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Rudy van den Heuvel

Mutual Fund Manager Skill

Performance Persistence and Different Economic Conditions

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Mutual Fund Manager Skill:
Performance Persistence and Different Economic Conditions

Master Thesis Department Finance

Student name: Rudy van den Heuvel

Administration number: S634402

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Preface

This Master Thesis is the last part of my MSc Finance at Tilburg University. The economic significance of mutual funds and the inconsistency in previous research gave me an interesting opportunity in writing my thesis. The subject of my thesis is to measure the skills of mutual fund managers. In the last four months I have enjoyed working on my Master Thesis.

I would like to show my gratitude to my supervisor Prof. Dr. J.J.A.G. Driessen for his valuable feedback and commitment. He could always find the time to give valuable responses. Furthermore, I would like to thank my family and friends for their endless support during my study at Tilburg University.

Rudy van den Heuvel

Abstract

This study investigates mutual fund managers' skills. Besides at alphas (abnormal returns), this research also looks at the persistence of these alphas and the differences in alphas and explanatory power of the dependent variables between different economic times. Results show that in the period January 1990 till December 2013 mutual funds were on average not able to outperform benchmark portfolios. In expansions, regression results show that past alpha has a positive and significant effect on future performance, while in recession periods this effect is significantly negative. Of the other explanatory variables, expense ratio has the most robust effect on performance. In both expansion and recession periods it has a negative effect on future alphas, although this effect is much higher in recession periods for a short-term horizon. Portfolio turnover ratio has a negative effect on future performance in expansion periods and a positive effect in recession periods. Level of diversification also has a negative effect, though this effect is not always significant. Furthermore, this study does not find evidence of differences between alphas generated in recession versus expansion periods.

Keywords: Mutual fund, performance, skill, alpha, abnormal return, persistence, financial crisis, recession

1 Introduction

Mutual funds belong to the most important investors, as they constitute about one-fifth of financial assets owned by households in the United States, and an even more significant proportion of discretionary investment assets. They appear to be first established by a Dutch merchant in 1744 (Rouwenhorst, 2004) and were introduced in the United States in 1890 (Fink, 2008). A mutual fund can be seen as an actively managed portfolio of multiple stocks and bonds. To choose in which mutual fund one should invest, one can look at the returns and risks related to each specific fund. The aim of this thesis is to investigate whether mutual fund managers in the United States in the period 1990 till 2013 have skills. In much research mutual fund performance has already been examined, but this paper looks at more recent data and also differentiates between different economic times. Furthermore, not only the difference in abnormal returns (alphas) between recessions and expansions is measured, but also the difference in explanatory power of the dependent variables is measured. Therefore, the difference in persistence of alphas is investigated using a regression with interaction terms with the NBER based regression indicator included in the model. This thesis has three main objectives. First, monthly alphas are calculated to determine whether mutual funds on average outperform expectations. Second, the persistence in mutual fund performance is measured using cross-sectional and logit regressions. Finally, the effect of different economic times on performance and the explanatory power of the variables is measured.

The main data source of this thesis is the Center for Research on Security Prices (CRSP) Survivorship-Bias Free Mutual Fund Database on Wharton Research Data Services (WRDS). Since the first sub question requires every observation to have 36 prior monthly returns, data from January 1987 till December 2013 are used. This study uses data from the same United States equity mutual funds as is used in research by Petajisto (2013). Only the companies for which all variable information is available for at least 36 prior months of returns and for which assets under management exceed one million United States Dollar (USD), are used in the definitive sample. The purpose of this final criterion is to reduce the influence on equally weighted performance statistics resulting from mutual funds with a relatively small number of assets.

First, alphas are calculated by differencing between actual returns and expected benchmark returns, calculated using the Carhart (1997) four-factor model. For this regression 75,515 observations are used. Prior research shows that active funds in general are not able to outperform passive benchmarks. Although some papers find little evidence of outperformance, most of the outperformance disappears after subtracting the fees and expenses related to mutual funds. This thesis finds similar results; the distribution of alphas in the period 1990 till 2013 shows that mutual fund managers on average did not outperform benchmark portfolios after subtraction of fees and expenses. Overall, the median mutual fund generates a monthly alpha of -0.11%, while the value-weighted average of the monthly alphas generated by all mutual funds in the full sample period was -0.07%. Besides that, only 46.43% of the monthly alphas was positive, with a maximum of 61.73% in 2009 and a minimum of 40.36% in 2013. The realised abnormal returns are widely spread. The mean level of alphas at the 95th percentile was 285 basis points, while the mean level of alphas at the fifth percentile was -305 basis points. The distribution of alphas shows that it is clustered around zero, but that the largest part of the distribution is at the negative side. To get a better understanding of mutual fund managers' skills, persistence in abnormal returns is measured.

Persistence in mutual fund performance is measured using a sample with 7,077 observations. Previous results on persistence are not consistent. While most of the existing research indicates that mutual funds are not able to persistently outperform passive benchmarks, some papers find slight persistence. Graphs of the persistence of positive and negative monthly alphas show that persistence is very limited for both alphas, though for negative monthly alphas it is slightly higher. Cross-sectional regressions on past alpha (PALPHA) and several control variables show that for regressions with one-month, three-month, as well as twelve-month alpha as dependent variable, PALPHA has a positive effect on future performance. Furthermore, these cross-sectional regressions show that expense ratio (EXPR) has a negative influence on future alphas. Of the other control variables only portfolio turnover ratio (TURN) and level of diversification (DIVERS) show a significant (and negative) effect on future alphas for the regression with twelve-month alpha as dependent variable. Logit regressions on the same three regression periods once again show that PALPHA has a significant and positive influence on future alphas and that expense ratio (EXPR) negatively and significantly influences future performance. Of the other control variables TURN and DIVERS again negatively influence future alphas, although the influence of DIVERS now is more robust. For both the cross-sectional and the logit regressions PALPHA seems to have the most explanatory power (with the exception of the regressions with one-month alpha as dependent variable). Both the regressions show that mutual funds with a positive three-year period past alpha, low expense ratio, low portfolio turnover ratio and low level of diversification are most likely to generate superior future alphas.

Finally, the effect of different economic times on mutual fund performance is measured. Most of the existing research shows that there is some evidence of stock-picking ability among fund managers in expansion periods, but that there is little evidence for market timing in recession periods. More recent studies, though, not only find evidence that successful managers pick stocks well in expansion periods, but also time the market well in recessions. Two-sided t-tests on the differences in both the arithmetic and value-weighted mean of monthly alphas between expansion and recession periods show that alphas generated in recession periods are not significantly different from alphas generated in expansion periods. In both periods the mean monthly alpha is negative, but the arithmetic average t-test shows that recession periods have little more negative alphas, while the value-weighted monthly average t-test shows that expansion periods have little more negative alphas. Therefore, the t-tests do not indicate that mutual fund managers have more skills in expansion periods than in recession periods. Regressions with interaction terms between the dependent variables and the NBER based recession indicator show that in recession periods mutual funds that on average produced positive alphas in the past three years, are likely to produce smaller alphas (or more negative alphas) than funds that on average produced negative alphas in the past 36 months. The interaction term between EXPR and the NBER based recession indicator is negative. The magnitude of this interaction term indicates that in recession periods, funds with high expense ratios are much more likely to generate lower (or more negative) alphas in the next month than funds with high expense ratios are in expansion periods. The interaction term between TURN and the NBER based recession indicator is positive, which indicates that funds with higher portfolio turnover ratios are more likely to produce higher alphas in recession periods, but are also more likely to underperform in expansion periods. The other control variables, including DIVERS, do not seem to have a significant influence on future performance in recession periods. To conclude, the regressions show that in expansion periods mutual funds with a positive three-year period past alpha, low expense ratio, low portfolio turnover ratio and low level of diversification are most likely to generate superior future alphas. In recession periods, though, mutual funds with a negative three-year period past alpha, low expense ratio, and high portfolio turnover ratio are most likely to generate superior future alphas.

2 Literature review

Mutual funds belong to one of the most important investors since they constitute about one-fifth of financial assets owned by households in the United States, and an even more significant proportion of discretionary investment assets. A mutual fund can be seen as an actively managed portfolio of multiple stocks and bonds. To choose in which mutual fund one should invest, one can look at the returns and risks related to each specific fund. By investing in mutual funds an investor has the opportunity to easily invest in a diversified portfolio. Though, investing in mutual funds also brings a lot of costs, like the fees charged by those funds, such as management expenses, operational expenses and load fees. The discussion about whether investors are better off when investing in indices or when investing actively has not led to a consistent answer.

If mutual funds on average are able to outperform passive benchmarks, this implies that the market is inefficient, since the fund would otherwise have to take higher risks to earn a higher return. Though, this statement only holds if one assumes that mutual funds capture the entire market. It is also possible that mutual funds outperform other groups of active investors, and therefore are able to outperform the benchmark. In general there are two ways in which mutual funds can outperform, namely market timing and stock picking. The first one indicates the ability to predict stock prices, while the latter one is the ability to choose the right stocks.

Research by Berk and Green (2004) shows that active funds do not outperform passive benchmarks because of two reasons. First, the competitive market of capital provision causes anomalies to disappear. If investors compete with each other, they exploit those anomalies and end up ensuring that none exist. This also clarifies the fact that if mutual funds on average cannot outperform a benchmark, it does not necessarily mean that they lack skill. The second reason why active funds do not outperform is the decreasing returns to scale in active portfolio management. When a fund outperforms, it is likely to obtain more capital, which it needs to invest. If funds become too big, the anomalies disappear and the fund will not be able to persist in outperforming the benchmark.

2.1 Mutual funds outperformance

Harlow and Brown (2006) show that because of trading costs and charged fees, the aggregate active fund will underperform the market by an amount equal to the fees and expenses. This only holds if one assumes that mutual funds capture the entire market, since it is also possible that mutual funds on average underperform or outperform other groups of active investors like hedge funds, insurance companies, and individual investors. Research by Jensen (1968), Barras, Scaillet, and Wermers (2010) and Busse, Goyal, and Wahal (2010) yield the same conclusion and shows that the average actively managed mutual fund does not capture alpha, net of fees and expenses. Jensen (1968) shows that mutual funds are on average not able to predict prices well enough to outperform, and that there is very little evidence that any individual fund is able to do significantly better than what is expected. Research by Fama and French (2007) confirms that, and shows that the estimate of true alpha for funds in the top percentiles is no better than the estimated alpha for large efficiently managed passive funds. Their results indicate that there is some existence of outperformance in returns before costs, but after extracting those expenses the results are almost gone. Furthermore, Bogle (1998) shows that investing passively results in a risk-adjusted performance that is on average almost 25% higher than when investing actively, a result he attributes directly to the cost of running an active management strategy. Therefore, he concludes that an investor should always emphasize the low-cost funds. Petajisto (2013) also finds that the average mutual fund underperforms the benchmark, but that the most active stock pickers can beat the benchmark by about 1.26% per year after subtracting fees and expenses.

Cuthbertson, Nitzsche and O'Sullivan (2005) test whether the outperformance of United Kingdom equity mutual funds is based on manager skills or is just the result of luck. They point out that a relatively small number of top performing UK equity mutual funds can outperform based on skills and not just solely based on luck. On the other hand, they find that underperformance of poor performing funds is not based on bad luck, but the result of bad skills. Research by Otten and Bams (2000) shows that French, Italian, Dutch and UK funds outperform significantly, while German funds underperform the market, though not significantly. In contrast with most United States mutual funds, the majority of European funds seem to be able to find and implement new information to offset their expenses, and therefore are able to add value for the investor. One factor that might explain this is, according to Otten and Bams (2000), the smaller market importance of the European versus the United States industry. If the mutual fund sector grows stronger, relative to the market, it becomes more difficult to outperform the market, and therefore European mutual funds would better be able to outperform than mutual funds in the United States.

