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Passive Investment Strategies: Analysis of Smart Beta ETFs Performance

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ABSTRACT

This End of Master Project examines the performance and efficiency of forty equity U.S. domiciled ETFs between 2014 and 2017. The objective is to analyse the efficiency of the Smart Beta ETFs to determine whether it is a more profitable investment than traditional Market Cap ETFs for a long-term period. In doing so, one aims to draw conclusions about the level of risk of these investment vehicles and determine whether it is an adequate product fitting every type of investor. The comparative analysis shows that on a general basis, Smart Beta ETFs should be consider passive investment products and do have a better performance than traditional Market Cap ETFs for a long-term period. However, the analysis captures a higher efficiency for Market Cap ETFs compared to Smart Beta ETFs based on the risk-adjusted return indicators. Hence, traditional ETFs have higher returns for the same level of risk.

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I. Introduction

There has always been a debate regarding the performance between the active investment and the passive investment and which one is the best strategy.

The most popular form of passive investment has been through the replication of benchmarks indexes. An exchange-traded fund (ETF) is an investment vehicle, which aims to replicate a specific index. Due to many advantages compared to the active management strategies, such as lower management costs, well diversification, transparency, lower risks and a simpler process, it has increasingly become popular over the past years. Nowadays, ETFs exist of most indexes, as well as of different markets sectors and basket of specific securities.

However the burst of the real estate bubble and the subsequent financial crisis in 2008 led to poor performance of investors and funds. The failure of traditional asset allocation resulted in different and new forms of asset management. One of them would be the Smart Beta ETFs that combines passive strategies with active strategies in order to beat a benchmark and yet have the beneficial advantages of the traditional ETFs.

These Smart Beta ETFs have become recently very popular in the market and the biggest investment companies are increasingly issuing new and more complex Smart Beta ETF to satisfy the investor goals. According to Morningstar (2016), the number of Smart Beta ETFs issued in 2016 increased by 23% compared to the previous year. In June 2016, the total asset under management from this investment vehicle was 550.5 billion dollars on a global level. The increase of this type of investment vehicle is representing a real threat to active managers.

The Smart Beta ETF name arises from the strategic beta strategies using factors such as momentum, value, quality, volatility, etc. to detect excess return that traditional market cap ETF do not take into account.

The novelty of this type of investment vehicle and its rapid intrusion in the financial markets marks the motivation to present this topic as the End of Master Project. This study aims to assess their performance and their place in the market for the future. It is a new and innovative investment vehicle that has not yet been fully investigated, which is why this study aims to extend the existing literature and contribute to closing this gap.

The main objective of this End of Master Project is to analyse the performance of the Smart Beta ETFs portfolios and to evaluate if it is the best strategy for a long-term period. Some interesting questions arise out of this topic for instance; do the Smart Beta ETFs always beat the market? What is the risk level in order to beat the market? Should the Smart Beta ETFs be considered a passive or active investment? Is it an investment vehicle fitting every type of investor? Therefore the aim of this project is to evaluate the efficiency and performance of the

Smart Beta ETFs through a comparison with the traditional ETFs in order to determine whether the Smart Beta ETF always deliver a higher excess return using the factor based approach.

Regarding the methodology, the strategic beta is based on the three-factor model of Fama and French (1993). The authors extended the Capital Asset Pricing Model (CAPM) and demonstrated that other significant variables such as size and value had an impact on the securities' evolution. In 1997, the model was extended by Carhart (1997) who included the variable momentum as another robust factor to evaluate the performance of securities. Therefore, for this study all the portfolio and investing theory will be used. Additionally, the Smart Beta ETF is studied supported by previous literature and studies done on the subject of previous authors such as Glushkov (2015) and Malkiel (2014), who question the performance and factor exposure of this investment vehicle taking a sample of United Stated domiciled Smart Beta ETFs.

In order to conduct the comparative analysis, a sample of representative ETFs has been retrieved. The data sample is selected with the database and screener of ETF.com. Moreover, the daily performance of each ETF and the corresponding indicators have been retracted from Thompson Reuters database.

The remainder of this End of Master Project proceeds as follows. The first chapter consists of an overview of the theoretical framework of the Portfolio Theory highlighting the importance of a well-diversified portfolio and explaining briefly the pros and cons of active and passive management. Then the Smart Beta strategies are introduced, revising the Fama and French (1993) factor based approach and other existing literature regarding the importance of factors when investing and constructing the portfolio. Moreover, the rise of the Smart Beta ETFs is commented and theoretically analysed by comparing them to the traditional ETFs, how they are structured and which factors they take into account. In the second chapter the data sample and characteristics of forty ETFs is introduced for a time period of three years between 2014 and 2017. On the one hand, the data sample consists of twenty equity ETFs domiciled in the United States following a vanilla strategy and weighted using the market capitalisation. On the other hand, the other twenty equity ETFs domiciled in the United States follow Smart Beta strategies, also called multi-factor strategies and weighted accordingly. The data sample consists of ETFs which underlying benchmark is an American index. Subsequently, the third chapter explains the methodology being used for this analysis. Moreover, the comparative analysis between ETFs is performed using proper return, risk and risk adjusted return indicators. After the comparison, the results will be presented and interpreted in order to draw some final conclusions. Final remarks conclude this End of Master Project in the last chapter.

II. Theoretical Framework and Literature Review

a) The Optimal Portfolio: The Importance of Diversification

A portfolio is a selection of assets among different markets (fixed income, equities, commodities, FX, alternatives investments, money markets, etc.) to obtain the highest performance for a specific level of risk or the lowest risk for a specific level of return. The foundation of portfolio theory has been largely studied by economists through different models such as the Markowitz Modern Portfolio Theory (1991), the mean-variance analysis or the Capital Asset Pricing Model (CAPM) studied by Treynor (1962), Sharpe (1964), Lintner (1965) and Mossin (1966). These studies conclude that the optimal portfolio is characterised by a mix of different investments in order to have a diversified portfolio.

The main characteristic of capital markets is the uncertainty; no one knows how the markets are going to react in the future, so in order to reduce the uncertainty, the optimal portfolio is a diversified portfolio (Markowitz, 1991)

With a diversified portfolio, the idiosyncratic risk of the assets can be reduced, the more diversified the portfolio, the lower the risk. A well-diversified portfolio consists of assets with negative correlations so whenever one asset increases, the other one decreases and the other way around.

The above-mentioned portfolio theories are mathematical relationship mainly based on two tools: First, the expected returns of the assets calculated as a mean and second, the risk of those assets expressed by the variance and standard deviation. Despite the fact that the Markowitz model and the CAPM are calculated under unrealistic assumptions, those models are still nowadays widely used by investors even if the empirical results show that they are not applicable in the real world (Buser, 2015).

The diversification of the portfolio is highly linked with the importance of asset allocation. Asset allocation refers to the wealth distribution among different asset classes in order to get a return accordingly to the investor's profile. It is well known that asset allocation represents the most relevant variable when defining the investment strategy and has a higher impact on the returns than other variables.

Moreover, in order to select the optimal portfolio, it is important to know the risk profile of each investor. The investment objectives need to match with the risk profile of the investor and personality. It is also important to highlight the weight of behavioural finance and how each individual reacts differently depending on their confidence and emotions and has different motivations and goals because "people are imperfect processors of information and are frequently subject to bias, error, and perceptual illusions" (Shefrin, 2002).

There are different types of investors that can be divided in two types. On the one hand, there are institutional investors, who are supposed to be eligible counterparties and are able to invest and trade a large amount of assets. Institutional investors have enough knowledge and financial resources to have a diversified portfolio. On the other hand, the retail investors that invest for their personal account can have troubles to have a well-diversified portfolio because they will have to assume more costs and they are not able to access to all the markets.

The arrival of mutual funds allows retail investors to have access to all kind of financial assets at lower transaction costs through these investment vehicles. Therefore, the main task of the mutual funds in a perfect capital market would be to maximize the wealth of the clients through a diversified portfolio considering the risk profile of the client (Sharpe, 1966).

b) Active Management vs. Passive Portfolio Management

Now after having introduced the mutual funds in the previous part, the following part will differentiate between funds following active or passive strategies. There has always been a debate regarding the performance between the active investment and the passive investment and which one is the best strategy.

Active mutual funds follow active strategies in order to beat the market and have higher returns than the benchmark or a mix of benchmarks. Usually the active investing management involves the use of the Capital Asset Pricing model (CAPM) to have a linear relation between the expected returns of an asset or a portfolio and the market beta in order to look for the so called "alphas" which is the difference between the portfolio against the benchmark, in other words the excess return.

Due to the diversification relevance, which at the end means to have different types of assets, from different sectors and markets lead to the creation of passive investing funds.

Funds following passive investment strategies do not need to perform any fundamental analysis of the companies because basically the fund manager's aim following the passive portfolio strategies is to replicate a specific index by buying proportionally to the specific market index. Moreover, periodically the manager will need to rebalance the weights on the portfolio according to the market capitalization of each security. However, an active fund manager, will buy and construct the portfolio depending on its fundamental analysis and its ability to detect profitable companies or companies that are undervalued. Moreover, it will adjust the weights on the portfolio to take advantage on the market conditions and to maximize the value of the portfolio. (Business Today, 2016)

There has been an eternal debate regarding which strategy to follow is better, but each one has its advantages and disadvantages. On the one hand, active strategies provide the opportunity to outperform the market and therefore get higher returns. However fund managers

will charge higher fees, usually between 1% and 2,5%. In addition to the custodian and administration fees, it is possible to get charged a performance fee, depending on the results of the fund. At the end, the risk undertaken and the transactions costs cannot be compensated by the return of an active fund. Even well-known portfolio managers such as Lynch confirm the difficulty to beat a benchmark and question the latest performance of those managers (Foley, 2016).

The graph below, retrieved from Reuters, shows the performance of asset managers and custody banks compared to a benchmark, S&P 500, during the period from 2007 and 2016. From 2007 to 2009, the asset managers were beating the market, this tendency ended up with the Global Financial Crisis. From 2009 and onwards, the asset management shares have underperformed the market. In 2016, the gap between the benchmark and the asset manager's performance is highly significant and it seems that this trend will continue for the upcoming years.

Figure 1: Asset Management Performance Compared to the S&P 500 Index

Source: Financial Times, 2016.

Furthermore, another downside of active strategies is, as it was mentioned before, that investors assume more risk, especially concerning physiological and emotional risk whereas passive investment strategies completely eliminate this risk.

Finally, the foundation of active fund managers' work is research and fundamental analysis. Fundamental analysis is based on forecast and predictions and there are significant differences amongst investors, giving room to wrong estimations and bad performances. Moreover, they apply the Portfolio Theory that is based on the assumptions and restrictions of efficient markets. Examples showing that the models do not always apply in reality are the sub-prime crisis in 2008, where active funds suffered a poor performance within the following years (Business Today, 2016).

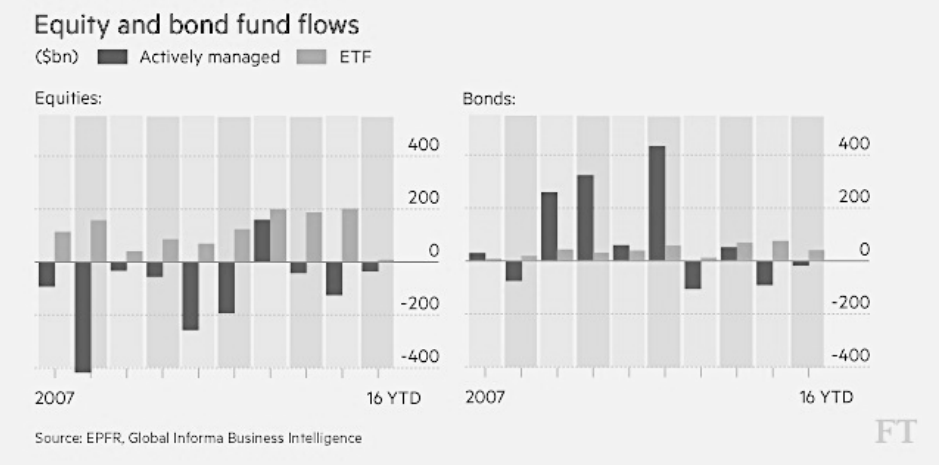
Robert Shiller (2000) argues the importance of behavioural finance and how fundamental analysis sometimes does not work properly when for instance during a speculative bubble period, asset's prices are overvalued. Furthermore the author discusses the irrational decisions made by investors on different financial cycles.

Due to the financial crisis and the raise of passive investing, the active managers have been struggling to keep competitive in the market with regard to the high transaction costs and the lowering demand of this kind of funds. In order to maintain their competitive advantage and differentiate from the rest, active managers started to offer "multi-allocation funds with strategies that incorporate both macroeconomic trends and stock-picking " (Clift, 2016).

However, it has been discussed in several papers if the active strategies are being measured properly. Andrew Lo (2007) discusses new measures to value the active investment management and questions if traditional measures such as the alpha, beta, Sharpe ratio and tracking error, which are static measures “based on characteristics of the marginal distribution of returns at a single date t”, are suitable indicators to capture the dynamic essence of active strategies. The author examines whether those measures are in fact representative of the performance and research analysis done by active investment managers. Additionally, it is important to know if those tools are suitable to evaluate the manager’s ability to forecast the market trends and financial assets prices in future, besides the importance of timing with respect to when buy/sell a financial asset in order to find new opportunities before the market does. Furthermore, nowadays the statistical and probabilistic indicators used to calculate the risk and performance of financial securities ordinarily assume that the variables are independently and identically distributed. These difficulties and problems could have had a negative impact regarding the performance of funds following active strategies, fuelling the pessimistic point of view of investors regarding active management and raise the popularity of passive investing especially of index funds (Lo, 2007).

