MSc Economics & Business – Master Thesis Financial Economics

Factor Investing in U.S. Equity Mutual funds and Exchange-Traded funds

Abstract

This paper compares U.S. equity mutual funds with low-cost U.S. equity exchange-traded funds (ETFs) operating under the same 'factor'-investment style. The analysis delivers mixed results: active Value mutual fund managers are able to add economic value over comparable ETF managers, while active Growth mutual fund managers underperform their ETF managers, especially for Small- and Mid Cap funds. The evidence is not consistent with my prediction that all equity mutual funds can outperform similar equity exchange-traded funds to compensate for the higher total costs. In my sample, I find evidence that Value equity mutual- and exchange-traded funds face constant returns to scale whereas Growth equity mutual- and exchange-traded funds have increasing returns to scale. Funds with a higher level of assets under management (AUM) do not earn lower gross alphas.

JEL Classification: G11, G12

Keywords: Mutual funds; Exchange-traded funds; Factor Investing; Gross alpha; Decreasing returns to scale

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1. Introduction

Exchange-Traded Funds (ETFs) have become very popular in the United States (U.S.) stock market. Assets under Vanguard ETF management have reached mammoth proportions with 3.2 trillion dollars in 2016 compared to 100 billion dollars in 2000 (Authers & Newlands, 2016). The growing popularity of ETFs coincides with enormous capital outflows for mutual funds. In 2016 130 billion dollars flowed out of mutual funds in the United States, while 240 billion dollars streamed into ETFs. Besides the fact that exchange-traded funds are cheaper to hold than mutual funds, the discussion on whether mutual funds yield on average higher returns than passive indexes already started decades ago. Most academics do not find evidence in favor of mutual fund outperformance relative to passive benchmarks.

Do U.S. mutual funds have on average higher expected gross returns across different investment factors than U.S. exchange-traded funds to compensate for the higher total costs?

Exchange-traded funds are assets traded on stock exchanges and were first introduced to the U.S. market in 1993. Investors basically track a large basket of securities against low total costs. Therefore, by owning a single exchange-traded fund a portfolio can be diversified. Mutual funds share this characteristic, but at much higher total costs. Mutual funds combine the capital from many investors to purchase securities. Portfolio managers can for example choose securities that they believe are undervalued in the market or have a high future growth potential depending on the objective of the fund. Mutual- and exchange-traded fund providers differentiate their funds on the basis of these investment objectives. Most of the investment objectives stem from groundbreaking research. Exchange-traded- and mutual funds can be either actively managed or passively managed by tracking an index.

This paper offers a detailed look at specific equity mutual and exchange-traded funds with similar investment styles to make it easier for investors to differentiate among the large amount of funds available. Why would an investor choose a U.S. Small Cap Value mutual fund and pay a high fee if the investor can also choose a U.S. Small Cap Value exchange-traded fund at lower total costs with the same expected return? Do U.S. equity mutual funds charge higher fees than U.S. equity exchange-traded funds because of a higher exposure to common risk factors?

I empirically show that active Value equity mutual funds outperform comparable low-cost equity ETFs, while active Growth equity mutual funds underperform their ETFs, especially for Small- and Mid Cap funds. There is not enough mutual fund outperformance to conclude

that all equity mutual funds have on average higher expected gross returns to compensate for the higher total costs. The outperformance of active Value equity mutual funds can be partly explained by the common risk factors, but there still is an unidentified set of skills of Value mutual fund managers left to be exposed. The comparison between U.S. equity exchange-traded and U.S. equity mutual funds across different investment strategies and company sizes delivers new insights to the debate. Furthermore, this paper demonstrates that equity exchange-traded funds are a suitable investment alternative for expensive equity mutual funds.

My paper differs from the numerous papers available on mutual fund performance by comparing equity mutual- and exchange-traded funds within investment styles instead of looking at different styles combined. Carhart (1997) does not find any evidence of skilled or informed mutual fund managers by looking at net mutual fund returns for different investment styles combined. Wermers (2000) and Fama and French (2010) are able to find some mutual fund outperformance after adding back fund expense ratios. By analyzing investment styles separately on the basis of gross fund returns I can identify the true source of mutual fund outperformance or underperformance. A paper closely related to the scope of this analysis is from Blitz and Huij (2012). They compare the performance of U.S. equity mutual funds against a set of passively managed index funds and find that some equity mutual funds have economic value over low-cost index funds. However, the comparison is made using net fund returns instead of gross fund returns. Because the passively managed index funds have lower expense ratios than the evaluated equity mutual funds, I argue that it would be better to make a comparison on the basis of gross alphas to ascertain whether equity mutual funds outperform passive index funds.

In the mutual fund industry the influence of size on the performance of a certain fund is also a relevant point of discussion. Berk and Green (2004) argue that the mutual fund industry displays diseconomies to scale. Berk and van Binsbergen (2015) extend this idea by introducing their value added measure. It is more difficult for fund managers to keep earning the same levels of gross alpha when the assets under management (AUM) grow explosively. However, Fama and French (2010) document that there is not enough evidence to conclude that mutual funds have decreasing returns to scale. This paper contributes to the diseconomies to scale debate by ranking U.S. equity mutual funds and U.S. equity exchange-traded funds with different investment objectives on the level of AUM in portfolios and evaluating the average gross abnormal returns of these portfolios. I find evidence that Growth equity mutual- and exchange-traded funds have increasing returns to scale, while Value equity mutual- and

exchange-traded funds have constant returns to scale. Increasing returns to scale in the equity mutual- and exchange-traded fund industry could be due to the fact that only skillful funds are able to survive and have to earn high abnormal returns to achieve this. These findings contradict with the notion of decreasing returns to scale in the mutual fund industry by Berk and Green (2004) and Berk and van Binsbergen (2015). Fund managers are able to earn the same or a higher gross alpha if the level of AUM increases aggressively.

The research proceeds with the literature review in chapter 2. Chapter 3 describes the hypotheses used for this analysis. In chapter 4, I elaborate on the data used. Chapter 5 contains the methodology and subsequently chapter 6 the results. I draw the conclusions and I make some recommendations for future research in chapter 7. Chapter 8 covers the references. Finally, chapter 9 contains the appendix.

2. Literature Review

The performance of the mutual fund industry, and therewith the skill of individual mutual fund managers to outperform a certain passive benchmark, is extensively documented by many renowned academics. Jensen (1968) provides evidence that active mutual funds do not outperform passive benchmarks. Mutual fund managers are evaluated on the basis of alpha, which is the excess return of a mutual fund after correcting for market risk. Jensen uses the work from Sharpe (1964) and Litner (1965) to calculate alphas (abnormal returns). The contributions of Sharpe and Litner are later combined and named the 'Sharpe-Litner Capital Asset Pricing Model (CAPM)'. The Sharpe-Litner CAPM is defined as: the expected return of an asset equals the risk-free rate plus a risk premium based on the market beta multiplied by the excess return of the market portfolio minus the risk-free rate. Beta represents the systematic risk of the portfolio. Systematic risk cannot be diversified away. Risk specific to a certain asset (idiosyncratic) is diversifiable.

The Sharpe-Litner CAPM builds upon the modern portfolio theory by Markowitz (1952). Both William Sharpe and Harry Markowitz were granted the Nobel Prize in Economics for their work in 1990. Markowitz argues that investors minimize the variance of the portfolio return, given the expected return, and maximize the expected return given a certain level of variance. In other words, investors choose 'mean-variance efficient' portfolios. The Sharpe-Litner CAPM incorporates the assumptions from the modern portfolio theory, such as risk-aversion and the notion that utility is a function of expected return and variance, and requires even more assumptions to become an equilibrium model. Some added assumptions: investors can lend and borrow at the risk-free rate and there is perfect competition in the market. As a result of these assumptions, the Sharpe-Litner CAPM is a descriptive model and does not reflect the real world.

After the introduction of the Sharpe-Litner CAPM, persistence in mutual fund performance becomes an important topic of discussion. Given that most mutual funds are unable to outperform passive benchmarks, it might be the case that these funds continue to do poorly in the future. The same can be true for mutual funds that have earned positive abnormal returns in the past and continue this outperformance in the near future. Grinblatt and Titman (1992) conclude there is positive persistence in mutual fund performance. By performing Fama and Macbeth (1973) tests, Grinblatt and Titman find evidence that the past 5-year performance is positively related to future performance. Hendricks, Patel and Zeckhauser (1993) extend this idea by looking at shorter evaluation horizons. Mutual funds

that performed well relative to the benchmark in the most recent year continue to earn superior returns in the near term (one to eight quarters). Up until this point in time, most academics used the Sharpe-Litner CAPM to evaluate the performance of different mutual funds.

In 1992, Fama and French find their first evidence that the two variables size and value (book-to-market equity) capture more cross-sectional variation in average stock returns than only the market risk factor. Fama and French (1993) propose a three-factor asset pricing model including an overall market factor and firm-specific factors related to size and book-to-market equity. Small firms tend to earn higher average returns than big firms and value firms (low market value relative to book value) tend to outperform growth firms (high market value relative to book value). Graham and Dodd (1934) are the first to provide investors with knowledge on how to seek undervalued securities. Banz (1981) points out that smaller firms have on average higher risk-adjusted returns than larger firms using the Sharpe-Litner CAPM, but he was unable to assess whether size alone was responsible for the higher abnormal returns. The Three-factor asset pricing model from Fama and French is a groundbreaking discovery with widespread applications in the modern financial world. Fama and French (2015) provide a new five-factor model with investments and profitability as newly added factors. The choice of new factors and therewith the decision of Fama and French to not include momentum, a factor that is discussed later on in this section, is questioned by many academics and therefore I decide not to use the five-factor model for this research.