Jones and Wermers (2011) mention that the conclusions of research on active investments often depend on the period covered, the methodology used, the universe and type of funds considered, and the authors' biases. Furthermore, they show that institutional funds outperform retail funds because they usually have lower management fees, can use more performance sensitive fees and have lower costs. They also mention that for investors who are unwilling or do not have the resources to identify superior active managers, the expected return to active management will be zero or negative. They should focus on developing an appropriate asset allocation while embracing passive management in each particular asset class. By doing so, they are likely to perform at least as well as the average investor in each asset class. Research by Carlson (1970) also mentions that the benchmark used in estimating expected returns can make the difference. In his sample most of the funds outperformed the Dow Jones Industrial Average, but failed to outperform the Standard & Poor's 500 and NYSE Composite indexes.

The influence of manager's characteristics has also been examined by Chevalier and Ellison (1999). They find that managers who graduated from colleges whose students had higher average SAT scores outperformed other managers. However, this does not mean that all those managers outperform and that other managers are not able to outperform. The results of this research only apply on average, and not necessarily to a specific manager or fund. Gottesman and Morey (2006) and Dincer, Gregory-Allen, and Shawsky (2010) also show that better trained managers outperform. This is supported by Shukla and Singh (1994), who show that managers who have earned the Chartered Financial Analyst (CFA) designation run funds that are riskier, better diversified, and outperform funds managed by non-CFA holders.

To conclude, existing research shows that active funds in general are not able to outperform passive benchmarks. Although some papers find little evidence of outperformance, most of the outperformance disappears after subtracting the fees and expenses related to mutual funds. As shown in previous research, there are some funds that outperform based on manager characteristics. In Europe, funds in some countries are able to outperform, but this outperformance can be attributed to anomalies.

2.2 Performance persistency

Much research has investigated the persistence of outperformance of mutual funds. Persistence indicates whether past winners continue to produce high returns and losers continue to underperform. Jones and Wermers (2011) point out that in a zero-sum game, if some investors (superior active managers, or SAMs) earn positive alphas, other investors (inferior active managers, or IAMs) must earn negative alphas. This being said, if one assumes that active funds hold the whole market, the aggregate of active fund returns should equal the market return.

If superior active managers have more information or analytical capabilities, they should persistently be able to outperform the benchmark. Though, inferior active managers are likely to change their strategies or to be replaced by better performing managers, which probably results in better future performance (Lynch and Musto, 2003). Therefore, they point out that lack of persistence does not necessarily imply a lack of skills among managers. Harlow and Brown (2006) document a selection process that improves an investor's probability of identifying a superior active manager to almost 60%, while median managers produce positive risk-adjusted performance in 45% of the time.

Chen, Jegadeesh and Wermers (2000) find that one-year persistence amongst winner funds is due to stocks passively carried over, rather than newly purchased stocks of winner funds performing better than newly purchased stocks of loser funds. Research by Wermers (2003) and Berk and Green (2004) also shows that persistent large cash inflows to winner funds are invested with a lag and that the average dollar invested in past winner funds does not earn a higher return than a dollar invested in past loser funds. Research by Cuthbertson, Nitzsche and O'Sullivan (2005) shows relatively weak short-term persistence among past winners and longer horizon persistence (up to 3-5 years) for past losers.

Research on mutual fund's performance based on UK data shows that there is little evidence of persistence in superior performance but much stronger evidence that poor performers continue to underperform (e.g. Blake and Timmermann 1998, Allen and Tan 1999, Fletcher and Forbes 2002, Tonks 2004). Keswani and Stolin (2005) find evidence that persistence in mutual fund performance is higher in sectors where concentration of assets under management is higher. Their results indicate that the competitiveness of a mutual fund sector influences the persistence in the relative performance of its members. Barras, Scaillet, and Wermers (2009) test the persistence of Swiss mutual fund performance and find that the majority of the funds create zero or negative alphas. They also find that such unskilled funds underperform for long time periods.

Although much research states that outperformance of active managers is not persistent over time (see for instance Malkiel (1995) and Sharpe (1966)), some empirical research finds evidence of a slight persistence effect. For instance Grinblatt and Titman (1989) and (1992) find evidence of persistence in five-year holding periods. This evidence is supported by Hendricks, Patel, and Zeckhauser (1993) who find a strong correlation between the funds that generated alphas from one twelve-month period to the next period. Teo and Woo (2001) also find persistence in style adjusted returns for up to six years. Brown and Goetzmann (1995) find the same results for both the best and worst managers, but find contradicting evidence for the average fund. Ignoring non-surviving funds can result in spurious persistence in the data, according to Brown, Goetzmann, Ibbotson, and Ross (1992). Carhart (1997) also finds evidence of performance persistence, but argues that most of that result could be explained by fund expenses and return momentum in the underlying holdings. This is supported by Elton, Gruber, and Blake (1996), who find that past risk-adjusted performance is predictive of future performance, particularly for funds that are best able to control their expenses. Research by Wermers (2003) shows that the level of performance persistence differs between value-oriented and growth-oriented funds.

The results on persistence are divergent. While most of the existing research indicates that mutual funds are not able to persistently outperform passive benchmarks, some papers find slight persistence. Since the persistence in mutual funds' performance is influenced by the competitiveness of the mutual fund sector, funds exploit anomalies and, therefore, make it harder to outperform in upcoming years. Because inferior active funds are likely to change their strategies, it becomes harder for superior funds to persistently outperform.

2.3 Recessions versus expansions

Most existing studies have ignored the fact that a fund's ability to outperform the market might change with the state of the business cycle. Research from Graham and Harvey (1996), Ferson and Schadt (1996), Daniel, Grinblatt, Titman, and Wermers (1997), Becker, Ferson, Myers, and Schill (1999) and Kacperczyk and Seru (2007) shows that there is some evidence of stock-picking ability among fund managers, but that there is little evidence for market timing.

According to Cederburg (2008) expansion investors earn higher returns and alphas by chasing returns and searching for managerial skill, but this can partially be explained by the momentum effect. On the other hand, recession investors do not chase returns and exhibit a weaker tendency to seek alpha. Recession investors do not base their decisions as heavily on mutual fund alpha and new mutual fund investments do not capture much of the benefit of high recession alphas. Although research by Kosowski (2006) suggests that recessions are the best times to capitalize on predictive manager skill, investors do not search for managerial skill during recession periods to the same extent as during expansion periods. Recession investors make investment decisions to change their exposure to risk factors, instead of chasing performance. During recession periods, investors tend to avoid funds with exposure to market risks and book-to-market factors, while they show the opposite behavior in expansion periods.

Research by Moskowitz (2000) and Kosowski (2006) shows that mutual funds achieve significantly higher alphas in recessions than in expansions. This might be explained by the higher variance of information signals in recessions. Because of this higher variance of information signals, there is more potential for fund managers to have different information signals and, therefore, possibly be better informed than the average investor. Thus, under certain conditions, fund managers may be able to outperform simple passive market benchmarks better in recessions than in expansions. Kosowski (2006) shows that the overall negative alpha of mutual funds is attributable to a significantly negative alpha in expansion periods. He also finds a significantly positive alpha of about 4% per year in recession periods. The difference in alphas between recession and expansion periods in the Kosowski (2006) paper is statistically and economically significant at three to five percent per year.

More recent research by Kacperczyk, Van Nieuwerburgh, and Veldkamp (2011) argues that recessions are times in which aggregate payoff shocks are more volatile and the price of risk is higher. They state that firms that have some general cognitive ability to process information about the aggregate economy can optimally change the allocation between booms and recessions. Kacperczyk et al. (2012) state that a manager's ability to earn positive alphas is not a talent one is born with. Instead, it is affected by the analysing skills and time spent by the manager. Kacperczyk et al. (2012) evaluate fund manager skill in a way that allows its nature to change, depending on economic conditions. They find that successful managers time the market well in recessions and pick stocks well in booms.

Mamaysky, Spiegel, and Zhang (2008), Bollen and Busse (2001), and Elton, Gruber, and Blake (2011) also look at market timing in different economic conditions. Their results are in accordance with the results from the Kacperczyk et al. (2012) paper. They also find that skilled managers are better able to time the market in recessions and can earn higher returns in those periods. According to Kacperczyk et al. (2012), the reason that other papers find no or little evidence that successful managers can time the market in recessions, is because of the small fraction of recession periods in the samples used.

Most of the existing research shows that there is some evidence of stock-picking ability among fund managers in expansion periods, but that there is little evidence for market timing in recession periods. More recent studies, though, not only find evidence that successful managers pick stocks well in expansion periods, but also time the market well in recessions. One possible explanation for this contradiction might be the small fraction of recession periods in earlier samples.

3. Methodology

3.1 Research question

The aim of this thesis is to investigate whether mutual funds in the United States outperform a benchmark (such as the Standard and Poor's 500 or Russell 3000) and whether these positive or negative alphas are persistent over time. For the regressions, this study follows the methods used in the paper of Harlow and Brown (2006). Since they look at data from 1979 till 2003, this research moves this period and evaluates mutual funds on more recent data. Therefore, the timespan will be January 1990 till December 2013. Furthermore, this thesis extends the Harlow and Brown (2006) paper by also differing between different economic times. To do that, the alphas generated in recessions and expansions are compared. Therefore, the research and sub questions are:

Main research question:

- Do mutual fund managers in the United States in the period 1990 till 2013 have skills?

Sub questions:

- Do mutual funds in the United States in the period 1990 till 2013 outperform the market net of fees and expenses?
- Is outperformance/underperformance of mutual funds in the United States in the period 1990 till 2013 persistent?
- Do active managers in the United States generate higher alphas in recessions or in expansions?

3.2 Empirical model

To answer these questions, data of quarterly holdings of mutual funds is collected. The data used for the analyses are Survivorship-Bias Free monthly returns from the Center for Research in Security Prices (CRSP) database. To calculate the superior performance of active managers, the difference between the active portfolio's return (net of fees and expenses) and the expected benchmark return is taken, given the capital commitment and level of risk involved. This is called the portfolio's abnormal return:

$$Abnormal\ Return = Actual\ Return - Expected\ Benchmark\ Return \quad (1)$$

Expected benchmark returns can be calculated in many different ways, such as benchmark portfolio returns, peer group comparison returns, and return-generating models. In this study, the last option is chosen, consistent with the Harlow and Brown (2006) paper. The existing literature has tested mutual fund performance with both the Fama and French (1992, 1993) three-factor model and the Carhart (1997) four-factor model. Since previous research has indicated that the momentum factor also explains part of the performance, in this research expected benchmark returns are not calculated in the same three-factor model as in the Harlow and Brown (2006) paper, but calculated using the Carhart (1997) four-factor model:

$$ER_{jt} = a_j + b_{jm}ER_{mt} + b_{jSMB}R_{SMBt} + b_{jHML}R_{HMLt} + b_{jUMD}R_{UMDt} + e_{jt} \qquad (2)$$

Where ER_{jt} is the month t excess return to the jth fund, ER_{mt} is the month t excess return on the Russell 3000 value-weighted portfolio of NYSE, AMEX, and NASDAQ stocks, R_{SMBt} is the difference in month t returns between small cap and large cap portfolios, R_{HMLt} is the difference in month t returns between portfolios of stocks with high and low book-to-market ratios, and R_{UMDt} is the difference between the month t returns on portfolios of the winners and losers of the past year. For every mutual fund, the parameters are calculated for fund j and every month t using the prior 36 monthly returns (up to the return for month t). The intercept a_j estimated on month t is the average abnormal return and approximates the jth manager's level of value added over the previous three-year period. In this research it is called the month t past alpha (PALPHA), reflecting the fact that it was generated at the same time and using the same set of data as the expected benchmark returns themselves. The resulting parameters from equation (2) are then used to calculate the expected benchmark return for month t. The returns for the risk factors (i.e., ER_{mt}, R_{SMBt}, R_{HMLt}, and R_{UMDt}) over this month are used in conjunction with the month t estimated parameters (over the past 36 months) to compute the expected benchmark excess return for fund j.