On the other hand, passive management strategies act on the contrary way, they likely perform close to the index, so it can't be possible to beat the market but it also has fewer probabilities to obtain losses from an investment. According to the Financial Times (2016), in 2015 the ETFs attracted almost 200 billion dollars whereas active management funds lost $124bn. Looking at the graph below, it can be noticed that the trend is mostly noticeably in equity funds but bonds funds seems to have a similar trend, especially since 2013. Active managed funds have downward flows, passive strategies and ETFs are representing a larger portion of the total market share and there seems to be a transformation with respect to the investment funds world. The raise of the passive investment, especially of the ETFs is due to its many benefits and advantages comparing it to other mutual funds.

Figure 2: Equity and Bond Fund Flows Between 2007 Until 2016



Source: Financial Times, 2016.

First of all, a passive strategy can be easily followed thanks to the arrival of the ETFs. ETFs are defined as "exchange-traded assets that represent a basket of securities comprising a particular index" (De Winne et al, 2011). Nowadays, ETF's are financial instruments that can be easily traded as normal stocks and they allow investors to trade intraday whereas with other mutual funds their prices are adjusted once a day. Moreover, ETFs have a high level of transparency and liquidity of their underlying assets, which means that a large number of shares can be traded during a day with a low impact on the market price (Gastineau, 2001).

The main reason that was mentioned before, ETFs are more transparent because they are traded in a regulated market, similar to the equity market, therefore prices are adjusted continuously and they can be traded at any time during the day. The ETFs need to comply with all the regulation and compliance requirements. Moreover, it is mandatory to publish the prospectus so that all the necessary and detailed information is available for the public so investors know where they are investing. On the contrary, usually mutual funds only need to disclose their portfolio's information on a quarterly basis, so in the meantime investors don't know if the portfolio manager is investing accordingly to the information given in the prospectus concerning risk, returns, class of assets and markets.

Furthermore, the passive strategies and ETFs allow retail investors to diversify in different markets or sectors with generally a uniform settlement procedure and lower operational transactional costs. Even if usually they can't beat the market, the investors will be certain that its return will be close to the market's return. Investors will only need to buy the index fund implying lower turnover rates, therefore, less transactional and trading costs. Especially brokerage commissions will be lower because they will only incur in those expenses in order to rebalance their portfolio.

Burton G. Makiel (2003) discusses how even if markets are inefficient contrary to the Fama's believes, passive strategies would be more effective than active management due to the extra expenses that "causes the typical actively managed equity fund to underperform its benchmark index by approximately that amount" (Makiel, 2003) (management fees). Moreover, he also states that according to historical data and performance, it has been proven that there are not enough tools to predict the stocks market movements in order to beat a passive indexing strategy and that it's more likely to get higher returns from it.

Compared to active strategies, "a passive portfolio has no forecast power, and can therefore be implemented more easily than an active portfolio" (Lo, 2007) because ETFs shares are traded in the secondary market, similar to equities or close-end mutual funds instead of being bought or sold between funds (Gastineau, 2001).

It is also important to highlight the fact that ETFs can be beneficial to certain types of investors due to its tax efficiency costs, investors will have to pay less taxes. Whenever, investors will have to prepare their personal income tax statement, the capital gains or losses arising from the transfer of assets generated and owned by the taxpayer independently of the generation period will have to be recognize in the savings component of the taxable base of their personal income tax. Therefore, when selling a mutual fund the investor will have to recognize a capital gain. When recognizing capital gains from a fund, they can be from the sale of this fund or when the fund has to meet redemptions from shareholders. As it has been mentioned before index funds and ETFs have usually lower turnover than other mutual funds, therefore passive investors will have to recognize lower capital gains and pay less taxes.

There is another structural difference between ETFs and other types of funds. On the one hand, when investors will ask for their money back because shareholders want to be redeem, then mutual funds will need to obtain cash to pay him back by selling securities. On the other hand, ETFs are designed like a stock, if the ETF owner wanted to sell it, he or she will sell it to another individual investor, no ETF is liquidated and no capital gain is created.

Furthermore, ETFs are also more tax efficient than other passive indexed fund due to their creation and redemption characteristics. With an ETF fund, there is the possibility to pay in kind using the underlying asset of the ETF instead of paying in cash. This way a sale cannot be recognized neither the capital gains from it. However, this may vary from one ETF to another, depending on the liquidity and the characteristics of the underlying assets, for instance those tax advantages cannot be so significant when talking about fixed income ETFs because they have a higher turnover and more cash-based creations and redemptions ("Why Are ETFs So Tax Efficient?; ETF.com", 2017).

Finally, agency problems occur when a person, organization, group (agent) must by virtue of their professional or social role, act with the best interest of another person (the

principal) but they act differently taking into account its self-interest first and by detriment of the principal. Grossman & Hart (1983) stated that the agent's actions are dependent on the risk sharing between him and the principal. Regarding mutual funds, this can usually happen between the portfolio manager and the client (investor), maybe sometimes even if the portfolio manager is supposed to maximize the value of its client's wealth, they sometimes will put their own self-interest before the ones of their client. However, this risk is eliminated with the passive investing strategies, because the same risk is assumed than the benchmark.

More and more mutual funds and asset manager, insurance companies, pension funds and retail investors are converting to passive investment assets especially ETFs. The most important investment companies are adapting to the new times and are launching a wide variety of ETFs. In the following fragments, the raise of ETFs and the Smart Beta strategies will be deeply commented.

c) Raise of Exchange Traded Funds

As mentioned previously, ETFs are investment funds that are listed on an exchange and can be traded on an ongoing basis. Like index funds, they "aim to replicate the benchmark performance of one benchmark index as closely as possible" (Deville, 2008) reducing the tracking error to a minimum. This way ETFs enable investors to diversify their investment and reduce risk, as indexes consist of hundreds sometimes up to thousands of different securities. ETFs are being managed passively tending to have lower management fees, brokerage costs, more tax efficiency and transparency, as discussed in the previous chapter (Kosev & Williams, 2011; Deville, 2008).

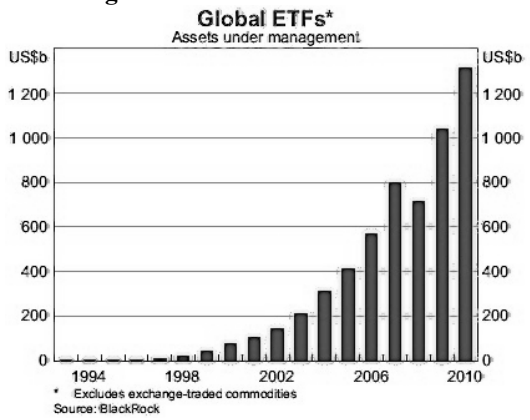
The very first trading of several stocks in a single transaction was done in the late 1970s. However, the world´s first ETF as we know them were first introduced in 1993 in the United States when the American Stock Exchange (AMEX) began trading Standard & Poor's 500 Depositary Receipt (Deville, 2008). In 1999, the launch of the Nasdaq-100 Index Tracking Stock dramatically accelerated the growth of trading ETFs both in terms of trading volume and fields of application. Figure 3 shows the rising ETF investment accounting for more than US$1.3 trillion in 2010 compared to less than US$100 billion in 2000 (Kosev et al, 2011). Additionally, new ETFs would not only replicate stock indices but extend "their fields to sectors, international markets, fixed-income instruments and lately commodities" (Deville, 2008).

While trading ETFs in the United States had become more and more popular, it was not until 2000 that the European stock exchanges listed their first ETFs. The Deutsche Börse and the London Stock Exchange were first to quote ETFs in April 2000. Shortly after the Stockholm Stock Exchange joined in October 2000 and so did the Paris Stock Exchange, Amsterdam Stock

Exchange in 2001, the Swiss Stock Exchange in March 2001, the Helsinki Stock Exchange in February of 2002, the Iceland Stock Exchange in 2004, the Oslo Stock Exchange in 2005, the Irish Stock Exchange in April 2005 and the Vienna Stock Exchange in November 2005 (Deville, 2008).

More than 2700 ETFs were globally traded over the last decade. The Figure 3 by Kosev and Williams (2011) illustrates the rapid ETF investment growth: While in 2000 ETFs still added up to approximately US$100 billion globally, ten years later more than US$1 trillion were invested in ETFs in the United States and another US$300 billion in Europe. The growth rate of ETFs continuously rises apart from 2008 due to the Global Financial Crisis and is assumed to continue to rise in coming years.

Figure 3: ETF Investment Growth

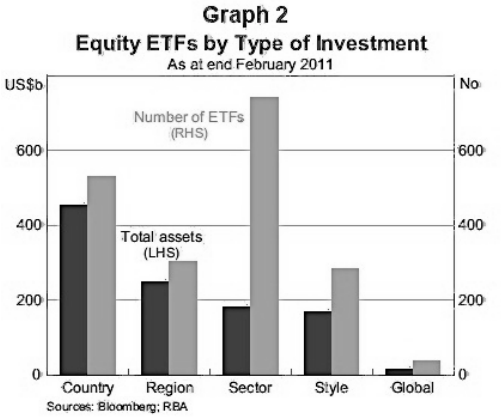


Source: Kosev & Williams, 2011.

Nowadays, there is an increasing variety of ETFs available in the market, retail investors are able to choose between a large amount of options in terms of product selection and product management. ETFs have evolved during the past years, financial institutions have created more complex ETFs allowing investors to trade more sophisticated and complex asset allocation or tailored products but with a higher fee structure. Those new products and range of ETFs can represent a profitable opportunity for brokers through higher commissions, if they manage to add value to the asset allocation packages (Gastineau, 2001).

There are three main ETF types as shown in the Figure 5. First, the so-called equity ETFs. Equity ETFs focus on replicating the performance of equity index as closely as possible such as the S&P 500 index and make up the majority of global ETF investment. In 2011, around 74% of the total ETFs investments tracked equity indexes. The Figure 4 shows the different types of investment equity ETFs generally focus on: Country, Region, Sector, Style and Global. Most equity ETFs invest in equities from a specific country or region in terms of assets. The market sector shows the highest number of ETFs containing diverse investments in specific market segments, such as financial and technology indices (Kosev & Williams, 2011).

Figure 4: Equity ETFs by Type of Investment



Source: Kosev & Williams, 2011.

Second, the fixed income ETFs that make up 15% of total ETF assets under management. Similar to Equity ETFs, fixed income ETF replicate a bond market index. However it is more difficult to replicate a bond index within the same proportion due to the bond characteristics such as maturity and significant interest. This implies that the ETF will need to be rebalanced more times and due to the replication's difficulties the tracking error is going to be higher. Fixed income ETFs recalls for the benefits from both, bonds and bonds funds (Meziani, 2006). Thirdly, commodity ETFs that represent around 10% of total ETF assets under management.

Figure 5: Global ETF Investment by Type of Asset (As at end February 2011)

ETF type	Number of ETFs	Assets under management US$b	Per cent of total assets
Equity	1 895	1 067	74.0
Fixed income	365	217	15.0
Commodity[(a)]	358	147	10.2
Other	86	12	0.8
Total	**2 704**	**1 442**	**100.0**

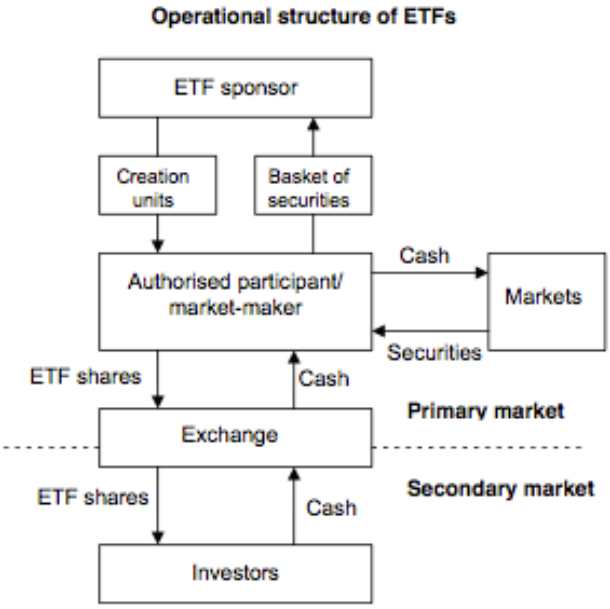
(a) Includes exchange-traded commodities.
Sources: Bloomberg; RBA

Source: Kosev & Williams, 2011.

There are two different types of replications of ETFs: physical and synthetic ETFs. "Physical ETFs hold the assets underlying a particular benchmark" (Kosev & Williams, 2011) and have the advantage of being more transparent regarding the ETFs asset holdings. Ramaswamy (2011) explains with different schemes the different replications options. The figure 6 below shows the operational structure of a physical ETF. In this case the market makers are going to build the ETF by purchasing the basket of securities in the market in order to replicate the index. Then the ETF sponsor who is the one creating the ETF will give the creation

units. Finally the market maker will distribute it by shares in the secondary market where investors are going to trade with them and in return they will receive cash.

