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Is passive investment management the better alternative? Evidence from the small-cap segment of the US equity fund universe.

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The purpose of this thesis is to ascertain if significant return differences between active- and passive managed investment funds exist. Over a 12 years observation period (2006-2018), alpha coefficients of more than 800 US small cap investment funds were tested. Findings revealed, 0.12% of the mutual funds managed to outperform the S&P SmallCap 600 Index and 76.9% displayed a negative significant risk-adjusted return. Comparing these results with the performance of passive funds confirms a comparative underperformance of mutual funds of 0.31% per month. An additional scenario analysis revealed that the dominance of index- and exchange-traded funds did not exist during the financial crisis 2007 – 2009. The results are showing no significant differences in the movement of returns, which could be explained by a sentiment-driven equity market during financially distressed times. Based on the aggregated results, it leads to the conclusion that passive investment funds are more beneficiary for investors with a long investment horizon but not necessarily superior during financially distressed times.

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1 Introduction

In the last couple of decades, passive investment funds gained more and more momentum in attracting capital from institutional- and private investors. Starting in 1976, Vanguard offered the first index fund based on the S&P 500 with the purpose to participate with only little expenses on the underlying performance. In 1993, exchange traded funds were introduced by State Street Global Advisors and gained because of low costs, tradability and a low tracking error more popularity.[1] As to the end of 2017, passive investment funds made up for more than 37% of the assets under management (AUM) in the US, up from three percent in 1995 (Anadu, Kruttli, McCabe, Osambela, & Shin, 2018). Seeing it from a global prospective, some experts forecast a worldwide market share of passive investment funds of 31% in 2020 (EY, 2017). Nevertheless, the majority of capital is still invested in actively managed funds and the crucial question is; can active management deliver higher risk-adjusted returns than passive investment funds? Based on the efficient market hypothesis (EMH), developed by Eugene Fama in 1960s, the current market price reflects all available information. According to the EMH, it would be impossible to find under- and overvalued stocks. Deriving this idea, the investor would be better off buying a low-cost passive investing portfolio.

The focus of this thesis relies on the small-cap US equity market and use the S&P SmallCap 600 as a benchmark. To assess risk-adjusted return differences, the price history of over 800 mutual-, index and exchange traded funds were collected and covers the years 2006 – 2018. The funds´ net asset values were converted into returns and regressed under the usage of the CAPM and the Fama French Three-Factor Model. Both regression models indicating a weaker performance of active mutual funds during the observation period. Additionally, a scenario analysis was introduced to measure performance differences during the financial crisis in 2007 – 2009 and revealed major discrepancies between the regression methods. Overall, findings suggest an outperformance of passive investment funds in the long run but not necessarily during financial distressed times. Within the literature, the topic is controversial discussed and opens a door for this thesis to contribute to the academic discussion as well as supporting investors in the product selection.

[1] The difference between index- and exchange traded funds result mainly in the high tradability and low tracking error of etfs. Index funds are basically mutual funds with the purpose to replicate a certain benchmark.

2 Literature Overview

As mentioned, the efficient market hypothesis is based on the assumption that all available information is included in the current market price. That implies that technical- and fundamental analyses are not rewarding in terms of superior returns generation. Among the existing literature, many authors claim that actively managed investment funds do not deliver significantly higher risk-adjusted returns after fees than the overall market. Busse, Goyal, & Wahal (2010) tracked 4,617 active institutional products from 1991-2008 and controlled for the Capital Asset Pricing Model (CAPM), the Fama French (1993) Three-Factor Model and the momentum strategy. They found no evidence of persistent superior performance on a gross return basis and noticed that the estimates strongly depend on the model choice. A recent paper of Elton, Gruber, & Souza (2019) tracked the performance of actively- /passively managed funds from 1994 – 2016 on a monthly return basis, with focus on US & emerging markets. They distinguished between US large-, middle- and small stocks as well as emerging market equity and foreign stocks. After analyzing, they concluded that the majority of passive products aim to track US stock indexes and that these investment vehicles outperform active funds by 0.75% per year. Another paper of Elton, Gruber, & de Souza 2019 aims to reproduce the risk profile of active funds in a certain period with a basket of exchange-traded funds. They tested if these baskets can outperform the actively managed funds in the following period. The researcher figured out that a combination of five ETFs fits best to replicate the most volatility of all available exchange-traded funds. Noticeable, the basket of exchange-traded funds outperformed active mutual funds within 78% of the time without allowing short selling and taking fees plus transaction costs into account, the percentage increases to over 90%. Noteworthy, the risk-adjusted outperformance of passive funds fluctuates between 1.37% respectively 1.44% per annum, even with a lower standard deviation than active funds. The paper of Cuthbertson, Nitzsche, & Niall (2010) paints an even more discouraging picture. They are claiming that only around 0 - 5% of the top performing UK and US equity mutual funds deliver a positive alpha after fees, 75% performing in line with the market and around 20% show poor alpha. Evidence shows that past loser funds remain as losers and past winners stay winners, whereby the economic gain for investors are only marginal taking transaction cost into account. Pace, Hili, & Grima (2016) focused on US-, European mutual funds and exchange-traded funds over a 10-year time horizon from 2004 to 2014. Their findings differ slightly from Busse et al. (2010) and show a

more balanced picture between active- and passive investment strategies. They found that both investment approaches deliver the same risk-adjusted return and suggest focusing more on expense ratios and transaction cost rather on past returns.

On the other hand, having a look at emerging markets Dyck, Lins, & Pomorski (2011) found different results. From 1993 to 2008 actively managed funds outperformed their peer by more than 1.80% per year and 0.50% per year in EAFE markets. The authors suggested that performance depend mainly on the efficiency level of the market. Also, Cremers, Ferreira, Matos, & Starks (2016) assuming that competition, especially from index funds, urges mutual funds to charge lower fees and to differentiate their product strategy. Findings are confirming the tendency of mutual funds to charge higher fees and to have a closer index exposure, within a low competition environment. That implicates that the growth of passive investment products would further enhance the competition among the asset management industry. Focusing more on a single country, Barnes & Scott (2013) examined trade patterns between active and passive investment management on the UK equity market. They covered the time period from 1991 – 2005 and explored sized based effects, which implies that companies with a lower market capitalization are more targeted by stock picking investors than larger capitalized stocks. Barnes and Scott outlined their thoughts regarding the upward trend in stock picking and explained the phenomena by increased usage of passively managed investment products. This trend could give evidence that small capitalized stocks are less covered by financial investors and create more opportunities to find undervalued companies. Furthermore, Eun, Huang, & Lai (2009) proved that small- and middle-cap US funds are low correlated among each other and particularly low correlated to large-cap funds. Whereby, US large-cap funds showing a high correlation to other large-cap funds, which can be explained by shared common risk factors. Knowing this phenomenon should encourage investors to spread risks and to diversify their exposure in favour of small-cap funds. This process would increase market efficiency and could abandon stock picking activities. On the other hand, Crane & Crotty (2014) find a strong negative relation between returns and the size of mutual funds. In particular, a high negative correlation exists among funds with high volatility, high turnover and funds specialized on small caps. That implies when a mutual fund grows in size, the ability to deliver outperformance declines. This tendency would hamper investors to invest in big mutual funds with a focus on small cap stocks. Nevertheless, a performance analysis regarding the active-/passive small-cap fund

segment of the US equity universe is not extensively conducted within the academic literature. The goal of this thesis is to cover this gap and to contribute to the academic discussion.