Even though the Three-factor model is widely accepted as being accurate, most of the critique on the work of Fama and French comes from behavioral economists and boils down to the failure of the Efficient Market Hypothesis (EMH) from Fama (1970). From the perspective of behavioral economists, the prices in a market do not fully reflect all the available information. De Bondt and Thaler (1985) believe that both value and growth stocks are systematically mispriced, because stocks with high prices relative to earnings are overvalued and stocks with low prices relative to earnings are undervalued. Lakonishok et al. (1994) argue that market participants appear to have consistently overestimated future growth rates of growth stocks relative to value stocks. Due to the preference of investors for stocks with high prices relative to book values (growth stocks) and the avoidance of value stocks, value stocks outperform growth stocks. Moreover, the outperformance of value stocks is not reversed during periods of relative financial distress. La Porta et al. (1997) find that approximately 15-30% of the return differences between value and growth stocks in the first 5

years after portfolio formation can be explained by different reactions to earnings announcements.

With the introduction of the Three-factor model the persistence discussion in mutual fund performance continued, Carhart (1997) extends the three-factor model with a momentum factor based on the lagged 12 months cumulative returns proposed by Jegadeesh and Titman (1993). Mutual funds with high returns last year have higher expected returns in the next year, but not in the years thereafter. Hence, the long-term persistence in mutual fund performance remains an issue and mutual fund managers do not have enough skill to consistently outperform passive benchmarks. Moreover, investors should avoid mutual funds with a persistently poor performance last year. Carhart uses net fund returns, which are the reported returns corrected for all operating expenses (expense ratios) and security level transaction costs. Only front and rear sales charges are not included and taxes are not taken into account. For my analysis gross fund returns are required, but I discuss this in more detail later. In addition to the four-factor model, Asness et al. (2013) propose a Quality minus Junk (QMJ) factor. Stocks that are safe, profitable, growing and well managed (high quality) have higher alphas than low quality stocks. The main reason for high quality stocks having high alphas is still a puzzle. Frazzini and Pedersen (2014) find evidence that a Betting against Beta (BAB) factor earns significant and high returns across different countries and asset classes. Assets with low average betas have higher alphas than assets with high average betas. Low beta assets with higher alphas are the result of investors that face leverage constraints and margin requirements.

Given that the sample period of this analysis covers the subprime credit crisis, it is important to touch upon earlier research about the value premium during periods of relative financial distress. Lettau and Ludvingson (2001) elaborate on the higher risk premia for value stocks during bad times by using the conditional CAPM by Black (1972). Value stocks earn higher average returns than growth stocks, because value stocks have higher conditional consumption betas in bad times than growth stocks. The conditional CAPM allows for changing betas in the cross-section over time. Gomes et al. (2003) also show that size and book-to-market ratio are correlated with the true conditional beta and are therefore able to explain the cross-section of stock returns from an equilibrium model perspective. The higher expected returns for value stocks are now not only linked to the Sharpe-Litner, unconditional CAPM anymore. Zhang (2005) contributes to the value premium discussion by linking the risk and expected returns of value and growth stocks to certain economic primitives. Value stocks are indeed more risky than growth stocks when the price of risk is high and during

times of disinvestment. As a result, value stocks require higher returns in bad times. More recently, Asness et al. (2013) provide evidence for value and momentum risk premia across eight different markets and asset classes and a negative correlation between value and momentum. Investors are still able to profit from the value premium in international markets. However, Lee et al. (2014) document that value stocks significantly underperformed growth stocks during the subprime crisis, despite a positive value premium before the financial crisis. The reversal in the value premium concentrates in financially constrained firms. Consequently, the value premium puzzle during periods of relative financial distress remains to be solved.

To conclude the literature review section, I shortly touch upon the net versus gross fund returns discussion. Up until the novel paper by Carhart (1997) on the failure of mutual funds to persistently outperform passive benchmarks, most academics use net fund returns for performance evaluation. Net fund returns are the reported returns including reinvested dividends and are net of all management expenses and 12-1b fees. Only front and rear loads are not subtracted from the Net Asset Value (NAV). After Carhart (1997) the main concern of academics on using net fund returns becomes the fact that the expense ratios of mutual funds differ enormously. Consequently, formulating a conclusion regarding the net performance of a certain fund with an expense ratio of 1.50% compared to a similar fund with an expense ratio of 1% is incorrect and gross fund returns are more appropriate (monthly gross fund returns are the monthly net fund returns plus 1/12 of a fund's annual expense ratio).

Wermers (2000) acquires gross alphas of mutual funds by looking at the underlying portfolio holdings and concludes that some mutual funds do add value over passive indices, however similar to Carhart net alphas are negative. Berk and Green (2004) create a rational model of active portfolio management and they argue that fund flows respond to past performance. Mutual fund managers do have a high level of skill and most funds earn positive gross abnormal returns. Another important assumption in the model from Berk and Green is decreasing returns to scale in the mutual fund industry (or diseconomies to scale). Positive net present value investment opportunities are not in infinite supply and therefore funds with a higher level of assets under management (AUM) earn lower alphas. Fama and French (2010) use bootstrap simulations to seek skill among mutual fund managers. Some mutual fund managers are able to produce positive abnormal returns, but these managers are hidden among the majority of unskilled managers. Moreover, the fact that the left tails alpha t-statistics of the larger mutual funds are as negative as the t-statistics of the smaller mutual funds does not allow them to conclude that there are diseconomies to scale in the mutual fund industry.

Berk and van Binsbergen (2015) extend the rational model from Berk and Green (2004) and introduce the value added measure to more accurately disentangle whether mutual fund performance is due to skill or luck. The skill of a mutual fund manager is equal to the gross excess return over the benchmark of the fund times AUM. Managers that add a gross alpha of 1% to a 10 billion dollar fund are more valuable than managers that add a gross alpha of 10% to a 1 million dollar fund and they argue that the mutual fund industry displays decreasing returns to scale. The debate on mutual fund outperformance relative to passive peers and whether the mutual fund industry faces decreasing returns to scale is still ongoing to date.

3. Hypothesis development

Equity mutual- and exchange-traded fund providers use prominent risk factors as the foundation for the investment objective to distinguish their fund from the large amount of funds available. Value fund managers seek stocks that are selling below their true prices. Hence, the fund manager believes these stocks are undervalued in terms of book value relative to market value. On the other hand, growth fund managers seek stocks that have an underestimated future growth potential. The market value of these stocks relative to the book value is higher, but the high future growth potential compensates for this. Another distinction fund providers frequently use is the market capitalization (size) of the stocks in the portfolio. Funds often invest in either small cap, mid cap or large cap stocks. Small firms tend to outperform large firms even after correcting for their market risk. The common explanation for this outperformance is that small firms are under less scrutiny from analysts and as a result small firms require a premium because the prices of small firms do not change as frequently as the prices of large firms.

3.1 Gross alpha

As previously discussed, I use the gross alpha to evaluate whether mutual funds outperform exchange-traded funds in a similar investment style and size portfolio. I discuss how the gross alpha is obtained more quantitatively in the methodology section. The gross alpha takes all the costs into account, except the front and rear load, and is therefore the ideal performance measure to identify whether expensive mutual fund managers using a certain investment

objective have the skill to outperform cheaper exchange-traded fund managers using the same investment style. I obtain the gross alpha by creating a portfolio that goes long in the mutual fund portfolio and short in the exchange-traded fund portfolio and regressing the portfolio returns in excess of the risk-free rate against the common risk factors.

$$\alpha = 0,\ indicates\ no\ significant\ outperformance\ or\ underperformance \quad (1)$$

If the gross alpha is equal to zero, mutual funds with a certain investment style do not outperform or underperform comparable, cheaper exchange-traded funds. Investors should be indifferent between mutual- and exchange-traded funds with the same investment objective.

$$\alpha < 0,\ indicates\ underperformance \quad (2)$$

If the gross alpha is significantly lower than zero, investors are better of by investing in an exchange-traded fund with the same investment objective against lower total costs.

$$\alpha > 0,\ indicates\ outperformance \quad (3)$$

If the gross alpha is significantly higher than zero, mutual funds are able to outperform comparable exchange-traded funds. Hence, mutual fund managers using a specific investment objective have the skill to outperform comparable exchange-traded fund managers. If a mutual fund portfolio beats a comparable exchange-traded fund portfolio after correcting for the common risk factors, the Betting against Beta and Quality minus Junk risk factors are also included in the model to disentangle whether these factors can 'capture' the outperformance.

Hypothesis 1: U.S. Small Cap Growth mutual funds have on average higher gross risk-adjusted returns than U.S. Small Cap Growth exchange-traded funds

Hypothesis 2: U.S. Small Cap Value mutual funds have on average higher gross risk-adjusted returns than U.S. Small Cap Value exchange-traded funds

Hypothesis 3: U.S. Mid Cap Growth mutual funds earn on average higher gross abnormal returns than U.S. Mid Cap Growth exchange-traded funds

Hypothesis 4: U.S. Mid Cap Value mutual funds earn on average higher gross abnormal returns than U.S. Mid Cap Value exchange-traded funds

Hypothesis 5: U.S. Large Cap Growth mutual funds have on average higher gross alphas than U.S. Large Cap Growth exchange-traded funds

Hypothesis 6: U.S. Large Cap Value mutual funds have on average higher gross alphas than U.S. Large Cap Value exchange-traded funds

3.2 Exposure to common risk factors

The factor exposures of the relevant portfolios are informative in assessing to what extent investors of a certain mutual- or exchange-traded fund truly benefit from conventional investment styles. Small Cap Value funds should have high exposures to the Small minus Big Size and High minus Low Market-to-book factors, because the fund managers incorporated these factors in the investment objective. Mutual funds are expected to have higher exposures to these factors than exchange-traded funds with comparable investment styles due to the higher total fees. For this to be true, the coefficient of the factor needs to be positive and significant. Especially if a mutual fund portfolio is not able to outperform an exchange-traded fund portfolio on the basis of gross alpha, the mutual fund portfolio is expected to have a higher exposure to the size and value factor to slightly compensate investors for the higher costs of the related mutual funds. The momentum, betting against beta and quality minus junk factors are not likely to be either positive or significant, because the funds in my sample do not use these factors as investment style.