Figure 6: Operational Structure of ETFs

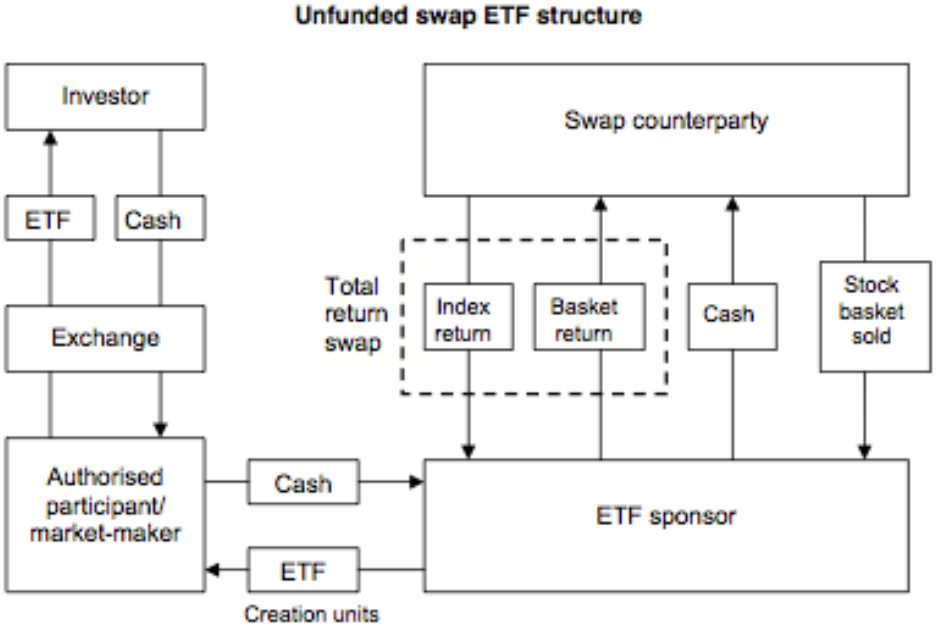


Source: Ramswamy, 2011.

Synthetic ETFs usually use "derivatives such as futures, forwards, options and swaps to simulate the return from physically holding the asset" (Kosev & Williams, 2011). Their advantages include "lower cost, improved accessibility to particular asset classes and investments (including emerging market shares) and greater accuracy in delivering the targeted return" (Kosev & Williams, 2011). However with the continuous increase on the popularity of ETFs leading to a large volume of ETF traded in the market, synthetic ETFs have a higher exposure to systemic risk because they use derivative assets.

There are several synthetic replications but one of the most popular ones according to Ramswamy (2011) is the total return swap usually called the "unfunded swap structure" by the ETF sponsor. The figure 7 shows the synthetic replication scheme. The market maker will receive the creation units of ETFs but instead of giving to the ETF sponsor the basket of goods for this index, the ETF sponsor will receive cash. The rest of the process until it reaches the investors and it is traded in the market is the same. However, the ETF sponsor on its side will enter into a two-parts total return swap contract. Firstly, the counterparty will give to the ETF sponsor the total return of the index. Then the swap counterparty will receive the cash and in exchange they will give the basket of collateral assets. Those assets don't need to be the same as the ones being replicating by the ETF. Using those collateral assets returns, the ETF sponsor will pay back to the swap counterparty.

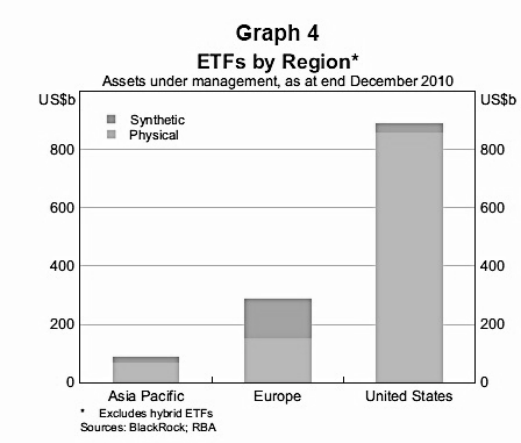
Figure 7: Unfunded Swap ETF Structure



Source: Ramswamy, 2011.

Finally, figure 8 shows that physical ETFs are widely used in the United States whereas synthetically ETFs have gained popularity in Europe.

Figure 8: Synthetic and Physical ETFs Distributed by Region (As at the end of December 2010)



Source: Kosev & Williams, 2011.

There is no clear opinion about what replication imitates the benchmark´s performance better: Mateus & Rahmani (2014) find no evidence to substantiate the popular opinion that synthetic ETFs have a lower tracking error compared to physical ETFs. Klym Naumenko &

Olena Chystiakova (2015) demonstrated in their study that both physical and synthetic ETFs had significant tracking errors so they didn't guarantee the same performance than the benchmark. The authors even find empirical evidence that synthetic ETFs have higher tracking errors than physical ETFs. In addition to that, Maurer & Williams (2015) conclude in their analysis that physical ETFs replicate the benchmark performance in similar manner as synthetic ETFs.

d) Smart Beta Strategies

Importance of Factor Weighting: Literature Review Fama and French

Fama & French (1993) introduced a three-factor model, which question previous portfolio models such as the CAPM or the Markowitz Portfolio Theory. According to Pappas, S. and Dickson, J. (2015), "factors are the underlying exposures that explain and influence an investment's risk".

Fama & French (1993) study is based on the CAPM model but the authors concluded that the portfolio performance is determined not only by one variable (market factor) but by three main factors: an overall market factor (excess return), the firm size showing that small size companies had historically higher returns than large companies and the book-to-market equity distinguishing value stocks and growth stocks for the U.S stock market. Moreover, the authors identified as well five-factors as well influencing the bond market including the maturity and the default risks. In their model, they showed the weakness of a unique factor model only using the Beta. Fama & French (1993) included in their model other returns and performance measures such as the size of the company, leverage, earnings / price (P/E ratio) and book-to-market which is the difference between the book value of a company and the market value. Concluding that portfolios replicating risk factors such as the size and the book-to-market value have a more significant ability to explain the average returns of the stock sample independently and when joined together the rest of the variables are not significant. The model used is based on the time-series regression model of Black, Jensen and Scholes using as a dependent variable the market excess return, which is the difference between the market return and the risk-free asset associated with the CAPM model.

Griffin (2002) analyses which version (global model or country specific) would explain better the time-series variation in the international stock returns and questions the Fama and French Factors model robustness. The author concludes that the domestic model is more significant and gave a better interpretation on the stock returns.

Carhart (1997) extended the Fama and French factor model approach by including momentum and demonstrated that common factors in stock returns and the differences in transaction costs have more impact on the performance of mutual fund rather than the persistence. The author explains that costs and turnover have a negative effect and decreases the

returns by 0,95 % of the stock market value. Moreover, the author states that in order to maximise the value of the portfolio of mutual funds, the investor should avoid mutual funds with a continuously historical performance and that momentum is measured by the short-term performance of the stock. Therefore "buying last year's winners is an implementable strategy for capturing Jegadeesh and Titman's (1993) one-year momentum effect in stock returns virtually without transaction costs, since the actual trading costs are shifted to the long-term holders of mutual funds" (Carhart, 1997). The investor should invest in the mutual funds that have momentum and have obtained a higher performance than the market the last year because he demonstrated that those funds will continue to have a high performance within the next year but not for the next following years.

In 2012, Fama and French tried to apply the factor model but for international markets (United States, Europe, Asia Pacific and Japan) and additionally they considered a new variable, the momentum in order to improve their previous model. They concluded that the model applied to a local region was satisfactory while the global model had a poor performance to explain the average returns of the stocks.

Therefore, the importance of factor weighting in the portfolio management has been demonstrate. When investing, different weighting factors strategies to measure the volatility of the assets and the risk-adjusted returns should be taken into account. Nevertheless, it is important to identify the significant factors that will allow outperforming the benchmark because not all the factor exposures imply a return premium (Pappas & Dickson, 2015).

In addition, it is also important to consider the weight of each individual asset in your portfolio because it will affect to the returns. Traditionally, most of the indexes funds and ETFs follow a market capitalization weighted (Block & French, 2002). For instance, if an ETF follows the S&P 500 index then the individual securities will be measured according to their market capitalization. This means that the larger the firm, the bigger will be the weight of this security in the portfolio, which as it has been remarked before didn't imply the best return and performance.

However, the financial market and main credit institutions have been creating more and more type of securities in order to satisfy the needs of the market. Nowadays, there is not just one type of ETF but they became such a popular passive investment tool that it is possible to find ETFs with different characteristics and alternative index constructions. One of the most popular one is the so call "Smart Beta" ETF.

Definition of Smart Beta Strategies

Even though the factor-based approach is far from being new, recently the "Smart Beta" strategies have gained importance in the market due to their performance. The Strategic Beta is a type of factor-based strategy, which takes several factors into consideration that can affect the

performance of the securities when deciding the adequate asset allocation for the portfolio. The Strategic Beta ETF does not only consider one single factor but it is exposed to different ones. The main objective of those funds is to enhance returns or minimize the risk compared to traditional ETFs (Morningstar, 2014). Smart Beta portfolios, by contrast, weight security holdings to increase exposures to certain preselected factors (Bruce & Kenneth, 2015)

A Strategic Beta ETF can be defined as a passive investment, a group of indexes or securities enhancing the use of active management factors. It is a combination between passive and active management, using alpha tools for instance momentum or value but with the benefits of the traditional ETFs such as transparency, liquidity, less costs and more regulation. Moreover, Strategic Beta strategies use historical data and the past performance of the assets in order to forecast the future.

In addition, there have been previous literature comparing Market Cap indexes and "Fundamental" indexes. According to the study of Arnott et al. (2005) where they constructed and analysed the performance of fundamental indexes. Fundamental indexes take into account the company size and fundamental indicators including book value, revenues, dividends, etc. The authors compared the fundamental indexation to traditional Market Cap indexes and concluded that fundamental indexes beat the benchmark in this case the S&P500 by an average of 1.97 pps a year for a time span of 43 years. Moreover, they tested the robustness of the fundamental indicators as factors and determined that for the long term run, the fundamental factors were in fact robust across time and during different macro economic environments. The main causes of the excess return identified by the authors were "superior market portfolio construction, price inefficiency and the additional exposure to distress risk" (Arnott et al, 2005).

At the end, a factor-based approach can help the investor to have a better management of risk and a deeper understanding on which factors could affect their portfolio and which variables can impact the price movements, which in turn will lead to a higher performance (Blackrock, 2015). To sum up Smart Beta ETF could be seen as an investment vehicle that highlights the importance of taking a factor-based approach when calculating the risk and returns of the portfolio.

Morningstar (2014) divides the strategic beta ETF into three categories according to their objective:

- Return-oriented which main aim is to increase the returns relative to a standard benchmark: Dividend screened/weighted, value, growth, fundamentally weighted, multifactor, momentum, buyback/shareholder yield, earning-weighted, quality, expected returns, size, revenue-weighted. Some of those strategies aim to "isolate" a source of return.
- Risk-oriented strategies aim to reduce/increase the level of risk relative to a standard benchmark: low/minimum volatility/variance, low/high beta, risk-weighted

- Other: non-traditional commodity, equal-weighted, non-traditional fixed-income, multi-asset.

Which Factor should be Considered and in which Measure?

According to Jason Hsu et al (2015), it is possible to find more than 250 factors, where many of them are noise, that could affect a portfolio and it is expected that the number of factors will increase every year. It could be discussed that many of those factors will not provide an excess return premium in the future. The authors discuss the difficulty to find an actual factor that will deliver a long-term performance compared to the traditional ETF following a Market Cap weighted. Therefore it is important to evaluate the robustness of the factors. The authors conclude that a factor will be considered robust whenever this factor is backed by previous literature and research studies presented by prestigious and experts of the field. Moreover, the factor will be significant whenever it has been demonstrated it can provide with a consistent excess return across time and space. At last, they conclude that for a factor to be able to be implemented taking a passive approach; it is necessary that the excess returns come from liquid assets and with a low turnover (Hsu et al, 2015).

As it can be noticed, there is a wide variety of different types of ETFs that focus on different risk and return factors, but the most important are the ones discussed previously such as value, size and market premium. Important economist such as Fama and French backed up those factors, which have proven to "provide a systemic risk-adjusted return premium" (Blackrock, 2015). Based on the Blackrock Smart Beta Guide (2015), the most important factors are the following one:

- Value: Using fundamental analysis in order to identify securities that are undervalued in the market and that will bring an excess return, which is the difference between the market value and the real value. The common tools for fundamental analysis are the P/E ratio, dividends, free cash flows, book to price, sales earnings, etc.
- Small size: Instead of using the Market Cap weighted, the portfolio will take the securities from small cap firms that have had a higher return compared to larger counterparties.
- Low volatility: Identifying securities that have a lower volatility or beta with higher risk-adjusted returns compared to other securities with a higher volatility (Pappas & Dickson, 2015). Usually the volatility of a security is measured by the standard deviation that can be calculated for different time periods, long term and short term or by the beta.
- High yield: Identifying securities that have had historically higher dividends pay-outs or policies compared to the average dividend yield and this will provide with an excess return.

- Quality: Using quality measures such as stable growth, a balance financial structure of the company with a low level of debt, etc. in order to identify securities with strong and stable positions in the market that could provide with an excess return. The quality of a company is usually measured with different ratios such as the return on equity, earnings evolution, dividend growth and policies, debt to equity ratio, etc.
- Momentum: Considering the historical past performance of securities during a short time period, usually one year, in order to identify the securities that have had stronger performances and higher returns than the average performance in the market. Therefore, the relative returns and alpha are the common measures to evaluate and compare the securities performances.

