ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Master Thesis [Financial Economics]

What is the influence of extreme positive payoffs on the value a mutual fund adds in the future.

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Abstract:

In this paper we investigate the role of extreme positive payoffs on the value which is added to a mutual fund in the subsequent month. We observe a positive relation between past extreme payoffs, which are a proxy for stock picking skills, measured by Max and future skill which is measured by AddedValue. This relationship is robust controlling for various fund characteristics and different measures of Max. While it is also still present when taking different time periods into account, as well as using the Skill ratio as skill measure.

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Introduction

With a total size of 21.29 trillion U.S. dollars, the mutual fund market based in the United States is immense. This enormous amount of money is invested by nearly 8,000 mutual funds who are active in the United States (Szmigiera, 2019). To choose out of these 8,000 different funds can be quite difficult. For the 46 percent of the United States households holding mutual fund assets it is important to choose the right mutual funds to invest in. It is convenient for investors if they observe fund characteristics which indicate which fund to invest in and which fund to stay as clear as possible from. Max is one of these characteristics. Max is the maximum style adjusted monthly return over the past twelve months of a mutual fund. Max measures thus the extreme payoffs of a mutual fund corrected for the style in which this fund is invested in. This concept is clearly understandable for investors, while this information is also easily accessible because many financial websites offer lists of the recent winners and losers.

The main research question is what is the influence of extreme payoffs measured by Max, on the AddedValue by mutual fund managers. In this research we can argue that Max is a proxy for the stock picking skills of a manager which are hard to observe in itself. If Max is a proxy for the stock picking skills of a manager and the AddedValue measure is a proxy for the skill of that manager. In that case we can broaden the research question to; Does a higher stock picking skill now predict more managerial skill in the future. In this paper we research this question by making use of the following hypothesis; Funds with a higher Max measure add less value in the subsequent month. This is done by performing a series of Fama-MacBeth regressions. Where Max is altered to check for robustness of the results. Robustness is also controlled for by controlling for size, time in the future and altering the AddedValue measure.

While there is still a debate present in the economic circles there is evidence present that there is at least some skill present in the mutual fund market. Grinblatt and Titman find that the risk-adjusted gross returns of some funds are significantly positive (Grinblatt & Titman, 1989). And while the persistence in performance is sometimes missing this does not need to mean that there is no difference between the different managers observable (Berk & Green, 2004). While skill is often measured using return-based variables like gross or net return. The returns-based measure only truly measure skill if all the funds have the same size. Skill should be measured as a value. If it is measured in that way skill can be persistent up until ten year (Berk & van Binsbergen, 2015).
One of the important parts of cumulative prospect theory is that people have subjective probabilities. This means that the changes of payoffs are not the same for all the investors. The main consequence of the subjective probabilities is that individuals overweight the extreme probabilities

of any decision he or she faces (Barberis, Mukherjee, & Wang, 2016). These subjective probabilities are also present by investors. This makes that investors are likely to be attracted to lottery like payoff investments. These lottery like pay offs makes these investments earn negative excess returns (Barberis & Huang, 2008). The attraction for extreme payoffs is measured using the Max measure. This because not the volatility or skewness per se that is important for the investors. But the attraction to extreme positive states (Brunnermeier, Gollier, & Parker, 2007). Max is defined as the maximum style adjusted monthly return over the past twelve months of a mutual fund.
Skill is measured in this paper as AddedValue, this is the excess returns a mutual fund obtains over the benchmark, times the size of the fund in the previous time period (Berk & van Binsbergen, 2015). Where the benchmark is formulated as the Carhart four factor model. Which includes parameters for market return, size, book-to-market ratio and momentum (Carhart, 1997). This model is based on a minimum of twelve datapoints (months).

In the empirical part of this research we first calculated the AddedValue for each fund in each month. We then compute different Fama-MacBeth regressions. In this regression we run for each month in the sample a cross-sectional regression of funds Max on the subsequent month's AddedValue, including control variables.
In contrast to our hypothesis that Max has a negative influence on the AddedValue, our regressions show that the opposite is true. Max has a significant positive effect on the AddedValue obtain in the month after. Because of the high correlation between volatility, past returns and Carhart alpha different measures of Max are used. When using Match-adjusted Max or Residual Max the positive relation between the Max measure and AddedValue keeps existing. This relation is not only present in the short term, one month. But as well when the AddedValue is measured over the next quarter or the next year. AddedValue is mainly obtained in the fifth quintile when we divide the fund based on their respective sizes. These features can be useful for investors, because it indicates that present Max is an indicator for the future AddedValue of a fund, especially in large funds. When changing AddedValue to the Skill ratio, a measure which controls for the size of the fund, this relationship keeps existing. We can thus conclude that there exists a robust significant positive relationship between the stock picking skills of the manager represented by Max and the skill of a manager in the next month, this skill can be measured by both AddedValue as well as the Skill ratio in both the short as the long term.

We find a positive correlation between Max and the AddedValue of a mutual fund, this is opposed to the results Barberis and Huang find (Barberis & Huang, 2008). This difference can possibly be explained by the fact that when investing in individual stocks, like Barberis and Huang do an extreme payoff is an onetime occurrence. While when investing in mutual funds, investing in this fund is also

investing in the manager who picks the right stock for you. This manager can have stock picking skill which can be observed by a higher Max. A higher Max in one period can be related to a high Max in the future, this can be explained by the stock picking skills of the manager.

The paper is structured in the following way; hereafter we describe the existing literature in the mutual fund industry, the prospect theory and how this refers to Max and skill the two main variables in our research. Thereafter the collection and structuring of data is described. The results follow this, where first the main results are shown and after this the robustness of this results is tested. And finally, we end with the conclusion.

Literature review

Mutual funds

Mutual fund performance is an already quite extensively researched topic, however researches do not always agree with each other. The debate is mostly concerned on the question if funds can systematically beat the market, or their relative benchmarks.

Treynor and Mazuy find already in 1966, that just one out of the 57 mutual funds have a characteristic line, and conclude from this that no investor can beat the market in the long run (Treynor & Mazuy, 1966). This is supported by including the Jensen measure and the positive period weighting measure proposed by Grinblatt and Titman as performance measures(Cumby & Glen, 1990), and further extended by Blake, Elton and Gruber who take fund expenses into account and find that bond fund underperform relevant benchmark indexes (Blake, Elton, & Gruber, 1993).

There is also another side of the story. Grinblatt and Titman find that there are at least some funds which have significant positive risk-adjusted gross returns (Grinblatt & Titman, 1989). While a few years later they find that for at least the aggressive growth funds exhibit a significant positive risk-adjusted return (Grinblatt & Titman, 1993). Later on they find that aggressive growth fund exhibit selectivity ability, which is an indicator of what we can call skill (Daniel et al. 1997). Wermers find that mutual funds outperform the stock market as a whole by 1.3 percent, but due to the underperformance in non-stock holdings and transaction costs and expenses the net return is minus one percent, this supports the theory that mutual fund management create value (Wermers, 2000). There is also evidence that stocks which were bought by funds outperform the stocks which were sold by funds (Chen, Jegadeesh, & Wermers, 2000). The fact that there is an absence of persistence in mutual fund performance does not imply that there is no difference between managers or that this difference is unobservable (Berk & Green, 2004). Thus gathering of information about past

performance is not necessarily money thrown down the drain. Berk and van Binsbergen argue that comparing the returns of a fund is not the right measure to do so, you should rather use their skill measure which they describe as the gross return over the respective benchmark times the size of the firm in the previous time period. This skill measure is recognized by investors and persistent up until ten years (Berk & van Binsbergen, 2015). This skill was earlier recognized by Edwards and Caglayan, who argue that 25% of hedge funds earn excess returns and they attribute this to the skill of the managers (Edwards & Caglayan, 2001). Even with an alternative definition of skill being used, that fund managers pick the right stocks in a rising market and time the market in a losing market, this managerial skill is still persistent in the mutual fund market (Kacperczyk, Nieuwerburgh, & Veldkamp, 2014).