Hypothesis 7: U.S. Small cap Value and Growth mutual funds have a higher exposure to existing risk factors than U.S. Small cap Value and Growth exchange-traded funds and therefore charge higher fees

Hypothesis 8: U.S. Mid cap Value and Growth mutual funds have a higher exposure to existing risk factors than U.S. Mid cap Value and Growth exchange-traded funds and therefore charge higher fees

Hypothesis 9: U.S. Large cap Value and Growth mutual funds have a higher exposure to existing risk factors than U.S. Large cap Value and Growth exchange-traded funds and therefore charge higher fees

3.3 Decreasing returns to scale

The literature review points out that to date there is no consensus on whether the mutual fund industry faces decreasing returns to scale (diseconomies) or not. If the fund size (AUM) increases, Berk and Green (2004) and Berk and van Binsbergen (2015) believe it is more difficult for fund managers to find investments large enough to positively influence the gross alpha. The supply of value added investments is finite in their opinion. I disagree with this point of view and argue that a higher level of AUM not necessarily has a negative effect on the gross alpha of funds consistent with Fama and French (2010). I do believe there is a point at which a fund becomes too big and cannot outperform its benchmark anymore, but it is difficult to uncover this exact fund size (AUM) because not every fund can produce a positive gross alpha at all and the investment objectives of the funds differ too much.

I obtain the gross alpha by creating a portfolio that goes long in the top 20% mutual- and exchange-traded funds with the highest level of AUM and short in the bottom 20% mutual- and exchange-traded funds with the lowest level of AUM. Henceforth, I regress the portfolio excess returns against the usual risk factors. The methodology section further elaborates on the regression. If the gross alpha is significantly higher than zero, funds with the evaluated investment objectives do not have decreasing returns to scale.

Hypothesis 10: A higher level of assets under management (AUM) from funds does not inevitably leads to a lower gross alpha

4. Data

My dataset includes all the U.S. equity mutual- and exchange-traded funds and covers the monthly sample period January 2001 to December 2016. This specific sample period is chosen, because most ETFs originate from 2000. As a result, the portfolios I use to evaluate the performance of different mutual- and exchange-traded funds have 192 observations. I obtain the data from the CRSP mutual funds database, which incorporates all the U.S. equity ETFs as well. The database is survivorship bias free, because it includes both surviving and non-surviving funds and as a consequence the results are not driven by the surviving funds. There are no duplicates in the panel dataset, so no need to remove them. The monthly total net assets (mtna) are important for the value-weighted portfolio creation and therefore cannot have missing values or values below zero. Luckily, there are no missing values. I drop funds with mtna-values below zero.

To capture equity mutual- or exchange-traded funds using a certain investment style (such as value or growth) with different market capitalizations of the fund holdings, I use the Lipper classification codes. The Lipper classification codes are based on a set of portfolio characteristics, such as price-to-book ratio or price-to-earnings ratio, and are provided by the CRSP mutual funds database. Tables 1 and 2 provide the number of funds in a portfolio and the average annual expense ratios of these funds. The number of funds in a certain portfolio varies on a yearly basis. Because exchange-traded funds are relatively new securities, the total number of ETFs is 7 across the different portfolios. The average annual expense ratios of the mutual fund portfolios are a lot higher than the average annual expense ratios of the ETF portfolios. To test the diseconomies to scale part of this research, mutual- and exchange-traded funds with the same investment objective are combined in the same portfolio.

Table 1: Summary statistics of mutual fund portfolios

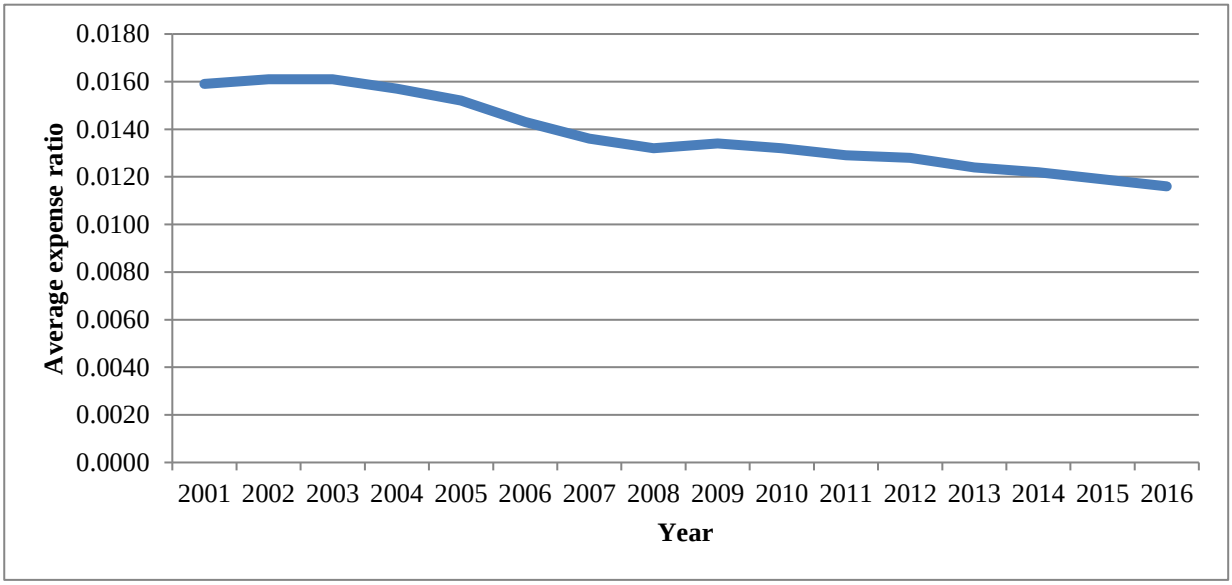
Portfolio	**Total number of funds**	**Average expense ratio**
Small Cap Growth	490	1.58%
Small Cap Value	269	1.50%
Mid Cap Growth	450	1.51%
Mid Cap Value	218	1.42%
Large Cap Growth	708	1.38%
Large Cap Value	462	1.27%

Table 2: Summary statistics of exchange-traded fund portfolios

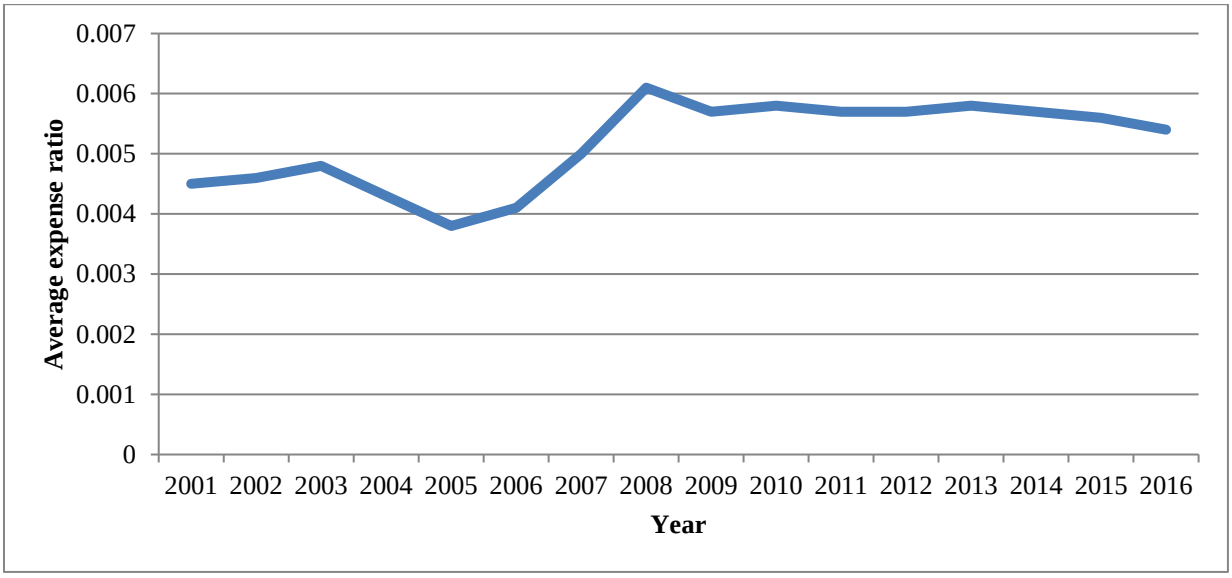
Portfolio	**ETFs (symbols)**	**Average expense ratio**
Small Cap Growth	SLYG, VKB, PXSG, IWO, IJT, JKK, RZG	0.30%
Small Cap Value	SLYV, VBR, PXSV, IWN, IJS, JKL, RZV	0.35%
Mid Cap Growth	MDYG, VOT, PXMG, IWP, IJK, JKH, RFG	0.39%
Mid Cap Value	MDYV, VOE, PXMV, IWS, IJJ, JKI, RFV	0.38%
Large Cap Growth	SPYG, VUG, PWB, IWF, IVW, JKE, RPG	0.31%
Large Cap Value	SPYV, VTV, PWV, IWD, IVE, JKF, RPV	0.29%

Graph 1 and 2 show the trend of decreasing average expense ratios for U.S. equity mutual funds in the period from 2001 to 2016, while the average expense ratios of U.S. equity ETFs increased slightly. If this trend continues, mutual funds become more interesting for investors with lower costs in the near future.