To answer the second sub question, persistence is measured on a one-month, three-month and twelve-month basis. To estimate the jth fund's predicted return over an n-month forecast period subsequent to month t, the returns for the risk factors (i.e., ER_{mt+n}, R_{SMBt+n}, R_{HMLt+n}, and R_{UMDt+n}) over this future period are used in conjunction with the month t estimated parameters (again over the past 36 months) to compute the expected benchmark excess return for fund j (i.e., ERjt+n) according to (2). Next, $ALPHA_{jt+n}$ is calculated by differencing the fund's actual excess return over the period from month t to month t+n and its estimated expected benchmark excess return. Therefore, $ALPHA_{jt+n}$ is the alpha generated by fund j in the upcoming month or the sum of the alphas generated by fund j in the upcoming three or twelve months after month t. The following equation is then estimated:

$$ALPHA_{jt+n} = c_o + c_1 PALPHA_{jt} + c_2 EXPR_{jt} + c_3 ASSET_{jt} + c_4 TURN_{jt} + c_5 DIVERS_{jt} + c_6 VOL_{jt} + e_{jt} \quad (3)$$

Where $PALPHA_{jt}$ is the historical alpha measured for the jth fund over the three-year period ending in month t, using equation (2), and $ALPHA_{jt+n}$ is the alpha for the same fund one n-month period into the future. $ALPHA_{jt+n}$ is calculated by differencing the fund's actual excess return over the period from month t to month t+n and its estimated expected benchmark excess return. The parameter c_1 provides a direct assessment of the extent to which risk-adjusted performance persists in the sample of active fund managers. The other variables are controls: $EXPR_{jt}$ is the expense ratio of the jth fund, $ASSET_{jt}$ is the natural logarithm of assets under management, $TURN_{jt}$ is the portfolio turnover ratio, $DIVERS_{jt}$ is the level of portfolio diversification, and VOL_{jt} is the level of return volatility. For the variables expense ratio, assets under management, and portfolio turnover ratio the most recent observations are used, meaning that expense ratio and portfolio turnover ratio are measured with values from the past quarter. Since assets under management is measured on a monthly basis, for this control variable the value of assets under management from the past month is used. The variable $DIVERS_{jt}$ is measured as a fund's coefficient of determination relative to the return generating model in (2) and VOL_{jt} is measured as the standard deviation of fund excess returns. A fund's return volatility accounts for some of the fund's unsystematic risk influences that are not otherwise captured in $ALPHA_{jt+n}$. Both of these additional control variables are measured over the same three-year period as $PALPHA_{jt}$. To permit a direct comparison of the size and statistical reliability of the resulting parameters from equation (3), data for all variables are standardized on a given date in a manner similar to that used by Brown et al. (1996).

To get an answer to the third sub question, the abnormal returns found in equation (1) are compared between recession periods and expansion periods. To define the recession and expansion periods, the NBER based recession indicators are retrieved from the Federal Reserve Bank of St. Louis. The results are then analysed using a two-sided t-test, to check whether the alphas created in expansions and recessions on average are different. Furthermore, the following regression with interaction terms is done to test whether the importance of the dependent variables changes in different economic times:

$$ALPHA_{jt+n} = c_o + c_1 PALPHA_{jt} + c_2 CRISIS * PALPHA_{jt} + c_3 EXPR_{jt} + c_4 CRISIS * EXPR_{jt} + c_5 ASSET_{jt} + c_6 CRISIS * ASSET_{jt} + c_7 TURN_{jt} + c_8 CRISIS * TURN_{jt} + c_9 DIVERS_{jt} + c_{10} CRISIS * DIVERS_{jt} + c_{11} VOL_{jt} + c_{12} CRISIS * VOL_{jt} + e_{jt} \quad (4)$$

Where CRISIS is measured as the NBER based recession indicators from the Federal Reserve Bank of St. Louis. Recession months are indicated with a one, while expansion months are indicated with a zero. The other dependent variables are measured in the same way as is done in regression (3).

3.3 Sample selection and data

As stated above, the main data source will be the Center for Research on Security Prices (CRSP) Survivorship-Bias Free Mutual Fund Database on Wharton Research Data Services (WRDS). Since CRSP contains only companies from the United States, this study also focuses on the United States. As the first sub question requires every observation to have 36 prior monthly returns, data from January 1987 till December 2013 are used. This study uses data from the same United States equity mutual funds as is done in research by Petajisto (2013). Only the companies for which all variable information is available for at least 36 prior months of returns and companies which assets under management exceed one million United States Dollar (USD) will be used in the definitive sample. The purpose of this final criterion is to reduce the influence on equally weighted performance statistics resulting from mutual funds with a relatively small number of assets.

In the quarterly holdings of mutual funds database in CRSP, the fund returns and net asset values for each mutual fund can be obtained, as well as the risk-free interest rate (one month treasury bill rate), the small minus big, high minus low, and momentum factors for each month. The variables needed for the second sub question, namely the expense ratio as of fiscal year-end, total net assets as of month end and portfolio turnover ratio, can also be retrieved from CRSP. The other two variables portfolio diversification and level of return volatility can be calculated using data from the CRSP database. As mentioned before, to identify the recession and expansion periods, the NBER based recession indicators are retrieved from the Federal Reserve Bank of St. Louis (see Appendix 1 for the whole set of dummies).

The sample selection procedure used to obtain the final number of observations is shown in Table 1. For the return regression, the total number of observations used is 75,515, while for the alpha regression 7,077 observations are used.

Table 1 Selection procedure

	Return Regression	Alpha Regression
Number of observations in sample period for firms used by Petajisto (2013)	545,935	143,918
Less: Observations in Fund Summary missing in Mutual Funds Returns and Fama-French Database	-	1,207
Less: Closed-end funds	23,216	12,966
Less: Index funds	8,125	8,001
Less: Missing variables needed for second regression	33,222	473
Less: Funds with less than 36 months of available data	403,464	104,362
Less: Funds that did only exist before 1990	515	60
Less: Funds with less than one million assets under management	1,116	223
Less: Funds with expense ratio or portfolio turnover ratio less than zero	-	1,220
Less: Winsorized data for variable assets under management	762	176
Less: Winsorized data for variables portfolio turnover ratio, and expense ratio	-	274
Less: Missing control variables needed for third regression	-	7,734
Less: Winsorized data for alpha	-	145
Total number of observations used in the final sample	75,515	7,077

This table reports the sample selection procedure used to obtain the final number of observations for both the Mutual Funds Returns and Fama-French Database and the Fund Summary Database. The selection procedure for the Mutual Funds Returns and Fama-French Database, which is used for the calculations of the first and third sub question, is shown in the second column. The selection procedure for the Fund Summary Database, which is used for the calculations of the second and third sub question, is given in the last column.

The observations for which data was not available or not sufficient for the sample procedure in the Mutual Funds Returns and Fama-French Database in CRSP are also dropped in the Fund Summary Database, since those variables are necessary for the calculations of the second and third sub question as well. Observations dropped in the Fund Summary Database are not dropped in the Mutual Funds Returns and Fama-French Database, since those data is not necessary for the calculations in the first sub question.

4. Results

4.1 Descriptive statistics

The number of mutual funds in each year is shown in Table 2 for every year between 1987 and 2013.

Table 2 Frequency distribution for the mutual fund sample.

Year	Frequency	Percentage	Cumulative
1987	414	4.67	4.67
1988	462	5.21	9.88
1989	480	5.42	15.30
1990	487	5.49	20.79
1991	448	5.05	25.85
1992	430	4.85	30.70
1993	153	1.73	32.42
1994	236	2.66	35.09
1995	304	3.43	38.52
1996	337	3.80	42.32
1997	339	3.82	46.14
1998	271	3.06	49.20
1999	273	3.08	52.28
2000	87	0.98	53.26
2001	191	2.15	55.42
2002	203	2.29	57.71
2003	258	2.91	60.62
2004	483	5.45	66.06
2005	479	5.40	71.47
2006	490	5.53	77.00
2007	424	4.78	81.78
2008	374	4.22	86.00
2009	189	2.13	88.13
2010	263	2.97	91.10
2011	265	2.99	94.09
2012	263	2.97	97.06
2013	261	2.94	100.00
Total	8,864	100.00	

This table reports the number of mutual funds by year included in the sample period spanning from January 1987 to December 2013. The percentages of the distribution among years and cumulative distribution are also shown. Each fund may appear in several years, and therefore, the total frequency does not equal the total number of unique firms in the sample.

Notice that the listed values reflect a tremendous drop in the number of mutual funds available to investors in the years 1993, 2000 and 2009. The largest number of mutual funds was available in the year 2006, with 490 funds. In the year 2000 the least amount of funds was available to investors, namely 87.

The variables used in regressions (2), (3) and (4) are summarized in Table 3, after winsorizing the upper one percent (99%) for the variables assets under management, expense ratio, and portfolio turnover ratio. The reason those variables are winsorized is to prevent the parameters in regression (3) and (4) to be influenced by outliers. Frequency resembles the total number of observations per variable, meaning that it is the sum of all periods the variable is available in the sample. The variables VOL and DIVERS from equation (3) and (4) are not reported in this table, since they will be calculated later on in this study using regression (2). Table 3 shows that the average mutual fund in the sample has a positive excess return, which also holds for the median fund. The average and median market excess returns are larger than the mutual fund excess returns for the average fund as well as the median fund. This already implies that the average and median mutual fund are not able to outperform the market. The difference between small cap and large cap portfolios (SMB) is positive for the mean and median fund in the sample, which indicates that large cap portfolios in general underperform small cap portfolios. The HML factor is negative for the median mutual fund but positive for the mean fund. Therefore, the summary statistics do not give a consistent answer about whether high book-to-market ratios generate lower or higher returns than portfolios of stock with low book-to-market ratios. The difference between the month t returns on portfolios of the winners and losers of the past year (UMD) is positive for both the mean and median fund, which implies that funds that outperformed last year are also likely to perform well this year.

Table 3 Variables summary

	Frequency	Mean	Minimum	Median	Maximum	Standard Deviation
ERjt	75,515	0.0071	-0.4648	0.0102	0.7486	0.0465
ERmt	75,515	0.0074	-0.2324	0.0128	0.1247	0.0392
SMB	75,515	0.0017	-0.1639	0.0005	0.2202	0.0272
HML	75,515	0.0009	-0.1268	-0.0003	0.1387	0.0252
UMD	75,515	0.0076	-0.3472	0.0064	0.1839	0.0362
EXPR	7,077	0.0121	0	0.0117	0.0290	0.0044
TURN	7,077	0.6795	0	0.5300	3.7400	0.5926
ASSET	75,515	721.1903	1	141.0720	19,577.9000	1,852.1115

This table shows the summary statistics for each of the variables used in the regressions. ERjt is the month t excess return to the jth fund, ERmt is the month t excess return on the Russell 3000 value-weighted portfolio of NYSE, AMEX, and NASDAQ stocks, SMB is the difference in month t returns between small cap and large cap portfolios, HML is the difference in month t returns between portfolios of stocks with high and low book-to-market ratios, and UMD is the difference between the month t returns on portfolios of the winners and losers of the past year. EXPR is the expense ratio, TURN is the portfolio turnover ratio, and ASSET is assets under management (in millions of dollars). Notice that ERjt, ERmt, SMB, HML and ASSET are monthly fund observations, while EXPR and TURN are quarterly fund observations.