Prospect theory

In their paper written in 1979, Kahneman and Tversky criticize the expected utility theory, which was the dominant decision making under risk model (Kahneman & Tversky, 1979). This paper was the publication of their own decision making under risk model, the prospect theory model. Which differs immensely from the expected utility theory because it no longer assumes fully rational people. Prospect theory assumes bounded rationality. But this bounded rationality is predicable. The prospect theory model had some shortcomings. It could only be applied to gambles with at most two non-zero outcomes. And it predicted people would sometimes choose dominated outcomes. Tversky and Kahneman fix these two issues in their paper in 1992, where they modify their model and then call it their cumulative prospect theory model (Tversky & Kahneman, 1992). Important additions in this paper are the different weights for gains and losses, and the addition of subjective probabilities. These are explained by diminishing sensitivity, and loss aversion.

The main consequence of the subjective probabilities is that individuals overweight the extreme probabilities of any decision he or she faces (Barberis et al., 2016). The overweighting of the tails is pictured by the fact that people are interested in both lotteries and insurance. Which are both cases with an expected negative payoff, but with very small probabilities of extreme payoffs. The preference for these extreme possibilities is partly explained by a preference for positive skewness (Åstebro, Mata, & Santos-Pinto, 2010). They find that subjects make significantly riskier choices when the payoff is positively skewed. Which is partly explained by the subjective distortion of probabilities. These very small probabilities with an extreme payoff are also favoured by investors of over the counter stocks as show by Eraker and Ready (2015). Boyer and Vorkink find that this preference is not only present in the OTC market, they find also demand for lottery features in the options market (Boyer & Vorkink, 2014). Doran et al. finds that this demand is mostly caused by retail investors, and that this effect is not driven by institutional investors (Doran, Jiang, & Peterson, 2012).

Due to the attraction for investments with extreme payoffs, these investments will become overpriced. This causes the investment to earn negative excess returns (Barberis & Huang, 2008). There is also a trend in the mutual funds who invest in lottery like stocks. Fund who hold these stocks tend to be smaller younger and poor recent performers. While they also have more retail investors and a lower managerial ownership (Agarwal, Jiang, & Wen, 2020).

Max

The attraction which investors have for lottery like payoffs can be conceptualized by the measure Max. Max as variable is constructed in that way to measure the attraction of investors to extreme positive states. This opposed to for example volatility and skewness, which measure both positive and negative states. According to Brunnermeier et al (2007) it is not skewness per se but the preference for the extreme positive state that drives the pricing effect. According to Barberis and Huang it are also these extreme positive returns which are taken into account by investors when maximizing their value function (Barberis & Huang, 2008). Max is calculated as the maximum style adjusted monthly return over the past twelve months of a mutual fund (Akbas & Genc, 2020). For this measure the style-adjusted monthly returns are calculated by subtracting the average monthly returns of all funds with the same style from a fund's monthly returns (Teo & Woo, 2005). The reason that Max needs to be corrected for style is that there is empirical evidence of attraction to investors by different styles (Pomorski, 2004). Thus when not correcting for different styles the variables Max is influenced by the attraction to different kind of funds.

Many websites which offer financial news also offer their rankings of best performing fund or stocks per category, see Bloomberg for example. This makes is assumable that investors can more easily grasp the idea of maximum style-adjusted returns, compared to volatility and skewness which need a second and third order moment calculation. This is why max is a simpler and more easily to access statistic and it is reasonable that investors take this into account when choosing firms (Akbas & Genc, 2020).

Recent literature finds that there is a positive relationship between Max as a measure and the fund flows. These finding are in line with the theory that investors overweight the extreme payoffs, when these occurred in the past (Akbas & Genc, 2020). But past extreme payoffs are not only related with fund flows. Funds with an high Max also underperform in both the portfolio sorts as in the cross-sectional tests (Goldie, Henry, & Kassa, 2019).

This measure of Max is not only used in data of US mutual funds. Cuthbertson Nitzsche and O'Sullivan find that there is a top in UK mutual fund performers which returns cannot only be attributed to *luck*. They describe that the stock picking of managers is present in the top performing

UK equity mutual funds can not solely be attributed to luck, but is an indication of skill. (Cuthbertson, Nitzsche, & O'Sullivan, 2008).

Max is a variable constructed to capture the attraction of investors to extreme payoffs, and only to the positive state of these payoffs. This is why investors are attracted to these funds. But Max is also a proxy for the stock picking skills of the manager of that fund, as described by Cuthbertson Nitzsche and O'Sullivan. This because managers with better stock picking skills will have higher monthly Max, as their superior past performance can partly be explained by the superior stock picking skills. (Wermers, 2000)

AddedValue

As described above there is evidence of at least some skill present in the mutual fund market. The difficulty for this is skill is to quantify this. Berk and van Binsbergen made their own skill measure which is called AddedValue in this paper. This skill measure is an alternative for the gross or net alpha often used to measure skill. According to Berk and van Binsbergen this measure does not describe skill because it is a returns measure, and not a value measure. They add the example that a manager who adds one percent over 10 billion dollars adds more value than a manager who adds ten percent over a one million dollar fund. That is why they state that the only time the gross alpha is a good skill measure is when the funds all have the same size. This follows on the following statement: Because competition drives the net alpha to zero the gross alpha equals the fund fee. Thus the fund manager chooses its own gross alpha, and if managers are allowed to index part of their investment this choice is arbitrary. There is therefore no reason skill and gross alpha are even correlated (Berk & van Binsbergen, 2015).

AddedValue is measured as follows;

$$(1)\ V_{it} = q_{i,t-1}\left(R_{it}^{g} - R_{it}^{B}\right)$$

In equation one $q_{i,t-1}$ stands for the total net asset value of the fund in the previous period, in our model this period is the previous month. $R_{it}^{g} - R_{it}^{B}$ stands for the realised gross returns of the mutual fund in a month minus the respective benchmark of this mutual fund. This benchmark value is calculated with the help of the Carhart four-factor model as explained below.

Benchmark

As a benchmark for the mutual funds we use the Carhart four factor model (1997). This benchmark is preferred over the CAPM model and the Fama-French three factor model, because the quality of the predictions of the performance are better (Bello, 2008).

$$(2)\ r_{i,t,} = \alpha_{iT} + b_{iT}RMRF_t + S_{iT}SMB_t + h_{iT}HML_t + p_{iT}PR1Yr_t + \varepsilon_i$$

Where RMRF is the excess return on a value-weighted aggregate market proxy; and SMB, HML, and PR1YR are returns on value- weighted, zero-investment, factor-mimicking portfolios for size, book-to-market equity, and one-year momentum in stock returns (Carhart, 1997). These factor loadings are not the value of interest here. Because we use the Carhart four-factor model as a benchmark it is important to see how a fund performs with regards to the risk it takes. These risks are implemented in the factors of the model. So the alpha plus the errors term are indicators of the relative performance of the fund. The Carhart model is based on a minimum of one year, so twelve datapoints. This number is growing if the fund gets older and there are more datapoints available.