After having identified the most significant factors, some more decisions need to be taken. For instance, the factor allocation needs to be taken into account when constructing the portfolio because it is important to determine the best combination of factors that will get the higher excess return or that will fulfil the investor's financial goals. Jason Hsu et al (2015) explained the importance of determining the investor's risk sensitiveness and distinguishing between absolute risk and risk relative to a benchmark. Moreover, the authors stated that when constructing the portfolio it is important to consider the different types of securities, correlations, risk and expected returns but that usually this can't guarantee the best asset allocation for your portfolio. They conclude that factor allocation faces the same challenges and problems than the traditional asset allocation because at the end the models still use the same historical data and the past can't assure the future performances of the securities.

Is it really a Passive Investment Strategy?

Up to now, the importance of the factor-based approach has been discussed and as remarked previously the Smart Beta ETF is a hybrid model combining characteristics of both active and passive strategies. Usually Smart Beta ETFs are included in the passive investment strategies. However, according to Kahn & Lemmon (2016), Smart Beta ETF are "active strategies because they require a periodic rebalancing in order to maintain the desired exposures and like any active strategy they can underperform their cap-weighted benchmark" (Kahn & Lemmon, 2016).

Therefore, even though they have a similar structure compared to traditional ETF, with a transparent, better-regulated scheme and enhancing the diversification effect that in turn lowers the risk, they should not be assessed as traditional passive strategies. Firstly, as they take on active factors, they consequently have a higher turnover and higher risks. Hence, the investor will need to evaluate its risk profile and determine at which extent he or she can tolerate risk to achieve their objective. In addition to that, there needs to be a prior analysis of the underlying securities and strategies, to substantiate the forthcoming returns of the investment. The investor

will need to take into account what the factors are that the fund is focusing on. As well as considering the macro economic environment and recognize the different economic cycle because regarding portfolio investment, timing is a very significant element. As commented before, the investor will need to evaluate the index tracking and the liquidity of the underlying securities. Nowadays, there is a large amount and constantly increasing number of Smart Beta strategies with more complex and sophisticated characteristics. So it is important to have previous knowledge that not every retail investor could have, hence it could not be the best or adequate investment for every investor.

Furthermore, another difference contrasting the traditional ETF is that the fee structure of Smart Beta ETF is higher. Nevertheless according to a Morningstar research (Assessing the True Cost of Strategic-Beta ETFs, 2016) even though they can be as three times more expensive especially in equities market, there has been a decline in the recent years on the average fees of European ETFs. Moreover, this decline is expected to continue the downward trend in the following years mainly due to the continuous increase on the number of Smart Beta ETF that increases the competition in the market. The higher costs compared to traditional market-cap weighted ETF is due to a higher turnover so they will have higher replication and transactional costs for the physically replicated funds and higher swap costs for synthetically replicated funds, especially when the underlying security is less liquid. It makes senses that Smart Beta ETF will have higher management fees compared to traditional ETF due to the fact that the portfolio needs to be rebalanced periodically (Malkiel, 2014). The Morningstar report concludes as well that Smart Beta fund have a broader range of fees than traditional market-cap-weighted indexes but that they have a lower fee structure than traditional actively managed funds. Concluding that Smart Beta ETFs could represent a real threat for active portfolio managers because they also allow an outperformance compared to the benchmark but with a more transparent model, lower risk exposure and less expensive fee structure.

To sum up, even though they are considered passive investment vehicles, it is not clear whether Smart Beta ETFs should be classified as passive investment.

Contrasting Opinion Regarding the Performance of Smart Beta ETFs

On the contrary, not everyone agrees with the advantages and benefits of Smart Beta ETFs compared to other type of funds. Bruce & Levy (2015) question the Smart Beta ETFs performance. They state that Smart Beta strategies are "neither passive nor well diversified" (Bruce & Levy, 2015), because they only focus on specific factors, they ignore possible risk-adjusted returns opportunities and their performance is not consistent in different market environments. They state that to consider all the relevant factor can be difficult using Smart Beta products. To successfully construct the portfolio using single factor Smart Beta ETFs can be uncertain and problematic because there is no certainty about the proper asset allocation

weights. Even the multi-factor Smart Beta ETFs are leaving behind other important factors. Finally, they remark that Smart Beta strategies are vulnerable to; on the one hand to front running which is when there is the possibility to anticipate the rebalancing needs of the portfolios leading to changes on the prices of the securities before the Smart Beta portfolios buy or sell their positions. And on the other hand Smart Beta funds could be exposed to factor crowding that can occur when significant amount of investors buy or sell at the same time and this can overvalue or undervalue the securities.

Moreover, Malkiel (2014) studied the past performance of the Smart Beta ETFs and concludes in his paper "Is Smart Beta Really Smart?" that a significant amount of them did not give reliable excess returns and that the ones having outperformed the benchmark should be link to the higher level of risk assumed compared to the traditional ETFs. And despite the fact that the financial market is characterized by repeating patterns and behaviour across time that could be used to predict future returns, the past performance of portfolio managers "do not suggest that they imply exploitable opportunities to produce alphas" (Malkiel, 2014). Implying that Smart Beta strategies are riskier funds than investors think and that investing in this type of fund the investor would be assuming a certain level of risk and get no returns because as it has been proven historically, it is hard to achieve a better performance than the market.

Additionally, Glushkov (2015) analysed the relative performance and factor exposure of a 164 domestic equity Smart Beta ETF sample and concluded that there was no empirical evidence that Smart Beta outperformed the risk-adjusted benchmarks. The author also analyses the factor exposure of those funds through a separation between static and dynamic effects. The results obtained show no conclusive evidence that a dynamic factor allocation allows an excess return.

III. Available Empirical Data on Exchange Traded Funds

a) Data Sample

This End of Master project studies the performance of Smart Beta ETFs through a comparison with traditional Market Cap weighted ETFs. The comparison will be divided in three parts relying on the different types of indicators. First, the performance will be analysed through returns indicators. Second, the level of risk will be assessed according to the risk indicators. Finally, the combination of risk adjusted return indicators will be evaluated in a third part.

Due to the novelty of Smart Beta strategies and their application to ETFs, there is only limited data for a representative sample to execute the comparison. The most well-known and used database for financial fields are Bloomberg and Thompson Reuters. However, the screener

tool still does not include the Smart Beta strategies for ETFs in order to take a representative sample. The data sample consists of forty traditional and Smart Beta ETFs in the time period from 2014 to 2017 (31st of May).

As commented previously in the literature review, there is a wide variety of Smart Beta ETFs with different factor approaches, different securities and location of where the funds are going to trade. Nevertheless, only twenty Smart Beta ETFs historical data are of practical avail to examine the funds performance.

Thus, the sample and time span has been stretched this far in order to cover up as much data as possible to provide a reasonable sample for further investigations. The data is acquired from the Thompson Reuters database. The Thompson Reuters DataStream provides the funds performance data on a daily basis as well as the cumulative performance and risk indicators in some cases. Otherwise, with the historical daily changes on funds' Net Asset Value (NAV), it can be possible to calculate those indicators.

The Thompson Reuters Eikon lists up the quote history of each fund with a daily interval and a history period of three years. The following data is included: Highest price, Lowest price, average price, the maximum volume, minimum volume, average volume, daily open price, daily close price, daily volume, daily highest price, daily lowest price, closes to close change and open to close change. For this project analysis the performance on a monthly basis will be used so consequently the end close price of every last day of the month during three years will be used.

Moreover, for certain funds, the cumulative performance by percentage for one month, three months, one year, three years, five years, ten years and since the inception date is also obtained. In addition, for specific funds depending on their inception date and in order to do the analysis, it will be extracted the technical analysis ratios for different time periods: one year, three years, five years and ten years. The following technical analysis indicators used for this project will be extracted: Alpha, Annualized Standard Deviation, Beta, Correlation, Information Ratio, Maximum Drawdown, R-Square, Sharpe Ratio, Tracking Error and Treynor Ratio. For this analysis, the ratios for a three years time period will be used.

b) Data Characteristics

After having retrieved the data according to the just mentioned criterions, this section continues describing the characteristics of the final sample as well as the initial sample.

The sample consists of forty ETFs where twenty will be traditional Market Cap weighted ETFs and the other twenty will be characterised as Smart Beta ETFs. To facilitate the analysis, it is necessary to select certain characteristics for the sample. The study will be based on the analysis of equity ETFs domiciled in the United States (U.S.) following an American

Index such as the S&P500, Dow Jones, NASDAQ, FTSE, etc. The sample chosen will consist of Equity ETFs domiciled in the U.S. because as mentioned previously the oldest and most well known ETFs are the ones replicating equities indexes. Moreover, the sample chosen consists of ETFs following American indexes in order to have a homogenous sample with similar characteristics. Finally, the ETFs selected are domiciled in the U.S. because in the United States it is possible to find the biggest selection of ETFs and a vast majority of the investment companies that create these investment vehicles are American.

In order to select the sample, the database and screener from the webpage ETF.com is used. The following tables showed below were build based on information retrieved from the webpage ETF.com, Thompson Reuters and the Prospectus of each ETF.

The table 1 and 2 below show the selected traditional ETFs following a vanilla strategy. The geography column indicates the location of the market to which the ETF provides exposure, in this case is the United States. The category column shows the first level of sorting in the ETF classification system and the focus row shows the second level of sorting indicating which type of sector or field the ETF is going to replicate (large cap, mid cap, financials, etc.). Moreover, the index provider and the underlying index state which is the firm that manages the underlying index and gives an idea of which is the benchmark that the ETF is going to replicate respectively. The weighting scheme column informs about the rules an index provider uses in weighting the constituents in the index. For traditional ETFs sample, the weighting scheme is the market capitalisation. The expense ratio is the net annual fee a fund holder pays to the issue. The Net Asset Value (NAV) is the market value of the total assets that a fund has accumulated and now manages on behalf of the investor. Finally the spread (%) column is the difference between the highest price a market participant is willing to pay to buy an ETF and the lowest price at which a market participant is willing to sell an ETF averaged over the past 60 days.

Table 1: Traditional Equity U.S. Domiciled ETFs Sample

TICKER	FUND NAME	ASSET CLASS	STRATEGY	GEOGRAPHY	CATEGORY	FOCUS	INDEX PROVIDER
SPY	SPDR S&P 500 ETF Trust	Equity	Vanilla	U.S.	Size/Style	Large Cap	S&P
IVV	iShares Core S&P 500 ETF	Equity	Vanilla	U.S.	Size/Style	Large Cap	S&P
VOO	Vanguard S&P 500 ETF	Equity	Vanilla	U.S.	Size/Style	Large Cap	S&P
IJH	iShares Core S&P Mid-Cap ETF	Equity	Vanilla	U.S.	Size/Style	Mid Cap	S&P
IJR	iShares Core S&P Small Cap ETF	Equity	Vanilla	U.S.	Size/Style	Small Cap	S&P
XLF	Financial Select Sector SPDR Fund	Equity	Vanilla	U.S.	Sector	Financials	S&P
MDY	SPDR S&P Midcap 400 ETF Trust	Equity	Vanilla	U.S.	Size Style	Mid Cap	S&P

XLK	Technology Select Sector SPDR Fund	Equity	Vanilla	U.S.	Sector	Technology	S&P
XLV	Health Care Select Sector SPDR Fund	Equity	Vanilla	U.S.	Sector	Health Care	S&P
XLE	Energy Select Sector SPDR Fund	Equity	Vanilla	U.S.	Sector	Energy	S&P
XLY	Consumer Discretionary Select Sector SPDR Fund	Equity	Vanilla	U.S.	Sector	Consumer Cyclicals	S&P
XLI	Industrial Select Sector SPDR Fund	Equity	Vanilla	U.S.	Sector	Industrials	S&P
SCHB	Schwab U.S. Broad Market ETF	Equity	Vanilla	U.S.	Size Style	Total Market	Dow Jones
SCHX	Schwab U.S. Large-Cap ETF	Equity	Vanilla	U.S.	Size Style	Large Cap	Dow Jones
XLP	Consumer Staples Select Sector SPDR Fund	Equity	Vanilla	U.S.	Sector	Consumer Non-cyclicals	S&P
ITOT	iShares Core S&P Total U.S. Stock Market ETF	Equity	Vanilla	U.S.	Size Style	Total Market	S&P
XLU	Utilities Select Sector SPDR Fund	Equity	Vanilla	U.S.	Sector	Utilities	S&P
SCHA	Schwab U.S. Small-Cap ETF	Equity	Vanilla	U.S.	Size Style	Small Cap	Dow Jones
VXF	Vanguard Extended Market ETF	Equity	Vanilla	U.S.	Size Style	Extended Market	S&P
OEF	iShares S&P 100	Equity	Vanilla	U.S.	Size Style	Large Cap	S&P

Source: Own Elaboration. Data: ETF.com and Prospectus

Table 2: Traditional Equity U.S. Domiciled ETFs Characteristics

TICKER	UNDERLYING INDEX	WEIGHTING SCHEME	EXPENSE RATIO	NAV
SPY	S&P 500	Market Cap	0.09%	237,3
IVV	S&P 500	Market Cap	0.04%	112
VOO	S&P 500	Market Cap	0.04%	224,3
IJH	S&P MidCap 400 Index	Market Cap	0.07%	176,65
IJR	S&P SmallCap 600 Index	Market Cap	0.07%	71,01
XLF	S&P Financial Select Sector Index	Market Cap	0.14%	24,47
MDY	S&P MidCap 400 Index	Market Cap	0.25%	321,93
XLK	S&P Technology Select Sector Index	Market Cap	0.14%	55,93
XLV	S&P Health Care Select Sector Index	Market Cap	0.14%	77,59
XLE	S&P Energy Select Sector Index	Market Cap	0.14%	67,27
XLY	S&P Consumer Discretionary Select Sector Index	Market Cap	0.14%	90,83

XLI	S&P Industrial Select Sector Index	Market Cap	0.14%	68,42
SCHB	Dow Jones U.S. Broad Stock Market Index	Market Cap	0.03%	59,10
SCHX	Dow Jones U.S. Large Cap Total Stock Market Index	Market Cap	0.03%	58,34
XLP	S&P Consumer Staples Select Sector Index	Market Cap	0.14%	56,71
ITOT	S&P Total Market Index	Market Cap	0.03%	55,95
XLU	S&P Utilities Select Sector Index	Market Cap	0.14%	53,55
SCHA	Dow Jones U.S. Small Cap Total Stock Market Index	Market Cap	0.05%	64,48
VXF	S&P Completion Index	Market Cap	0.08%	103,02
OEF	S&P 100 Index	Market Cap	0.20%	108,06

Source: Own Elaboration. Data: ETF.com and Prospectus

In table 3 the strategies and objectives of each Smart Beta ETF of the sample are described. In the following tables 4 and 5, the same information than previously described for the traditional ETF can be founded but for the Smart Beta sample taken for this analysis. The selected equity Smart Beta U.S. domiciled ETFs follow a multi-factor strategy based on the Fama and French approach commented in the literature review. Regarding the location of the market to which the ETF provides exposure is the United States but with some exceptions that are exposed to the global market. The sample has been be expanded due to the Smart Beta's novelty and limited amount of sufficient historical data for certain funds. While looking for the data, it was noticed that most of the Smart Beta ETFs had a recent inception date, especially in 2016 a significant amount of Smart Beta ETFs were created. Initially, the comparison was going to be based on funds that followed a well-known benchmark index such as the S&P 500. Though it was not possible for the same reasons mentioned before, it was decided again to extend the sample and consider Smart Beta ETFs following an American index or benchmark.