As shown in Table 3, the smallest mutual fund in the sample has assets under management of one million dollars, which was set as the minimum amount of assets. The largest fund has assets under management of 19.5779 billion dollars, while the mean and median funds have respectively 721.1903 and 141.0720 million assets under management. This implies that the distribution of ASSET is skewed to the right, even after winsorizing the upper one percent. The reason the first percent is not winsorized, is that the minimum value for the variable assets under management was already set to one million dollars. Since assets under management has a wide distribution, which influences resulting parameters from the alpha regression, the natural logarithm of assets under management is used in the alpha regression. The distribution of the natural logarithm of the variable ASSET both before and after winsorizing is shown in Appendix 2a. The maximum expense ratio is 0.0290 (2.90%), while the minimum expense ratio is 0 (0.00%). The mean and median expense ratios are respectively 0.0121 (1.21%) and 0.0117 (1.17%), which implies that EXPR is also slightly skewed to the right after winsorizing the upper one percent. The minimum value for EXPR is set to zero, and therefore, the first one percent is not winsorized either. The distribution for the variable EXPR both before and after winsorizing is shown in Appendix 2b. For the variable portfolio turnover ratio, the minimum and maximum values are respectively 0 and 3.7400. The mean portfolio turnover ratio is 0.6795 (67.95%), while the median portfolio turnover ratio is 0.5300 (53.00%), meaning that TURN is skewed to the right after winsorizing as well. The distribution for the variable TURN both before and after winsorizing is shown in Appendix 2c. Notice that ERjt, ERmt, SMB, HML and ASSET are monthly fund observations, while EXPR and TURN are quarterly fund observations.

4.2 Correlation matrix

Since multicollinearity problems will affect the multivariate regression used to answer the second sub question, the correlation matrix between the variables in equation (3) is listed in Table 4 below. The variables used in equation (2) are not tested for multicollinearity, since the correlation between those variables is not important, as the parameters are used to get the best prediction of excess returns and determine alphas in equation (1).

Table 4 Correlation matrix

	$ALPHA_{jt+1}$	$ALPHA_{jt+3}$	$ALPHA_{jt+12}$	PALPHA	EXPR	ASSET	TURN	DIVERS	VOL
$ALPHA_{jt+1}$	1.0000								
$ALPHA_{jt+3}$	0.5915	1.0000							
	(0.000)								
$ALPHA_{jt+12}$	0.3228	0.5834	1.0000						
	(0.000)	(0.000)							
PALPHA	0.0124	0.0944	0.1051	1.0000					
	(0.297)	(0.000)	(0.000)						
EXPR	-0.0246	-0.0507	-0.0675	-0.0572	1.0000				
	(0.039)	(0.000)	(0.000)	(0.000)					
ASSET	0.0116	0.0340	0.0354	0.0843	-0.5028	1.0000			
	(0.330)	(0.006)	(0.015)	(0.000)	(0.000)				
TURN	-0.0121	-0.0373	-0.0620	-0.1212	0.2000	-0.1336	1.0000		
	(0.307)	(0.024)	(0.000)	(0.000)	(0.000)	(0.000)			
DIVERS	-0.0159	-0.0241	-0.0591	-0.0793	-0.2189	0.1966	-0.0446	1.0000	
	(0.182)	(0.050)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
VOL	0.0038	0.0232	-0.0455	-0.0729	0.1362	-0.0705	0.2123	0.1356	1.0000
	(0.747)	(0.0593)	(0.017)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

This table shows the pairwise correlations between the dependent and independent variables from the alpha regression. The dependent variables are ALPHAjt+1, ALPHAjt+3, and ALPHAjt+12, which are respectively the one-month, three-month, and twelve-month future alphas. The independent variables are PALPHA, which is the three-year past alpha, EXPR, which is the quarterly expense ratio for fund j, ASSET , which is the monthly assets under management, TURN, which is the quarterly portfolio turnover ratio, DIVERS, which is the level of diversification measured on the past three-year period, and VOL, which is the return volatility measured on the past three-year period. The p-value of each correlation is mentioned between brackets.

$ALPHA_{jt+1}$, $ALPHA_{jt+3}$, and $ALPHA_{jt+12}$ are the three different dependent variables used in the alpha regression. Their correlation is not important, but still informative. The correlation between the one-month and three-month alpha is significantly higher than the correlation between the one-month and twelve-month alpha, which indicates that alphas change over time. The correlation between the three-year past alpha, PALPHA, and the dependent variables, $ALPHA_{jt+1}$, $ALPHA_{jt+3}$, and $ALPHA_{jt+12,}$ is positive and significant (except for $ALPHA_{jt+1}$), which is consistent with expectations and implies that there is at least slight persistence in alphas. Expense ratio has a significant negative correlation with each of the three dependent variables, which is consistent with previous papers. Assets under management is also positively and significantly correlated with the dependent variables (except for the one-month alpha), which is as expected. The correlation between portfolio turnover ratio and the dependent variables is negative. For the one-month future alpha, the correlation is insignificant, but for the three-month and twelve-month alpha it is significant, which is in contradiction with results from Harlow and Brown (2006), who find a significant and positive relationship between TURN and future alphas. Level of diversification also has a significant and negative correlation with the dependent variables (once again with the exception of the one-month alpha), which is consistent with expectations. The correlations between level of return volatility and the one-month and three-month alphas are positive, but only significant for the three-month alpha, and negative and significant for the twelve-month alpha. The correlations between the dependent variables and the independent variables do not indicate multicollinearity problems, since the correlations are not higher than 80 percent. Also, the correlations between the independent variables do not give problems, as the highest absolute correlation (between the variables assets under management and expense ratio) is 50.28%.

4.3 Mutual funds outperformance

To answer the first sub question, the expected benchmark returns are calculated using the parameters obtained by a regression on the previous 36-month excess returns and the month t risk factors ER_m, SMB, HML, and UMD. Those expected benchmark returns are then differenced with the actual returns to calculate the abnormal returns (alphas) generated by every firm in each month. The distribution of those alphas among years is listed in Table 4 below.

Table 5 The distribution of monthly alphas: 1990-2013

Year	# of obs.	Monthly mean ALPHA value net of fees and expenses at percentile (%): Weighted Average	5th	25th	Median	75th	95th	%pos. Alphas
1990	1,496	-0.14	-3.50	-1.21	-0.22	0.74	2.76	43.25
1991	4,490	-0.13	-3.55	-1.20	-0.17	0.85	2.82	45.48
1992	4,319	0.01	-2.68	-0.91	-0.05	0.85	3.03	48.39
1993	318	0.24	-2.50	-0.63	0.13	1.24	3.71	53.77
1994	881	-0.04	-3.48	-0.84	-0.09	0.74	2.40	47.22
1995	1,331	-0.05	-3.48	-0.98	-0.05	0.84	2.92	48.38
1996	1,604	-0.05	-2.80	-1.01	-0.04	0.90	2.81	48.69
1997	2,158	-0.17	-3.23	-1.15	-0.14	0.75	2.89	46.57
1998	1,910	-0.14	-3.57	-1.27	-0.18	0.99	3.37	45.76
1999	2,324	0.01	-4.21	-1.58	-0.10	1.28	4.48	47.76
2000	76	0.10	-7.58	-1.42	0.93	2.96	7.51	56.58
2001	606	-0.17	-5.22	-1.55	-0.08	1.52	4.71	48.02
2002	829	-0.05	-4.38	-1.40	-0.16	1.01	4.18	45.11
2003	1,125	-0.20	-2.85	-1.02	-0.24	0.50	2.33	41.16
2004	1,667	-0.15	-2.41	-0.88	-0.14	0.62	2.08	45.41
2005	1,673	0.00	-1.92	-0.65	-0.02	0.66	1.97	48.83
2006	2,075	-0.10	-2.31	-0.93	-0.20	0.47	1.75	41.69
2007	2,235	0.01	-2.17	-0.76	-0.04	0.67	1.91	48.50
2008	2,636	-0.23	-3.68	-1.27	-0.09	1.01	3.04	48.22
2009	358	1.21	-3.11	-0.56	0.64	2.01	5.61	61.73
2010	175	0.24	-4.69	-1.19	-0.17	0.87	3.98	43.43
2011	1,185	-0.27	-2.70	-0.98	-0.19	0.53	2.02	44.64
2012	1,398	-0.01	-2.21	-0.75	-0.06	0.62	1.97	47.00
2013	1,779	-0.04	-1.98	-0.76	-0.20	0.39	1.42	40.36
Total	38,648	-0.07	-3.05	-1.01	-0.11	0.78	2.85	46.43

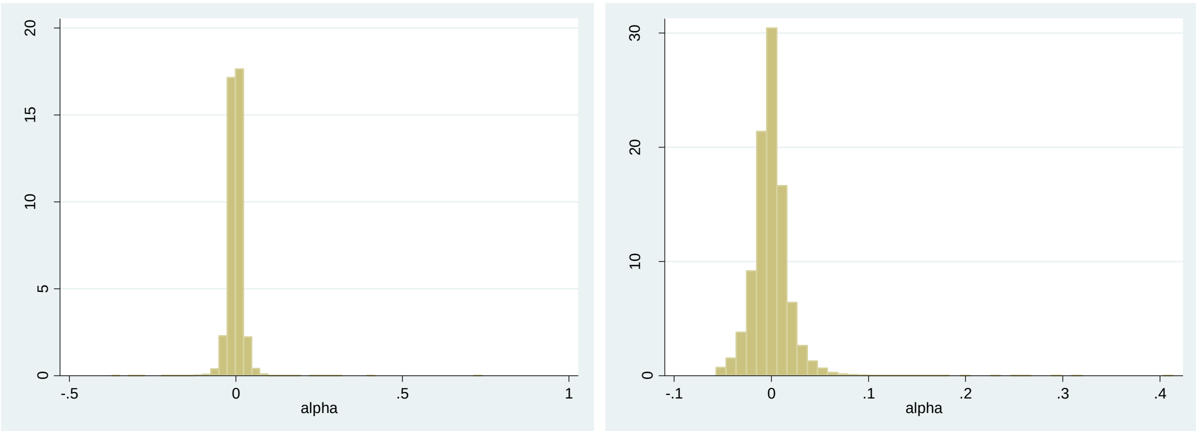
This table shows the values of the alphas net of fees and expenses by year occurring at various percentile breaks. Alphas are calculated using the difference between actual returns and expected benchmark returns. Expected benchmark returns are calculated each month from January 1990 to December 2013 using the prior 36 months of return data. Separate mean ALPHA distributions are listed for both the entire fund sample and every year in the sample. The weighted average alphas are calculated based on monthly net asset values. Also the percentage of positive alpha values for every year and the total sample are reported.

Consistent with Table 3, the distribution of alphas in the period 1990 till 2013 shows that mutual fund managers on average did not outperform expectations after subtraction of fees and expenses. This is shown in the weighted average, median and last column of Table 4. The table indicates that the mean monthly alpha for the median mutual fund is -0.11%. Furthermore, for almost all years in the sample, the median fund generated negative alphas varying from -24 basis points per month to -2 basis points, with the exception of the years

1993 (13 basis points), 2000 (93 basis points), and 2009 (64 basis points). Additionally, the overall percentage of mutual funds producing positive alphas was less than fifty percent. The weighted average alpha also confirms that over the full sample period the investigated mutual fund industry underperformed expectations.

The results reported in Table 4 have several important implications. First, the data shows that the average mutual fund manager failed to produce positive risk-adjusted returns, net of fees and expenses. However, it is important to note that not all of the mutual funds underperformed expectations in the period from 1990 till 2013. A substantial number of mutual funds did produce positive alphas. Overall, 46.43% of the funds produced positive alphas, with a maximum of 61.73% in 2009 and a minimum of 40.36% in 2013. The rewards to investors that are able to identify superior managers were substantial. The mean level of alphas at the 95th percentile in the overall sample was 285 basis points. Besides that, it should also be mentioned that the fifth percentile distribution of -305 basis points indicates the substantial benefit to investors that were able to avoid inferior mutual funds.