Graph 1: Trend of decreasing average annual expense ratio equity mutual funds



Graph 2: Average annual expense ratio equity ETFs



Next to the average expense ratio patterns of U.S. equity mutual- and exchange-traded funds, the difference in average fund turnover ratios between Value and Growth mutual- and exchange-traded funds is also interesting. Carhart (1997) argues that the fund turnover ratio negatively influences performance in the mutual fund industry. Table 3 reports the average fund turnover ratios of the relevant mutual- and exchange-traded fund portfolios. The fund turnover ratio is the purchases divided by the average net assets over a twelve-month period. Growth funds tend to have higher average fund turnover ratios than Value funds and mutual funds also tend to have higher average fund turnover ratios because they trade more actively.

Table 3: average fund turnover ratios mutual- and exchange-traded fund portfolios

Portfolio	Average Fund Turnover Ratio
Small Cap Growth mutual fund	119%
Small Cap Growth ETF	58%
Small Cap Value mutual fund	77%
Small Cap Value ETF	51%
Mid Cap Growth mutual fund	115%
Mid Cap Growth ETF	70%
Mid Cap Value mutual fund	78%
Mid Cap Value ETF	63%
Large Cap Growth mutual fund	87%
Large Cap Growth ETF	39%
Large Cap Value mutual fund	61%
Large Cap Value ETF	31%

As previously stated, I use monthly gross fund returns to evaluate different mutual fund and ETF portfolios. To acquire monthly gross fund returns the monthly expense ratios have to be merged into the current dataset. I delete the entire fund if a monthly expense ratio is missing.

$$Monthly\ gross\ fund\ returns = monthly\ net\ fund\ returns + \frac{1}{12} * expense\ ratio \quad (4)$$

The net fund returns are the reported returns and are the percentage changes between the Net Asset Values (NAV) of the funds. The NAV is equal to the fund's assets minus the costs divided by the number of shares outstanding. Moreover, the NAV includes reinvested dividends from one period to another and is net of all management expenses and 12-1b fees. Only front and rear loads are not included.

I download the loadings for the common risk factors and risk-free rates from the Kenneth French data library. Similarly, I download the Betting against Beta (BAB) and Quality minus Junk (QMJ) factors from the AQR Capital Management website. Table 4 (appendix) displays the monthly excess returns, minimum- and maximum values as well as the standard deviations of the different equally and value weighted mutual fund portfolios. Table 5 (appendix) shows the descriptive statistics of the exchange-traded fund portfolios. Noteworthy is the fact that the monthly excess returns of the both the mutual- and exchange-traded fund portfolios are pretty similar. Only the excess returns of the Small Cap Value and Mid Cap Value mutual fund portfolios are slightly higher than the comparable exchange-traded fund portfolios. Moreover, table 6 (appendix) describes the descriptive statistics of the risk factors. The market risk factor is the value-weighted average return of all the CRSP firms listed on a stock exchange with share code 10 or 11 minus the risk-free rate (one-month U.S. Treasury bill rate). The Small minus Big (SMB) factor is the average return of three portfolios with solely small stocks (market capitalization) minus the average return of three portfolios with only big stocks. The High minus Low (HML) factor is the average return of two portfolios with value stocks minus the average return of two portfolios with growth stocks. In addition, the Up minus Down (UMD) momentum factor is the average return of two portfolios of stocks with high returns last year minus the average return of two portfolios of stocks with low returns last year. Lastly, the Betting against Beta (BAB) factor is long in low-beta stocks and short in high-beta stocks. The Quality minus Junk (QMJ) factor is long in high-quality stocks and short in low-quality stocks, where quality is defined as safe, profitable and growing stocks.

5. Methodology

To compare the different portfolios and empirically test the hypotheses I use the Capital Asset Pricing Model (CAPM), the Three-factor model and the Four-factor model. Even though the normal distribution does not hold in the real world and the results are solely an approximation of the expected portfolio returns, these models have enough explanatory power to form a conclusion regarding the performance of different U.S. equity mutual- and exchange-traded funds across distinctive investment styles. I specify the following CAPM regression model to capture the gross alpha of portfolio i:

$$R_i - R_f = \alpha + \beta_i * (R_m - R_f) + \varepsilon_i \quad (5)$$

Similarly, I specify the following Three- and Four-factor regression models to acquire the gross alpha of portfolio i:

$$R_i - R_f = \alpha + \beta_i * (R_m - R_f) + S_i * (SMB) + H_i * (HML) + \varepsilon_i \quad (6)$$

$$R_i - R_f = \alpha + \beta_i * (R_m - R_f) + S_i * (SMB) + H_i * (HML) + U_i * (UMD) + \varepsilon_i \quad (7)$$

As documented in the literature review, the Three-factor and Four-factor asset pricing models capture more variation in the cross-section of average stock returns than the CAPM and therefore I will formulate the main conclusions using these models.

Another model to identify mutual fund outperformance is a six-factor asset pricing model with the Betting against Beta (BAB) and Quality minus Junk (QMJ) factor added to the standard four-factor model. I use the six-factor model for robustness testing if a certain mutual fund portfolio is able to outperform the comparable exchange-traded fund portfolio on the basis of the three- and four-factor gross alpha. I obtain the six-factor gross alpha for every portfolio i by performing the following regression:

$$R_i - R_f = \alpha + \beta_i * (R_m - R_f) + S_i * (SMB) + H_i * (HML) + U_i * (UMD) + Z_i * (BAB) + Q_i * (QMJ) + \varepsilon_i \quad (8)$$

For the first part, the portfolio creation process is relatively straightforward. Funds do not have to be ranked on the basis of a certain characteristic. Small Cap Growth mutual funds enter the Small Cap Growth mutual fund portfolio and Large Cap Value exchange-traded

funds enter the Large Cap Value exchange-traded fund portfolio. I create both equally- and value-weighed portfolios to be sure that the results are not driven by the small funds. In the value-weighted portfolio, the weight of a certain fund depends on the ratio of assets under management to total assets under management of all funds in the portfolio combined. However, the portfolio creation process for the diseconomies to scale part of the analysis is slightly more difficult. I rank funds on the basis of monthly assets under management (MAUM) and create quintile portfolios both equally- and value-weighted. Mutual- and exchange-traded funds with matching investment objectives enter the same portfolio, because the goal is to test whether funds face decreasing returns to scale and the differences between mutual- and exchange-traded funds are not relevant for this part of the research.

The next step before the performance evaluation of the relevant mutual- and exchange-traded fund portfolios begins is the creation of self-financing portfolios. The self-financing portfolios allow for critical evaluation of the formulated hypotheses. I make self-financing portfolios by going long in a certain mutual fund portfolio and short in the comparable exchange-traded fund portfolio. For the diseconomies to scale analysis, I create self-financing portfolios as well by going long in the top 20% mutual- and exchange-traded funds with the highest level of MAUM and short in the bottom 20% mutual- and exchange-traded funds with the lowest level of MAUM.

Furthermore, I correct all the regressions for heteroskedasticity and autocorrelation by using HAC-Newey West standard errors. Both heteroskedasticity and autocorrelation appear to be present, because the null hypotheses of homoscedasticity and no serial correlation are rejected for almost all portfolios. Autocorrelation can be problematic, because the standard error in a period contains information about the standard error in the next period. Hence, the standard errors could be biased after a period of relative financial distress and therewith also the significance of the coefficients can be questioned. Heteroskedasticity leads to the variance of the residuals not being constant and similar significance problems with the coefficients. Besides heteroskedasticity and autocorrelation, multicollinearity can lead to high standard errors of the coefficients due to a high correlation between independent variables in multifactor regression models resulting in linear relationships between these independent variables. Correlations above 0.9 are often too high. In my analysis, the highest correlation is only 0.32 between the market risk factor and the size factor and therefore multicollinearity does not influence the standard errors of the estimated coefficients.

6. Empirical results

6.1 Gross alpha

*Table 7: Annualized average excess returns and gross alphas (intercept) of the different portfolios similar to Carhart (1997). The mutual- and exchange-traded fund portfolios are value-weighted (table 10 and 11, equally weighted) and sorted on the basis of the investment style. The t-statistics are in parentheses. Significance: * 10%, ** 5%, *** 1%.*

