) matplot(1:ndays,sim.dataSP500t[,100:200],type="l")

#Mean of all simulations. mean(sim.dataSP500t[ndays,])

rentabilida esperad al final de a??o
mean(sim.dataSP500t[ndays,])/S-1

#Probability of having a positive profitability/yield. sum(sim.dataSP500t[ndays,]>S)/nSim

#Probability of having a value of the price index below 1.605,34 (1.478,49 * (1+8,58%)) sum(sim.dataSP500t[ndays,]<1605)/nSim

#Probability of having a value of the price index between XXXX and XXXX. 1-(sum(sim.dataSP500t[ndays,]<1605)/nSim)sum(sim.dataSP500t[ndays,]>50000)/nSim

#Probability of having a value of the price index over XXXX. sum(sim.dataSP500t[ndays,]>1605)/nSim

#Probability of having a value of the price index below 1.735,74 (1.478,49 * (1+17,4%))
average above index
sum(sim.dataSP500t[ndays,]<1735)/nSim</pre>

#Probability of having a value of the price index between XXXX and XXXX. 1-(sum(sim.dataSP500t[ndays,]<1735)/nSim)sum(sim.dataSP500t[ndays,]>50000)/nSim

#Probability of having a value of the price index over XXXX. sum(sim.dataSP500t[ndays,]>1735)/nSim

#Probability of having a value of the price index below 2391,16 (1.478,49 * (1+61,73%)) best performer

sum(sim.dataSP500t[ndays,]<2391)/nSim</pre>

#Probability of having a value of the price index between XXXX and XXXX. 1-(sum(sim.dataSP500t[ndays,]<2391)/nSim)sum(sim.dataSP500t[ndays,]>50000)/nSim

#Probability of having a value of the price index over XXXX. sum(sim.dataSP500t[ndays,]>2391)/nSim

#Histogram - data distribution. hist(sim.dataSP500t[ndays,])

#Exclusive use by Ignacio de José Rincón and Ziwenxi Wang.
#Use of this code only if aforementioned names grant written permission.
#Code used for final thesis for the Master in International Finance - CUNEF.
#Final Thesis: ¿Is active management a charade? The shift to passive management and the abolition of an industry.