Table 3: Smart Beta ETFs' Strategies and Objectives

Fund Name	Strategy overview
ProShares Ultra S&P Regional Banking	The Fund seeks a return of 200% of the return of an index (target) for a single day. The KBW Regional Banking Index is an equal-weighted index that seeks to provide diverse regional banking exposure. The Index includes stocks of 50 publicly traded companies that do business as regional banks or thrifts.
First Trust Mega Cap AlphaDEX Fund	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the Nasdaq AlphaDEX Mega Cap Index. The Fund will invest at least 90% of its total assets in common stocks that comprise the Index that is designed to select stocks from the NASDAQ US 500 Large Cap Index.
First Trust Total US Market AlphaDEX ETF	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the NASDAQ AlphaDEX Total US Market Index. It invests 90% of its total assets in common stocks that comprise the Index that is designed to quantitatively identify and select stocks across market capitalizations.

Powershares S&P Small cap financials	The Fund seeks investment results that correspond generally to the price and yield performance of the index called the S&P SmallCap 600 Capped Financials Index. The Fund will normally invest at least 80% of its total assets in common stocks of small capitalization financial service companies.
FlexShares Morningstar Global Upstream Natural Resources Index Fund	The Fund seeks investment results that correspond generally to the performance of the Morningstar Global Upstream Natural Resources IndexSM. The companies included in the Underlying Index have significant business operations in the management and/or production of natural resources in energy, agriculture and others.
First Trust Dorsey Wright Focus 5 ETF	The Fund seeks investment results that correspond generally to the price and yield (before fees and expenses) of the Dorsey Wright Focus Five Index. The Fund will normally invest at least 90% of its assets in ETFs that comprise the Index. It seeks a performance correlation of 0.95 or better between the Fund and the Index.
FlexShares Quality Dividend Index Fund	The Fund seeks investment results that correspond generally to the price and yield performance, before fees and expenses, of the Northern Trust Quality Dividend Defensive Index. The underlying index is designed to provide exposure to a high-quality, income oriented portfolio of US equity securities.
First Trust Large Cap Core AlphaDEX Fund	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the Nasdaq AlphaDEX Large Cap Core Index. The Fund will invest at least 90% of its total assets in common stocks that comprise the Index that is designed to select stocks from the NASDAQ US 500 Large Cap Index.
First Trust Industrials/Producer Durables AlphaDEX Fund	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the StrataQuant Industrials Index. The Fund will normally invest at least 90% of its total assets in common stocks that comprise the Industrials Index.
First Trust Utilities AlphaDEX Fund	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the StrataQuant Utilities Index. The Fund will normally invest at least 90% of its total assets in common stocks that comprise the Utilities Index.
WisdomTree US Quality Dividend Growth Fund	The Fund seeks to track the price and yield performance, before fees and expenses, of the WisdomTree US Dividend Growth Index. The Index is a fundamentally weighted index that consists of dividend-paying US common stocks with growth characteristics and comprises of the 300 companies in the WisdomTree Dividend Index.
FlexShares Morningstar US Market Factor Tilt Index Fund	The Fund seeks investment results that correspond generally to the Morningstar US Market Factor Tilt Index. This Index reflects the performance of US equity securities that seeks to provide broad exposure to the overall US equities market, with a slightly weighted tilt to small-capitalization stocks and value stocks.
First Trust Health Care AlphaDEX Fund	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the StrataQuant Health Care Index. The Fund will normally invest at least 90% of its total assets in common stocks that comprise the Health Care Index.
First Trust Financials AlphaDEX Fund	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the StrataQuant Financial Index.
iShares Morningstar Large-Cap ETF	The Fund seeks investment results that correspond generally to the price and yield performance, before fees and expenses, of the Morningstar Large Core Index (the "Index").
First Trust US Equity Opportunities ETF	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the IPOX-100 U.S. Index. The Fund will normally invest at least 90% of its total assets in common stocks that comprise the Index. The Index is comprised of IPO's.
PowerShares KBW Bank Portfolio	The Fund seeks investment results that generally correspond to the price and yield of the KBW Bank Index. The Index is a float adjusted modified-market capitalization-weighted index that seeks to reflect the performance of national money centers and regional banks and thrifts that are publicly-traded in the US.
iShares Morningstar Mid-Cap ETF	The Fund seeks investment results that correspond generally to the price and yield performance, before fees and expenses, of the Morningstar Mid Core Index (the "Index").

PowerShares Dynamic Pharmaceuticals Portfolio	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the Dynamic Pharmaceuticals Intellidex Index. The Fund will normally invest at least 80% of its total assets in common stocks of pharmaceutical companies
First Trust Consumer Staples AlphaDEX Fund	The Fund seeks investment results that correspond generally to the price and yield of an equity index called the StrataQuant Consumer Staples Index. The Fund will normally invest at least 90% of its total assets in common stocks that comprise the Consumer Staples Index.

Source: Thompson Reuters Database

Table 4: Smart Beta Equity U.S. Domiciled ETFs Sample

TICKER	FUND NAME	ASSET CLASS	STRATEGY	GEO.	CATEGORY	FOCUS	INDEX PROVIDER
KRU	ProShares Ultra S&P Regional Banking	Equity	Multi-factor	U.S.	Sector	Theme	S&P
FMK.O	First Trust Mega Cap AlphaDEX Fund	Equity	Multi-factor	U.S.	Size and Style	Total Market	NASDAQ
TUSA.O	First Trust Total US Market AlphaDEX ETF	Equity	Multi-factor	U.S.	Growth and value	Total Market	NASDAQ
PSCF	Powershares S&P Small cap financials	Equity	Multi-factor	U.S.	Size and Style	Small Cap	S&P
GUNR	FlexShares Morningstar Global Upstream Natural Resources Index Fund	Equity	Multi-factor	Global	Sector	Theme	Morningstar
FV	First Trust Dorsey Wright Focus 5 ETF	Equity	Multi-factor	Global	Size and Style	Total Market	Dorsey Wright
QDF	FlexShares Quality Dividend Index Fund	Equity	Multi-factor	U.S.	Size and Style	Total Market	Northern Trust
FEX	First Trust Large Cap Core AlphaDEX Fund	Equity	Multi-factor	U.S.	Size and Style	Large Cap	NASDAQ
FXR	First Trust Industrials/Producer Durables AlphaDEX Fund	Equity	Multi-factor	U.S.	Sector	Industrials	NYSE
FXU	First Trust Utilities AlphaDEX Fund	Equity	Multi-factor	U.S.	Sector	Utilities	NYSE
DGRW	WisdomTree US Quality Dividend Growth Fund	Equity	Multi-factor	U.S.	Size and Style	Total Market	WisdomTree
TILT	FlexShares Morningstar US Market Factor Tilt Index Fund	Equity	Multi-factor	U.S.	Size and Style	Total Market	Morningstar
FXH	First Trust Health Care AlphaDEX	Equity	Multi-factor	U.S.	Sector	Health Care	NYSE

	Fund						
FXO	First Trust Financials AlphaDEX Fund	Equity	Multi-factor	U.S.	Sector	Financials	NYSE
JKD	iShares Morningstar Large-Cap ETF	Equity	Multi-factor	U.S.	Size and Style	Large Cap	Morningstar
FPX	First Trust US Equity Opportunities ETF	Equity	Multi-factor	U.S.	Size and Style	Total Market	IPOX Schuster
KBWB	PowerShares KBW Bank Portfolio	Equity	Multi-factor	U.S.	Sector	Financials	KBW
JKG	iShares Morningstar Mid-Cap ETF	Equity	Multi-factor	U.S.	Size and Style	Mid Cap	Morningstar
PJP	PowerShares Dynamic Pharmaceuticals Portfolio	Equity	Multi-factor	U.S.	Sector	Health Care	NYSE
FXG	First Trust Consumer Staples AlphaDEX Fund	Equity	Multi-factor	U.S.	Sector	Consumer Non-cyclicals	NYSE

Source: Own Elaboration. Data: ETF.com and Prospectus

Table 5: Smart Beta Equity U.S. Domiciled ETFs Characteristics

Ticker	UNDERLYING INDEX	WEIGHTING SCHEME	NAV
KRU	S&P Regional Banks Select Industry Index	Equally weighted	71,3
FMK.O	NASDAQ US 500 Large Cap Index	Multi factor	29,81852
TUSA.O	NASDAQ AlphaDEX® Total US Market Index	Multi-factor	29,63199
PSCF	S&P Small Cap 600 Capped Financials Index	Multi-factor	52,57
GUNR	Morningstar Global Upstream Natural Resources Index	Tiered	29,3
FV	Dorsey Wright Focus Five Index	Tiered	25,14
QDF	Northern Trust Quality Dividend Index	Multi-Factor	41,52
FEX	NASDAQ AlphaDEX Large Cap Core Index	Tiered	53,51
FXR	StrataQuant Industrials Index	Tiered	35,43
FXU	StrataQuant Utilities Index	Tiered	28,13
DGRW	WisdomTree U.S. Quality Dividend Growth Index	Dividend	36,9
TILT	Morningstar US Market Factor Tilt Index	Proprietary	102,65
FXH	StrataQuant Health Care Index	Tiered	65,51
FXO	StrataQuant Financials Index	Tiered	27,8
JKD	Morningstar Large Core TR USD	Multi-facto	147,98
FPX	IPOX-100 U.S. Index	Multi-factor	59,93
KBWB	KBW Nasdaq Bank Index	Tiered	46,59
JKG	Morningstar Mid Core TR USD	Multi-factor	169,31
PJP	Dynamic Pharmaceutical Intellidex Index	Tiered	59,22
FXG	StrataQuant Consumer Staples Index	Tiered	46,82

Source: Own Elaboration. Data: ETF.com and Prospectus

After having introduced the data sample and described its main characteristics, the following chapter presents the methodology and the comparison between the two samples using performance, risk and risk-adjusted returns indicators.

IV. Comparison Traditional Exchange Traded Funds and Smart-Beta Exchange Traded Funds

a) Methodology

In order to be able to examine the efficiency of the Smart Beta ETFs, a comparative analysis is applied. In the following chapter the methodology is described providing a deeper understanding on the indicators used for the comparison. Afterwards, the comparison between traditional ETFs and Smart Beta ETFs is performed and several conclusions are drawn from the analysis. The statistical indicators used for this analysis are the following ones:

- Average Return: The average return is a statistical measure and gives information about the profitability of an investment; in this case it will measure the returns for each ETF for a time period *N* (3 years).

$$\mu_{arithmetic} = \frac{1}{N}\sum_{i=1}^{n} r_i = \frac{1}{N}(r_1 + \ldots + r_N)$$

- Average Standard Deviation: The average standard deviation is a statistical measure that it is use to measure the dispersion of the data sample around the mean. In the financial field, the standard deviation denotes the volatility of a security, so the higher the standard deviation, the higher is the risk of this asset. Therefore, the average standard deviation is a risk indicator.

$$\sigma = \sqrt{\frac{1}{N} * \left[(r_1 - \mu)^2 + (r_2 - \mu)^2 + \ldots + (r_N - \mu)^2\right]}$$

  Where *r* represents the return of each ETF, μ is the arithmetic mean (average return) of the fund and *N* the time period.

- Annualized Total Returns: An annualized total return is a performance statistic indicator that provides a geometric average of the return of each fund on a yearly basis for a time period N. The two variables needed are the returns for the time period N and the time period *N*.

$$\mu_{Geometric} = \left(\prod_{i=1}^{N}(1 + r_i)\right)^{\frac{1}{N}} - 1 = \sqrt[N]{\prod_{i=1}^{N}(1 + r_i)} - 1$$

Where *r* represents the return for each year of each ETF and *N* represents the time period.