Another important aspect is to evaluate the performance of active management during different states. Glode (2011) covered 3,147 actively managed US equity funds over the period from 1980–2005. His goal was to find the optimal policy for an active manager to generate returns depending on the state economy. He found persistent fund performance but argues that only skillful manager offers some protection against bad states. Badrinath & Gubellini (2012) dived more into detail and divided the funds into sub-groups and tested for conditional outperformance during different business cycles. Their findings indicate that active growth fund managers deliver superior returns in reducing their risk in economically difficult situations compared to passive portfolios. Value managers are not able to deliver outperformance in recessions due to the conditional riskiness of their value portfolio. Moving on to small and mid-caps, Haque & Glabadanidis (2012) focused on the Australian equity market from 1996 – 2010 and showed that Australian small and mid-caps funds often outperformed the market, based on a risk-adjusted basis, due to strong performance during down-markets. Taking passive investment funds into account Wong & Shum (2010) conducted a study of 15 globally investing exchange-traded funds, covering the period 1999 to 2007 and tested through several scenario analysis for performance differences. They show that bullish markets lead to significantly higher returns within equity ETFs comparing to their underlying. Contrary, bearish markets seem to influence exchange-traded funds negatively in terms of benchmark tracking. The results from the former researcher painting a picture of deficient performance from active and passive managed funds during stressed economical situations. Nevertheless, Badrinath & Gubellini (2012) and Haque & Glabadanidis (2012) revealed differences in performance according to the funds´ characteristics, which gives room for further research in this thesis.

3 Research Question

Based on the findings, the majority of active mutual funds cannot deliver higher risk-adjusted returns than the benchmark. The gap in the literature, mainly related to small cap companies, leaves room for further analysis. This thesis takes up the thought and examines the question whether or

not passive investment funds are a better alternative to actively managed mutual funds. The following questions are going to be discussed:

Question I:
Do passive investment funds deliver a significant higher risk–adjusted return than active managed mutual funds within the small-cap US equity segment?

H_0: Passive investment funds do not deliver higher risk-adjusted returns than active managed mutual funds within the small-cap US equity segment

H_a: Passive investment funds deliver higher risk-adjusted returns than active managed mutual funds within the small-cap US equity segment

Question II:
Do passive investment funds perform significantly better than mutual funds in a bear market?

H_0: Passive investment funds do not perform significantly better than mutual funds in a bear market

H_a: Passive investment funds perform significantly better than mutual funds in a bear market

4 Data and Methodology

4.1 Data Collection & Models

Following the methodology of Barnes & Scott (2013), Dyck et al. (2011) and Pace et al. (2016), the monthly net asset values of the US mutual funds, index funds and exchange-traded funds were gathered by the Thomson Reuters Eikon Terminal. The raw dataset embraces 2019 investment funds and covers a period from December 2005 to December 2018. The dataset accounts also for funds which did not survive the entire time horizon to eliminate any appearance of survivorship bias. To ensure the validity of the data, several filters were used during the

screening process. All investment vehicles were filtered by funds which are registered for sale in the United States, with focus on small & mid cap US equity[2], funds currency in US Dollar and certain funds attributes which include active, liquidated, merged and primary funds. Additional, active managed index- and exchange traded funds need to follow an index tracking strategy to exclude "exotic" investment products from the sample. After collecting the dataset from Eikon, another screening process was needed to delete all funds with focus on middle- sized companies or other non-small cap indices.[3] In the end, the dataset contains 708 actively managed- and 99 passively managed funds which can be further differentiated into 36 index funds, 63 exchange-traded funds. In order to transform the data into a stationary time series, the LN (NAV_t / NAV_{t-1}) method were applied on the monthly NAV of the funds and the index value. Based on this transformation one observation dropped form the sample who ranges after the treatment from January 2006 to December 2018, including 156 observations.

Based on the concept of Wong & Shum (2010) a scenario analysis is introduced to find differences in the risk-adjusted returns among active- and passive investment strategies. Deriving from these findings, the dataset will be additional divided in a bearish period. Conducting a scenario analysis within such a framework is not widely covered by the academic literature yet. The next obstacle to overcome is to define a bear market cycle. Recent findings of Shi, Powell, Hoang, & Gonzalez (2015), Maheu, Mccurdy, & Song (2009) and Pagan & Sossounov (2000) propose several technical methods to detect such a market cycle. Besides these approaches it is assumed that the turmoil on the US equity market started in February 2007 and remained until July 2009. These assumptions are based on measurements of Schwert (2011) regarding the volatility on the US stock markets.

Furthermore, the funds' performance will be analyzed by two different asset pricing models. First, the Capital Asset Pricing Model (CAPM) and second the Fama French Three-Factor Model. As a starting point, the CAPM explains the relationship between systematic risk and return, which enables investors to calculate the expected return of an asset.

[2] No filter was available to exclude middle caps right away.

[3] This process was needed to ensure the quality of the dataset. Eikon categorized some funds into the wrong category, therefore a manual monitoring of the funds was necessary.

CAPITAL ASSET PRICING MODEL:

$$E(R_p) = R_f + \beta\,[\,E(R_m) - R_f\,]$$

Utilizing the methodology of the CAPM, the Jensen´s Alpha (Jensen, 1967) single regression model is used as a first attempt to measure risk-adjusted fund returns. The model compares the excess returns of the market portfolio and the excess returns of the funds to use the ordinary last square regression to calculate alpha and beta coefficients.

JENSEN'S ALPHA:

$$E(R_p) - R_f = \alpha_p + \beta_p\,[\,E(R_M) - R_f\,] + \varepsilon_p$$

A positive significant alpha coefficient expresses the ability of the fund manager to outperform the market portfolio. Conversely, a negative alpha implicates the disability to exceed the minimum expected return. To run the OLS regression properly, the risk free-rate (R_f) and the market return (R_m) needs to be obtained. Within the literature, several researchers indicating the use of government bonds as a proxy for the risk-free rate (Blake, Fallon, & Zolotic, 2012; Ghavami & Dilmaghani, 2017). According to the research question, the 1-month US Treasury Bill yield rate is used as a proxy for the risk-free rate (FRED, 2019). The market portfolio return is usually derived from a broad equity index like the S&P 500 or the Russell 3000. These indices do not explicitly cover small-sized companies which could lead to biased regression results. Taking the limitations into consideration, the S&P SmallCap 600 is used as a benchmark portfolio to cover the performance of the small-cap segment of the US equity market.[4] The S&P SmallCap 600 embraces stocks with an unadjusted market cap of USD 600 million to USD 2.4 billion and is designed to track companies which are liquid and financially viable (S&P Dow Jones Indices, 2019).
Nevertheless, the conclusion derived from the CAPM and Jensen´s alpha can be biased in particular when certain stocks are over represented in the funds´ portfolio. These stocks tend to yield a higher return, over the long run, than assumed by the CAPM. This makes it more difficult to address the performance of the fund management correctly. Fama & French (1993) researched this phenomena and evidence was found in favor of small cap and value stocks. In adding more risk factors to the

[4] The Russell 2000 was also considered as a broad small cap benchmark but could not be used because of Thomson Reuters Eikon data constrains.

regression equation could measure the alpha more precise. These circumstances led to the introduction of multi-factor regression models.