Model		**CAPM**	**Three-factor**	**Four-factor**
Portfolio	Excess Return	Gross Alpha	Gross Alpha	Gross Alpha
Small Cap Growth Mutual fund	7.2%	0.48%	**-1.56%****	**-1.92%****
		(0.44)	*(-2.07)*	*(-2.27)*
Small Cap Growth ETF	8.2%	1.44%	-0.96%	-1.20%*
		(1.23)	*(-1.55)*	*(-1.90)*
Difference Mutual minus ETF	-1%	**-1.08%****	**-0.72%*****	**-0.72%*****
		(-2.39)	*(-2.66)*	*(-2.69)*
Small Cap Value Mutual fund	10.92%	4.80%	**1.20%*****	**1.20%*****
		(1.57)	*(3.54)*	*(3.76)*
Small Cap Value ETF	10.32%	3.60%	-0.72%	-0.36%
		(1.31)	*(-1.16)*	*(-0.53)*
Difference Mutual minus ETF	0.60%	**1.20%*****	**1.92%****	1.56%*
		(3.19)	*(2.21)*	*(1.79)*
Mid Cap Growth Mutual fund	6.12%	-0.36%	-0.96%	-1.08%
		(-0.42)	*(-1.34)*	*(-1.47)*
Mid Cap Growth ETF	6.96%	0.48%	-0.24%	-0.60%
		(0.52)	*(-0.60)*	*(-1.19)*
Difference Mutual minus ETF	-0.84%	-0.84%	-0.60%	-0.48%
		(-0.94)	*(-0.95)*	*(-0.75)*
Mid Cap Value Mutual fund	9.96%	4.20% *	**2.40%*****	**2.40%*****
		(1.81)	*(3.30)*	*(3.56)*
Mid Cap Value ETF	9.72%	3.72%*	**1.68%*****	**1.80%*****
		(1.68)	*(3.12)*	*(3.70)*
Difference Mutual minus ETF	0.24%	**0.48%****	**0.72%****	**0.60%****
		(2.06)	*(2.34)*	*(2.04)*
Large Cap Growth Mutual fund	4.20%	-1.56%	-0.60%*	**-0.72%****
		(-1.49)	*(-1.82)*	*(-2.16)*
Large Cap Growth ETF	4.20%	-1.92%	-0.36%	-0.24%
		(-1.30)	*(-1.55)*	*(-0.63)*
Difference Mutual minus ETF	0%	0.36%	-0.24%	-0.48%
		(0.70)	*(-0.66)*	*(-1.31)*
Large Cap Value Mutual fund	6.00%	0.60%	0.24%	0.24%
		(0.85)	*(0.86)*	*(0.87)*
Large Cap Value ETF	5.52%	0.12%	-0.12%	-0.12%
		(0.34)	*(-0.83)*	*(-0.52)*
Difference Mutual minus ETF	0.48%	0.48%	0.36%	0.36%
		(1.20)	*(1.18)*	*(1.08)*

Table 7 displays the different value-weighted annualized gross alpha coefficients of the mutual fund portfolios, exchange-traded fund (ETF) portfolios and the difference portfolios (long in the relevant mutual fund portfolio and short in the comparable exchange-traded fund portfolio). Equally weighted portfolios have similar coefficients so the results are not driven by the small funds. The CAPM gross alpha coefficients are not significant, because the standard errors of the estimated intercepts are too high and therefore I decide not to use the CAPM to compare mutual funds with exchange-traded funds. The first thing to notice is that the average annualized excess return pattern of the different Growth and Value mutual fund- and exchange-traded fund portfolios is relatively similar. Growth mutual fund portfolios often have a lower average excess return than Growth ETF portfolios, while Value mutual fund portfolios have a higher average excess return than Value ETF portfolios.

More interesting is the gross alpha comparison. The Small Cap Value mutual fund portfolio has a significantly positive average annualized gross alpha of 1.20% for both the three- and four-factor model (t-statistic of 3.54 and 3.76 respectively). Similarly, the Mid Cap Value mutual fund portfolio has a significantly positive average gross alpha of 2.40% per annum in the three- and four-factor model (t-statistic of 3.30 and 3.56 respectively). However, the Mid Cap Value exchange-traded fund portfolio also has a significantly positive average annualized gross alpha of 1.68% (three-factor with a t-statistic of 3.12) and 1.80% (four-factor with a t-statistic of 3.70). Following the theory regarding the size and value factor of Fama and French (1993), the best performing investment style should be Small Cap Value. Consequently, the discovery that the best performing portfolio is the Mid Cap Value mutual fund is surprising. Even more surprising is the significantly negative average gross alpha of -1.56% per annum (three-factor with a t-statistic of -2.07) and -1.92% per annum (four-factor with a t-statistic of -2.27) for the Small Cap Growth mutual fund portfolio. Moreover, the Large Cap Growth mutual fund portfolio has a significantly negative average annualized four-factor gross alpha of -0.72% as well (t-statistic -2.16). Small Cap Growth and Large Cap Growth mutual fund managers significantly underperform the passive market portfolio. The gross alpha coefficients of the other mutual fund portfolios are not significant and therefore not interesting to investigate in more detail. Mid Cap Growth and Large Cap Value mutual funds have similar average expected returns as the passive market index. Wermers (2000) and Fama and French (2010), among others, support the finding that only some mutual fund managers have the skill to outperform the passive market portfolio before taking costs into account.

The difference portfolios allow me to further identify whether a mutual fund portfolio is able to significantly outperform a comparable, cheaper exchange-traded fund portfolio on the basis of the gross alpha. Growth mutual fund portfolios underperform growth ETF portfolios, while Value mutual fund portfolios outperform value ETF portfolios. However, these findings are not always significant. Mid Cap Growth, Large Cap Growth and Large Cap Value mutual funds do not significantly out-or underperform Mid Cap Growth, Large Cap Growth and Large Cap Value exchange-traded funds on the basis of gross alpha. Consequently, I am unable to reject the null hypotheses of 3, 5 and 6. Investors should be indifferent between funds using these investment objectives. Small Cap Growth mutual funds significantly underperform Small Cap Growth ETFs by -0.72% in both the three- and four-factor model (t-statistic of -2.66 and -2.69 respectively). Therefore, I am also unable to accept hypothesis 1. Consistent with Carhart (1997), Small Cap Growth mutual funds have the highest average fund turnover ratio (table 3) and the lowest abnormal returns. In addition, Small Cap Value and Mid Cap Value mutual funds significantly outperform Small Cap Value and Mid Cap Value exchange-traded funds by 1.92% and 0.72% respectively per annum (three-factor gross alpha). As a consequence, I can reject the null hypotheses of 2 and 4.

Altogether, the gross alpha analysis delivers mixed results. Active Value equity mutual funds are able to add economic value over comparable equity exchange-traded funds, while active Growth equity mutual funds underperform their exchange-traded funds. Consequently, I cannot conclude that all equity mutual fund managers have the skill to outperform cheaper exchange-traded fund managers.

6.2 Exposure to common risk factors

Given that not every mutual fund portfolio is able to outperform the comparable, cheaper exchange-traded fund portfolio one would expect that investors have at least a higher exposure to existing risk factors as compensation. Additionally, the fact that some mutual funds are able to outperform raises questions regarding the corresponding factor coefficients. Is the outperformance due to an unidentified set of skills from mutual fund managers or can the existing risk factors completely explain it?

*Table 8: Factor coefficients of value-weighted equity mutual fund portfolios. The second column and third column display the monthly Three- and Four-factor coefficients respectively. T-statistics are in parentheses. Significance: * 10%, ** 5%, *** 1%.*

Model	**3-factor**					**4-factor**					
Independent variable	Alpha	Market	SMB	HML	Adj. R^2	Alpha	Market	SMB	HML	UMD	Adj. R^2
Portfolio	**(1)**	**(2)**	**(3)**	**(4)**		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	
Small Cap Growth	**-0.0013****	1.0622***	0.7423***	-0.2664***	0.97	**-0.0016****	1.0989***	0.7427***	-0.2654***	0.0640***	0.97
	(-2.07)	*(65.82)*	*(31.64)*	*(-12.36)*		*(-2.27)*	*(31.03)*	*(40.90)*	*(-33.25)*	*(2.93)*	
Small Cap Value	**0.0010*****	0.9339***	0.7128***	0.3241***	0.98	**0.0010*****	0.9397***	0.7129***	0.3243***	0.0100	0.98
	(3.54)	*(36.81)*	*(82.80)*	*(9.35)*		*(3.76)*	*(54.13)*	*(79.25)*	*(10.12)*	*(0.74)*	
Mid Cap Growth	-0.0008	1.0837***	0.3966***	-0.3324***	0.95	-0.0009	1.1052***	0.3969***	-0.3318***	0.0376	0.95
	(-1.34)	*(49.39)*	*(18.74)*	*(-19.81)*		*(-1.47)*	*(28.14)*	*(21.20)*	*(-13.22)*	*(1.36)*	
Mid Cap Value	**0.0020*****	0.9430***	0.3334***	0.2013***	0.96	**0.0020*****	0.9446***	0.3334***	0.2013***	0.0028	0.96
	(3.30)	*(33.55)*	*(12.51)*	*(2.79)*		*(3.56)*	*(49.13)*	*(12.40)*	*(2.82)*	*(0.15)*	
Large Cap Growth	-0.0005*	1.0443***	-0.0288	-0.2957***	0.97	**-0.0006****	1.0668***	-0.0286*	-0.2951***	0.0393***	0.97
	(-1.82)	*(129.70)*	*(-1.52)*	*(-13.48)*		*(-2.16)*	*(110.62)*	*(-1.79)*	*(-27.52)*	*(2.94)*	
Large Cap Value	0.0002	0.9562***	-0.0916***	0.2363***	0.98	0.0002	0.9560***	-0.0916***	0.2362***	-0.0003	0.98
	(0.86)	*(53.74)*	*(-5.66)*	*(7.06)*		*(0.87)*	*(56.29)*	*(-5.66)*	*(7.03)*	*(-0.08)*	

*Table 9: Factor coefficients of value-weighted equity exchange-traded fund portfolios. The second column and third column display the monthly Three- and Four-factor coefficients respectively. T-statistics are in parentheses. Significance: * 10%, ** 5%, *** 1%.*