- Annualized Standard Deviation: The annualized standard deviation is a risk statistic indicator that provides with the geometric standard deviation for each fund on a yearly basis for a time period *N*. As commented previously the standard deviation measures the volatility of a security or fund in this case. The variables needed are the geometric mean of a sample denoted $\mu_{Geometric}$, the set of returns represented by an *r* and the time period *N*.

$$\sigma_{Geometric} = exp\left(\sqrt{\frac{\sum_{i=1}^{N}(ln\ \frac{r_n}{\mu_{Geometric}})^2}{N}}\right)$$

- Correlation: The correlation coefficient measures the relationship between two variables X and Y. The value range is from -1 until 1. When the correlation coefficient is equal to one then there is a linear relationship between the two variables. If the coefficient of correlation is close to -1 then there is a negative relationship between the two variables. Consequently whenever the coefficient of correlation is close to 1 there is a possitive relationship between the two variables. In this case, the correlation coefficient measures how much correlated the ETFs returns are with the benchmark index. The variables needed will be the returns for the two variables and their standard deviation respectively.

$$\mathrm{r} = \frac{cov\,(X\,;\,Y)}{\sigma_x\ *\ \sigma_y}$$

- Alpha: The Alpha measure was created by Michael C. Jensen (1967) and is a risk-adjusted measure of the performance of funds. It is based on the Capital Asset Pricing Theory (CAPM) formulate by Sharpe (1964), Lintner (1965), Treynor (1962) and Mossin (1966). Jensen (1967) extended the model to multi-period in order to measures the absolute performance of funds. Therefore it compares the performance of the funds against the benchmark (Perold, 2004).

  The variables needed to calculate the Jensen Alpha are the return for each fund denoted by R_i, β_{iM} measures the systematic risk and the relationship between the market and the asset. R_f denotes the risk-free rate of return and R_M denotes the realized returns on the market portfolio.

$$\alpha_J = R_i - \left[R_f + \beta_{iM} * (R_M - R_f)\right]$$

- Beta: Beta is a risk indicator that measures the systemic risk of an asset. Therefore, it measures the relation between the benchmark and the fund. There are two type of risk. On the one hand, the risk inherent to the security which can be decrease by the

diversification effect. On the other hand, the systemic risk refers to the inherent risk of the market movements. If the beta is higher than 1 this means that the security or fund has more risk than the market or in this case the benchmark index. It also means that the security moves in the same direction than the market. When the beta is lower than 1, the risk of the security or fund is lower than the market and is not highly correlated with the market or benchmark. Moreover, when the beta is equal to 1, it refers to the beta of the market portfolio. In this case, the beta will measure the risk exposure of the ETF to its benchmark index.

$$\beta = \frac{Cov\ (r_{ETF}\ ;\ r_M)}{Var\ (r_M)}$$

Where the $Var\ (r_M)$ denotes the return from the market or the chosen benchmark and $Cov\ (r_{ETF}; r_M)$ denotes the covariance between the asset / fund and the return of the market / benchmark.

- Information Ratio: The information ratio is a statistical risk adjusted measure of the returns of an active portfolio. The information ratio is based on the Markowitz mean-variance paradigm. The ratio divides the excess return, which is the difference between the return on an active portfolio and the return on a benchmark index by the standard deviation of the excess returns from the benchmark or by the tracking error for a time period *N* (Goodwin, 1998). The ratio measures the skills of the fund to be able to outperform the benchmark. It is a measure of achievement. When it takes on negative values, this means that the portfolio manager or the fund is not performing well. Therefore, the higher the information ratio, the higher the returns of the portfolio or fund. The information ratio's value range is between 1.0 and -1.0. Investment managers with an information ratio of one half are in the top-quartile range (Grinold & Kahn, 2000).

$$\overline{ER} = \frac{1}{N}\sum_{N=1}^{N} ER_N\ \ ;\ where\ ER_N = R_i - R_M$$

$$IR = \frac{\overline{ER}}{\sigma_{ER}}$$

Where $\overline{ER}$ denotes the arithmetic average of excess returns over the time period from N=1 through N and σ_{ER} denotes the standard deviation of the excess returns from the benchmark or the tracking error for the time period N.

- Maximum Drawdown: A drawdown is the "accumulated percentage loss due to a sequence of drops in the price of an investment" (Leal & Mendes, 2005). The maximum drawdown refers to a risk indicator that measures the maximum losses from a market

peak for a security, portfolio or fund during a time period N (Magdon-Ismail & Atiya, 2004).

$$MDD(N) = max\ [max\ r\ (N) - \ r\ (\tau)]$$

- R-Squared: R-Squared is a statistical measure, which represents the proportion of variability in a dependent variable explained by the variability in X. For the funds, the R-Squared represents the fraction of the variance of the portfolio return (ETF returns) that is explained by the variations on the benchmark returns. R-Squared is equal to the square of the correlation coefficient. The variables needed are the $Var\ (\hat{y})$ that is the predicted or forecasted variance and $Var\ (y)$ that is the variance observed on the data. The higher the R-Squared, the better the variable *X* explains the changes on the dependent variable *Y*. Therefore the higher R-Squared means that the performance of the ETF, the higher the connection with its benchmark. The R-Squared is usually interpreted as a percentage so if a fund has a R-Squared of 100% this indicates that the fund replicates all the movements in the benchmark. If it has a low percentage between 1 and 40% then the ETF will poorly replicate the benchmark index (Morningstar).

$$R^2 = \frac{Var\ (\hat{y})}{Var\ (y)} = \frac{Var\ (e)}{Var\ (y)} - 1$$

- Sharpe Ratio: The Sharpe ratio is a risk-adjusted measure created by William F. Sharpe (1996) previously called the "reward-to-variability". The author introduces the initial Sharpe Ratio in 1966 in his paper "Mutual Fund Performance" but in 1994 the author presents a modified ratio. The Sharpe ratio attempts to measure the expected return per unit of risk by calculating the differences between the expected excess return over the risk-free rate over the standard deviation of the fund. It is noticed that the Sharpe Ratio does not take into account the correlations. Therefore allowing the analysis and comparison of funds with different level of risk and returns. The variables needed to calculate the Sharpe Ratios are the following ones: *R* denotes the return of the fund, R_f denotes the risk-free return and $Var\ [R]$ meaning the standard deviation (volatility) of the asset or fund. According to Morningstar investing glossary, the higher the Sharpe ratio, the better the fund's historical risk-adjusted performance. Investors want to obtain the highest returns for the lowest risk possible. Therefore, the higher the Sharpe ratio, the higher the returns for the same level of risk. The Sharpe ratio informs about how well the return of an asset compensates the investor for the risk taken and allows investors to compare the exposure to risk of different funds to obtain an excess return over the risk-free rate.

$$SR = \frac{E\left[R - R_f\right]}{\sqrt{Var\ [R]}}$$

- Tracking Error: The tracking error is a risk indicator; it is used to assess the replication of the fund regarding the benchmark index. "The extent to which fund performance differs from the underlying benchmark index is assessed by quantifying the level of tracking error" (Gallagher, 2006). The tracking error is measured as the difference between the fund's return and the returns of the underlying benchmark index. Theoretically, ETFs are meant to replicate the index so there should not be any difference between them and the index. However, as mentioned before there are synthetically replications that use derivates instead of buying the assets composing the index, so there is room for differences.

  The variables needed to calculate the tracking error are the following ones: e_{ETF} denotes the tracking error for the time period *N*, $\bar{e}_{ETF}$ denotes the average tracking error of the fund and *N* means the time period.

$$TE = \sqrt{\frac{1}{N-1}} * \sum_{t=1}^{N} (e_{ETF} - \bar{e}_{ETF})^2$$

- Treynor Ratio: The Treynor ratio is a risk-adjusted measure created by Jack Treynor also known as the "reward-to-volatility ratio". It is used to measure the performance and efficiency for each individual fund and indicates the expected excess return per unit of systematic risk, which is measured by the beta. According to the Morningstar investing glossary, the higher the ratio, the better has been the historical performance of the fund. Therefore it is similar to the Sharpe ratio because it allows investors to compare different funds and analyse which one is the one that gives the highest returns for the same level of risk. The variables needed to calculate the Treynor ratio are the following ones: R_i designates the return of the fund, R_f denotes the risk free rate and β measures the systemic risk or the market risk. The higher the Treynor ratio, the better the performance of the portfolio or fund.

$$TR = \frac{R_i - R_f}{\beta}$$

b) Comparative Analysis

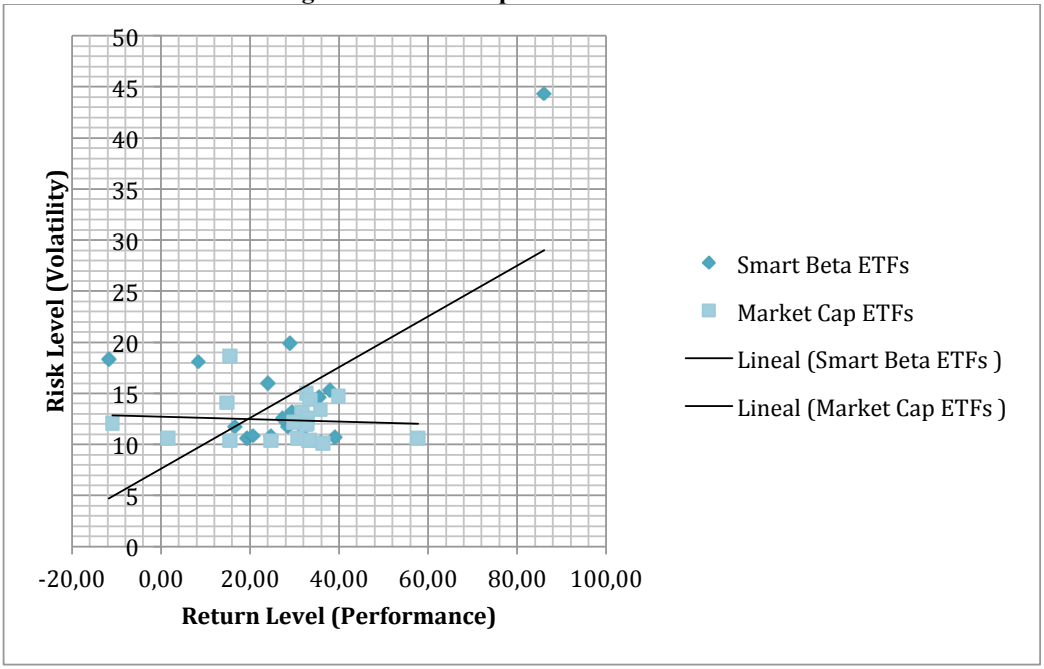
In the following part the comparative analysis will be carried out. As commented previously the sample taken consists of twenty Market Cap equity ETFs and twenty Smart Beta equity ETFs domiciled in the United States and for a time period of three years. In order to be able to comment on all the ratios for the sample taken, the average, maximum and minimum value are calculated for each indicator. Firstly, descriptive statistic risk and return indicators will be analysed. Thereafter, the most relevant risk adjusted return indicators will be examined and some conclusions will be retrieved through out all the analysis of the data obtained.

Tables 6 and 7 in the appendix show the returns performance for one month, three months, six months, one year and three years for both samples. On the one hand, for the Smart Beta ETF sample, the results obtained for the average cumulative performance of one month (-0,27%) and three months (-1.10%) are negative. On the other hand, for the Market Cap ETF sample, the performance is 0,69% for one month and 1,81% for three months. Therefore, for a short time period the Smart Beta ETF do not deliver the promised outperformance. However, focusing on the long term, Smart Beta ETFs have on average a higher cumulative performance with 17,11% for the last year (2016 to 2017) and 28,97% for the last three years (2014 until 2017). The maximum return value is 86,07% for Smart Beta ETFs for a time period of three years and 57,76% for the Market Cap ETF sample. There is a significant difference of 28,31% between both samples. Hence, at first glance it seems that Smart Beta ETFs deliver the promised excess return in the long run. Nevertheless, this information could be misleading because the risk exposure of those funds has not been taken into account. It is important to highlight that for the last six months and one year, none of the Market Cap ETF sample delivers a negative performance, whereas for every time period analysed, the Smart Beta ETFs have higher minimum returns, hence some Smart Beta ETF do not deliver the promised outperformance.

The volatility is measured by the annualized standard deviation. For Market Cap ETF and Smart Beta ETF it is 12,38% and 14,82% respectively. There is a logical difference between both samples that can be explained with Smart Beta ETF having wider returns dispersion because they seek to outperform the benchmark index assuming a higher risk. The maximum values obtained for both samples are 18,69% and 44,35% respectively. Connecting with the previous indicator analysis, the highest volatility for Smart Beta ETF is the ProShares Ultra S&P Regional Banking fund which has the highest performance, so with a standard deviation of 44,35%, it is harder to predict the evolution of the performance of the fund in the future. Additionally, the level of risk needs to be assessed as well with risk-adjusted return

indicators in order to determine whether it is worth for investors to invest in this type of funds and to assume the according level of risk

Figure 9: ETF Sample Return - Risk Level



Source: Own Elaboration

Figure 9 shows a scatter plot of the ETF sample taken according to their volatility and performance. On the one hand, it can be seen that Market Cap ETFs have lower returns and the dispersion among them is lower. On the other hand, Smart Beta ETFs have a higher spread and the dispersion among returns is higher. Hence, when investing in Smart Beta ETFs products, it is important to have a previous knowledge and be aware of the characteristics and investment policies the fund has.