FAMA FRENCH THREE-FACTOR MODEL:

$$R_p - R_f = \alpha_p + \beta_{0p} (R_M - R_f) + \beta_{1p} SMB + \beta_{2p} HML + \varepsilon_p$$

In 1993, Fama and French developed the Fama French Three-Factor Model to add to the market risk a value- and a size- risk factor. This extension of the CAPM was made based on the findings that on average small- caps and value stocks outperform the benchmark. In fact, when the performance of an active managed portfolio can be attributed to these factors, active investment management added no additional value. In order to calculate the multiples, companies were ranked by small-, big-, value-, neutral- and growth stocks.

	Median Market Capitalization	
70th Book to Market percentile	*Small Value*	*Big Value*
	Small Neutral	*Big Neutral*
30th Book to Market percentile	*Small Growth*	*Big Growth*

The risk factor small minus big (SMB) illustrate the outperformance of small cap- towards large cap companies. The SMB variable is calculated by grouping all companies with below the median market cap and subtract all companies with an above median market capitalization to obtain the excess return.

SMALL MINUS BIG:

$$SMB = 1/3 (Small\ Value + Small\ Neutral + Small\ Growth) - 1/3 (Big\ Value + Big\ Neutral + Big\ Growth)$$

A significant and high beta would give evidence of a large exposure to small capitalized stocks. The second risk factor HML (high minus low) tries to capture the exposure to value stocks with a high book to market ratio.

HIGH MINUS LOW:

$$HML = 1/2\ (Small\ Value + Big\ Value) - 1/2\ (Small\ Growth + Big\ Growth)$$

The same procedure is applied by grouping the top / bottom 30% of stocks with the highest / lowest book to market multiple and subtract both to obtain the risk premium. Equally, a high significant beta would indicate a high exposure towards value stocks.

The dataset to calculate the SMB and HML multiplies was derived from siblisresearch (siblisresearch, 2019) and contains all actual and former members of the S&P SmallCap 600. Usually, the Kenneth R. French database is used to access the multiplies since it embraces all corporates listed on the NYSE, AMEX, or NASDAQ excluding foreign, ADRs, REIT and Closed End Funds (Kenneth R. French – Data Library, 2019). Because of the narrow research question, multiples were calculated manually according to the methodology explained above by using the index members of the S&P SmallCap 600 for every individual period.

4.2 Ordinary Least Squares Regression Assumptions

To rely on the OLS regression several assumptions need to be tested to ensure BLUE[5] results. Plotting the residuals of the portfolios over time revealed on the first view a stationary dataset, which indicates a stationary mean and variance over time (Figure 1).[6] The high fluctuation of the residuals can be explained by the high volatility of the financial markets in 2008-2009 and specially in late 2018. Testing for stationarity, the Dickey-Fuller test for unit root was conducted and confirms a stationary time dataset (appendix Table 9 - Table 11). Furthermore, the Durbin-Watson test was applied to control for autocorrelation and showed no autocorrelation exists (appendix Table 12 - Table 14). Taking these findings in consideration a BLUE alpha and beta coefficient can be assumed.

[5] Best Linear Unbiased Estimator

[6] Figure 1 displays the plotted residuals of the mutual-, index- and etf portfolios over time. The portfolios were constructed by grouping all funds in their respective fund category and taking the median return of every period.

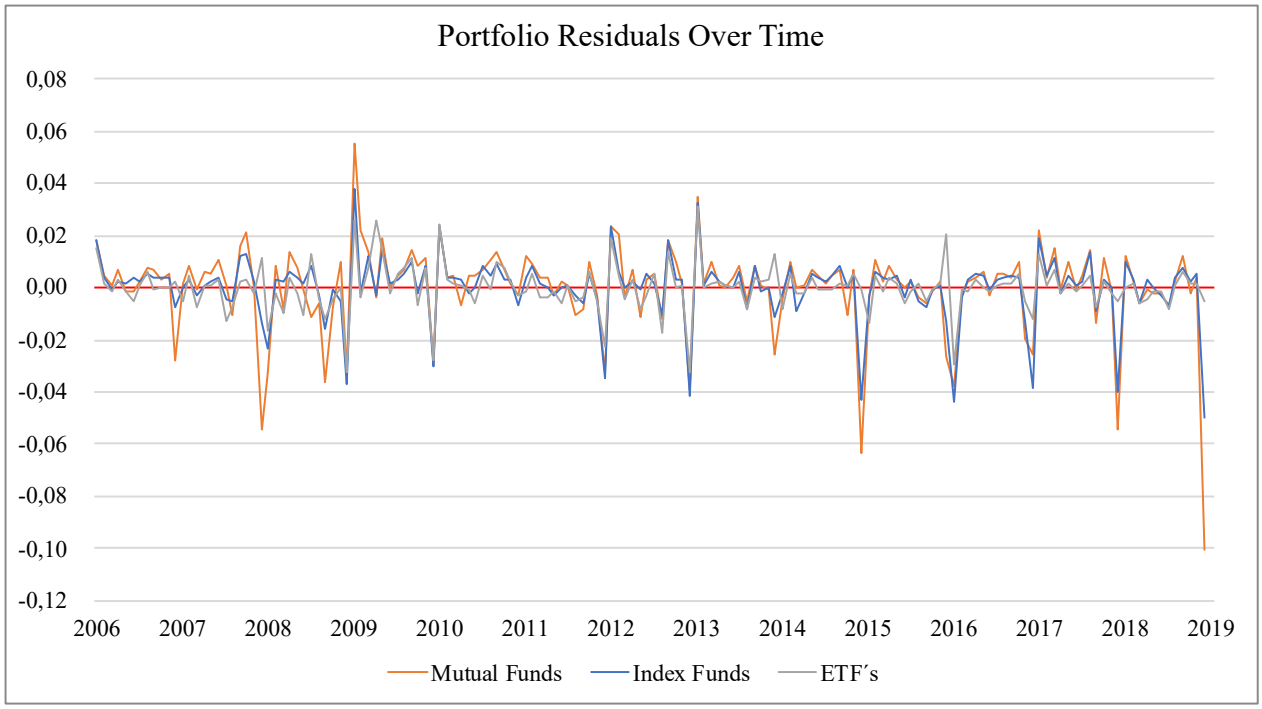

FIGURE 1. PLOTTED PORTFOLIO RESIDUALS OVER TIME

4.3 Descriptive Statistics

A first look on the descriptive return statistics (Table 1) shows that mutual funds underperform on average the market index, index funds and exchange traded funds. One explanation could be higher total expense ratios and different investment strategies among the mutual fund's management.

TABLE 1. DESCRIPTIVE RETURN STATISTICS

	N	Mean	Median	Std. Dev.	Min.	Max.
S&P SmallCap 600	-	0.00753	0.01325	0.06210	-0.21531	0.20525
Risk Free Rate	-	0.00087	0.00011	0.00133	0.00000	0.00424
Mutual Funds	708	0.00046	0.00887	0.06760	-0.96864	0.59667
Index Funds	36	0.00207	0.00893	0.06567	-0.49965	0.39486
Exch. Traded Funds	63	0.00414	0.00960	0.06080	-0.33282	0.42747

Returns per month and expressed as decimal numbers; Example: The mean return of the S&P SmallCap 600 amount to 0.75% per month across the observation period.