Model	**3-factor**					**4-factor**					
Independent variable	Alpha	Market	SMB	HML	Adj. R^2	Alpha	Market	SMB	HML	UMD	Adj. R^2
Portfolio	**(1)**	**(2)**	**(3)**	**(4)**		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	
Small Cap Growth	-0.0008	1.0441***	0.7912***	-0.1983***	0.98	-0.0010*	1.0787***	0.7915***	-0.1973***	0.0603***	0.98
	(-1.55)	*(113.61)*	*(25.20)*	*(-9.70)*		*(-1.90)*	*(46.43)*	*(29.69)*	*(-21.24)*	*(3.31)*	
Small Cap Value	-0.0006	1.0368***	0.7763***	0.4903***	0.96	-0.0003	0.9950***	0.7759***	0.4891***	-0.0729*	0.96
	(-1.16)	*(44.56)*	*(32.50)*	*(16.55)*		*(-0.53)*	*(73.57)*	*(35.16)*	*(11.00)*	*(-1.83)*	
Mid Cap Growth	-0.0002	1.0739***	0.3587***	-0.1988***	0.93	-0.0005	1.1137***	0.3592***	-0.1977***	0.0695**	0.94
	(-0.60)	*(61.95)*	*(11.61)*	*(-4.53)*		*(-1.19)*	*(36.24)*	*(13.93)*	*(-7.54)*	*(2.52)*	
Mid Cap Value	**0.0014*** **	1.0086***	0.3277***	0.2945***	0.95	**0.0015*** **	0.9973***	0.3276***	0.2942***	-0.0197	0.95
	(3.12)	*(39.30)*	*(11.00)*	*(7.76)*		*(3.70)*	*(54.71)*	*(11.36)*	*(6.71)*	*(-1.10)*	
Large Cap Growth	-0.0003	1.1072***	-0.0542*	-0.4534***	0.96	-0.0002	1.0780***	-0.0545*	-0.4542***	-0.0510**	0.96
	(-1.55)	*(40.30)*	*(-1.67)*	*(-4.56)*		*(-0.63)*	*(79.54)*	*(-1.84)*	*(-5.44)*	*(-2.34)*	
Large Cap Value	-0.0001	0.9596***	-0.1407***	0.2892***	0.97	-0.0001	0.9534***	-0.1408***	0.2890***	-0.0108	0.97
	(-0.83)	*(130.62)*	*(-5.36)*	*(15.40)*		*(-0.52)*	*(128.05)*	*(-5.51)*	*(13.23)*	*(-1.49)*	

Tables 8 and 9 show that the exposure to the common risk factors for both equity mutual funds and equity exchange-traded funds (ETFs) is as expected (value-weighted portfolios). The SMB-coefficient is high and positive for Small Cap mutual fund portfolios and Small Cap ETF portfolios and low and negative for Large Cap mutual fund- and ETF portfolios. The HML-coefficient is positive for both mutual- and exchange-traded fund portfolios with a value investment objective and negative for funds with a growth investment objective. Some portfolios have significantly positive UMD-coefficients, which is not part of their investment style. The comparison between the common factor exposures for mutual funds and ETFs does not deliver the expected findings. Mutual fund portfolios do not have a higher exposure to the risk factors size and value than exchange-traded fund portfolios. Only the momentum factor is higher for some mutual fund portfolios than for the comparable exchange-traded fund portfolio. However, since this is not part of the investment objective of the funds I conclude that the null hypotheses of 7, 8 and 9 cannot be rejected. Equally weighting portfolios does not alter the result (table 10 and 11, appendix). The common risk factors are unable to completely explain the performance of the Small Cap Value and Mid Cap Value mutual fund portfolios. Hence, part of the outperformance comes from an unidentified set of skills of these mutual fund managers. This unidentified set of skills could be related to the Betting against Beta (BAB) factor, because the outperforming mutual fund portfolios have a lower average beta than the equivalent ETF portfolios but have higher gross abnormal returns.

6.3 Decreasing returns to scale

Table 12 reports three- and four-factor gross alphas of the value-weighted quintile portfolios sorted on the basis of monthly assets under management (MAUM) to test whether funds with different investment styles face decreasing returns to scale. For the investment styles Small Cap Value, Mid Cap Value, Large Cap Growth and Large Cap Value both the three- and four-factor gross alpha stay relatively constant. The self-financing portfolio P5-P1 for these investment styles is not significant and consequently funds with a Small Cap Value, Mid Cap Value, Large Cap Growth or Large Cap Value investment objective face constant returns to scale instead of decreasing returns to scale. Funds using the investment styles Small Cap Growth and Mid Cap Growth even have increasing returns to scale, because the gross alpha significantly increases with the level of AUM and the difference between the four-factor gross alpha of portfolio 5 and 1 is 0.10% per month (t-statistic of 10.36) for Small Cap Growth funds and 0.05% per month (t-statistic of 3.54) for Mid Cap Growth funds.

*Table 12: Monthly risk-adjusted returns of value-weighted quintile portfolios for different investment styles (mutual- and exchange-traded funds combined). The funds are ranked every month on the basis of the AUM and assigned to one of the quintile portfolios. P5-P1 is the self-financing portfolio that goes long in the top 20 percent funds with the highest level of AUM and short in the bottom 20 percent funds with the lowest level of AUM. T-statistics are in parentheses. Significance: * 10%, ** 5%, *** 1%.*

Portfolio **Investment Style**	**P1** (Low AUM)	**P2**	**P3**	**P4**	**P5** (High AUM)	**P5-P1**
Small Cap Growth						
Three-factor Alpha	**-0.0020***** *(-2.95)*	**-0.0018****** *(-2.30)*	**-0.0014****** *(-2.03)*	-0.0016* *(-1.92)*	-0.0009 *(-1.52)*	**0.0010***** *(10.37)*
Four-factor Alpha	**-0.0022***** *(-3.02)*	**-0.0020****** *(-2.47)*	**-0.0017****** *(-2.31)*	**-0.0018****** *(-2.10)*	-0.0011* *(-1.67)*	**0.0010***** *(10.36)*
Small Cap Value						
Three-factor Alpha	**0.0008***** *(3.56)*	**0.0011***** *(4.35)*	**0.0009***** *(3.88)*	**0.0014***** *(6.76)*	**0.0012***** *(3.27)*	0.0004 *(1.45)*
Four-factor Alpha	**0.0009***** *(4.11)*	**0.0010***** *(4.95)*	**0.0009***** *(4.47)*	**0.0014***** *(7.39)*	**0.0012***** *(3.38)*	0.0003 *(1.15)*
Mid Cap Growth						
Three-factor Alpha	-0.0008* *(-1.88)*	**-0.0013****** *(-2.07)*	**-0.0013****** *(-2.22)*	-0.0008 *(-1.46)*	-0.0003 *(-0.51)*	**0.0005***** *(2.62)*
Four-factor Alpha	**-0.0010****** *(-2.17)*	**-0.0015****** *(-2.18)*	**-0.0014****** *(-2.34)*	-0.0010* *(-1.67)*	-0.0004 *(-0.63)*	**0.0006***** *(3.54)*
Mid Cap Value						
Three-factor Alpha	**0.0021***** *(3.28)*	**0.0018***** *(3.10)*	**0.0020***** *(3.83)*	**0.0019***** *(2.95)*	**0.0020***** *(3.95)*	-0.0001 *(-0.27)*
Four-factor Alpha	**0.0021***** *(3.56)*	**0.0018***** *(3.37)*	**0.0020***** *(4.22)*	**0.0020***** *(3.09)*	**0.0020***** *(4.30)*	-0.0001 *(-0.32)*
Large Cap Growth						
Three-factor Alpha	**-0.0006****** *(-2.08)*	**-0.0005****** *(-2.00)*	**-0.0007****** *(-2.41)*	-0.0006* *(-1.93)*	-0.0004 *(-1.28)*	0.0002* *(1.87)*
Four-factor Alpha	**-0.0007****** *(-2.30)*	**-0.0006****** *(-2.37)*	**-0.0008***** *(-2.72)*	**-0.0008****** *(-2.26)*	-0.0005 *(-1.57)*	0.0003* *(1.89)*
Large Cap Value						
Three-factor Alpha	0.0003 *(0.76)*	-0.0001 *(-0.22)*	-0.0001 *(-0.31)*	0.0001 *(0.45)*	0.0004* *(1.74)*	0.0001 *(1.16)*
Four-factor Alpha	0.0002 *(0.72)*	-0.0001 *(-0.13)*	-0.0001 *(-0.21)*	0.0001 *(0.38)*	0.0004* *(1.65)*	0.0001 *(1.07)*

A possible explanation for increasing returns to scale is that funds with low AUM can be both skillful and unskillful, because these funds are often new and the market is yet to find out whether the fund managers are skilled or not. Once the level of AUM increases only the skilled funds remain and consequently funds in Portfolio 5 should have the highest abnormal returns. Especially for Growth funds a higher level of AUM increases the gross alpha, because these funds have the highest turnover ratios (table 3) and they rely on short-term arbitrage opportunities. Growth funds need to change the holdings frequently and need to have the appropriate resources (high level of AUM) to fully benefit from these opportunities. Equally weighted portfolios deliver similar gross alphas (table 13, appendix).

To summarize, Value equity mutual- and exchange-traded funds face constant returns to scale and Growth equity mutual- and exchange-traded funds even face increasing returns to scale. Increasing returns to scale in the equity mutual- and exchange-traded fund industry could be related to the fact that only skillful funds are able to survive and need to earn high abnormal returns to achieve this. I reject the null hypothesis of 10. This is inconsistent with Berk and Green (2004) and Berk and van Binsbergen (2015) who believe funds have decreasing returns to scale. I do think that there is a point at which a fund becomes too big and is not able to outperform its benchmark anymore, but it is difficult to uncover this exact general fund size (AUM) because a lot of funds do not produce a positive gross alpha in the first place. Future research could elaborate on a common level of AUM at which fund managers are unable to positively influence the gross alpha.

6.4 Six-factor asset pricing model

The six-factor model is the standard four-factor model with the Betting against Beta (BAB) factor and Quality minus Junk (QMJ) factor added to disentangle whether the outperformance of the Small Cap Value- and Mid Cap Value mutual fund portfolios can be explained by these new investment styles. Is the outperformance unidentifiable and a true set of skills of the mutual fund managers?