Furthermore, the average beta for Market Cap ETF and Smart Beta ETF are 0,88 and 0,94 respectively. The beta measures the fund's sensitivity to market variations. In this case both samples have a beta close to 1, which is the beta of the benchmark index. This means that both samples will have a lower risk than the benchmark index. The maximum value for the Smart Beta ETF is higher than for Market Cap ETF with a beta equal to 1,28, therefore higher risk than the benchmark. For this sample, it should be noticed that the Smart Beta ETF has a higher and closer beta to their benchmark index. This means that the Smart Beta will have closer variations to the benchmark. It is important to highlight that the beta indicator does not measure the level of risk of the funds (volatility).

Contrary to the beta results, the correlation results show that Market Cap ETF have an average correlation closer to 1 with a maximum correlation value of 0,99 of the Schwab U.S. Small-Cap ETF, meaning a perfect correlation with its benchmark.

Additionally, another statistical measure is analysed with the objective to support the dependence of the fund to its benchmark index. The results for the data sample taken show significant high R-Squared which it is logical because both are considered passive investment funds that replicate their benchmark indexes. Therefore the proportion of the variability of the returns of the ETF is explained mainly due to the variations on the benchmark index returns. Although both samples have a high average R-Squared, differences have been spotted. On the one hand, for the sample of Market Cap ETFs, on average 83% of the returns on the ETF are explained by the variations on the benchmark index. On the other hand, for the sample of Smart Beta ETFs, on average the variations on the benchmark index only explain 71% of the returns on the funds. In general terms, both sample have on average a satisfactorily replication of the benchmark index but there is a difference of 12%. It is an expected difference because the Smart Beta ETFs sample taken uses a multi-factor strategy based on the Fama and French factor model that leads to a different weighting scheme than the one of the benchmark index (market capitalization). Another significant difference between both samples is with respect to the minimum R-Squared obtained for this sample. For the sample of Smart Beta ETFs the minimum R-Squared obtained is 0,0718 so the variations on the benchmark index will only explain 7,18% of the returns of the ETF, hence the ETF poorly replicates the benchmark index and the returns of the fund are explained by other unknown variables. As commented before, a R-Squared between 1 and 40% delivers a poor replication. In the Smart Beta ETF sample, a quarter of the sample has an R-Squared between 7% and 45%. While in the Market Cap ETFs, only one fund has a R-Squared below 40%. Consequently, it could be questioned whether Smart Beta ETFs should be considered as passive investment assets because as observed in the results there is a significant amount of them that do not adequately replicate the benchmark index.

For a time period of three years, the average accumulated percentage loss from a market peak, maximum drawdown, obtained were the following ones. For the sample of Smart Beta ETF, the average maximum drawdown is -17, 21% for a time period of three years. Whereas, for the sample of Market Cap ETF, the average maximum drawdown is -12,33% for a time period of three years. Hence, there is a difference of almost 5% between both samples. The results point out a higher level of risk of the Smart Beta ETFs. Individuals investing on a Smart Beta ETF will therefore need to assume a higher level of losses and risk that could not be compensated with higher returns. Besides for the Market Cap ETFs sample, it can be discerned that only just one fund, Energy Select Sector SPDR Fund, has a considerable percentage of losses of -41%. However, the selected ETF is focused and only invests mostly in the energy

sector. It is well known that commodity markets, especially the energy and oil sector have a higher volatility than other business sectors. Hence, a higher volatility means a higher dispersion between the historical returns and hence the maximum drawdown is higher. For the Smart Beta ETF sample the following funds have a maximum drawdown higher than -21%: ProShares Ultra S&P Regional Banking, FlexShares Morningstar Global Upstream Natural Resources Index Fund, First Trust Dorsey Wright Focus 5 ETF, First Trust Industrials/ Producer Durables AlphaDEX Fund, First Trust Health Care AlphaDEX Fund and PowerShares Dynamic Pharmaceuticals Portfolio.

Following on to the descriptive statistic indicators, the next analysis will comment the results obtained for the risk-adjusted returns indicators. The risk-adjusted return indicators allow comparing different funds with different level of risks and characteristics.

Regarding the Alpha results obtained, the average alpha for a time period of three years is 0,4 for Smart Beta ETFs against a 0,34 for Market Cap ETF. The difference is not very significant. It would be reasonable to think that Market Cap ETF have a lower alpha because their aim is to simply replicate their respective benchmark. However it can be noticed that Smart Beta ETFs do not deliver a significant return over the benchmark index. Moreover, the maximum alpha delivered by Smart Beta ETFs was 2,21 from the ProShares Ultra S&P Regional Banking fund which objective is to obtain a return of 200% of the return of the benchmark index. Compared to a maximum alpha value of Market Cap ETF of 0,85 delivered by the Consumer Discretionary Select Sector SPDR Fund. The difference is here significant but as demonstrated previously Smart Beta ETFs assume a higher level of risk. The minimum alpha for both cases has negative values (underperformance). Negative values can be caused by the management fees and expenses as commented previously in the literature review.

Firstly, the average information ratio for the Market Cap ETF sample and the Smart Beta ETF are 0,29 and 0,17 respectively for a time period of three years. There is a significant difference of 0,12 between both samples that reflects a better performance of the traditional ETF with respect to its benchmark. This means that Market Cap ETFs generate a higher excess return taking into account the level of risk; hence they have a higher efficiency than Smart Beta ETFs. In the previous section of the analysis, the return indicators showed better returns for the Smart Beta ETFs than for the Market Cap. However, taking into account the risk, it can be deduce that the Market Cap ETFs provide the highest returns for the same level of risk. In addition, the maximum information ratio values obtained for the Market Cap and the Smart Beta ETF are 0,47 and 0,43 respectively. This confirms the previous conclusions; the Market Cap ETF delivers a more consistent and efficient performance. Concerning the minimum information value for the Smart Beta ETF is negative -0,13; hence, the fund is underperforming its benchmark. It can be observed as well that for the Market Cap ETF sample, none of the ETF

delivered a negative performance for the time period taken. While for the Smart Beta ETFs sample, the following three funds have negative information ratio: First Trust Mega Cap AlphaDEX Fund, First Trust Total US Market AlphaDEX ETF and PowerShares Dynamic Pharmaceuticals portfolio.

The Sharpe ratio results capture similar conclusions as the ones obtained with the information ratio. The average Sharpe ratio for the Market Cap ETF and the Smart Beta ETF sample are 0,21 and 0,17 respectively for a time period of three years. The Market Cap ETF have a higher Sharpe ratio than the Smart Beta, therefore they deliver a better performance for a lower risk. Individuals are characterized by a risk aversion, therefore it will be preferable to invest in the traditional ETF because the Smart Beta do not compensate accordingly to the risk taken by investors. While for the information ratio, none of the Market Cap ETF had negative values, in this case, the minimum Sharpe ratio value is -0,15 corresponding to the Energy Select Sector SPDR Fund mentioned previously. For the Smart Beta ETF sample, the minimum Sharpe ratio is of -0,07 from the FlexShares Morningstar Global Upstream Natural Resources Index Fund. It is reasonable to think for both cases that they delivered a negative value due to the sector they are focused because both funds invest on commodities such as energy, agriculture, etc. which are areas with a higher volatility and that is significantly influenced by economic cycles.

One of the most important ratios to analyse ETFs is the tracking error, which allows the assessment of the replication of the fund regarding the benchmark. The results obtained reinforce the previous conclusions drawn through the analysis of statistical indicators such as the correlation. The tracking error for the Smart Beta ETF sample is higher than for the Market Cap ETF with a 2,38% against a 1,35% on average for a three years time period. For the Smart Beta, half of the sample has a tracking error higher than 2% reaching a maximum of 11,94%. Whereas for the traditional ETF only a quarter of the sample has a tracking error between 2% and 3,9%. The difference is significant, especially when dealing with the maximum values. Therefore, Smart Beta ETFs have a higher spread return over the benchmark index returns than the traditional ETFs. It is assumed that the returns follow a normal distribution. Then for instance, an ETF with a tracking error of 3,9% will mean that the returns of the ETF will be between -3,9% and +3,9% of its benchmark index returns. The tracking error supports the previous conclusions that Smart Beta ETFs have a higher volatility and they assume more risk than Market Cap ETFs.

In order to calculate and analyse the Treynor ratio, the beta results are needed. As commented in the previous part of the analysis both average betas obtained are close but below the market beta 1. However, it is observed that for the Market Cap ETF sample only three ETF have a beta above 1. While the number of Smart Beta ETFs with a beta higher than 1 is more

than double compared to traditional ETFs. The average Treynor ratio for both samples are possitive but Market Cap ETFs have a higher Treynor ratio (0,821) which supports the evidence shown in the analysis of the Sharpe ratio. The Market Cap ETFs give a higher return for the same level of risk. Additionally, focusing on the minimum values obtained, both are negative, which means that the funds have lower returns than the risk-free rate. As observed the values obtained for the Treynor ratio are higher than for the Sharpe ratio because the Treynor ratio only takes into account the risk of the market (beta).

To sum up, several conclusions can be drawn from this comparative analysis done for forty equity U.S. domiciled ETFs during a time period of three years. Before doing so, it is highlighted that both samples have similar and close results.

Concerning the replication of the benchmark index and which type of ETFs has a better replication, the results are inconclusive. As seen on the analysis, outcomes differ from the results obtained for the beta, correlation and R-Squared. It is observed that both samples have on average a high correlation with their benchmark indexes and that the tracking error is considerably low in both cases. Hence, it could be asserted that Smart Beta ETFs should be considered as passive investment strategies because they adequately replicate its benchmark index and in general have a low volatility compared to other types of investment vehicles.

Moreover, regarding the risk and returns indicators, it has been noticed that the Smart Beta ETFs have a better performance than Market Cap ETFs but they also assume a higher level of risk and a higher maximum drawdown. In addition, the risk-adjusted return indicators results are significant and conclusive. Information ratio, Sharpe ratio and Treynor ratio results demonstrate that for the sample and time period taken, the Market Cap ETFs achieve a better performance (higher returns) for the same level of risk; hence proving that traditional ETFs are more efficient than the Smart Beta ETFs.

Although, it is noteworthy that for the sample taken, some exceptions exist. These include the ETFs focusing on commodity sectors for both cases (Smart Beta and non Smart Beta) because they have extreme values and deliver the worst performances (losses) for the time period chosen.

c) Limitations and Further Analysis

There are several limitations to the analysis of this study and recommendations for extensions for further research that are pointed out in this chapter.

First, as mentioned previously, due to the novelty of the Smart Beta ETFs with its boom during the last year 2016. Even the most well known financial database still does not include the beta strategies on its screener tools. In addition, for this comparative analysis only one type of Smart Beta ETF following a multi factor strategy has been selected. However, in the Smart Beta

ETFs universe, there are a significant wide variety of funds. There are Smart Beta ETFs using diverse weighting scheme and that only use one factor such as equally weighted, dividend weighted, fundamentals weighted, risk-weighted, earnings weighted, etc. Other Smart Beta ETFs only follow one factor such as quality, dividends, value, momentum, size, etc. One needs to be cautions with interpreting the results obtained due to the mentioned reasons above. Therefore, further research using a comparative analysis should include a wider sample that could take into account different types of Smart Beta ETFs to assess their performance in comparison to traditional ETFs, but as well evaluate which are the preferable categories of Smart Beta ETFs to invest in.

Second, the time period chosen does not contemplate different economic cycles; further research could extend this study by using a larger time period that captures different economic situations in order to assess the efficiency of the Smart Beta ETFs during expansion and recession cycles.

Finally, another pending issue is the construction of a model based on the Fama and French factor model that could show and allow to assess the exposure of the Smart Beta ETFs to the factors contemplated by each fund. Besides, it could be fruitful for further analysis to evaluate how each factor has influenced the returns of the Smart Beta ETF following a multi-factor strategy.

V. Conclusion

In this End of Master Project, the performance and efficiency of forty equity U.S. domiciled ETFs has been examined for the time between 2014 and 2017. The first objective was to analyse the efficiency of the Smart Beta ETFs and to determine whether it is a better investment vehicle than traditional Market Cap ETFs for a long-term period. The second objective of this study was to assess the level of risk of those investment vehicles and determine whether it is a suitable investment vehicle for every type of investor.

The relevance of this End of Master Project is based on the lack of sufficient research on the Smart Beta ETFs performance. Their novelty and rapid intrusion in the financial markets as an investment product that delivers an excess return such as active products but with the benefits and lower costs of passive ETFs has marked the motivation to present this topic as the End of Master Project. Therefore, this study aims to shed some light over the Smart Beta ETFs and contribute to the literature on this topic.