Figure 1 Distribution of monthly alphas



These graphs show the distribution of monthly alphas created by mutual funds in the period January 1990 till December 2013 in percentages. The left graph shows the (unwinsorized) distribution of all monthly alphas, while the graph on the right shows the winsorized distribution (at the 1% and 99% level) of the monthly alphas.

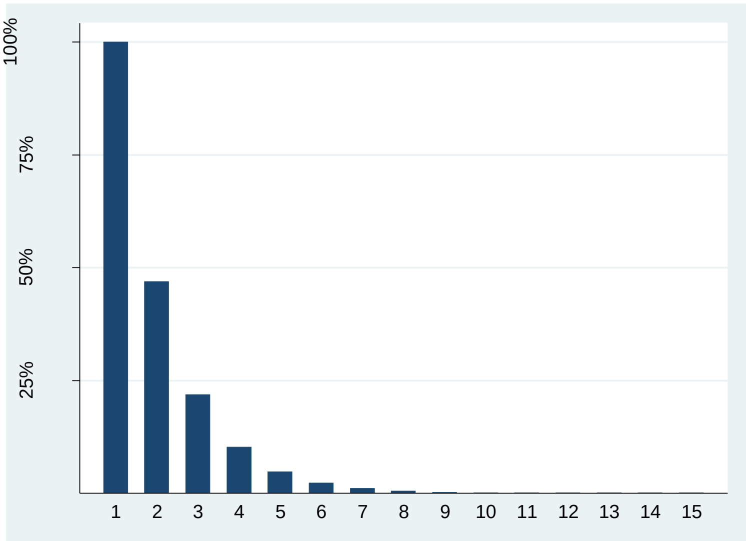
Figure 1 above also confirms the results from Table 4. In the graphs above it is clear that the distribution is clustered around zero, which is also in accordance with results from previous papers. Though, as is also stated by earlier research, the largest part of the distribution of alphas is at the negative side. This shows that mutual fund managers on average slightly underperform expectations, net of fees and expenses, and therefore, it seems more profitable to invest passively. Since outliers in monthly alphas influence results from the alpha regressions, monthly alphas are winsorized at the 1% and 99% level.

4.4 Performance persistency

The alphas generated by mutual funds are instructive, but what is even more important for investors is the persistence in these alphas. If there is some persistence in positive alphas, this might enable investors to predict future alphas by past performance, and identify superior mutual funds. To get a first impression of the persistence in positive alphas, Figure 2 shows the percentage of funds that not only produced positive monthly alphas in the first period, but also in the next periods.

Figure 2 indicates some persistence in positive monthly alphas, but this persistence is very limited. For the mutual funds that produced positive alphas in the first period, less than 50% also produced positive alphas in the second period. After two periods only less than 25% of the funds that outperformed in the first period, have also outperformed in the second and third period.

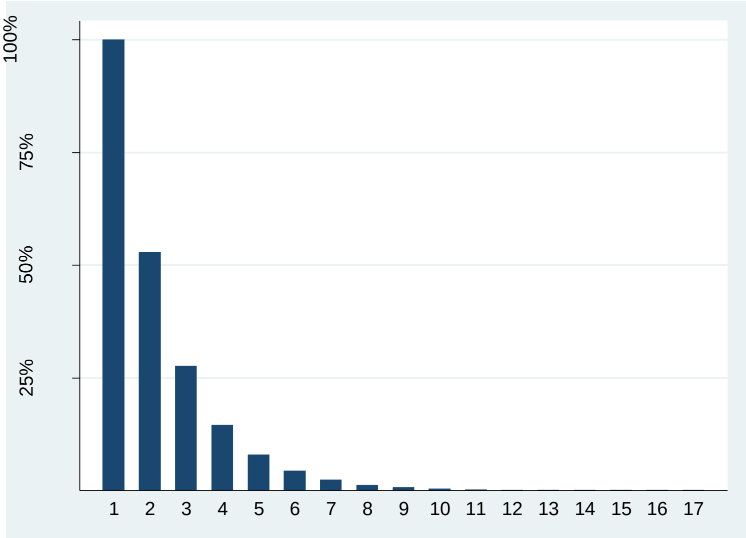
Figure 2 Persistence in positive monthly alphas



This graph shows the persistence in positive monthly alphas. The first bar represents the total number of positive alphas in one month. The second bar shows the percent of funds that generated positive alphas in at least two consecutive months. The third bar indicates the percent of funds that produced positive alphas in at least three consecutive months, and so on.

Not only persistence in positive alphas is important for investors, since it is also important to avoid inferior mutual funds. To get an impression of the persistence in negative alphas, Figure 3 shows the percentage of funds that not only produced negative monthly alphas in the first period, but also in the next periods.

Figure 3 Persistence in negative monthly alphas



This graph shows the persistence in negative monthly alphas. The first bar represents the total number of negative alphas in one month. The second bar shows the percent of funds that generated negative alphas in at least two consecutive months. The third bar indicates the percent of funds that produced negative alphas in at least three consecutive months, and so on.

As indicated in Figure 3, the persistence in negative monthly alphas is slightly higher than for positive monthly alphas. However, the persistence is still very limited. For the mutual funds that produced negative alphas in the first period, slightly more than 50% also produced negative alphas in the second period. After two periods only little more than 25% of the funds that outperformed in the first period, also outperformed in the second and third period.

The persistence in alphas may, however, be influenced by other variables like expense ratio, portfolio turnover ratio, assets under management, portfolio diversification, and return volatility. To get a more distinct relation between past and future alphas, future alphas are regressed using cross-sectional regressions on the three-year PALPHA and control variables. This is done for one-month, three-month, and twelve-month future alphas. The variable PALPHA as well as the n-period ALPHA's are averaged as monthly values. The regressions are corrected for fund and month clustering in alphas. Results are shown in Table 5.

Table 5 Predicting future alphas in the period 1990-2013: cross-sectional regressions

	Independent Variables							
	PALPHA	EXPR	ASSET	TURN	DIVERS	VOL	R^2	# of obs.
Panel A. One-month ALPHA as dependent variable								
Model 1	0.0103						0.0002	7,077
	(0.771)							
Model 2		-0.0120					0.0006	7,077
		(0.132)						
Model 3	0.0092	-0.0195					0.0007	7,077
	(0.798)	(0.168)						
Model 4	0.0072	-0.0236	0.0006	-0.0076	-0.0227	0.0110	0.0014	7,077
	(0.837)	(0.111)	(0.970)	(0.680)	(0.236)	(0.578)		
Panel B. Three-month ALPHA as dependent variable								
Model 1	0.0855						0.0089	6,613
	(0.001)							
Model 2		-0.0458					0.0026	6,613
		(0.004)						
Model 3	0.0833	-0.0414					0.0110	6,613
	(0.001)	(0.010)						
Model 4	0.0788	-0.0397	0.0073	-0.0168	-0.0281	-0.0021	0.0121	6,613
	(0.003)	(0.022)	(0.668)	(0.488)	(0.142)	(0.947)		
Panel C. Twelve-month ALPHA as dependent variable								
Model 1	0.0939						0.0111	4,757
	(0.004)							
Model 2		-0.0657					0.0045	4,757
		(0.000)						
Model 3	0.0912	-0.0610					0.0150	4,757
	(0.005)	(0.000)						
Model 4	0.0832	-0.0647	0.0032	-0.0381	-0.0736	-0.0122	0.0213	4,757
	(0.009)	(0.000)	(0.852)	(0.049)	(0.001)	(0.701)		

This table reports mean time-series values for a series of regression parameters estimated cross-sectionally using the Carhart (1997) four-factor model from equation (2). The regressions are corrected for fund and month clustering in alphas. The dependent monthly variable ALPHA is measured on a one-month, three-month, and twelve-month basis. PALPHA is the average monthly alpha over the past three-year period estimated for each fund on a given month in the period 1990 till 2013. The other variables are control variables. Expense ratio (EXPR), and portfolio turnover ratio (TURN) are measured as their past quarter values. The natural logarithm of assets under management (ASSET) is measured as the latest monthly value. The control variables level of diversification (DIVERS) and level of return volatility (VOL) are measured on the same three-year period as PALPHA. Each of the variables is standardized using the same method as in Brown et al. (1996). P-values of all the variables are listed between brackets under the parameters. R^2 and number of observations are listed on the right for each of the different regressions.

Model 1 in the three separate regressions in Table 5 examines the separate ability of PALPHA to predict future alphas, while model 2 focuses on the separate ability of EXPR to predict future alphas. Model 3 examines the combined explanatory power of PALPHA and EXPR, while model 4 also uses the remaining control variables ASSET, TURN, DIVERS, and VOL.

Results from Model 1 show a positive (0.0103) but insignificant relationship between PALPHA and the one-month future alpha. On the other hand, Model 1 shows a positive and significant relationship between PALPHA and the three-month and twelve-month future alphas (0.0855 and 0.0939, respectively). Model 2 shows a significant negative relationship between EXPR and future alphas for the regression models with three-month and twelve-month future alphas as dependent variable (-0.0458, and -0.0657, respectively). With the exception of the one-month future alpha model, Table 5 indicates that PALPHA is much more important as an explanatory variable than EXPR, which is shown by the relative magnitudes of the coefficients for Model 1 and Model 2 and their coefficients of determination.

Model 3 shows that when PALPHA and EXPR are combined, the coefficient of determination significantly increases, while the parameters of both variables do not change much in magnitude. The inclusion of the other control variables in Model 4 does not change the alpha persistence effect, nor the influence of expense ratio on future performance. Model 4, though, shows that the additional explanatory variables lead to significant increases in the forecasting ability of the three separate regression models. Those four additional factors (ASSET, TURN, DIVERS and VOL) are statistically insignificant in the one-month and three-month future alpha models when considered separately, which shows that only the combined impact of the control variables is considerable. In the twelve-month future alpha model the variables TURN and DIVERS show a significant and negative (-0.0381 and -0.0736, respectively) relationship with future alphas. Furthermore, the coefficient for one of the controls (VOL) changes sign when the one-month future alpha is used as the dependent variable. Only for the twelve-month future alpha as dependent variable, the variables TURN and DIVERS indicate a significant and negative relationship with future alphas. Univariate regressions of twelve-month FALPHA on TURN and DIVERS, which are not reported in Table 5, also produce robust negative parameters (p-values) of -0.0618 (0.002) and -0.0638 (0.004), respectively (see Appendix 3).

Overall, results from Table 5 show that mutual funds with superior past performance (PALPHA), a low expense ratio (EXPR), a low portfolio turnover ratio (TURN), and a low level of diversification (DIVERS) are the most likely to produce positive future alphas and outperform expectations. One possible explanation for the insignificance of PALPHA in the one-month regressions is that it is more difficult to predict significance on a short time period, which is caused by noise in alphas. Besides that, three and twelve-month explanatory power should economically be more important than one-month explanatory power. If only the one-month regressions would show a significant effect, that would mean that an investor needs to switch to another mutual fund every month.

As an additional check, the regression models from Table 5 are also examined using a logit model in which ALPHA is transformed in a binary variable. These logit regressions reduce the potential influence of alpha outliers, since the dependent variable is not the actual future alpha, but takes the value of one if the forecasted alpha in a given period is positive and zero otherwise. Table 6 summarizes the results.