Data

All the fund characteristics are obtained from the Centre for Research in Security Prices (CRPS) Survivor-Bias-Free U.S. Mutual Fund Database. The dataset consists of actively managed domestic equity fund from January 2000 until December 2019. These boundaries are chosen to get both complete data years as well as an attempt to obtain a dataset with at least as possible missing datapoints, which were more present before 2000. Only mutual equity funds who fall into one of the following six CRSP objective codes are included; EDCI EDCCM EDCS EDYB EDYG or EDYI. This excludes bond, balanced, international and sector funds from the sample. Index funds and funds are excluded from the remaining sample using the index fund flag in the CRSP database, as well as M funds, variable underlying annuity funds and ETF/ETN funds, which are all excluded using their respective flags. Data from the year 1999 is used to calculate values based on the previous twelve months. For example: Carhart alpha, volatility and skewness.

Because this research is conducted at the fund level, we have to aggregate the data for funds with multiple share classes. This is done by summing the total net assets across all share classes. Further are the returns, expense ratio management ratio and turnover weighted for each share class using last month's total net assets as weight. Fund age is defined as the age of the oldest share class. Qualitative characteristics such as the objective or name is taken from the largest class of the fund. We exclude funds with zero or negative expenses because these observations most likely indicate missing information (Barber, Odean, & Zheng, 2005). Further are fund who are less than one year old excluded to account for the incubation bias (Evans, 2010)**.** Next to this fund with less than $1 million in assets under management and fund with a missing fund name in the CRSP database are excluded. This makes that there are a total of 6410 distinct funds in the period, with a total of 485,768 fund months.

The main dependent variable in our research in AddedValue. This consist of the realised gross returns of the fund in a period minus the benchmark return. This benchmark is the Carhart alpha in our paper. This Carhart alpha is multiplied by the total net assets of the fund in the previous period. In total this will be the dollar value which is added in this period over the benchmark. That is why it is called AddedValue. AddedValue measures the skill a manager adds to the fund in dollars.
The main variable of interest in this research is Max. Max is defined as the maximum style-adjusted monthly return over the past twelve months. Where style-adjusted monthly returns are calculated by subtracting the mean monthly returns of a style from a funds returns (Teo & Woo, 2005). Mutual funds most often trade stocks within their style, which makes fund returns within the same style have a high cross-sectional correlation. Due to this, funds with superior returns are more likely to belong to styles with above-average performance. Style-adjusted returns control for the time-varying style effect and mitigate concerns related to categorizing funds as high-MAX funds because of the popularity of the style to which they belong (Akbas & Genc, 2020). Where AddedValue measures the skill, a manager adds to the fund, Max measures the stock picking skills of the manager.
The other control variables used in this research are defined as follows: TNA is the total net assets of a fund, aggregated for all share classes across the fund. Family_TNA is the total net assets of all the funds that belong to the same family. Age is the number of years since the date of inception.[1] ExpenseRatio is the total operating expenses as a percentage of the fund's net assets. ManagementFee is the management fee over the average net assets in that month. Flow is measured as follows; the increase of funds in a period times one plus the return divided by the total net assets in the period before. Returns is the mean style adjusted cumulative return over the last twelve months. Performance is measured as the within-style ranking based on the cumulative returns of the last twelve months. Where there has been made a distinction between the first quintile which is labelled as LOW_PERF, the middle three quintiles which are MID_PERF, and the highest quintile which is labelled as HIGH_PERF.[2] Volatility is the standard deviation of the monthly returns over the last twelve months, and the Skewness is the third moment also calculated over the same twelve months.

In panel A of table 1 the fund characteristics are summarized by year. We see an increase of the number of funds during the first years, which slows down after five years. On average a fund adds more than 4.7 million dollars over the benchmark per month. This AddedValue is the largest in the first years of the dataset and decreases over time. Max has its peak in the first few years, in which it

[1] *first_offer_date* is used as proxy for date of inception
[2] Specifically, the performance ranking for fund i is given by the following: LOW PERFi,t−1 = min PERFi,t−1, 0.2 , MID PERFi,t−1 =min(PERFi,t−1 −LOWi,t−1, 0.6), and HIGH PERFi,t−1 = PERFi,t−1 −MID PERFi,t−1 −LOW PERFi,t−1, where PERFi,t−1 is fund i's performance percentile.

was over 7%, while in the last years of the time period the Max measure was around 2%. The average size of the funds is differing over time. Where in 2000 the average size was 1500 million US dollars first few years of the data period the size decreases somewhat, then there is a runup before the financial crisis in 2008, which decreases the size of funds for two years. And after this the size continued to grow immensely till in 2019 the average size doubled that of 2000 with over 2930 million dollars. The average size of the funds' family sees a somewhat similar path as the total net assets, the only difference is that the increase after the financial crisis is even more than in fund size. The average age of the fund increased slightly over the time. The Carhart's alpha is on average 0.20% which means that on average funds beat their respective benchmark, this alpha is larger in the first few years of the time period, and decreases over time. Both the expense ratio as the management fee clearly decreased over time. The Turnover decreases over time but with a bump in 2007. We can observe an increase in flow over time. While in volatility skewness and returns there is no clear trend visible.

In panel B of table 1 the summary statistics are shown sorted by their decile of Max. Where Max is 0.56% in the low Max decile it is 10.42% in the high Max decile. We observe that low Max funds have on average an AddedValue which is only half on the high Max funds. (3.48 to 6.98) While it is also visible that high Max funds are on average smaller and have a smaller family size. They have a higher expense ratio and management fee compared to low Max. Fund in the highest Max decile trade more than funds in the low decile it goes from 65% in the lowest decile to 128% in the highest decile. The cumulative returns over the last twelve months corrected by style also shows that fund in the lowest decile attain an average return of -2.78% while the highest Max decile shows a growth of 5.28%. Remarkably is the huge break in the scale between decile 9 and 10. This break is also the present if we take a look at skewness which is on average negative. Only for the highest decile there is a positive skewness. Higher deciles show also a higher volatility.

In panel C we see the pairwise correlation between the variables, and see that Max is mostly correlated with volatility and the twelve-month style-adjusted cumulative returns, both 54%. Which shows that recent winners and more volatile funds show a higher Max. Which also explains the huge correlation between volatility and return. Carhart's alpha is for 32% correlated to Max, and also to volatility and return with 47% and 42% respectively.