Nevertheless, an isolated view on the monthly average return could be biased since some funds highly over- or underperform in certain periods which influences the mean value significantly. Another look on the median value paints are more realistic picture of the performance and shows that mutual- and index funds perform relatively similar whereby mutual funds show the highest standard deviation of the sample. It is also mentionable that whether active nor passive investment strategies offer a higher return than the S&P SmallCap 600. This observation is certainly myopic since we do not take different market risk factors in to account, but it gives a first indication on the overall performance.

TABLE 2. OVERVIEW TOTAL EXPENSE RATIOS

	Mean	Median	Std. Dev.	Min.	Max.
Mutual Funds	1.22	1.21	0.36	0.20	4.04
Index Funds	0.44	0.35	0.33	0.05	1.07
Exch. Traded Funds	0.40	0.35	0.19	0.06	0.80

Total expense ratios (TER) per annum and expressed in %; Example: The average TER of mutual funds amount to 1.22% per annum.

Figure 2 illustrates the performance of the S&P SmallCap 600 and active- as well as passively managed funds over time. A portfolio construction where used to pool the median returns of the mutual-, index- and exchange traded funds of every observation period. Additionally, all portfolios have the same starting point which correspond to 100 index points. In every period the median returns of the portfolios where added to the previous index value. Looking at the graph shows a relatively parallel movement of the portfolios until summer 2011. After this date, the S&P SmallCap 600 and exchange traded funds disengaged from the poorer performance of mutual- and index funds. One part of the return difference could be explained by higher overall costs of mutual funds relatively to passive products.

Table 2 shows big differences in the expense ratios among the three fund types. A high total expense ratio poses a disadvantage to mutual funds since it could offset excess return.

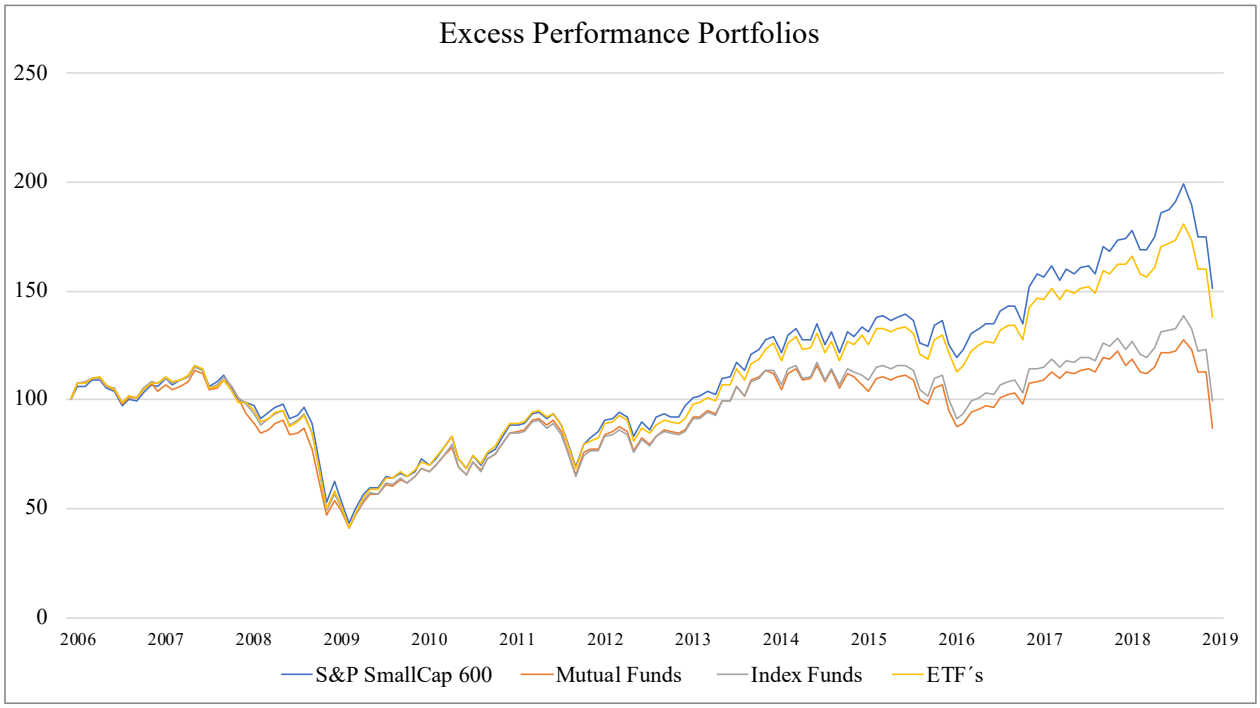

FIGURE 2. OVERVIEW EXCESS PERFORMANCE PORTFOLIOS

5 Analysis

5.1 Portfolio Regression Results

The central role of chapter 5 is to analyze if passive investment strategies deliver superior risk-adjusted returns. In section 5.1, portfolios were used as described in the previous section to obtain alphas on a portfolio basis. These findings give a performance indication and are used as a robustness check for further regression results. In chapter 5.2, alphas of every single fund were obtained and in section 5.3 for significant differences tested. Chapter 5.4 conclude, based on scenario analysis, if the performance distribution found in previous sections persist during the financial crisis 2007 – 2009.

Regarding the portfolio OLS regression, the Capital Asset Pricing Model and the Fama French Three Factor Model were used to determine alpha and beta. The alpha coefficient indicated whether the fund manager added additional gains over the market portfolio under given underlying risks.

The market´s beta coefficient expresses the marginal impact of the market index on the funds´ portfolio return.

CAPITAL ASSET PRICING REGRESSION MODEL:

$$R_{pi,t} - R_{f,t} = \alpha_i + \beta_i (R_{mi,t} - R_{f,t}) + \varepsilon_{i,t}$$

The beta coefficient of SMB and HML represent the exposure to small sized- and value stocks, where a high coefficient indicates large exposure to the mentioned risk factors.

FAMA FRENCH THREE-FACTOR REGRESSION MODEL:

$$R_{pi,t} - R_{f,t} = \alpha_i + \beta_i (R_{mi,t} - R_{f,t}) + \beta_i SMB + \beta_i HML + \varepsilon_{i,t}$$

The descriptive return statistic (Table 1) revealed, on average, no additional benefit of investing in an actively managed mutual fund. Going one step further and taking the market risk factor into account, Table 3 shows a slightly significant negative performance of exchange-traded fund portfolio with an insignificant alpha of -0.05% per month regressed with the CAPM.

TABLE 3. OVERVIEW PORTFOLIO REGRESSION RESULTS

Model	Portfolio	α	Market Index	SMB	HML	Adjusted R^2
CAPM	*Mutual Fund*	-0.0033**	0.9431***	-	-	0.9223
	Index Fund	-0.0025**	0.9920***	-	-	0.9611
	Exch. Traded Funds	-0.0005	0.9839***	-	-	0.9789
Fama French	*Mutual Fund*	-0.0061***	0.9799***	-0.0294	-0.0709	0.9231
	Index Fund	-0.0033**	0.9973***	0.0568	-0.0506	0.9610
	Exch. Traded Funds	0.0004	0.9635***	0.1065**	-0.0203	0.9794

Alpha per month and expressed as decimal number; Confidence level is significant at 10% (*); at 5% (**); at 1% (***); Example: The mutual fund portfolio returns regressed with the Fama French model amount to -0.61% per month comparing to the benchmark, at a significant level of 1%.