Table 14 displays the six-factor gross alpha coefficients and the factor loadings of the value-weighted portfolios that were able to significantly outperform the market portfolio. The Small Cap Value mutual fund portfolio six-factor gross alpha decreases to -0.01% per month instead of the significantly positive 0.10% per month in the three- and four-factor model. However, the three-factor gross alpha of the Small Cap Value ETF portfolio also decreases to a significantly negative -0.20% per month (t-statistic -2.16) and as a consequence the Small

Cap Value mutual fund portfolio still significantly outperforms the equivalent ETF portfolio by 0.19% per month (t-statistic 1.97). The six-factor gross alphas of the Mid Cap Value portfolios show the same pattern. Even though the six-factor gross alpha of the Mid Cap Value mutual fund portfolio decreases to 0.13% per month (t-statistic 4.53), the six-factor gross alpha of the Mid Cap Value ETF portfolio also decreases to 0.08% per month (t-statistic 3.55). Equally weighted portfolios deliver similar results (table 15, appendix). Hence, the outperformance of Small Cap Value- and Mid Cap Value mutual fund managers over comparable ETF managers cannot completely be explained by the risk factors Betting against Beta (BAB) or Quality minus Junk (QMJ).

*Table 14: Monthly Six-Factor regression coefficients of the value-weighted Small Cap Value and Mid Cap Value mutual- and ETF portfolios. T-statistics are in parentheses. Significance: * 10%, ** 5%, *** 1%.*

Model	**Six-factor**							
Independent variable	Alpha	Market	SMB	HML	UMD	BAB	QMJ	Adj. R^2
Portfolio	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	
Small Cap Value Mutual fund	-0.0001	0.9786***	0.7414***	0.3096***	-0.0318***	0.0653***	0.0990***	0.99
	(-0.94)	*(129.40)*	*(74.22)*	*(17.71)*	*(-5.12)*	*(4.33)*	*(6.59)*	
Small Cap Value ETF	**-0.0020****	1.0702***	0.8257***	0.4781***	-0.1300***	0.0609***	0.1986***	0.97
	(-2.16)	*(54.87)*	*(25.22)*	*(11.08)*	*(-4.01)*	*(3.82)*	*(3.09)*	
Difference Mutual minus ETF	**0.0019****	-0.0916***	-0.0843***	-0.1685***	0.0982***	0.0044	-0.0996*	0.40
	(1.97)	*(-4.05)*	*(-3.41)*	*(-3.41)*	*(3.38)*	*(0.28)*	*(-1.87)*	
Mid Cap Value Mutual fund	**0.0013*****	0.9324***	0.3364***	0.1659***	-0.0389***	0.1306***	-0.0481*	0.96
	(4.53)	*(77.62)*	*(12.68)*	*(3.23)*	*(-6.08)*	*(11.07)*	*(-1.65)*	
Mid Cap Value ETF	**0.0008*****	0.9976***	0.3355***	0.2680***	-0.0556***	0.0986***	-0.0104	0.95
	(3.55)	*(43.69)*	*(9.00)*	*(8.83)*	*(-4.25)*	*(6.87)*	*(-0.18)*	
Difference Mutual minus ETF	0.0005	-0.0651***	0.0009	-0.1022**	0.0167	0.0320**	-0.0376	0.19
	(1.23)	*(-4.49)*	*(0.07)*	*(-2.41)*	*(1.53)*	*(2.14)*	*(-1.12)*	

7. Conclusion

The skill of expensive mutual fund managers to consistently outperform passive benchmarks is questioned by many well-known academics. More recent contributions all share the notion that gross returns have to be used instead of net returns to distinguish between luck and skill. With the introduction of exchange-traded funds (ETFs), investors benefit from diversification at lower total costs than mutual funds. This paper compares U.S. equity mutual funds with U.S. equity exchange-traded funds using the same investment style to find out if the higher fees of mutual funds lead to higher average expected returns.

My analysis provides miscellaneous results. I find empirically that active Value equity mutual funds are able to outperform similar equity ETFs, while active Growth equity mutual funds underperform comparable equity ETFs, especially for Small- and Mid Cap funds. There is not enough mutual fund outperformance to conclude that all equity mutual fund managers have the skill to beat low-cost equity ETF managers. Common risk factors cannot completely explain the outperformance of Small- and Mid Cap Value mutual funds over exchange-traded funds. Hence, Small- and Mid Cap Value mutual fund managers have a special set of skills that is yet to be revealed. Future research can investigate whether these investment styles benefit from other prominent risk factors, such as low-volatility and liquidity. My results imply that equity exchange-traded funds are a proper investment alternative for equity mutual funds.

In addition, I show that the equity mutual- and exchange-traded fund industry does not exhibit decreasing returns to scale. In my sample, Growth equity mutual- and exchange-traded funds have increasing returns to scale, while Value equity mutual- and exchange-traded funds have constant returns to scale. Investment opportunities that positively influence the gross alpha are still available for funds with a high level of assets under management (AUM). Increasing returns to scale in the equity mutual- and exchange-traded fund industry could be due to the fact that only skillful funds are able to survive and have to earn high abnormal returns to achieve this. Extending the analysis by looking at the influence of size in the cross-section might lead to different conclusions, because I do believe that funds can become too big but a general fund size at which this happens is difficult to identify. Until further notice, investors do not have to worry about decreasing returns to scale when they select an equity mutual- or exchange-traded fund.

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9. Appendix

Table 4: Descriptive statistics mutual fund portfolios (192 observations)

Portfolio (mutual)	Mean	Min	Max	St. deviation
EW-Small Growth	0.0058	-0.21	0.15	0.057
VW-Small Growth	0.0060	-0.21	0.15	0.056
EW-Small Value	0.0090	-0.20	0.18	0.052
VW-Small Value	0.0091	-0.20	0.18	0.052
EW-Mid Growth	0.0049	-0.21	0.13	0.053
VW-Mid Growth	0.0051	-0.20	0.14	0.053
EW-Mid Value	0.0083	-0.21	0.15	0.047
VW-Mid Value	0.0083	-0.21	0.15	0.047
EW-Large Growth	0.0035	-0.17	0.12	0.046
VW-Large Growth	0.0035	-0.17	0.12	0.046
EW-Large Value	0.0048	-0.17	0.12	0.043
VW-Large Value	0.0050	-0.17	0.11	0.042

Table 5: Descriptive statistics exchange-traded fund portfolios (192 observations)

Portfolio (ETFs)	Mean	Min	Max	St. deviation
EW-Small Growth	0.0065	-0.21	0.17	0.057
VW-Small Growth	0.0068	-0.21	0.15	0.056
EW-Small Value	0.0085	-0.24	0.27	0.059
VW-Small Value	0.0086	-0.22	0.30	0.060
EW-Mid Growth	0.0056	-0.23	0.13	0.053
VW-Mid Growth	0.0058	-0.23	0.13	0.052
EW-Mid Value	0.0081	-0.25	0.21	0.054
VW-Mid Value	0.0081	-0.23	0.18	0.050
EW-Large Growth	0.0032	-0.19	0.13	0.049
VW-Large Growth	0.0035	-0.22	0.13	0.050
EW-Large Value	0.0050	-0.17	0.11	0.043
VW-Large Value	0.0046	-0.16	0.11	0.043

Table 6: Descriptive statistics risk factors (192 observations)

Factor	Mean	Min	Max	St. deviation
Risk-free rate	0.0011	0	0.0054	0.0014
Market-risk	0.0047	-0.17	0.11	0.04
SMB	0.0040	-0.06	0.07	0.03
HML	0.0025	-0.11	0.13	0.03
MOM	0.0007	-0.35	0.12	0.05
BAB	0.0079	-0.15	0.13	0.04
QMJ	0.0037	-0.10	0.09	0.03

*Table 10: Factor coefficients of equally weighted equity mutual fund portfolios. The second column and third column display the monthly Three- and Four-factor coefficients respectively. T-statistics are in parentheses. Significance: * 10%, ** 5%, *** 1%.*

Model	**3-factor**					**4-factor**					
Independent variable	Alpha	Market	SMB	HML	Adj. R^2	Alpha	Market	SMB	HML	UMD	Adj. R^2
Portfolio	**(1)**	**(2)**	**(3)**	**(4)**		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	
Small Cap Growth	**-0.0016****	1.0724***	0.7668***	-0.2888***	0.97	**-0.0019****	1.1135***	0.7672***	-0.2877***	0.0715***	0.97
	(-2.29)	*(59.88)*	*(25.38)*	*(-13.55)*		*(-2.48)*	*(27.85)*	*(31.67)*	*(-27.53)*	*(2.88)*	
Small Cap Value	**0.0010*****	0.9227***	0.7063***	0.3162***	0.98	**0.0010*****	0.9273***	0.7063***	0.3163***	0.0079	0.98
	(4.69)	*(41.16)*	*(73.36)*	*(8.70)*		*(5.26)*	*(68.89)*	*(71.11)*	*(9.23)*	*(0.51)*	
Mid Cap Growth	-0.0010*	1.0811***	0.4041***	-0.3352***	0.95	-0.0011*	1.1096***	0.4044***	-0.3344***	0.0496*	0.95
	(-1.77)	*(59.71)*	*(19.34)*	*(-20.85)*		*(-1.94)*	*(30.42)*	*(22.45)*	*(-15.11)*	*(1.75)*	
Mid Cap Value	**0.0019*****	0.9549***	0.3374***	0.2155***	0.96	**0.0019*****	0.9571***	0.3374***	0.2155***	0.0039	0.96
	(3.30)	*(34.56)*	*(16.84)*	*(3.09)*		*(3.53)*	*(52.21)*	*(16.61)*	*(3.14)*	*(0.22)*	
Large Cap Growth	**-0.0006****	1.0447***	-0.0306	-0.3005***	0.97	**-0.0007****	1.0683***	-0.0303*	-0.2999***	0.0411***	0.97
	(-2.05)	*(125.66)*	*(-1.52)*	*(-13.02)*		*(-2.38)*	*(128.75)*	*(-1.78)*	*(-26.97)*	*(3.22)*	
Large Cap Value	0.0001	0.9599***	-0.0859***	0.2336***	0.98	0.0001	0.9598***	-0.0859***	0.2336***	-0.0002	0.98
	(0.21)	*(58.30)*	*(-5.17)*	*(7.45)*		*(0.21)*	*(60.38)*	*(-5.17)*	*(7.43)*	*(-0.04)*	