Table 1A

In table 1 the summary statistics of the dataset are shown. Panel A shows the cross-sectional means over each year between January 2000 and December 2019. Panel B shows the same statistics, but funds are divided into their respective decile based on their Max, decile one is made up with funds which have the lowest Max and decile ten is filled with the highest Max funds. Panel C shows the pairwise correlation between the respective fund characteristics. No. of Funds is the distinct number of funds in a year. AddedValue is the size of a fund in the previous month times the excess return in a period. Max is the maximum monthly return in the previous twelve months. TNA is the total net assets of a fund. Family_TNA is the sum of all the net assets of the funds in a family. Age is the total age of a fund since the inception date in years. Expense Ratio is the total cost in administrative and management fees as percentage of the net assets. Turnover is the minimum of aggregate purchases or sales of securities during the year, divided by the average total net assets. Management Fee is the fee paid to management over the net assets. RETURN is the twelve-month style-adjusted cumulative returns. Carhart Alpha is the intercept of the regression over a minimum of twelve months onto the Carhart four factor model (Carhart, 1997). Flow is measured as the increase of funds in a period times one plus the return divided by the total net assets in the period before. Volatility is the standard deviation over the previous twelve months. Skewness is the skewness (third moments) over the previous twelve months.

Year	No. of Funds	Added Value	Max	TNA	Family TNA	Age	Expense Ratio	Turnover	Mgt. Fee	Return	Carhart Alpha	Flow	Volatility	Skewness
2000	1820	12.9354	7.38%	1535.82	26042.79	11.59	1.28%	107.12%	0.70%	-0.40	0.81%	0.77%	6.81%	39.60%
2001	1969	9.0352	6.28%	1222.55	22319.82	11.66	1.33%	102.54%	0.69%	1.23	0.71%	0.36%	6.92%	16.58%
2002	2153	5.1999	4.24%	984.73	19540.06	11.67	1.35%	96.65%	0.67%	0.29	0.44%	0.22%	6.13%	-8.19%
2003	2178	4.0028	3.64%	967.32	20522.70	11.80	1.33%	89.70%	0.71%	0.13	0.23%	0.29%	5.45%	-5.13%
2004	2219	4.2395	2.47%	1209.91	26926.01	12.16	1.31%	84.80%	0.70%	0.11	0.15%	0.77%	3.26%	-3.45%
2005	2203	4.6544	2.42%	1372.56	31548.17	12.53	1.28%	86.66%	0.71%	0.02	0.17%	1.18%	3.49%	-13.37%
2006	2177	5.3663	3.04%	1602.41	37199.70	13.24	1.22%	84.17%	0.71%	0.21	0.21%	1.55%	3.29%	-14.29%
2007	2269	7.2952	3.05%	1831.05	45305.34	13.57	1.19%	88.55%	0.69%	0.33	0.31%	2.04%	3.08%	-54.28%
2008	2314	5.1378	2.73%	1423.64	36991.04	13.48	1.19%	105.51%	0.61%	-3.73	0.28%	1.40%	5.01%	-40.06%
2009	2261	3.9770	3.65%	1135.93	33215.39	13.90	1.16%	85.95%	0.60%	0.19	0.25%	1.01%	8.28%	-32.84%
2010	2251	4.2153	2.45%	1338.23	42468.86	14.25	1.12%	78.52%	0.61%	0.17	0.19%	1.54%	5.30%	-35.58%
2011	2238	4.1593	2.06%	1539.60	53559.43	14.64	1.09%	73.90%	0.60%	0.12	0.16%	1.90%	5.14%	-5.09%
2012	2197	3.3653	2.17%	1607.25	62462.49	15.18	1.04%	70.32%	0.57%	0.08	0.10%	2.20%	5.10%	-1.79%
2013	2217	3.7899	1.70%	1931.57	75709.92	15.46	1.02%	67.96%	0.60%	0.17	0.09%	2.43%	2.83%	-44.67%
2014	2299	3.8611	1.78%	2255.49	90560.93	15.60	0.99%	66.39%	0.59%	0.16	0.05%	2.99%	3.07%	-39.57%
2015	2355	3.2986	1.91%	2166.46	96605.76	16.07	0.97%	68.58%	0.56%	0.14	0.03%	3.11%	3.29%	11.49%
2016	2346	2.7812	2.15%	2213.17	101079.36	16.41	0.95%	66.92%	0.54%	0.08	0.01%	2.49%	4.06%	15.91%
2017	2402	3.1923	2.18%	2575.28	113141.81	16.60	0.90%	63.29%	0.50%	0.13	0.02%	4.56%	2.31%	26.66%
2018	2399	3.2985	1.92%	2758.29	132025.93	16.65	0.87%	63.85%	0.46%	0.05	0.02%	4.58%	2.83%	-38.20%
2019	2452	4.0667	2.42%	2936.99	156388.34	17.12	0.79%	46.76%	0.32%	-0.03	0.05%	3.91%	5.22%	-42.85%
Total	*6410*	*4.7658*	*2.90%*	*1750.94*	*62900.96*	*14.27*	*1.12%*	*80.50%*	*0.62%*	*-0.04*	*0.20%*	*2.02%*	*4.49%*	*-14.31%*

Table 1B

GroupMax	Added Value	Max	TNA	Family TNA	Age	Expense ratio	Turnover	Mgt. fee	RETURN	Carhart	Flow	Volatility	Skewness
1	3.48	0.56	3023.34	104071.88	13.23	0.85	65.12	0.39	-2.78	0.04	1.85	3.24	-26.79
2	4.80	1.00	2308.78	90146.22	14.76	0.94	68.18	0.50	-1.71	0.09	1.94	3.63	-22.86
3	4.69	1.29	2049.52	75398.62	15.21	1.01	68.53	0.55	-1.29	0.11	2.30	3.75	-19.41
4	4.75	1.58	1880.12	71856.06	15.68	1.07	71.71	0.59	-0.88	0.13	2.08	3.93	-18.95
5	4.81	1.87	2070.11	70202.49	15.82	1.10	74.98	0.62	-0.42	0.15	2.63	4.10	-17.65
6	5.01	2.21	1682.20	58074.72	14.83	1.13	74.09	0.64	-0.29	0.16	2.45	4.22	-15.97
7	4.37	2.62	1381.25	54789.28	14.43	1.18	78.64	0.67	0.19	0.19	2.16	4.47	-13.54
8	4.13	3.21	1207.63	45384.21	13.94	1.22	82.59	0.69	0.52	0.23	1.91	4.77	-11.63
9	4.63	4.24	1050.94	35924.05	13.10	1.29	91.73	0.71	0.99	0.30	1.73	5.32	-7.02
10	6.98	10.42	851.08	22424.87	11.68	1.47	128.83	0.79	5.28	0.61	1.10	7.50	10.75
Total	*4.77*	*2.90*	*1750.51*	*62827.81*	*14.27*	*1.13*	*80.50*	*0.62*	*-0.04*	*0.20*	*2.02*	*4.49*	*-14.31*

Table 1C

	Max	TNA	Family TNA	Age	Expense Ratio	Turnover	Mgt fee	Return	Carhart	Flow	Volatility	Skewness
Max	1.0000											
TNA	-0.0105	1.0000										
Family_TNA	-0.0236	0.2778	1.0000									
Age	-0.0056	0.2138	0.0785	1.0000								
ExpenseRatio	0.0668	-0.1262	-0.2876	-0.0178	1.0000							
Turnover	0.0293	-0.0462	-0.0547	-0.0577	0.1977	1.0000						
Management fee	0.0437	-0.0446	-0.1451	0.0766	0.4084	0.0787	1.0000					
Return	0.5489	0.0086	0.0107	0.0151	-0.0441	-0.0405	0.0123	1.0000				
Carhart	0.3220	0.0200	-0.0394	0.0346	0.0414	-0.0251	0.1113	0.4362	1.0000			
Flow	-0.0020	0.0175	0.0062	0.0007	-0.0131	-0.0102	0.0094	-0.0020	0.0139	1.0000		
Volatility	0.5444	-0.0169	-0.0360	-0.0130	0.1290	0.0528	0.0714	0.8249	0.4731	-0.0088	1.0000	
Skewness	0.1207	-0.0044	-0.0260	0.0073	0.0422	0.0004	0.0414	0.0766	0.1036	-0.0009	0.0853	1.0000