This result was expected since exchange-traded funds aim to replicate a particular benchmark and not necessarily to deliver alpha. Interestingly, both passive investment vehicles performed relatively better than the mutual fund portfolio. Mutual funds deliver the highest negative alpha of

-0.33% per month, which suits to the relatively poor performance displayed in Figure 2. Noticeable, the lower adjusted R2 of actively managed funds regressed with the CAPM lead to the assumption that more factors, than just the market risk exposure, explains alpha. Introducing the Fama French Three Factor Model to this regression changes only slightly former results. The gap of negative alphas increased among the portfolios, especially mutual funds performing with an alpha -0.61% per month significantly worse than the benchmark when accounting for small value stocks. Only the exchange-traded fund portfolio shows a significant exposure to small stocks, which is plausible since the SMB multiple embraces the lower 30% capitalized S&P SmallCap 600 companies.

The second research question aims to measure differences in performance during financially distressed times. Table 4 reveals that whether active nor passive managed funds perform differently from the underlying between February 2007 to July 2009, regardless of the applied model. This observation is interesting since active stock picking, and rule-based investing does not lead to superior results. To control for biased results, the observation period was extended from January 2007 to December 2009, but not significantly different results were found (Appendix Table 15).

TABLE 4. PORTFOLIO REGRESSION RESULTS - BEAR MARKET (FEBRUARY 2007 – JULY 2009)

Model	Portfolio	α	Market Index	SMB	HML	Adjusted R^2
CAPM	*Mutual Fund*	-0.0032	0.8962***	-	-	0.9494
	Index Fund	-0.0022	0.9693***	-	-	0.9821
	Exch. Traded Funds	-0.0008	0.9841***	-	-	0.9849
Fama French	*Mutual Fund*	-0.0094	0.9806***	0.1755	-0.2369*	0.9524
	Index Fund	-0.0024	0.9534***	0.2397**	-0.1182	0.9838
	Exch. Traded Funds	0.0017	0.9201***	0.2947***	-0.0758	0.9882

Alpha per month and expressed as decimal number; Confidence level is significant at 10% (*); at 5% (**); at 1% (***); Example: The index fund portfolio return, regressed with the CAPM equals -0.22% per month with no statistical significance.

One explanation could be that during distressed financial times, the correlation of all assets class come closer to 1 (Campbell, Koedijk, & Kofman, 2002). That indicates that regardless of the risk profile or the expected return, all asset classes move in the same direction based on sentiment and not due to underlying facts. The correlation matrix (Appendix Table 16, Table 17) shows evidence

of an increased correlation among the portfolios during the financial crisis. This finding could support to explain the insignificant alpha results.

5.2 Funds Alpha Regression Results & Distribution

The former findings were based on median portfolio returns and did not take the individual return/risk characteristic of each fund into account. Therefore, every funds´ alpha and the p-value was regressed with the CAPM and the Fama French Three Factor Model. A view on the descriptive statistic (Table 5) reveals only little return differences between the CAPM and Fama French models in terms of mean and median values, but a higher overall standard deviation.

TABLE 5. DESCRIPTIVE STATISTIC OF REGRESSED ALPHAS WITH CAPM & FAMA FRENCH THREE FACTOR MODEL

Model	Category	Mean	Median	Std. Dev.	Min.	Max.
CAPM	*All funds*	-0.0066	-0.0064	0.0042	-0.0435	0.0128
	Mutual Funds	-0.0071	-0.0068	0.0042	-0.0435	0.0128
	Index Funds	-0.0059	-0.0059	0.0029	-0.0134	-0.0012
	Exch. Traded Funds	-0.0025	-0.0024	0.0024	-0.0077	0.0033
Fama French	*All funds*	-0.0064	-0.0062	0.0075	-0.0545	0.0417
	Mutual Funds	-0.0070	-0.0069	0.0075	-0.0545	0.0417
	Index Funds	-0.0046	-0.0045	0.0051	-0.0140	0.0116
	Exch. Traded Funds	-0.0007	-0.0006	0.0056	-0.0149	0.0151

Return per month and expressed as decimal number; Example: Using CAPM, mutual funds deliver on average a negative alpha of -0.71% per month.

Comparing Table 5 with findings from the previous section paints a relatively similar picture based on regressed alphas. Without taking significance levels into account, actively managed mutual funds underperformed on average, the S&P SmallCap 600 index by 0.70% per month. Figure 3 gives an overview of the alpha distribution depending on the applied regression model.[7] At first

[7] The grey bars showing the regressed alphas based on the CAPM (I) and the brown/yellow bars representing the regressed alphas based on the Fama French Model (II). Alpha indicates monthly risk-adjusted returns and is expressed as decimal number. Example: Regressing alphas with CAPM (I), approx. 55% of the mutual funds (I) deliver an alpha of -1% to -0.5% per month. Whereby only approx. 29% of mutual funds (II) regressed with the Fama French Model (II) showing an alpha of -1% to -0.5% per month.

glance, alphas regressed with CAPM (I) showing a lower variance than the results of the Fama French (II) regression. It stands out that the great majority of alphas within the CAPM Model do not exceed zero and therefore do not deliver superior returns, whereby funds regressed with the Fama French Model do. Especially exchange-traded funds offer on a relatively high frequency a greater alpha than zero, which is contrary to earlier findings. It seems to be that correcting for small value companies, alpha shifts towards more positive values.

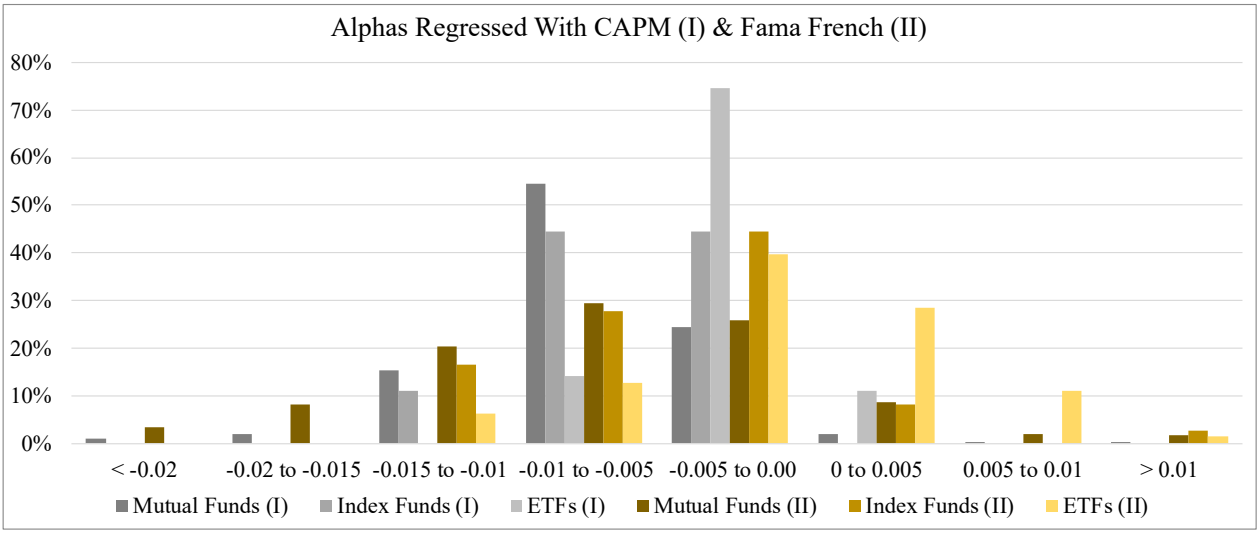

FIGURE 3. ALPHA DISTRIBUTION REGRESSED WITH CAPM (I) & FAMA FRENCH THREE FACTOR MODEL (II)