Table 6 Predicting future alphas in the period 1990-2013: logit regressions

		Independent Variables							
	Intercept	PALPHA	EXPR	ASSET	TURN	DIVERS	VOL	Chi-square	# of obs.
Panel A. Sign of one-month ALPHA as dependent variable									
Model 1	-0.1272	0.0437						3.1800	7,077
	(0.000)	(0.075)						(0.075)	
Model 2	-0.1274		-0.0574					5.7500	7,077
	(0.000)		(0.017)					(0.017)	
Model 3	-0.1276	0.0405	-0.0551					8.4800	7,077
	(0.000)	(0.099)	(0.022)					(0.014)	
Model 4	-0.1219	0.0360	-0.0703	-0.0104	-0.0237	-0.0556	0.0282	13.5400	7,077
	(0.000)	(0.150)	(0.014)	(0.708)	(0.352)	(0.060)	(0.254)	(0.014)	
Panel B. Sign of three-month ALPHA as dependent variable									
Model 1	-0.2981	0.1437						31.3300	6,613
	(0.000)	(0.000)						(0.000)	
Model 2	-0.2971		-0.0721					8.2200	6,613
	(0.000)		(0.004)					(0.004)	
Model 3	-0.2993	0.1407	-0.0655					38.0700	6,613
	(0.000)	(0.000)	(0.010)					(0.000)	
Model 4	-0.2832	0.1276	-0.0879	-0.0091	-0.0305	-0.1241	-0.0043	57.1200	6,613
	(0.000)	(0.000)	(0.004)	(0.756)	(0.258)	(0.000)	(0.869)	(0.000)	
Panel C. Sign of twelve-month ALPHA as dependent variable									
Model 1	-0.4772	0.1357						23.2400	4,757
	(0.000)	(0.000)						(0.000)	
Model 2	-0.4761		-0.0746					6.0000	4,757
	(0.000)		(0.015)					(0.014)	
Model 3	-0.4807	0.1336	-0.0690					28.3400	4,757
	(0.000)	(0.000)	(0.024)					(0.000)	
Model 4	-0.4538	0.1108	-0.1219	-0.0197	-0.1111	-0.2937	0.0341	106.9300	4,757
	(0.000)	(0.000)	(0.001)	(0.575)	(0.001)	(0.000)	(0.251)	(0.000)	

This table reports mean time-series values for a series of regression parameters for a logit analysis estimated using the Carhart (1997) four-factor model from equation (2). The dependent variable ALPHA is measured on a one-month, three-month, and twelve-month basis. ALPHA takes the value of one if the risk-adjusted future alpha (FALPHA) is positive, and zero otherwise. PALPHA is the three-year period past alpha estimated for each fund on a given month in the period 1990 till 2013. The other variables are control variables. Expense ratio (EXPR), and portfolio turnover ratio (TURN) are measured as their past quarter values. Assets under management (ASSET) is measured as the latest monthly value. The control variables level of diversification (DIVERS) and level of return volatility (VOL) are measured on the same three-year period as PALPHA. Each of the explanatory variables is standardized using the same method as in Brown et al. (1996). P-values of all the variables are listed between brackets under the parameters. Chi-square and number of observations are listed on the right for each of the different regressions.

First of all, Table 6 shows that PALPHA has a positive influence on future alphas, although this relationship is not significant for Model 4 with the sign of one-month alpha as dependent variable. EXPR once again negatively and significantly (at least at the five percent level) influences future alphas for each of the different future periods. Table 6 also indicates that three-year period past alpha has more explanatory power than expense ratio, except for the sign of one-month alpha as dependent variable. Of the remaining control variables DIVERS once again seems to be the most reliable, as it consistently shows a negative sign, and is significant for each of the three future alphas periods (at the ten percent level for the sign of one-month alpha as dependent variable and one percent level for the sign of three-month and twelve month alpha as dependent variable). The control variable ASSET shows a negative sign, but is not significant for each of the models, while VOL shows changing signs and is not significant as well. TURN, on the other hand, has a negative influence on future alphas, but this influence is only significant for the regression with the sign of twelve-month alpha as dependent variable. The marginal fixed effects (p-values) of PALPHA in the regressions with sign of one-month, three-month, and twelve-month alphas as dependent variable in Model 1 are respectively 0.0109 (0.075), 0.0351 (0.000), and 0.0321 (0.000). This indicates that a one percent change in PALPHA leads to a 1.09, 3.51, and 3.21 percent higher chance of getting a positive future alpha at respectively the sign of one-month, three-month, and twelve-month alpha as dependent variable. Overall, Table 6 shows that mutual funds with a positive three-year period past alpha, low expense ratio, low portfolio turnover ratio and low level of diversification are most likely to generate superior future alphas. This is in accordance with results from the cross-sectional regressions in Table 5.

4.5 Recessions versus expansions

Since previous papers do not provide consistent results about market timing skills of mutual fund managers, in this section the alphas generated in expansion and recession periods are compared. Most of the existing research shows that there is some evidence of stock-picking ability among fund managers in expansion periods, but that there is little evidence for market timing in recession periods. More recent studies, though, not only find evidence that successful managers pick stocks well in expansion periods, but also time the market well in recessions. One possible explanation for this contradiction might be the small fraction of recession periods in earlier samples. To test mutual fund managers' skills in expansion and recession periods, the difference between alphas in these periods is examined using a two-sided group t-test. Results are reported in Table 7.

Table 7 Differences in alphas between expansion and recession periods

Group	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	33,372	-0.00115	0.00011	0.02005	-0.00137	-0.00094
1	5,276	-0.00120	0.00034	0.02446	-0.00186	-0.00054
Combined	38,648	-0.00116	0.00011	0.02071	-0.00137	-0.00095
Diff		0.00005	0.00031		-0.00055	0.00065
Diff = mean(0) – mean (1)						t = 0.1578
H0: diff = 0					Degrees of freedom = 38,646	

This table shows the results from the two-sided t-test on monthly alphas. Group 0 represents the months in expansion periods, while group 1 represents the months in recession periods. The number of degrees of freedom is 38,646, while the resulting t-statistic is 0.1578.

Table 7 shows that the mean monthly alpha for both expansion (group 0) and recession periods (group 1) is negative. The total number of alphas used in this differences in means t-test is 38,648, from which 33,372 alphas are generated in expansion periods and 5,276 in recession periods. The mean monthly alpha for expansion periods is -0.00115, while the mean monthly alpha for recession periods is slightly more negative, namely -0.00120. The difference between these two means is only 0.00005, which results in a t-statistic of 0.1578. With 38,646 degrees of freedom, this results in a five percent significance value of 1.96, where the test is whether the difference between those means is different from zero. The t-statistic of 0.1578 is lower than the five percent significance value of 1.96 and, therefore, results from Table 7 do not indicate that the difference in alphas generated in expansion and recession periods is significantly different from zero.

Although the mean monthly alpha is slightly more negative in recession periods than in expansion periods, the two-sided group t-test does not indicate that mutual fund managers have more skills in expansion periods than in recession periods. The hypothesis that monthly alphas in expansion and recession periods are significantly different from each other is rejected, because the t-statistic of 0.1578 is lower than the five percent significance value 1.96. Since small funds and monthly clustering in alphas may influence the outcomes in Table 7, the two-sided t-test is also done on the monthly value-weighted average alphas. Results are shown in Table 8 below.

Table 8 Differences in value-weighted alphas between expansion and recession periods

Group	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	254	-0.00042	0.00022	0.00350	-0.00085	0.00002
1	34	-0.00023	0.00108	0.00631	-0.00243	0.00197
Combined	288	-0.00039	0.00023	0.00392	-0.00085	0.00006
Diff		-0.00019	0.00072		-0.00160	0.00006
Diff = mean(0) – mean (1)						t = -0.2633
H0: diff = 0						Degrees of freedom = 286

This table shows the results from the two-sided t-test on monthly value-weighted average alphas. Group 0 represents the months in expansion periods, while group 1 represents the months in recession periods. The number of degrees of freedom is 288, while the resulting t-statistic is -0.2633.

Table 8 once again shows that the mean monthly value-weighted average alpha for both expansion (group 0) and recession periods (group 1) is negative. The total number of average monthly alphas used in this differences in means t-test is 288, from which 254 are expansion months and 34 are recession months. The mean monthly value-weighted average alpha for expansion periods is -0.00042, while the mean monthly value-weighted alpha for recession periods is less negative, namely -0.00023. The difference between these two means is -0.00019, which results in a t-statistic of -0.2633. With 286 degrees of freedom, this results in a five percent significance value of -1.96, where the test is whether the difference between those means is different from zero. The t-statistic of -0.2633 is smaller (less negative) than the five percent significance value of -1.96 and, therefore, results from Table 8 do not indicate that the difference between value-weighted average alphas generated in expansion and recession months is significantly different from zero.

Although alphas generated in recession and expansion periods are not significantly different, the effect of the dependent variables may differ in different economic times. Therefore, a cross-sectional regression with interaction terms between the dependent variables and the NBER based recession dummy is done. Results are shown in Table 9.

Table 9 Predicting future alphas in the period 1990-2013: cross-sectional regressions with interaction terms

	Independent Variables													
	PALPHA	C.PALPHA	EXPR	C.EXPR	ASSET	C.ASSET	TURN	C.TURN	DIVERS	C.DIVERS	VOL	C.VOL	R^2	# of Obs.
Panel A. One-month ALPHA as dependent variable														
Model 1	0.0567	-0.2048											0.0108	7,077
	(0.016)	(0.001)												
Model 2			-0.0086	-0.0745									0.0017	7,077
			(0.512)	(0.019)										
Model 3	0.0564	-0.2083	-0.0054	-0.0865									0.0128	7,077
	(0.018)	(0.001)	(0.684)	(0.010)										
Model 4	0.0521	-0.2026	-0.0106	-0.0886	-0.0053	0.0153	-0.0233	0.1025	-0.0292	0.0764	0.0093	0.0537	0.0172	7,077
	(0.035)	(0.001)	(0.401)	(0.128)	(0.682)	(0.815)	(0.084)	(0.198)	(0.130)	(0.251)	(0.644)	(0.504)		
Panel B. Three-month ALPHA as dependent variable														
Model 1	0.1116	-0.1153											0.0118	6,613
	(0.000)	(0.065)												
Model 2			-0.0357	-0.0715									0.0034	6,613
			(0.009)	(0.167)										
Model 3	0.1098	-0.1169	-0.0298	-0.0777									0.0147	6,613
	(0.000)	(0.053)	(0.039)	(0.119)										
Model 4	0.1063	-0.1076	-0.0319	-0.0579	-0.0022	0.0637	-0.0236	0.0542	-0.0200	-0.0503	0.0098	-0.0879	0.0174	6,613
	(0.000)	(0.095)	(0.059)	(0.275)	(0.884)	(0.437)	(0.263)	(0.591)	(0.335)	(0.273)	(0.770)	(0.431)		
Panel B. Twelve-month ALPHA as dependent variable														
Model 1	0.0889	0.0212											0.0112	4,757
	(0.021)	(0.728)												
Model 2			-0.0645	-0.0092									0.0046	4,757
			(0.000)	(0.855)										
Model 3	0.0859	0.0226	-0.0601	-0.0083									0.0151	4,757
	(0.024)	(0.703)	(0.000)	(0.857)										
Model 4	0.0725	0.0378	-0.0647	0.0081	-0.0057	0.0796	-0.0602	0.1700	-0.0842	0.1166	-0.0227	0.0744	0.0277	4,757
	(0.043)	(0.596)	(0.001)	(0.853)	(0.738)	(0.256)	(0.002)	(0.019)	(0.000)	(0.124)	(0.487)	(0.486)		

This table reports mean time-series values for a series of regression parameters with interaction terms with the NBER based recession dummy estimated cross-sectionally using the Carhart (1997) four-factor model from equation (2). The regressions are corrected for fund and month clustering in alphas. The dependent monthly variable ALPHA is measured on a one-month, three-month, and twelve-month basis. PALPHA is the average monthly alpha over the past three-year period estimated for each fund on a given month in the period 1990 till 2013. The other variables are control variables. Expense ratio (EXPR), and portfolio turnover ratio (TURN) are measured as their past quarter values. Assets under management (ASSET) is measured as the latest monthly value. The control variables level of diversification (DIVERS) and level of return volatility (VOL) are measured on the same three-year period as PALPHA. The variables C.PALPHA, C.EXPR, C. ASSET, C.TURN, C.DIVERS, and C.VOL are interaction terms between the corresponding variable and the NBER based recession dummy for the past month. Each of the variables is standardized using the same method as in Brown et al. (1996). P-values of all the variables are listed between brackets under the parameters. R^2 and the number of observations are listed on the right for each of the different regression models.