Results

In this research we are interested to see if stock picking of the manager will lead to less or more skill in the future. We research this by using the following question does a higher Max leads to less AddedValue in the subsequent period. We estimate this by a Fama-Macbeth (1973) regression with multiple controlling variables;

$$(3)\ AddedValue_{i,t} = \alpha + \beta_{i,t-1} * MAX_{i,t-1} + \delta_{i,t-1} * X_{i,t-1} + \varepsilon_{i,t-1}$$

AddedValue is the returns of a fund over the benchmark, measured by the Carhart four factor model (Carhart, 1997). This return over benchmark is multiplied by the total net assets of the fund in the previous period. This measure is taken in period t. The symbol delta stands for all the coefficients of the control variables, which are symbolized by the X, these control variables are all from the period t-1. The control variables in the regression used are the following; Volatility and skewness of the funds returns over the previous twelve months. The natural logarithm of the age of the fund stated in years. The natural logarithm of size of both the fund as the fund family. The expense ratio, the turnover ratio and the management fee of a fund as stated in the CRSP survivor-bias free database. Flow calculated by the increase of funds in a period times one plus the return divided by the total net assets in the period before. And a performance-based measure based on the style-adjusted cumulative returns of the previous twelve months. Previous literature states these variables as solid control variables. (Akbas & Genc, 2020)

As performance measure we use a performance based ranking measure. The mutual funds are ranked on their performance in their respective style, after which they get a number between 0 (Lowest Performance) and 1 (Highest Performance) based on the previous monthly return. These performance measures are also divided into quintile in which the lowest quintile is labelled as low performance (Low_Perf), the middle three deciles are mid performance (Mid_Perf) and the highest decile is high performance(High_Perf). (Sirri & Tufano, 1998) As alternative measure we use the performance-based ranking as control variable (Perf), and its squared term. (Perf2)

Regressions one and three are run without any fixed effects. Regressions two and four are run with style fixed effects, based on the CRSP objective code of a fund. These style fixed effects are included by using six different dummy variables one for each of the styles.

In table 2 the results of the first regressions are represented. In columns one and two the results of the piecewise linear regressions are shown. In columns three and four the parameters of the quadratic regressions are shown. In the even columns the style fixed effects are included, which are

excluded in the odd columns. In all the regressions standard error are Newey and West autocorrelation and heteroskedasticity-consistent standard errors (Newey & West, 1987).

If we take a look at the coefficients of Max, we see that this is around 0.5 for all the regressions. This means that an increase of one percent in Max yield an increase in AddedValue of half a million dollars in the following month. These results are significant at the one percent level. Volatility has a negative influence on the AddedValue in the subsequent month. Both the age and size of a fund have a positive influence on the value a fund adds in the next month. While the size of the fund has a positive effect, the size of the family of the fund negatively affects the value which is added.

Table 2

Table 2 shows the results from monthly Fama-MacBeth regressions between January 2000 and December 2019. The dependent variable is the AddedValue in month t. Max is the maximum style-adjusted monthly return in the last twelve-month period ending at t-1. The following control variables are all lagged one month: volatility and skewness are taken from the previous twelve months. The natural logarithm of the fund age, the natural logarithm of the fund total net assets, (TNA) the natural logarithm of family TNA, the expense ratio, the turnover ratio, the management fee, and monthly fund flows. Low_Perf, Mid_Perf and High_Perf refer to the lowest middle three, and highest quintiles of the fund performance based on a 0 to 1 scale within each investment style. Perf refers to this same performance-based ranking. Perf2 is the quadratic variable of Perf. In columns 1 and 2 we use a piecewise linear regression. In columns 3 and 4 we use a quadratic regression. Standard errors are corrected for heteroskedasticity and autocorrelation using the method of Newey and West (1987). Stars indicate the significant levels of the results of which the one star corresponds with the 10 percent confidence level, two stars with five percent and three stars with one percent.

	(1)	(2)	(3)	(4)
Max	.525***	.490***	.519***	.487***
	(5.98)	(5.53)	(5.86)	(5.44)
Volatility	-.869***	-.759***	-.863***	-.762***
	(-7.14)	(-4.54)	(-7.20)	(-4.60)
Skewness	.0021	.002	.002	.002
	(0.97)	(0.69)	(0.87)	(0.61)
LnAge	1.596***	1.551***	1.578***	1.534***
	(11.86)	(11.40)	(11.68)	(11.23)
LnSize	5.861***	5.867***	5.866***	5.873***
	(11.64)	(11.83)	(11.64)	(11.84)
LnFamily	-.468***	-.447***	-.471***	-.450***
	(-15.71)	(-16.40)	(-16.28)	(-16.76)
ExpenseRatio	4.220***	4.339***	4.207***	4.333***
	(6.14)	(5.58)	(6.11)	(5.56)
Turnover	-.001	-.002	-.001	-.001
	(-1.64)	(-1.66)	(-1.77)	(-1.80)
ManagementFee	-6.622***	-6.537***	-6.618***	-6.534***
	(-13.41)	(-13.87)	(-13.45)	(-13.92)
Flow	-.009	-.0082	-.009*	-.008
	(-0.59)	(-0.56)	(-0.59)	(-0.56)
Low_Perf	-5.708	-2.982		
	(-0.50)	(-0.27)		
Mid_Perf	1.003	1.419		
	(0.60)	(0.81)		
High_Perf	7479827	8199977		
	(1.55)	(1.55)		
Perf			-9.156**	-7.123

			(-2.09)	(-1.51)
Perf2			10.237**	8.466*
			(2.40)	(1.80)
Fe	No	Yes	No	Yes
N	434,994	434,994	434,994	434,994
R2	0.1674	0.1694	0.1670	0.1689

The expense ratio affects the upcoming AddedValue in a positive manner. While the management fee of a fund has negative effect on AddedValue. Turnover, flow and the performance quintile measure have an insignificant effect on AddedValue. The performance rank as well as the squared rank are at the five percent level significant in the third regression, while in the fourth regression only the squared measure is significant at the ten percent level. The results in table 2 show that a higher Max leads to more AddedValue in the following month. This means that Max can be seen as an indicator for future superior skill measured by AddedValue.

In table 1 the correlation between the fund characteristics were shown. The high correlation between Max and both volatility and return could be a concern regarding collinearity, and the influence this has on our results. To relieve these concerns Max will be replaced in the regression by two different kind of measures. First of all Match-adjusted Max, and second of all residual Max. Match-adjusted Max tries to capture the correlation between past returns, volatility and Max. This is done by dividing funds into five quintiles based on passed returns in each month per style. Then within each return quintile, funds are divided into five quintiles based on their volatility. This creates 150 different groups into which the funds can be put in (6 (Styles) x 5 (returns) x 5(volatility)). The difference between the funds' Max and the average Max of the respective benchmark based on style returns and volatility is called the Match-adjusted Max. Residual Max is constructed by performing a cross-sectional regression of Max onto volatility and the returns of a fund adjusted for their respective style. The *residuals* of this regression are then used as measure instead of the original Max, and this is called residual Max.