To determine the efficiency of Smart Beta ETFs, a comparison with Market Cap ETFs was performed in order to determine whether the Smart Beta ETFs always deliver a higher excess return. The sample of Smart Beta ETFs consisted of twenty equity U.S. domiciled Smart

Beta ETFs. The sample of Smart Beta ETFs followed a multi-factor strategy based on the Fama and French factor model approach. The sample of Market Cap ETFs consisted of twenty equity U.S. domiciled Smart Beta ETFs, which followed a vanilla strategy and have a market capitalisation weighted scheme accordingly to the benchmark index. Additionally, the sample taken consisted of forty ETFs whose underlying benchmark indexes were American ones. Following Glushkov (2015) and Malkiel (2014) which findings argue that there was no empirical evidence of Smart Beta ETFs delivering a reliable excess return compared to its risk-adjusted benchmark. The comparative analysis performed in this study found as well weak evidences that Smart Beta ETFs have a higher efficient performance than the Market Cap ETFs. Although both samples had resembling results, the risk-adjusted return indicators were significant and conclusive. For the sample and time period taken, the traditional ETFs achieved a better performance (higher returns) for the same level of risk; hence proving that traditional ETFs are more efficient than the Smart Beta ETFs. On the other side, the statistical results obtained concluded that Smart Beta ETFs should be considered as passive investment strategies because they adequately replicate their benchmark index with high correlations and low tracking error results. However, investors interested and willing to invest in Smart Beta ETFs should have a previous financial knowledge and a deep understanding of how those investment vehicles function because they are exposed to a higher level of risk.

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VII. Appendix

Table 6: Cumulative Performance, Market Cap ETFs (2014-2017)

Name	1 Month	3 Months	6 Months	1 Year	3 Years
SPDR S&P 500 ETF Trust	1,40	2,54	10,74	17,35	33,18
iShares S&P 100 ETF	0,83	2,83	8,00	9,74	15,57
Vanguard Extended Market Index Fund;ETF	-0,79	0,26	6,83	18,72	24,76
Schwab US Small-Cap ETF	-3,37	1,05	10,52	23,44	-10,91
Utilities Select Sector SPDR Fund	4,19	4,79	17,17	13,33	39,81
iShares Core S&P Total US Stock Market ETF	1,01	2,14	10,09	17,59	32,66
Schwab US Large-Cap ETF	1,37	2,55	10,83	17,68	32,71
Schwab US Broad Market ETF	1,04	2,18	10,12	17,63	31,78
Industrial Select Sector SPDR Fund	1,78	2,98	9,40	23,34	32,86
Consumer Discretionary Select Sector SPDR Fund	0,83	2,83	8,00	9,74	15,57
iShares Core S&P Small-Cap ETF	-2,15	-1,34	3,10	19,57	32,67
SPDR S&P MidCap 400 ETF	-0,52	-0,12	6,41	16,81	29,86
Energy Select Sector SPDR Fund	0,10	0,29	0,54	0,95	1,67
Health Care Select Sector SPDR Fund	0,78	1,91	11,62	8,43	33,10
Financial Select Sector SPDR Fund	-1,20	-4,75	4,31	23,27	36,36
iShares Core S&P Mid-Cap ETF	-0,49	-0,05	6,53	17,06	30,66
Vanguard 500 Index Fund;ETF	0,91	1,83	6,86	13,84	14,90
iShares Core S&P 500 ETF	1,40	2,56	10,79	17,42	33,39
Consumer Staples Select Sector SPDR Fund	2,70	3,37	13,50	10,17	35,80
Technology Select Sector SPDR Fund	3,90	8,29	19,98	29,97	57,76
Average	**0,69**	**1,81**	**9,27**	**16,30**	**27,71**
Maximum	**4,19**	**8,29**	**19,98**	**29,97**	**57,76**
Minimum	**-3,37**	**-4,75**	**0,54**	**0,95**	**-10,91**

Table 7: Cumulative Performance, Smart Beta ETFs sample (2014-2017)

Name	1 Month	3 Months	6 Months	1 Year	3 Years
First Trust Consumer Staples AlphaDEX Fund	-2,19	-0,38	5,76	0,59	24,00
PowerShares Dynamic Pharmaceuticals Portfolio	-3,34	-3,48	5,12	-8,51	8,41
iShares Morningstar Mid-Cap ETF	0,64	1,26	9,17	15,09	29,39
PowerShares KBW Bank Portfolio	-2,40	-7,22	2,61	27,67	35,92
First Trust Equity Opportunities ETF	1,57	4,58	11,12	15,72	30,92
iShares Morningstar Large-Cap ETF	2,23	3,68	13,23	22,38	37,87
First Trust Financials AlphaDEX Fund	-0,79	-2,82	6,01	16,91	32,81
First Trust Health Care AlphaDEX Fund	1,32	2,67	12,23	10,19	24,72
FlexShares Morningstar US Market Factor Tilt Index	-0,24	-0,05	7,21	18,23	28,61
WisdomTree US Quality Dividend Growth Fund	1,67	3,85	12,12	18,94	35,53
First Trust Utilities AlphaDEX Fund	1,93	1,43	10,60	12,79	32,95
First Trust Industrials/Producer Drbls AlphaDEX Fd	1,07	0,82	6,89	23,86	19,39
First Trust Large Cap Core AlphaDEX Fund	1,23	2,06	9,79	18,40	27,25
FlexShares Quality Dividend Index Fund	-0,17	-0,07	6,03	15,52	28,95
First Trust Dorsey Wright Focus 5 ETF	1,81	2,48	8,69	13,50	32,11
FlexShs Morningstar Glbl Upsteam Ntrl Res Idx Fd	-0,96	-1,86	3,46	15,93	-11,72
PowerShares S&P SmallCap Financials Port	-3,78	-7,05	0,47	18,08	39,05
ProShares Ultra S&P Regional Banking	-7,37	-21,94	-4,09	53,81	86,07
First Trust Mega Cap AlphaDEX Fund	1,16	-0,66	8,29	14,08	20,69
First Trust Total US Market AlphaDEX ETF	1,25	0,75	9,28	19,03	16,55
Average	**-0,27**	**-1,10**	**7,20**	**17,11**	**28,97**
Maximum	**2,23**	**4,58**	**13,23**	**53,81**	**86,07**
Minimum	**-7,37**	**-21,94**	**-4,09**	**-8,51**	**-11,72**

Table 8: Market Cap ETF Sample Results between 2014 and 2017

TICKER	Alpha for 3 Years to Last Month End	Annualized Standard Deviation for 3 years	Beta for 3 Years to Last Month End	Correlation	Information Ratio for 3 Years to Last Month End	Max Drawdown for 3 Years to Last Month End	Return/Risk Ratio for 3 Years to Last Month End	R-Squared for 3 Years to Last Month End	Sharpe Ratio for 3 Years to Last Month End	Tracking Error for 3 Years to Last Month End	Treynor Ratio for 3 Years to Last Month End
SPY	0,28754	10,35248	0,93316	0,98282	0,43178	-8,34797	0,28179	0,96586	0,26296	0,58465	0,83329
IVV	0,29092	10,37389	0,93501	0,98279	0,43967	-8,3665	0,28273	0,96581	0,26391	0,58406	0,83629
VOO	0,29204	10,37408	0,93514	0,9829	0,44304	-8,3684	0,28313	0,96603	0,2643	0,58229	0,83744
IJH	0,26662	12,04938	0,89371	0,97652	0,25132	-12,66185	0,23112	0,95355	0,21007	0,84426	0,81057
IJR	0,21804	14,71696	1,0713	0,96446	0,22371	-11,71518	0,20585	0,9302	0,18322	1,1379	0,71577
XLF	0,6473	14,98965	0,9159	0,83235	0,26291	-15,23338	0,22069	0,69269	0,19707	2,39373	0,92037
MDY	0,25059	12,01625	0,89158	0,97667	0,23097	-12,74301	0,22669	0,95383	0,20563	0,84449	0,79331
XLK	0,50499	13,17463	0,87696	0,89944	0,23575	-7,94928	0,35322	0,80863	0,33425	1,69988	1,42304
XLV	0,38726	12,57152	0,83595	0,93472	0,21296	-13,0516	0,23755	0,87372	0,21244	1,46041	0,92805
XLE	-0,17315	18,69362	0,72229	0,86195	0,02672	-41,0064	-0,12742	0,74267	-0,1581	3,25706	-1,17661
XLY	0,85061	11,9712	0,8481	0,84434	0,43286	-7,97116	0,3173	0,71257	0,29825	1,89684	1,19752
XLI	0,60569	12,20155	0,73812	0,82342	0,24696	-11,92175	0,24178	0,67752	0,22216	2,21542	1,04421
SCHB	0,24118	10,64212	0,96526	0,987	0,4444	-8,79803	0,26527	0,97413	0,24562	0,50166	0,77501
SCHX	0,27114	10,43333	0,94538	0,98709	0,47769	-8,50951	0,2765	0,9743	0,25735	0,50755	0,81195
XLP	0,57184	10,13929	0,6526	0,68388	0,18317	-7,73379	0,30574	0,46702	0,28652	2,36723	1,27418
ITOT	0,26067	10,62846	0,96337	0,98694	0,47979	-8,38803	0,27164	0,97401	0,25217	0,50321	0,79573
XLU	0,8186	14,0726	0,5478	0,45403	0,1896	-12,7011	0,24993	0,20505	0,22572	3,90854	1,66585
SCHA	0,02493	14,37333	1,09012	0,99417	0,12705	-16,22724	0,16556	0,98841	0,1412	0,5596	0,53512
VXF	0,07451	13,38422	1,01806	0,99353	0,18867	-16,47153	0,17832	0,98709	0,15437	0,44395	0,58543
OEF	0,27836	10,62196	0,93636	0,96243	0,28921	-8,53748	0,27289	0,92615	0,25415	0,84695	0,82243
Average	0,348484	12,38902	0,885808	0,9055	0,2909115	-12,3351	0,237014	0,836962	0,215663	1,356984	0,821447
Maximum	0,85061	18,69362	1,09012	0,99417	0,47979	-7,73379	0,35322	0,98841	0,33425	3,90854	1,66585
Minimum	-0,17315	10,13929	0,5478	0,45403	0,02672	-41,0064	-0,12742	0,20505	-0,1581	0,44395	-1,17661

Table 9: Smart Beta ETF Sample Results between 2014 and 2017

TICKER	Alpha for 3 Years to Last Month End	Annualized Standard Deviation for 3 years	Beta for 3 Years to Last Month End	Correlation	Information Ratio for 3 Years to Last Month End	Max Drawdown for 3 Years to Last Month End	Return/Risk Ratio for 3 Years to Last Month End	R-Squared for 3 Years to Last Month End	Sharpe Ratio for 3 Years to Last Month End	Tracking Error for 3 Years to Last Month End	Treynor Ratio for 3 Years to Last Month End
KRU	2,21043	44,35	1,28101	0,268	0,17764	-41,74628	0,20468	0,0718	0,14601	11,94505	1,41056
FMK.O	0,01068	10,87	0,98024	0,97088	-0,00068	-9,97132	0,19931	0,94257	0,17885	0,76072	0,57727
TUSA.O	-0,17326	11,76	1,00108	0,92971	-0,13877	-15,90079	0,13743	0,86409	0,11667	1,24411	0,39331
PSCF	0,73589	15,9707	0,75534	0,64841	0,19116	-11,93584	0,22145	0,4204	0,19815	3,57618	1,18788
GUNR	0,3515	18,10185	0,76455	0,94306	0,24909	-39,90336	-0,04095	0,88925	-0,07015	2,29675	-0,47714
FV	0,97402	13,21567	0,67062	0,44679	0,30254	-18,65428	0,22256	0,19928	0,19462	3,57477	1,12607
QDF	0,24475	10,25055	1,02626	0,97245	0,37452	-8,52019	0,25364	0,94564	0,23583	0,68378	0,67016
FEX	0,14957	10,74684	0,95489	0,96719	0,15847	-12,16442	0,23147	0,93534	0,21173	0,7944	0,68179
FXR	0,26748	15,26155	0,92263	0,82188	0,10027	-21,97818	0,13307	0,67497	0,10905	2,49509	0,51353
FXU	0,66348	12,21772	0,63652	0,61031	0,19888	-10,51447	0,24215	0,37131	0,22134	3,02269	1,21387
DGRW	0,36408	10,83957	1,07005	0,95786	0,43407	-8,93478	0,28599	0,91735	0,26755	0,90842	0,77192
TILT	0,13782	11,74672	1,03341	0,95802	0,16032	-10,78489	0,22316	0,91775	0,20257	0,96907	0,65851
FXH	0,13273	14,67398	0,99495	0,93897	0,08758	-23,82258	0,16652	0,88164	0,13755	1,48871	0,5982
FXO	0,59705	12,73753	0,80883	0,85914	0,2759	-12,79742	0,23303	0,73785	0,21033	2,01594	0,95179
JKD	0,38578	10,56688	0,92899	0,95564	0,37899	-8,91959	0,30849	0,9131	0,28855	0,91952	0,94042
FPX	0,15022	12,61856	1,10397	0,94365	0,16402	-16,00075	0,22398	0,89043	0,20035	1,24875	0,66122
KBWB	0,5785	19,92744	1,19633	0,81253	0,18135	-22,2118	0,17664	0,66035	0,14575	3,42116	0,69719
JKG	0,27086	11,61935	0,83269	0,94239	0,14462	-12,5655	0,23036	0,88799	0,20946	1,28028	0,83752
PJP	-0,33387	18,34752	1,16141	0,88284	-0,09937	-27,3163	0,06862	0,77982	0,03835	2,60477	0,17733
FXG	0,30765	10,67287	0,68209	0,67555	0,07361	-9,72828	0,20943	0,45621	0,18868	2,46079	0,84898
Average	0,401268	14,824765	0,940293	0,8252635	0,1707105	-17,21851	0,1965515	0,717857	0,171562	2,3855475	0,722019
Maximum	2,21043	44,35	1,28101	0,97245	0,43407	-8,52019	0,30849	0,94564	0,28855	11,94505	1,41056
Minimum	-0,33387	10,25055	0,63652	0,268	-0,13877	-41,74628	-0,04095	0,0718	-0,07015	0,68378	-0,47714