Consistent with results from the cross-sectional regressions in section 4.4, Table 9 shows that PALPHA has a significant and positive effect on future alphas. However, when interaction terms with the NBER based recession indicator are added, PALPHA becomes also significant for the regressions with one-month alpha as dependent variable. Both for the one-month (at the one percent level) and three-month alpha (at the ten percent level), the interaction term between PALPHA and the NBER based recession indicator is negative and significant. This implies that in recession periods mutual funds that on average produced positive alphas in the past three years, are likely to produce smaller alphas (or more negative alphas) than funds that on average produced negative alphas in the past 36 months. For the twelve-month alpha as dependent variable, the interaction between PALPHA and the NBER based recession indicator is positive, but insignificant.

Table 9 shows that EXPR once again has a negative influence on future alphas. EXPR is not significant for regressions with one-month alpha as dependent variable. The interaction term between EXPR and the NBER based recession indicator is also negative for each of the three periods, but only significant for Model 2 and 3 in the regressions with one-month alpha as dependent variable. The magnitude of this interaction term is about eight times as high as the magnitude of EXPR for the one-month regressions. This indicates that in recession periods, funds with high expense ratios are much more likely to generate lower (or more negative) alphas in the next month than funds with high expense ratios in expansion periods. For the three-month and twelve-month alpha as dependent variable, the interaction term between EXPR and the NBER based recession indicator is not significant.

Both ASSET and ASSET in interaction with the NBER based recession indicator are not significant for each of the three regression periods. However, in contrast with the cross-sectional regressions in section 4.4, ASSET now has a negative effect on future alphas for each of the three periods. The interaction term with the NBER based recession indicator on the other hand, has a positive (but insignificant) influence on future alphas. This would imply that in recession periods, large mutual funds are more likely to produce positive alphas, while in regression periods they are more likely to perform worse than small mutual funds. Since these variables are not significant, this interpretation should be taken carefully.

In accordance with the cross-sectional regressions in section 4.4, TURN has a negative influence on future alphas. This influence, though, is now also significant at the ten percent level for the regression with one-month alpha as dependent variable, and significant at the five percent level for the regression with twelve-month alpha as dependent variable. The interaction term with the NBER based recession indicator is positive for each of the three regression periods, but only significant for the regression with twelve-month alpha as dependent variable. This indicates that funds with higher portfolio turnover ratios are more likely to produce higher alphas in recession periods, but are also more likely to underperform in expansion periods.

DIVERS once again has a negative impact on future performance, which is only significant at the one percent level for the regression with twelve-month alpha as dependent variable. The interaction term with the NBER based recession indicator, however, is insignificant and does not have a consistent sign for the three different regression periods. Therefore, not much can be concluded about the effect of level of diversification in recession periods. VOL and its interaction term with the NBER based recession indicator both are not significant and do not give a consistent sign for the three different regression periods. Not much, thus, can be said about the influence of volatility in both recession and expansion periods.

5 Conclusion and summary

The aim of this thesis is to investigate whether mutual fund managers in the United States in the period 1990 till 2013 have skills. Much prior research examined mutual fund performance, but this paper looks at more recent data and also differs between different economic times. Not only the difference in alphas between recessions and expansions is measured, but also the difference in explanatory power of the dependent variables. Therefore, the difference in persistence of alphas between recession and expansion periods is investigated using a regression with interaction terms with the NBER based regression indicator. This study has three main objectives. First, it tries to determine whether mutual funds produce positive monthly alphas. Second, the persistence in these alphas is measured using different regression models. And finally, the differences in alphas and explanatory power of the different dependent variables are examined between different economic times.

First, alphas are calculated by differencing between actual return and expected benchmark returns, calculated using the Carhart (1997) four-factor model. For this regression 75,515 observations are used. Previous research shows that active funds in general are not able to outperform passive benchmarks. Although some papers find little evidence of outperformance, most of this outperformance disappears after subtracting the fees and expenses related to mutual funds. This study finds similar results, as the distribution of alphas in the period 1990 till 2013 shows that mutual fund managers on average did not outperform benchmark portfolios. Overall, the median mutual fund generates a monthly alpha of -0.11%, while the value-weighted average of the monthly alphas generated by all mutual funds in the full sample period was -0.07%. Furthermore, only 46.43% of the monthly alphas were positive. The realised abnormal returns are widely spread. The mean level of alphas at the 95th percentile was 285 basis points, while the mean level of alphas at the fifth percentile was -305 basis points. The distribution of alpha shows that it is clustered around zero, but that the largest part of the distribution is at the negative side.

Second, this thesis measures persistence in mutual fund performance on a sample with 7,077 observations. Previous results on persistence are not consistent. Most of the existing research indicates that mutual funds are not able to persistently outperform passive benchmarks, but some papers find slight persistence. Persistence in both positive and negative monthly alphas is very limited; though for negative monthly alphas persistence is slightly higher. Cross-sectional regressions on past alpha (PALPHA) and several control variables show that for regressions with one-month, three-month, as well as twelve-month alpha as dependent variables, PALPHA has a positive effect on future alphas. Furthermore, these cross-sectional regressions show that expense ratio (EXPR) has a negative effect on future alphas. Of the other control variables only portfolio turnover ratio and level of diversification have a significant (and negative) effect on future alphas. Logit regressions on the same three regression periods once again show the same results for PALPHA, EXPR, TURN and DIVERS. For both the cross-sectional and the logit regressions PALPHA seems to have the most explanatory power (with the exception of the regressions with one-month alpha as dependent variable, since in those regressions EXPR has the most explanatory power). Both the cross-sectional and logit regressions show that mutual funds with a positive three-year period past alpha, low expense ratio, low portfolio turnover ratio and low level of diversification are most likely to generate superior future alphas.

Finally, the effect of different economic times on mutual fund performance and persistence is measured. Most of the existing research shows that there is some evidence of stock-picking ability among fund managers in expansion periods, but that there is little evidence for market timing in recession periods. Therefore, mutual funds would not be able to outperform in recessions. More recent studies, though, not only find evidence that successful managers pick stocks well in expansion periods, but also time the market well in recessions. Two-sided t-tests on the differences in both the arithmetic and value-weighted mean of monthly alphas between expansion and recession periods show that alphas generated in recession periods are not significantly different from alphas generated in expansion periods. In both periods the mean monthly alpha is negative, but the arithmetic average t-test shows that recession periods have little more negative alphas, while the value-weighted monthly average t-test shows that expansion periods have little more negative alphas. Therefore, the t-tests do not indicate that mutual fund managers have more skills in expansion periods than in recession periods. Regressions with interaction terms between the dependent variables and the NBER based recession indicator show that in recession periods mutual funds that on average produced positive alphas in the past three years, are likely to produce smaller alphas (or more negative alphas) than funds that on average produced negative alphas in the past 36 months. This in in contrast with expansion periods, as PALPHA has a significant and positive influence on future alphas in the cross-sectional regressions. The interaction term between EXPR and the NBER based recession indicator is negative, while the magnitude of this interaction term is about eight times as high as the magnitude of EXPR on itself for the one-month regressions. This indicates that in recession periods, funds with high expense ratios are much more likely to generate lower (or more negative) alphas in the next month than funds with high expense ratios in expansion periods. The interaction term between TURN and the NBER based recession indicator is positive, which indicates that funds with higher portfolio turnover ratios are more likely to produce higher alphas in recession periods, but on the other hand are also more likely to underperform in expansion periods. The other control variables, including DIVERS, do not seem to have a significant influence on future alphas in recession periods. Therefore, the regressions show that in expansion periods mutual funds with a positive three-year period past alpha, low expense ratio, low portfolio turnover ratio and low level of diversification are most likely to generate superior future alphas. In recession periods, on the other hand, mutual funds with a negative three-year period past alpha, low expense ratio, and high portfolio turnover ratio are most likely to generate superior future alphas.

Results from this thesis are limited, since only the mutual funds from the Petajisto (2013), who looks at the timespan from 1990 till 2009, sample are used. This creates a gap in the year 2010, since the return regression requires funds to have at least 36 months of data. Therefore, funds that were established in the year 2010 and existed for at least three years are missing in the used sample. This limitation is caused by the need of the MFLINKS database, to which Tilburg University does not have access to. This database is needed to create a link between CRSP_fundno (fund ID in CRSP) and fundno (fund ID in the Thomson Reuters database). Therefore, future studies may also add those funds to the data. Furthermore, future research may calculate alphas with more different measures to test the robustness of the results from this study and differentiate between stock-picking and market timing skills.

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Appendix 1 NBER Based Recession Dummies