In table 3 the results of the regressions including the Match-adjusted Max are shown. The results of the residual Max regression are shown in table 4. In the first and third row the results without the style fixed effects are shown. In the second and fourth row the fixed effects are included. In the first two regressions the performance ranking as described above is used, while the third and fourth regressions use a quadratic regression. All the regression's standard error are Newey and West autocorrelation and heteroskedasticity-consistent standard errors (Newey & West, 1987).

Table 3

Table 3 shows the results from monthly Fama-MacBeth regressions between January 2000 and December 2019. The dependent variable is the AddedValue in month t. Match-adjusted Max is the difference between the funds Max and the average Max of the respective benchmark based on style returns and volatility in the last twelve month period ending at t-1.The following control variables are all lagged one month: volatility and skewness are taken from the previous twelve months. The natural logarithm of the fund age, the natural logarithm of the fund total net assets, (TNA) the natural logarithm of family TNA, the expense ratio, the turnover ratio, the management fee, and monthly fund flows. Low_Perf, Mid_Perf and High_Perf refer to the lowest middle three, and highest quintiles of the fund performance based on a 0 to 1 scale within each investment style. Perf refers to this same performance-based ranking. Perf2 is the quadratic variable of Perf. In columns 1 and 2 we use a piecewise linear regression. In columns 3 and 4 we use a quadratic regression. Standard errors are corrected for heteroskedasticity and autocorrelation using the method of Newey and West (1987). Stars indicate the significant levels of the results of which the one star corresponds with the 10 percent confidence level, two stars with five percent and three stars with one percent.

	(1)	(2)	(3)	(4)
Match-adjusted Max	.425***	.394***	.439***	.407***
	(5.14)	(4.99)	(5.24)	(5.09)
Volatility	-477***	-.410***	-.476***	-.411***
	(-3.47)	(-2.45)	(-3.57)	(-2.52)
Skewness	.004	.003	.004	.003
	(1.51)	(1.06)	(1.48)	(1.03)
LnAge	1.588***	1.552***	1.571***	1.535***
	(12.11)	(11.91)	(11.90)	(11.71)
LnSize	5.862***	5.866***	5.866***	5.870***
	(11.69)	(11.90)	(11.68)	(11.90)
LnFamily	-.481***	-.454***	-.484***	-.457***
	(-15.35)	(-16.57)	(-15.70)	(-16.92)
ExpenseRatio	4.277***	4.396***	4.251***	4.378***
	(6.26)	(5.67)	(6.22)	(5.63)
Turnover	-0.001	-.001	-.001*	-.002
	(-1.69)	-(1.67)	(-1.81)	(-1.80)
ManagementFee	-6.617***	-6.522***	-6.610***	-6.516***
	(-13.44)	(-13.88)	(-13.50)	(-13.95)
Flow	-.0137	-.011	-.0146	-.012
	(-0.74)	(-0.65)	(-0.75)	(-0.67)
Low_Perf	-6.619	-4.539		
	(-0.72)	(-0.50)		
Mid_Perf	2.493*	2.944*		
	(1.75)	(1.93)		
High_Perf	6695655	7468750		
	(1.53)	(1.53)		
Perf			-10.652*	-8.501
			(-2.34)	(-1.70)
Perf2			14.008**	12.011**
			(3.28)	(2.59)
Fe	No	Yes	No	Yes
N	434,994	434,994	434,994	434,994
R2	0.1664	0.1686	0.1657	0.1679

The Match-adjusted Max is significant at the one percent level, it has a positive coefficient which differs a bit across the different regressions, but the coefficients are consistent with each other. A

percentage increase in Max leads to an increase in AddedValue in the next month of around four hundred thousand dollars. Concerning the control variables; Volatility has a negative result on the value which is added by the funds. Skewness is insignificant related to the AddedValue in all of the regressions. Both the natural logarithms of age and size of the fund are positively related to AddedValue at the one percent level. The natural logarithm of the size of the family is significant at the one percent level and negatively related to the AddedValue. Expense ratio is positively significant related to the AddedValue. The turnover ratio is negatively related but only significant at the ten percent level in the second regression, and insignificant in the first, third and fourth regression. Management fee is negatively significant related to the AddedValue. The relation between flow and AddedValue is insignificant. With regard to the performance measure the Mid_Perf is positively related to AddedValue and significant at the ten percent level. While the other quintiles are insignificant. The performance ranking (Perf) is negatively related but only significant in regression three and not in the fourth one. While the quadratic measure (Perf2) is positively related and significant at the five percent level in both of the regressions.

If we take a look at the Residual Max regressions the results are quite similar to the Match-adjusted Max. The relationship between Residual Max and AddedValue is positively significant at the one percent level and the coefficient is slightly more than 0.45. Which would offer an increase in AddedValue of four hundred fifty thousand dollars if Max increases one percent. Volatility is in these regressions somewhat less significant; it is only significant at the five percent level in the first and third regression. Skewness is insignificantly related. The natural logarithm of age and size, and expense ratio is just like in table 3 positively significant related to AddedValue. The natural logarithm of family size is negatively related to AddedValue. Turnover is at the ten percent significant and negatively related. The relationship between flow and AddedValue is insignificant. While all the performance-based measures are insignificant except for the quadratic performance measure in the third regression, this one is positively related and significant at the five percent level.

We can argue that the results shown in tables 3 and 4 are consistent with the results of table 2. In both the alternative measures of Max the results are significant at the one percent level. Both the measures give consistent positive results. Where the Match-adjusted Max shows a significant result around the 0.4, this differs slightly for the different regressions. The Residual Max shows slightly larger results which are somewhat above the 0.45. These numbers indicate that a one percent increase in the respective Max measure increase the AddedValue of the fund with over four hundred thousand dollars.

Table 4

Table 4 shows the results from monthly Fama-MacBeth regressions between January 2000 and December 2019. The dependent variable is the AddedValue in month t. Residual Max is the residuals of a cross-sectional regression of Max onto volatility and the style-adjusted in the last twelve-month period ending at t-1. The following control variables are all lagged one month: volatility and skewness are taken from the previous twelve months. The natural logarithm of the fund age, the natural logarithm of the fund total net assets, (TNA) the natural logarithm of family TNA, the expense ratio, the turnover ratio, the management fee, and monthly fund flows. Low_Perf, Mid_Perf and High_Perf refer to the lowest middle three, and highest quintiles of the fund performance based on a 0 to 1 scale within each investment style. Perf refers to this same performance-based ranking. Perf2 is the quadratic variable of Perf. In columns 1 and 2 we use a piecewise linear regression. In columns 3 and 4 we use a quadratic regression. Standard errors are corrected for heteroskedasticity and autocorrelation using the method of Newey and West (1987). Stars indicate the significant levels of the results of which the one star corresponds with the 10 percent confidence level, two stars with five percent and three stars with one percent.