However, the first research question tries to asses' differences in the risk-adjusted performance between active- and passive investment funds. Figure 4 displays the regressed alpha, distributed and distinguish between funds and methods.[8] Actively managed funds are colored in grey with a red border around the bars, and passively managed funds are represented by the blue shaped bars. It is striking that the majority of the mutual fund's alphas are more negatively distributed than passive investment funds. On the other hand, the majority of passive investment funds alphas are very close to zero allocated. With respect to the methodology of the index- and exchange-traded funds, the results were expected and confirming former findings.

[8] Figure 4 differentiates between alphas depending on the fund characteristic (active-/passive) and between the CAPM (I) and Fama French Model (II). Alpha indicates monthly risk-adjusted returns and is expressed as decimal number.

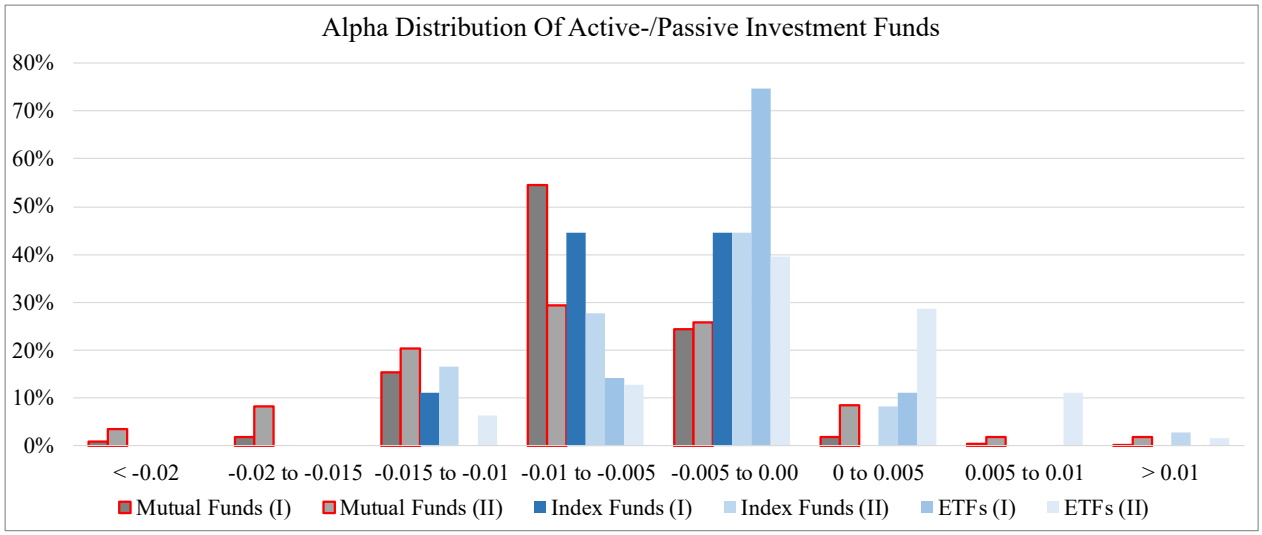

FIGURE 4. ALPHA DISTRIBUTION OF ACTIVE-/ PASSIVE INVESTMENT FUNDS

Table 6 gives a detailed overview of the funds´ alphas and the level of significance. Regardless of the applied model, it stands out that the majority of mutual funds risk-adjusted returns are significant negative, as shown in Figure 4. Having in mind that mutual fund managers aiming to deliver a higher risk-adjusted return than the respected underlying, the results turning relatively sobering. In fact, using the results of the CAPM, only one (equals 0.14%) of all active funds managed to outperform the underlying S&P SmallCap 600 Index significantly. Whereas 76.9%[9] delivered a significant negative alpha and 23%[10] showed no difference in performance to the benchmark. The effect changes slightly by correcting for size and value factors by taking the Fama French Model. Only 1.8%[11] of all mutual funds outperformed their pear and 47.2%[12] achieved an alpha not different from zero, which indicates a co-movement with the small cap index. On the other hand, specially exchange traded funds seems to achieve their goal in replicating the index. Alphas regressed with the CAPM and the Fama French Model indicating mostly a co-movement or slightly underperformance of the tracked benchmark and are therefore in line with findings from Figure 4.

[9] Number is derived by adding up the significant negative alpha values of mutual funds (41.1% + 24.2% + 11.6% = 76.9%)

[10] Number is derived by adding up the insignificant alpha values of mutual funds (2.5% + 20.5% = 23%)

[11] Number is derived by adding up the significant positive alpha values of mutual funds (0.5% + 1.0% + 0.3%= 1.8%)

[12] Number is derived by adding up the insignificant alpha values of mutual funds (10.6% + 36.6%= 47.2%)

TABLE 6. ALPHA SIGNIFICANCE DISTRIBUTION AMONG MODELS & CATEGORY

Model	Category		Alpha (+/-)	Not Significant	Significant*	Significant**	Significant***
CAPM	*All funds (807)*	(+)	26 (3.2%)	25 (3.1%)	-	-	1 (0.12%)
		(-)	781 (96.8%)	181 (22.4%)	89 (11.0%)	183 (22.7%)	328 (40.7%)
	Mutual Funds (708)	(+)	19 (2.7%)	18 (2.5%)	-	-	1 (0.14%)
		(-)	689 (97.3%)	145 (20.5%)	82 (11.6%)	171 (24.2%)	291 (41.1%)
	Index Funds (36)	(+)	-	-	-	-	-
		(-)	36 (100%)	4 (11.1%)	2 (5.6%)	5 (13.9%)	25 (69.4%)
	ETFs (63)	(+)	7 (11.1%)	7 (11.1%)	-	-	-
		(-)	56 (88.9%)	32 (50.8%)	5 (7.9%)	7 (11.1%)	12 (19.2%)
Fama French	*All funds (807)*	(+)	118 (14.6%)	98 (12.1%)	4 (0.5%)	11 (1.4%)	5 (0.6%)
		(-)	689 (85.4%)	297 (36.8%)	71 (8.8%)	124 (15.4%)	197 (24.4%)
	Mutual Funds (708)	(+)	88 (12.4%)	75 (10.6%)	4 (0.5%)	7 (1.0%)	2 (0.3%)
		(-)	620 (87.6%)	259 (36.6%)	61 (8.6%)	111 (15.7%)	189 (26.7%)
	Index Funds (36)	(+)	4 (11.1%)	2 (5.6%)	-	2 (5.6%)	-
		(-)	32 (88.9%)	12 (33.3%)	7 (19.4%)	9 (25.0%)	4 (11.1%)
	ETFs (63)	(+)	26 (41.3%)	21 (33.3%)	-	2 (3.2%)	3 (4.8%)
		(-)	37 (58.7%)	26 (41.3%)	3 (4.8%)	4 (6.3%)	4 (6.3%)

Alpha is (+) positive >= 0; (-) negative < 0; in brackets (%) explains the proportion to the corresponding category; Confidence level is significant at 10% (*); at 5% (**); at 1% (***)

Example: Using the CAPM, 1 out of all 807 funds (equals 0.12%) has a significant positive alpha with an p-value < 0.01. Whereby 328 funds showing a significant negative alpha at a significant level of 1%, which equals 40.7% of all funds in the dataset.