*Table 11: Factor coefficients of equally weighted equity exchange-traded fund portfolios. The second column and third column display the monthly Three- and Four-factor coefficients respectively. T-statistics are in parentheses. Significance: * 10%, ** 5%, *** 1%.*

Model	**3-factor**					**4-factor**					
Independent variable	Alpha	Market	SMB	HML	Adj. R^2	Alpha	Market	SMB	HML	UMD	Adj. R^2
Portfolio	**(1)**	**(2)**	**(3)**	**(4)**		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	
Small Cap Growth	-0.0012*	1.0795***	0.7868***	-0.2186***	0.98	-0.0013	1.0828***	0.7868***	-0.2185***	0.0057	0.98
	(-1.67)	*(36.38)*	*(29.13)*	*(-15.31)*		*(-1.63)*	*(30.00)*	*(29.68)*	*(-13.86)*	*(0.37)*	
Small Cap Value	-0.0006	1.0341***	0.7289***	0.5298***	0.96	-0.0004	1.0005***	0.7286***	0.5288***	-0.0587	0.96
	(-1.55)	*(31.80)*	*(48.84)*	*(14.23)*		*(-0.85)*	*(48.29)*	*(48.13)*	*(10.53)*	*(-1.55)*	
Mid Cap Growth	-0.0004	1.0924***	0.3610***	-0.2089***	0.93	-0.0007	1.1332***	0.3614***	-0.2077***	0.0712*	0.93
	(-0.87)	*(50.39)*	*(11.67)*	*(-4.06)*		*(-1.33)*	*(37.76)*	*(14.09)*	*(-6.63)*	*(2.38)*	
Mid Cap Value	0.0009*	1.0704***	0.3282***	0.3503***	0.94	**0.0010****	1.0546***	0.3280***	0.3499***	-0.0275	0.95
	(1.92)	*(27.23)*	*(10.36)*	*(8.76)*		*(2.39)*	*(35.01)*	*(10.85)*	*(7.39)*	*(-1.24)*	
Large Cap Growth	**-0.0007*****	1.0908***	-0.0750***	-0.3865***	0.97	**-0.0006*****	1.0742***	-0.0752***	-0.3870***	-0.0288*	0.97
	(-4.30)	*(42.87)*	*(-5.14)*	*(-5.73)*		*(-2.98)*	*(61.43)*	*(-5.21)*	*(-6.61)*	*(-1.74)*	
Large Cap Value	0.0003	0.9610***	-0.1532***	0.2921***	0.97	0.0004*	0.9511***	-0.1533***	0.2918***	-0.0173**	0.97
	(1.48)	*(96.04)*	*(-8.92)*	*(11.99)*		*(1.82)*	*(105.85)*	*(-9.28)*	*(9.84)*	*(-2.31)*	

*Table 13: Monthly risk-adjusted returns of equally weighted quintile portfolios for different investment styles (mutual- and exchange-traded funds combined). The funds are ranked every month on the basis of the AUM and assigned to one of the quintile portfolios. P5-P1 is the self-financing portfolio that goes long in the top 20 percent funds with the highest level of AUM and short in the bottom 20 percent funds with the lowest level of AUM. T-statistics are in parentheses. Significance: * 10%, ** 5%, *** 1%.*

Portfolio **Investment Style**	**P1** (Low AUM)	**P2**	**P3**	**P4**	**P5** (High AUM)	**P5-P1**
Small Cap Growth						
Three-factor Alpha	**-0.0018*****	**-0.0018****	**-0.0014****	**-0.0016****	**-0.0014****	**0.0005*****
	(-2.98)	*(-2.29)*	*(-2.09)*	*(-1.98)*	*(-2.10)*	*(6.06)*
Four-factor Alpha	**-0.0020*****	**-0.0021****	**-0.0017****	**-0.0019****	**-0.0016****	**0.0004*****
	(-3.10)	*(-2.46)*	*(-2.39)*	*(-2.15)*	*(-2.26)*	*(4.40)*
Small Cap Value						
Three-factor Alpha	**0.0007*****	**0.0011*****	**0.0008*****	**0.0013*****	**0.0010*****	0.0004
	(3.05)	*(4.23)*	*(3.63)*	*(6.20)*	*(4.10)*	*(1.54)*
Four-factor Alpha	**0.0006*****	**0.0011*****	**0.0008*****	**0.0013*****	**0.0010*****	0.0004*
	(3.06)	*(4.83)*	*(4.10)*	*(6.92)*	*(4.54)*	*(1.65)*
Mid Cap Growth						
Three-factor Alpha	-0.0008*	**-0.0012****	**-0.0012****	-0.0008	-0.0008	-0.0001
	(-1.74)	*(-2.05)*	*(-2.20)*	*(-1.41)*	*(-1.45)*	*(-0.38)*
Four-factor Alpha	**-0.0010****	**-0.0014****	**-0.0014****	-0.0010	-0.0010	-0.0001
	(-2.02)	*(-2.15)*	*(-2.29)*	*(-1.62)*	*(-1.59)*	*(-0.15)*
Mid Cap Value						
Three-factor Alpha	**0.0018*****	**0.0019*****	**0.0020*****	**0.0019*****	**0.0017*****	-0.0001
	(3.46)	*(3.31)*	*(3.63)*	*(3.03)*	*(3.20)*	*(-0.47)*
Four-factor Alpha	**0.0018*****	**0.0019*****	**0.0020*****	**0.0019*****	**0.0018*****	-0.0001
	(3.61)	*(3.61)*	*(3.92)*	*(3.17)*	*(3.46)*	*(-0.29)*
Large Cap Growth						
Three-factor Alpha	**-0.0006****	**-0.0005****	**-0.0006****	**-0.0006****	**-0.0006****	0.0000
	(-1.97)	*(-2.01)*	*(-2.20)*	*(-1.96)*	*(-1.99)*	*(-0.04)*
Four-factor Alpha	**-0.0007****	**-0.0006****	**-0.0008****	**-0.0008****	**-0.0007****	0.0000
	(-2.27)	*(-2.39)*	*(-2.50)*	*(-2.30)*	*(-2.33)*	*(-0.05)*
Large Cap Value						
Three-factor Alpha	0.0002	-0.0001	-0.0001	0.0001	0.0002	0.0001
	(0.52)	*(-0.07)*	*(-0.22)*	*(0.43)*	*(0.72)*	*(0.07)*
Four-factor Alpha	0.0001	0.0001	-0.0001	0.0001	0.0002	0.0001
	(0.41)	*(0.02)*	*(-0.11)*	*(0.38)*	*(0.67)*	*(0.30)*

*Table 15: Monthly Six-Factor regression coefficients of the equally weighted Small Cap Value and Mid Cap Value mutual- and ETF portfolios. T-statistics are in parentheses. Significance: * 10%, ** 5%, *** 1%.*

Model	**Six-factor**							
Independent variable	Alpha	Market	SMB	HML	UMD	BAB	QMJ	Adj. R^2
Portfolio	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	
Small Cap Value Mutual fund	-0.0002	0.9648***	0.7348***	0.2985***	-0.0374***	0.0766***	0.0940***	0.99
	(-1.19)	*(180.56)*	*(72.09)*	*(16.86)*	*(-6.44)*	*(5.41)*	*(6.45)*	
Small Cap Value ETF	**-0.0022*** **	1.0705***	0.7770***	0.5114***	-0.1216***	0.0836***	0.1817***	0.97
	(-2.84)	*(60.01)*	*(35.41)*	*(11.10)*	*(-4.38)*	*(5.24)*	*(3.13)*	
Difference Mutual minus ETF	**0.0020*** **	-0.1056***	-0.0422***	-0.2129***	0.0842***	-0.0070	-0.0878*	0.46
	(2.89)	*(-6.84)*	*(-2.71)*	*(-4.20)*	*(3.51)*	*(-0.58)*	*(-1.88)*	
Mid Cap Value Mutual fund	**0.0012*** **	0.9477***	0.3414***	0.1825***	-0.0360***	0.1221***	-0.0397	0.97
	(4.82)	*(84.70)*	*(15.75)*	*(3.64)*	*(-4.48)*	*(10.92)*	*(-1.19)*	
Mid Cap Value ETF	0.0001	1.0626***	0.3417***	0.3203***	-0.0724***	0.1135***	0.0090	0.95
	(0.40)	*(32.48)*	*(8.77)*	*(8.94)*	*(-4.48)*	*(7.74)*	*(0.14)*	
Difference Mutual minus ETF	**0.0011** **	-0.1150***	-0.0003	-0.1378**	0.0364***	0.0086	-0.0487	0.32
	(2.30)	*(-5.02)*	*(-0.02)*	*(-2.72)*	*(3.26)*	*(0.56)*	*(-1.39)*	