	(1)	(2)	(3)	(4)
Residual Max	.473***	.466***	.459***	.455***
	(5.63)	(5.70)	(5.36)	(5.50)
Volatility	-.339**	-.285	-.344**	-.290
	(-2.14)	(-1.48)	(-2.22)	(-1.54)
Skewness	.004	.003	.005	.004
	(1.46)	(1.01)	(1.49)	(1.05)
LnAge	1.604***	1.555***	1.583***	1.534***
	(11.92)	(11.46)	(11.69)	(11.23)
LnSize	5.866***	5.860***	5.871***	5.865***
	(11.63)	(11.93)	(11.62)	(11.93)
LnFamily	-.479***	-.447***	-.484***	-.451***
	(-14.81)	(-16.48)	(-15.26)	(-16.86)
ExpenseRatio	4.195***	4.306***	4.175***	4.293***
	(6.06)	(5.51)	(6.02)	(5.47)
Turnover	-.002*	-.002*	-.002*	-.002*
	(-1.70)	(-1.69)	(-1.79)	(-1.80)
ManagementFee	-6.650***	-6.540***	-6.639***	-6.529***
	(-13.31)	(-13.87)	(-13.36)	(-13.93)
Flow	-.017	-.0136	-.0187	-.015
	(-0.87)	(-0.81)	(-0.89)	(-0.83)
Low_Perf	7.862	9.443		
	(0.78)	(0.93)		
Mid_Perf	1.808	2.539		
	(1.00)	(1.31)		
High_Perf	7446369	8248464		
	(1.55)	(1.55)		
Perf			-5.547	-3.263
			(-1.24)	(-0.64)
Perf2			8.614**	6.701
			(2.03)	(1.39)
Fe	No	Yes	No	Yes
N	434,994	434,994	434,994	434,994
R2	0.1662	0.1686	0.1655	0.1679

Tables 2 to 4 show that a higher Max leads to more AddedValue in the next month. This can be interesting for investors, because if they invest solely in past high Max funds, they achieve excess

returns. But most investors have a longer investing horizon that this one month. This is why in table 5 the same Fama-MacBeth regression is performed but the dependent variable is the AddedValue in the next quarter in the first row, and AddedValue in the next year in the second row. For brevity only the coefficients of the Max measures are shown.

Just like in the tables 2 to 4 is the result in table 5 that Max has a positive influence on the value which a fund adds in the period following. Investing in a one percent higher Max fund, could earn between the 1.1 and 1.4 million dollars according to table 5. With the results for the control variables are comparable to the original regressions in table 2. If we look at the second row, we see a higher Max will predict a higher AddedValue which is measured over the following year. An one percent higher Max lead to an increase between 4 and 5.2 million dollars in the following year.

Table 5

Table 5 shows the results from monthly Fama-MacBeth regressions between January 2000 and December 2019. The dependent variable is the AddedValue in next quarter in the first row, and AddedValue in the following year in the second row. Max is the maximum style-adjusted monthly return in the last twelve-month period ending at t-1 in columns 1 and 2, in columns 3 and 4 Max is the Match-adjusted Max, and in columns 5 and 6 Max is the Residual Max. The following control variables are all included volatility and skewness of fund returns, the natural logarithm of fund age, the natural logarithm of fund total net assets (TNA), the natural logarithm of family TNA, management fees, expense, turnover, fund flows, and fund performance over the previous year. In the interest of brevity, we report only the coefficient of Max. In columns 1, 3 and 5 we use a piecewise linear regression. In columns 2, 4 and 6 we use a quadratic regression. Standard errors are corrected for heteroskedasticity and autocorrelation using the method of Newey and West (1987). Stars indicate the significant levels of the results of which the one star corresponds with the 10 percent confidence level, two stars with five percent and three stars with one percent.

	(1)	(2)	(3)	(4)	(5)	(6)
Next quarter	1.466***	1.460***	1.175***	1.216***	1.399***	1.369***
	(5.77)	(5.67)	(5.12)	(5.21)	(5.91)	(5.71)
Next year	5.223***	5.171***	4.043***	4.213***	5.051***	4.921***
	(5.84)	(5.78)	(4.80)	(4.90)	(5.68)	(5.56)

In table 6 the results of the Fama-MacBeth regression are shown when dividing the dataset into subsamples based on the size of the mutual fund. We can see that when dividing the dataset into subsamples the relation between Max and future AddedValue is still present and significant. But we can also observe that the total value which is added by the funds is mainly obtained in the largest quintile. Where the all the coefficients of Max in these regressions are statistically significant. The economic significance of the first couple of quantiles can be questioned. An increase in Max of one percent leads to only an increase of five thousand dollars in the first quintile.

Table 6

Table 6 shows the results from monthly Fama-MacBeth regressions between January 2000 and December 2019. The dependent variable is the AddedValue in month t. The data sample is divided into five quintiles based on the size of the mutual fund. Max is the maximum style-adjusted monthly return in the last twelve-month period ending at t-1 in columns 1 and 2, in columns 3 and 4 Max is the Match-adjusted Max, and in columns 5 and 6 Max is the Residual Max. The following control variables are all included Regressions include the following lagged control variables: volatility and skewness of fund returns, the natural logarithm of fund age, the natural logarithm of family TNA, management fees, expense, turnover, fund flows, and fund performance over the previous year. In the interest of brevity, we report only the coefficient of Max. In columns 1, 3 and 5 we use a piecewise linear regression. In columns 2, 4 and 6 we use a quadratic regression. Standard errors are corrected for heteroskedasticity and autocorrelation using the method of Newey and West (1987). Stars indicate the significant levels of the results of which the one star corresponds with the 10 percent confidence level, two stars with five percent and three stars with one percent.

	(1)	(2)	(3)	(4)	(5)	(6)
Quintile 1	.005***	.005***	.004***	.004***	.004***	.003***
	(8.16)	(8.47)	(5.83)	(6.16)	(7.28)	(6.91)
Quintile 2	.023***	.022***	.021***	.021***	.018***	.017***
	(6.96)	(7.03)	(5.88)	(6.05)	(4.66)	(4.51)
Quintile 3	.069***	.069***	.053***	.054***	.060***	.056***
	(5.80)	(5.82)	(4.57)	(4.92)	(4.88)	(4.39)
Quintile 4	.257***	.251***	.238***	.241***	.228***	.216***
	(7.85)	(7.92)	(9.25)	(8.80)	(6.79)	(6.44)
Quintile 5	1.971***	2.000***	1.297***	1.341***	1.827***	1.959***
	(4.95)	(5.15)	(4.04)	(4.22)	(4.89)	(5.34)

AddedValue measures the dollar value which is added to the fund in a certain period. Because this is a dollar value, it is by definition a value measure. This is described above in the literature section as a positive feature because this value measure is the only way to truly measure the skill of a manager, opposed to the returns measures such as gross and net alpha often used (Berk & van Binsbergen, 2015). However, there is also a downside to this value measure, namely the funds with more assets under management will need a lower return to achieve the same AddedValue. For example, a fund with $10 million under management achieves 1 percent excess returns, is an AddedValue of $100,000. If a fund with only $1 million under management achieves the same 1 percent excess return the AddedValue is just $10,000.

For this reason an alternative measure for AddedValue is used in table 6. Skill ratio is defined as follows:

$$(4)\quad SKR_{\tau i} = \frac{S_i^{\tau}}{\sigma S_i^{\tau}}$$

Where $\hat{S}_i^{\tau} = \sum_{t=1}^{\tau} \frac{V_{it}}{\tau}$ and $S_i^{\tau} = \frac{\sqrt{\sum_{t=1}^{\tau}(V_{it} - \hat{S}_i^{\tau})}}{\tau}$. This means that the Skill ratio at any given point in time, is the t value of the AddedValue regressions, added up over time since the inception date of the fund (Berk & van Binsbergen, 2015). In this way size is not affecting the skill ratio.