5.3 Comparison of risk-adjusted returns

The previous section revealed that a big portion of mutual funds underperform their benchmark and only a few manage to deliver superior returns. Whereby passive investment funds seem to replicate the benchmark as expected. This chapter assess the question if significant differences in risk-adjusted returns between active- and passive investment strategies exist. Using the methodology of Harper, Madura, & Schnusenberg (2006) the following multiple regression model was utilized to test for alpha differences.

Alpha Regression Model:

$$\alpha_i = \beta_{i,t} + \beta_1 D\_Mutual_i + \beta_2 D\_Index_i + \beta_3 D\_ETF_i + \beta_4 D\_Passive_i + \beta_5 TER_i + \varepsilon_i$$

The dependent variable *alpha* embraces the risk adjusted performance of all funds. The independent dummy variables *D_Mutual*, *D_Index*, *D_ETF* capturing the alphas over the sample period. Furthermore, the dummy variable *D_Passive* embraces index- and exchange traded funds to give a precise answer of the over- or underperformance of both passive investment products. To account for fund specific expense characteristics the total expense ratio *TER* is introduced and serves as a control variable.

Table 7 shows the alpha regression results and confirms that mutual funds underperform passive investment funds from 2006 – 2018 with 0.31% per month.[13] A closer look at the different investment strategies revealed that particularly exchange traded funds deliver superior results comparing to mutual- and index funds with an outperformance of 0.43% respectively 0.37%. These results confirming the findings from Figure 2 of a better performance of exchange traded funds against mutual- and index funds. Furthermore, the overall trend does not change when controlling for small value stocks as proposed by the Fama French model. To conduct a robustness check a two sample t-test and a Mann-Whitney-U-Test were applied and confirming the regression results (appendix Table 18, Table 19).

[13] Table 7 displays the over- and underperformance of funds comparatively to their benchmark. For example, the risk-adjusted returns (alpha) of mutual funds were regressed against the performance of index funds, exchange traded funds and the combined performance of passive funds. The displayed return (-0.0006; -0.0043***; -0.0031***) describes an underperformance of the mutual funds against the respective benchmark.

TABLE 7. PERFORMANCE DIFFERENCES AMONG FUND CATEGORIES

Model	Benchmark	*Mutual Funds*	*Index Funds*	*Exch. Traded Funds*
CAPM	*Mutual Funds*	-	-0.0006	0.0043***
	Index Funds	-0.0006	-	0.0037***
	Exch. Traded Funds	-0.0043***	-0.0037***	-
	Passive Funds	-0.0031***	-	-
Fama French	*Mutual Funds*	-	0.0009	0.0059***
	Index Funds	-0.0009	-	0.0049***
	Exch. Traded Funds	-0.0059***	-0.0049***	-
	Passive Funds	-0.0043***	-	-

Alpha per month and expressed as decimal number; Confidence level is significant at 10% (*); at 5% (**); at 1% (***); Example: Using alphas regressed by the CAPM, exchange traded funds outperformed mutual funds with 0.43% per month at a level of significance of 1%.

The first research question aimed to ascertain if passive investment strategies generate a higher risk-adjusted return than mutual funds. It turned out that funds with an active investment management were inferior to passive investment strategies within the small-cap US equity segment. This observation leads to the rejection of the null hypothesis and the acceptance of the alternative hypothesis of superior risk-adjusted returns of passive investment funds.

5.4 Scenario Analysis

The scenario analysis pursues the question if the persistency of underperformance among mutual funds during a financial distressed time stays. Findings of Glode (2011) shows that only skilled asset managers outperformed the market. Wong & Shum (2010) found evidence that exchange traded funds facing difficulties during a financial crisis but outperform on the other hand in bullish times. Focusing on Table 8, the CAPM regression revealed an outperformance of both index- and exchange traded funds.[14] Passively managed funds delivered higher returns than the active managed counterpart with an outperformance of 1.11% per month. Accounting for additional

[14] Table 8 implies the same methodology as in Table 7. Additionally, the Fama French (II) Regression Model contains the multiplies provided by Kenneth R. French. The multiples SMB and HML were gathered from the Kenneth R. French website: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/six_portfolios.html.

factors as proposed by the Fama French Model, the results flipped surprisingly and are highly statistically significant.

TABLE 8. PERFORMANCE DIFFERENCES AMONG FUND CATEGORIES DURING FEBRUARY 2007 - JULY 2009

Model	Category	*Mutual Funds*	*Index Funds*	*Exch. Traded Funds*
CAPM	*Mutual Funds*	-	0.0130***	0.0091***
	Index Funds	-0.0130***	-	0.0040
	Exch. Traded Funds	-0.0091***	-0.0040	-
	Passive Funds	-0.0111***	-	-
Fama French (I)	*Mutual Funds*	-	-0.0368***	-0.0337***
	Index Funds	0.0368***	-	-0.0031
	Exch. Traded Funds	0.0337***	0.0031	-
	Passive Funds	0.0353***	-	-
Fama French (II)	*Mutual Funds*	-	0.0008	0.0037
	Index Funds	-0.0008	-	0.0029
	Exch. Traded Funds	-0.0037	-0.0029	-
	Passive Funds	-0.0023	-	-

Alpha per month and expressed as decimal number; Confidence level is significant at 10% (*); at 5% (**); at 1% (***); Example: Using alphas regressed by the CAPM, mutual funds underperformed passive funds with 1.11% per month at a level of significance of 1%.

Under this condition's mutual funds exceeded the passive investment funds by 3.53% per month, which was unexpected and against former findings. Diving deeper into detail, a robustness check containing the factors SMB and HML from the Farmer French website confirms former findings of a co-movement of active- and passive funds with no significant risk-adjusted return differences. The main purpose of this additional regression was to test the validity of the surprising results with a highly significant outperformance of mutual funds. Analyzing the dataset regarding SMB and HML multiples revealed that especially small stocks suffered during the financial crisis. The high negative return values influencing the regression results and makes mutual funds appear in a brighter light than they actually might deserve. The Fama French (II) regression includes explicitly all on the US stock exchanges listed companies and does not focus only on small stocks. This

greater diversification leads to less negative and volatile SMB and HML multiples, which paints a more realistic performance picture.

Finally, the objective of the second research question is to ascertain if passive investment funds perform better in a bear market than mutual funds. Findings of Busse et al. (2010) showed that the estimates strongly depend on the model choice. The regression results confirm that view and offer room for interpretations. The results derived by the CAPM indicates a significant underperformance of mutual funds comparing to their counterpart. Using the Fama French model (I) with small sized company multiples, the result switches in favor of mutual funds. Taking the Fama French model (II) with the broader scope into consideration only a co-movement of all fund categories is detected with an insignificant positive tendency in favor of passive funds, which is in line with former results. However, it seems that especially in economically distressed times results from different regressions models vary as assumed by Busse, Goyal, & Wahal (2010). Relying on the CAPM regression results and including former findings, the null hypothesis of lower performing passive funds can be rejected and the alternative hypothesis of superior performance during bear markets compared to mutual funds can be accepted. Focusing on the Fama French (II) regression, however, leads to a slightly different conclusion of a not significant outperformance of passive funds compared to mutual funds.