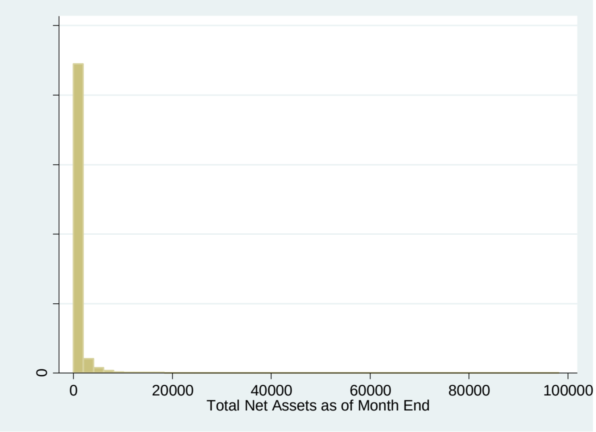
Monthly NBER Based Recession Dummies							
Month	Recession	Month	Recession	Month	Recession	Month	Recession
1990-01-01	0	1996-01-01	0	2002-01-01	0	2008-01-01	1
1990-02-01	0	1996-02-01	0	2002-02-01	0	2008-02-01	1
1990-03-01	0	1996-03-01	0	2002-03-01	0	2008-03-01	1
1990-04-01	0	1996-04-01	0	2002-04-01	0	2008-04-01	1
1990-05-01	0	1996-05-01	0	2002-05-01	0	2008-05-01	1
1990-06-01	0	1996-06-01	0	2002-06-01	0	2008-06-01	1
1990-07-01	0	1996-07-01	0	2002-07-01	0	2008-07-01	1
1990-08-01	1	1996-08-01	0	2002-08-01	0	2008-08-01	1
1990-09-01	1	1996-09-01	0	2002-09-01	0	2008-09-01	1
1990-10-01	1	1996-10-01	0	2002-10-01	0	2008-10-01	1
1990-11-01	1	1996-11-01	0	2002-11-01	0	2008-11-01	1
1990-12-01	1	1996-12-01	0	2002-12-01	0	2008-12-01	1
1991-01-01	1	1997-01-01	0	2003-01-01	0	2009-01-01	1
1991-02-01	1	1997-02-01	0	2003-02-01	0	2009-02-01	1
1991-03-01	1	1997-03-01	0	2003-03-01	0	2009-03-01	1
1991-04-01	0	1997-04-01	0	2003-04-01	0	2009-04-01	1
1991-05-01	0	1997-05-01	0	2003-05-01	0	2009-05-01	1
1991-06-01	0	1997-06-01	0	2003-06-01	0	2009-06-01	1
1991-07-01	0	1997-07-01	0	2003-07-01	0	2009-07-01	0
1991-08-01	0	1997-08-01	0	2003-08-01	0	2009-08-01	0
1991-09-01	0	1997-09-01	0	2003-09-01	0	2009-09-01	0
1991-10-01	0	1997-10-01	0	2003-10-01	0	2009-10-01	0
1991-11-01	0	1997-11-01	0	2003-11-01	0	2009-11-01	0
1991-12-01	0	1997-12-01	0	2003-12-01	0	2009-12-01	0
1992-01-01	0	1998-01-01	0	2004-01-01	0	2010-01-01	0
1992-02-01	0	1998-02-01	0	2004-02-01	0	2010-02-01	0
1992-03-01	0	1998-03-01	0	2004-03-01	0	2010-03-01	0
1992-04-01	0	1998-04-01	0	2004-04-01	0	2010-04-01	0
1992-05-01	0	1998-05-01	0	2004-05-01	0	2010-05-01	0
1992-06-01	0	1998-06-01	0	2004-06-01	0	2010-06-01	0
1992-07-01	0	1998-07-01	0	2004-07-01	0	2010-07-01	0
1992-08-01	0	1998-08-01	0	2004-08-01	0	2010-08-01	0
1992-09-01	0	1998-09-01	0	2004-09-01	0	2010-09-01	0
1992-10-01	0	1998-10-01	0	2004-10-01	0	2010-10-01	0
1992-11-01	0	1998-11-01	0	2004-11-01	0	2010-11-01	0
1992-12-01	0	1998-12-01	0	2004-12-01	0	2010-12-01	0
1993-01-01	0	1999-01-01	0	2005-01-01	0	2011-01-01	0
1993-02-01	0	1999-02-01	0	2005-02-01	0	2011-02-01	0
1993-03-01	0	1999-03-01	0	2005-03-01	0	2011-03-01	0
1993-04-01	0	1999-04-01	0	2005-04-01	0	2011-04-01	0
1993-05-01	0	1999-05-01	0	2005-05-01	0	2011-05-01	0
1993-06-01	0	1999-06-01	0	2005-06-01	0	2011-06-01	0
1993-07-01	0	1999-07-01	0	2005-07-01	0	2011-07-01	0
1993-08-01	0	1999-08-01	0	2005-08-01	0	2011-08-01	0
1993-09-01	0	1999-09-01	0	2005-09-01	0	2011-09-01	0
1993-10-01	0	1999-10-01	0	2005-10-01	0	2011-10-01	0
1993-11-01	0	1999-11-01	0	2005-11-01	0	2011-11-01	0
1993-12-01	0	1999-12-01	0	2005-12-01	0	2011-12-01	0
1994-01-01	0	2000-01-01	0	2006-01-01	0	2012-01-01	0
1994-02-01	0	2000-02-01	0	2006-02-01	0	2012-02-01	0

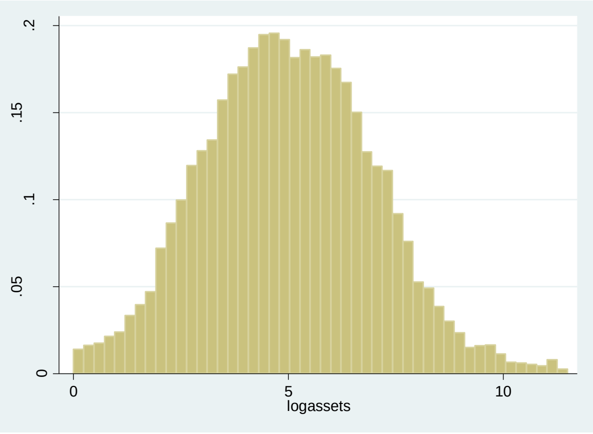
1994-03-01	0	2000-03-01	0	2006-03-01	0	2012-03-01	0
1994-04-01	0	2000-04-01	0	2006-04-01	0	2012-04-01	0
1994-05-01	0	2000-05-01	0	2006-05-01	0	2012-05-01	0
1994-06-01	0	2000-06-01	0	2006-06-01	0	2012-06-01	0
1994-07-01	0	2000-07-01	0	2006-07-01	0	2012-07-01	0
1994-08-01	0	2000-08-01	0	2006-08-01	0	2012-08-01	0
1994-09-01	0	2000-09-01	0	2006-09-01	0	2012-09-01	0
1994-10-01	0	2000-10-01	0	2006-10-01	0	2012-10-01	0
1994-11-01	0	2000-11-01	0	2006-11-01	0	2012-11-01	0
1994-12-01	0	2000-12-01	0	2006-12-01	0	2012-12-01	0
1995-01-01	0	2001-01-01	0	2007-01-01	0	2013-01-01	0
1995-02-01	0	2001-02-01	0	2007-02-01	0	2013-02-01	0
1995-03-01	0	2001-03-01	0	2007-03-01	0	2013-03-01	0
1995-04-01	0	2001-04-01	1	2007-04-01	0	2013-04-01	0
1995-05-01	0	2001-05-01	1	2007-05-01	0	2013-05-01	0
1995-06-01	0	2001-06-01	1	2007-06-01	0	2013-06-01	0
1995-07-01	0	2001-07-01	1	2007-07-01	0	2013-07-01	0
1995-08-01	0	2001-08-01	1	2007-08-01	0	2013-08-01	0
1995-09-01	0	2001-09-01	1	2007-09-01	0	2013-09-01	0
1995-10-01	0	2001-10-01	1	2007-10-01	0	2013-10-01	0
1995-11-01	0	2001-11-01	1	2007-11-01	0	2013-11-01	0
1995-12-01	0	2001-12-01	0	2007-12-01	0	2013-12-01	0

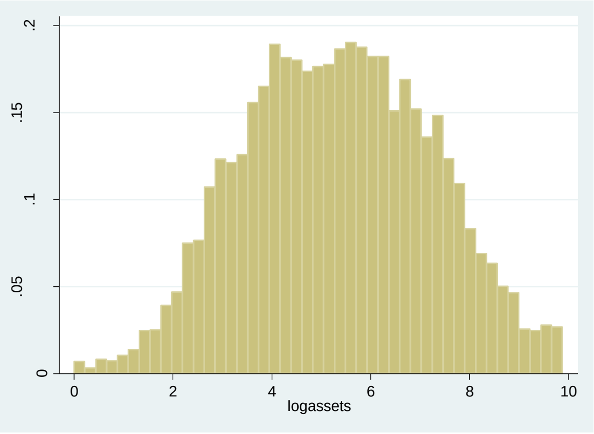
This table shows which months are indicated as recession months by the NBER Based Recession Indicator for the United States. In total there are 34 recession months (indicated with a 1) and 254 expansion months (indicated with a 0).

Appendix 2 Distributions of winsorized variables

Appendix 2a Assets under management

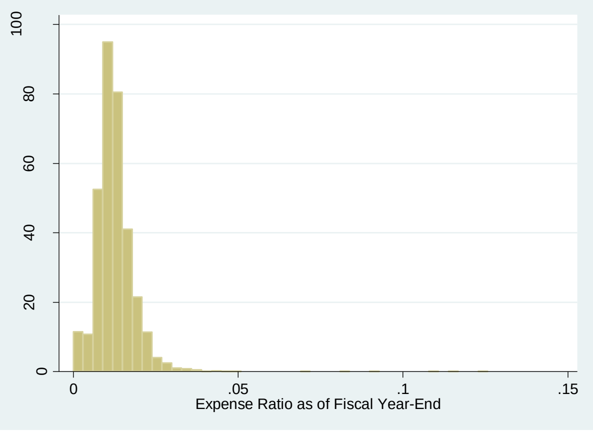


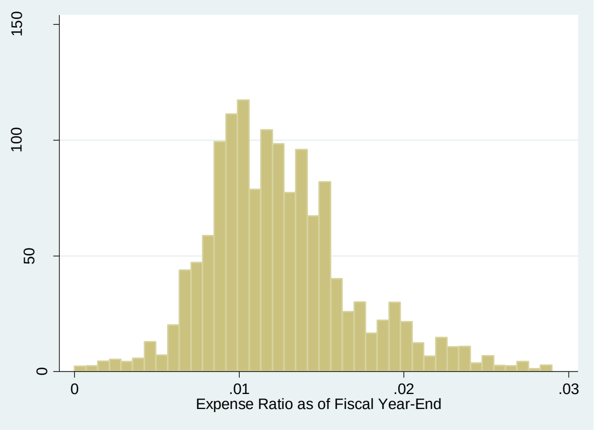




These graphs show the distribution of the variable assets under management before and after winzorizing the upper one percent (99%). The upper graph shows the distribution before winsorizing, while the graph below shows the distribution of the natural logarithm of assets under management and the graph on the right shows the distribution of the natural logarithm of assets under management after winsorizing the upper 99%.

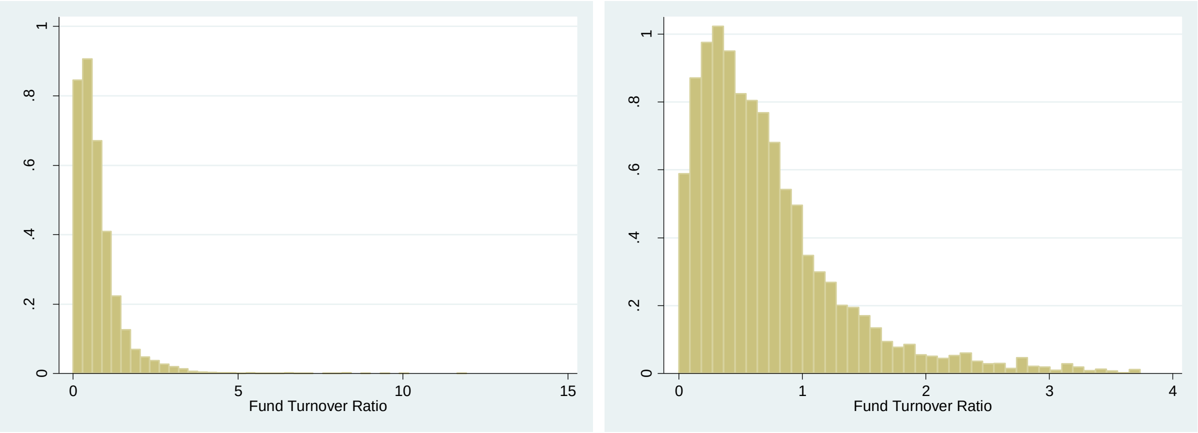
Appendix 2b Expense ratio





These graphs show the distribution of the variable expense ratio before and after winzorizing the upper one percent (99%). The left graph shows the distribution before winsorizing, while the graph on the right shows the distribution after winsorizing.

Appendix 2c Portfolio turnover ratio



These graphs show the distribution of the variable portfolio turnover ratio before and after winzorizing the upper one percent (99%). The left graph shows the distribution before winsorizing, while the graph on the right shows the distribution after winsorizing.

Appendix 3 Univariate regressions of twelve-month ALPHA on TURN and DIVERS

	Independent Variables			
	TURN	DIVERS	R^2	# of obs.
Model 1	-0.0618 (0.002)		0.0038	4,757
Model 2		-0.0638 (0.004)	0.0034	4,757

This table reports mean time-series values for a series of regression parameters estimated cross-sectionally using the Carhart (1997) four-factor model from equation (2). The regressions are corrected for fund and month clustering in alphas. The dependent monthly variable ALPHA is measured on a twelve-month basis. Portfolio turnover ratio (TURN) is measured as its past quarter value, while level of diversification (DIVERS) is measured on the past three-year period. Each of the variables is standardized using the same method as in Brown et al. (1996). P-values of all the variables are listed between brackets under the parameters. R^2 and the number of observations are listed on the right for each of the different regressions.