Table 7

Table 7 shows the results from monthly Fama-MacBeth regressions between January 2000 and December 2019. The dependent variable is the Skill ratio in month t. Max is the maximum style-adjusted monthly return in the last twelve-month period ending at t-1in columns 1 and 2, in columns 3 and 4 Max is the Match-adjusted Max, and in columns 5 and 6 Max is the Residual Max. The following control variables are all lagged one month: volatility and skewness are taken from the previous twelve months. The natural logarithm of the fund age, the natural logarithm of the fund total net assets, (TNA) the natural logarithm of family TNA, the expense ratio, the turnover ratio, the management fee, and monthly fund flows. Low_Perf, Mid_Perf and High_Perf refer to the lowest middle three, and highest quintiles of the fund performance based on a 0 to 1 scale within each investment style. Perf refers to this same performance-based ranking. Perf2 is the quadratic variable of Perf. In columns 1, 3 and 5 we use a piecewise linear regression. In columns 2, 4 and 6 we use a quadratic regression. Standard errors are corrected for heteroskedasticity and autocorrelation using the method of Newey and West (1987). Stars indicate the significant levels of the results of which the one star corresponds with the 10 percent confidence level, two stars with five percent and three stars with one percent.

	(1)	(2)	(3)	(4)	(5)	(6)
Max	3.113***	2.998***	2.470***	2.475***	2.902***	2.742***
	(5.91)	(6.09)	(4.66)	(4.89)	(4.97)	(4.77)
Volatility	-9.119***	-8.855***	-5.950***	-5.900***	-5.656***	-5.570***
	(-5.16)	(-5.11)	(-3.97)	(-3.91)	(-3.73)	(-3.62)
Skewness	-.006	-.008	-.002	-.001	.001	.003
	(-0.19)	(-0.25)	(-0.06)	(-0.04)	(0.02)	(0.09)
LnAge	43.196***	43.023***	43.004***	42.856***	43.147***	42.985***
	(5.88)	(5.86)	(5.86)	(5.85)	(5.86)	(5.85)
LnSize	19.568***	19.627***	19.629***	19.677***	19.578***	19.625***
	(23.60)	(23.62)	(23.35)	(23.39)	(23.35)	(23.32)
LnFamily	-6.142***	-6.207***	-6.184***	-6.247***	-6.157***	-6.227***
	(-11.50)	(-11.45)	(11.21)	(-11.19)	(-11.56)	(-11.50)
ExpenseRatio	-24.230***	-24.260***	-23.851***	-23.917***	-24.281***	-24.308***
	(-7.27)	(-7.42)	(-7.23)	(-7.41)	(-7.31)	(-7.51)
Turnover	-.074***	-.074***	-.075***	-.075***	-.074***	-.074***
	(-7.54)	(-7.84)	(-7.27)	(-7.58)	(-7.34)	(-7.63)
Management fee	0.304	.337	.349	.411	.360	.472
	(0.13)	(0.14)	(0.14)	(0.17)	(0.15)	(0.19)
Flow	-.402	-.405	-.401	-.402	-.408	-.410
	(-1.23)	(-1.24)	(-1.23)	(-1.23)	(-1.24)	(-1.24)
Low_Perf	261.399*		276.942**		365.830***	
	(1.66)		(2.14)		(2.72)	
Mid_Perf	34.266***		42.293***		45.438***	
	(3.02)		(4.04)		(3.38)	
High_Perf	4.97e+07		4.52e+07		5.07e+07	
	(1.14)		(1.11)		(1.14)	
Perf		156.810***		139.400***		167.086***
		(2.86)		(2.61)		(3.26)
Perf2		-145.950**		-120.137*		-145.556**
		(-2.24)		(-1.94)		(-2.32)
Fe	Yes	Yes	Yes	Yes	Yes	Yes
N	435,006	435,006	435,006	435,006	435,006	435,006
R2	0.2046	0.2036	0.2039	0.2030	0.2042	0.2033

In table 7 we see the results of a Fama-MacBeth regression where the dependent variable is the skill ratio. These regressions are conducted by regressing the three different Max variables used above, on the skill ratio while controlling for the usual control variables.

All the different Max measures are positively significant at the one percent level. This shows that a higher Max leads to a higher Skill ratio in the following month. Volatility is negatively related to the skill ratio. Skewness is insignificantly related to the skill ratio. Both the natural logarithms of size and age are positively related to the skill level at the one percent level. The natural logarithm of the size of the fund's family is negatively related to the skill ratio at the one percent level significant. So is the expense ratio and the turnover ratio. Both the coefficients of the management fee and the flow rate are insignificant. The performance measure of Low_Perf is significant at the ten percent level in the first column, at five percent in the third column and at one percent in the fifth column, all these coefficients are positive. The Mid_Perf if is positively related to the skill level at the one percent level in all the regressions. The High_Perf measure is insignificant. Perf is positively significant at the one percent level in all of the regressions, while the quadratic measure is negatively related to skill ratio at the five percent level in the second and sixth regression and at the ten percent level in the fourth regression. The results in table 7 show that Max is a predictor for skill of the manager, whether this is measured by the AddedValue measure or by the Skill ratio.

Table 2 to 7 show the results of the respective regressions, while the coefficients differ between the different tables that results obtained are clear and robust. A present higher Max leads to a higher AddedValue in the future, this is unaffected by the way Max is measured as shown in tables 3 and 4. It is also not affected by the time over which AddedValue is measured. The relationship exists if AddedValue is measured over one month, one quarter or one year. Table 6 shows that most of the AddedValue is obtained in the largest quintile, but the relation between Max and AddedValue is present in all five of the quintiles. Table 7 shows that not only AddedValue is affected by the different Max measures, but Max also forecasts Skill if this is measured by the Skill ratio.

Conclusion

Is current stock picking an indicator of the future skill of a mutual fund manager? If we measure stock picking skills by Max and skill by AddedValue than; Yes, it is. With the help of Fama-Macbeth regressions we found that a higher Max leads to a higher AddedValue in the following month. This relationship between Max and AddedValue is not only present when using Max as measure but also with the alternatives; Match-adjusted Max and Residual Max which are used to correct for the correlation between volatility, past returns and the Carhart Alpha. This relation is not only present in the next month, but also in the quarter after the measurement of Max, and even in the year after it still exists. We observe that the largest funds obtain the largest AddedValue, which can be translated into the statement that these funds exhibit the most skill, but we also see that this skill is present in all five of the quintiles. AddedValue is a value measure instead of a returns measure, as alternative for this the Skill ratio is used as well. Regressing all three Max measures on the Skill ratio gives similar results as when using AddedValue, namely that present Max forecast future Skill. This all indicates that the results obtained are robust. Thus, we can argue that better stock picking skills leads to more future skill in the mutual fund market.

Future research can concern themselves with the question if the proxies used in this paper for stock picking skills and skill, respectively Max and AddedValue, are valid proxies. Further can there be researched if there are certain types of funds which exhibit the most skill and if certain types of funds exhibit no skill at all.

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