6 Conclusion

Many studies showed lacking performance regarding mutual funds comparing to less costly and passively managed investment funds. In this thesis, a performance analysis based on the small-cap US equity fund universe was conducted embracing more than 800 investment funds between the years 2006 - 2018. First regression results based on a portfolio constructing revealed the highest negative performance among mutual investment funds, followed by index- and exchange-traded funds. Interestingly, no significant return differences were detected between active-/passive investment strategies during the financial crisis in 2007 – 2009. Diving more into detail and taking individual return/risk characteristics into account, the majority of mutual funds alphas are significant negative. In fact, only 0.14% of the active mutual funds managed to outperform S&P SmallCap 600 Index, 23% showed a co-movement and 76.9% displayed a negative significant risk-adjusted return. These findings mirror the results of Elton, Gruber, & de Souza (2019),

Cuthbertson, Nitzsche, & Niall (2010) and paints a sobering picture of active mutual investment funds. Even though passive investment funds underperform their benchmark, the risk-adjusted performance is less negative compared to actively managed funds. Testing for statistical differences in the alpha distribution confirms former findings of a comparatively superiors' performance of passive investment funds over mutual funds with 0.31% (CAPM) respectively 0.43% (Fama French) per month. This leads to the conclusion that passive investment funds deliver higher risk-adjusted returns than actively managed mutual funds.

Focusing on the scenario analysis revealed a less conclusive situation. The regression based on the CAPM model shows an underperformance of mutual funds during the financial crisis of -1.11% per month comparing to passive products. Taking additionally size and value factors into account, the results flipped in favor of mutual funds with an exceeding return of 3.53% per month. Since the Fama French (I) regression results were not expected, a second regression with multiples obtains from the Kenneth R. French website were conducted as a robustness check and revealed an insignificant underperformance of actively managed funds. These results lead to the conclusion that the estimated results depend on the model of choice during distressed financial times. Therefore, using CAPM passive investment funds outperform mutual funds significantly with 1.11% per month, whereby the Fama French (II) model revealed a not significant better performance of passive funds of 0.23% per month. Overall, passive investment funds seem to perform better than mutual funds during the financial crisis in 2007 – 2009.

The results highlight the challenge for private- and institutional investors to allocate resources to the right investment product. It also shows the difficulties active investment management has to face an increasing competition of passive investment products. To enhance further research, a second benchmark could be introduced to show marginal effects as well as focusing on other equity markets. Findings of this thesis lead to the conclusion that especially over a longer investment horizon, passive investment funds would be more beneficiary for investors. Nevertheless, the results could change by focusing on a different benchmark, sample period or stock market.

Appendix

TABLE 9. DICKEY-FULLER TEST MUTUAL FUNDS

excess_mutual_fund_return	**Interpolated Dickey-Fuller**			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical V.
Z (t)	-11.280	-3.492	-2.886	-2.576
MacKinnon approximate p-value for Z(t) = 0.0000				

TABLE 10. DICKEY-FULLER TEST INDEX FUNDS

excess_index_fund_return	**Interpolated Dickey-Fuller**			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical V.
Z (t)	-12.021	-3.492	-2.886	-2.576
MacKinnon approximate p-value for Z(t) = 0.0000				

TABLE 11. DICKEY-FULLER TEST EXCHANGE TRADED FUNDS

excess_etf_return	**Interpolated Dickey-Fuller**			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical V.
Z (t)	-12.029	-3.492	-2.886	-2.576
MacKinnon approximate p-value for Z(t) = 0.0000				

TABLE 12. DURBIN-WATSON TEST MUTUAL FUNDS

excess_mutual_fund_return		
Durbin-Watson d-statistic	(2, 156)	= 1.814693
Critical values are estimated as	dL = 1.611	dU = 1.637

TABLE 13. DURBIN-WATSON TEST INDEX FUNDS

excess_index_fund_return		
Durbin-Watson d-statistic	(2, 156)	= 2.208927
Critical values are estimated as	dL = 1.611	dU = 1.637

TABLE 14. DURBIN-WATSON TEST EXCHANGE TRADED FUNDS

excess_etf_return		
Durbin-Watson d-statistic	(2, 156)	= 2.623679
Critical values are estimated as	dL = 1.611	dU = 1.637

TABLE 15. PORTFOLIO REGRESSION RESULTS – BEAR MARKET EXTENDED PERIODS (JANUARY 2007 – DECEMBER 2009)

Model	Portfolio	α	Market Index	SMB	HML	Adjusted R^2
CAPM	*Mutual Fund*	-0.0026	0.8926***	-	-	0.9476
	Index Fund	-0.0024	0.9634***	-	-	0.9793
	Exch. Traded Funds	-0.0012	0.9780***	-	-	0.9818
Fama French M.	*Mutual Fund*	-0.0071	0.9806***	0.1763	-0.1935*	0.9490
	Index Fund	-0.0015	0.9325***	0.2341**	-0.0912	0.9808
	Exch. Traded Funds	0.0022	0.9032***	0.2856***	-0.0519	0.9854

TABLE 16. CORRELATION MATRIX PORTFOLIOS – WHOLE PERIOD

	S&P SmallCap 600	***Mutual Fund***	***Index Fund***	***ETF***
S&P SmallCap 600	-			
Mutual Fund	0.9605	-		
Index Fund	0.9805	0.9910	-	
ETF	0.9894	0.9716	0.9903	-

TABLE 17. CORRELATION MATRIX PORTFOLIOS – BEAR MARKET (FEBRUARY 2007 – JULY 2009)

	S&P SmallCap 600	***Mutual Fund***	***Index Fund***	***ETF***
S&P SmallCap 600	-			
Mutual Fund	0.9753	-		
Index Fund	0.9913	0.9910	-	
ETF	0.9927	0.9813	0.9958	-

TABLE 18. TWO-SAMPLE T-TEST WITH EQUAL VARIANCES

Group	Obs	Mean	Std. Error	Std. Dev.	[95% Conf. Interval]	
0	708	-.0071215	.0001589	.0042273	-.0074334	-.0068096
1	99	-.0038222	.0003124	.0031083	-.0044422	-.0032023
Combined	807	-.0067168	.0001494	.0042454	-.0070101	-.0064234
diff		-.0032993	.0004407		-.0041644	-.0024342

diff = mean(0) - mean(1) t = -7.4859

Ho: diff = 0 degrees of freedom = 805

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 1.0000

TABLE 19. TWO-SAMPLE WILCOXON RANK-SUM (MANN-WHITNEY) TEST

dummy_active_passive	Obs	rank sum	expected
0	708	267438	286032
1	99	58590	39996
Combined	807	326028	326028

unadjusted variance 4719528.00

adjustment for ties -1.99

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adjusted variance 4719526.01

Ho: alpha(dummy_~e==0) = alpha(dummy_~e==1)

z = -8.559

Prob > |z| = 0.0000

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