Johann Wolfgang Goethe-Universität Frankfurt am Main

Bachelor Thesis

The effect of Morningstar ratings on mutual fund flows – Evidence from the U.S.

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List of Symbols

△	Delta: Difference between two values
Σ	Sigma: Sum of preceding values
*	Significance at the 10% level
**	Significance at the 5% level
***	Significance at the 1% level
⋆	Morningstar Star Rating star

List of Abbreviations

AMFP	Average Monthly Flow Percent
LN	Natural Logarithm
mn	Million
MS	Morningstar
TNA	Total Net Assets
U.S.	United States
USD	United States Dollar

1. Introduction

There exists a large literature on mutual fund flows and fund-specific determinants influencing flows. Past performance appears to be most salient as Sirri and Tufano (1998) show evidence on a convex flow-performance relation for U.S. mutual funds. Further academic research proves that investment costs such as load fees and operating expenses (Barber, Odean, and Zheng, 2005), advertising of funds (Jain and Wu, 2000), and tax motivations when realizing gains or losses from selling investments (Ivković and Weisbrenner, 2009) also affect mutual fund flows.

The one to five Star Rating of Morningstar, which was introduced in 1985, is well-established today. Morningstar as a brand is well-known and considered as an independent and reputable source of information. The accessible Star Rating information shows substantial effects on investors' allocation decisions. Del Guercio and Tkac (2008) find statistically significant positive (negative) abnormal flows following Star Rating upgrades (downgrades). Contrary to the literature on the cross-sectional flow-performance relation, Del Guercio and Tkac (2008) find evidence on investor punishment of poorly performing funds since investors withdraw money from funds experiencing a rating downgrade. Furthermore, they defined the independent influence of Star Rating changes as the "Morningstar effect", measuring additional dollars allocated to mutual funds as a consequence of a Morningstar Star Rating change.

This bachelor thesis analyzes how Morningstar's Star Rating affects net fund flows of U.S. mutual equity funds and is structured as follows. The next section reviews the data and provides brief descriptions of Morningstar's general rating methodology. In addition, Star Rating change events as well as the persistence of Star Ratings are evaluated. In section 3 I report the results of various regression analyses, using differently designed variables showing the effect of Morningstar ratings on mutual fund flows. Section 4 concludes.

2. Data Description and Summary Statistics

2.1 Morningstar Star and Analyst Rating

The Morningstar Star Rating for funds was first introduced in 1985 and has established itself as an influential and value-adding source of information for investors. This quantitative fund rating, often called Star Rating, uses a scale

of one to five stars to assess funds older than 36 months (Morningstar, 2016). As the Star Rating offers compact information on salient fund characteristics, it reduces search costs for investors and helps to assess the quality of funds. Sirri and Tufano (1998) conclude that a reduction in search costs has a material impact on investors' fund choices.

The Star Rating is based on a fund's risk-adjusted return relative to the fund's peer group, the Morningstar Category. The calculation of the risk-adjusted return considers a fund's monthly total return, adjusted by risk, fees, and return above the risk-free rate. Following the expected utility theory, downside risks have a relative overweight on upside risks. Investors gain free access to a fund's Star Rating which is available for three-year, five-year, and ten-year periods, and then an overall rating calculated with respect to the weighted average of the available time-period ratings. Morningstar updates Star Ratings on a monthly basis. According to the bell-shaped Gaussian normal distribution curve, funds belonging to the top 10% of their peer group are assigned five stars, followed by the next 22.5% with a four-star rating, the next 35% receive a three-star rating, the following 22.5% receive two stars and, finally, the lowest 10% of their peer group are one-star funds (Morningstar, 2016).

As stated before, Morningstar Categories form the relevant peer groups of the Star Ratings. A fund's Morningstar Category is identified by the fund's investment style which represents a summary of a fund's risk-factor exposures. Morningstar analyzes the underlying securities a fund invests in to determine its category. Regarding the U.S. mutual fund market, a fund can be assigned to 122 different Morningstar Categories. Morningstar reviews the portfolios within each category twice a year to ensure that each fund is classed within its appropriate category (Morningstar, 2016).

Whereas the Morningstar Star Rating relies on quantitative past-looking results, the Morningstar Analyst Rating targets forward-looking and qualitative information. The Analyst Rating is expressed in a five-tier scale: Gold, Silver, Bronze, Neutral, and Negative. The grading represents the fund's potential to outperform its peer group over a longer time horizon on a risk-adjusted basis. The research methodology leading to the Analyst Rating is composed of five pillars: Process, Performance, People, Parent, and Price. The positive ratings (Gold, Silver, and Bronze) signalize high assessment of Morningstar's ana-

lysts. The Morningstar Analyst Rating is not an orderable service since Morningstar analysts select themselves the funds they award an Analyst Rating. The Morningstar Analyst Rating for U.S. mutual funds was first implemented in 2011 (Morningstar, 2011).

2.2 Data Description

The sample obtained from Morningstar Direct includes U.S. mutual funds that invest in U.S. equities. The sample period ranges from 1990 to 2016. In total, there are 507,385 observations of fund months from 4,226 distinct funds with a Morningstar Star Rating. The sample is free from survivorship bias.

The data on Morningstar Star Ratings is rounded to integral values as the underlying sample also contains values with decimals. Share classes of the same fund are rated independently since they are showing various cost structures and, therefore, influence net return differently. When aggregating the several ratings of each fund's share classes on fund level, in some cases Star Ratings with decimals emerge (Morningstar, 2016). Table 1 reports summarized information on the sample measured at the end of each year using December observations.

Starting with 60% star rated funds of all U.S. equity funds, the share of funds with a Star Rating has increased up to nearly 90% in 2016, demonstrating the high relevance of Morningstar's Star Rating. Triggered by the financial crisis, the sum of total net assets across all funds in 2007 dropped within one year by more than one trillion dollars, accounting for a 36% loss. This decline is in accordance with the findings of Bartram and Bodnar (2009) who examine the effects of global crisis in equity markets. While there was a decrease in the total number of funds between 2007 and 2008, I find an asymmetric relation to the relative number of funds rated by Morningstar increasing by 3.35 percentage points. This fact underlines the crisis resilience and the strength of Morningstar as a reliable source at all economic situations. The number of funds peaked in 2006, accounting for 2,814 observations, and declined in the years following the financial crisis. This trend can be justified by the consequences of the crisis as asset management companies had to adjust their product range or set up new funds to achieve a more attractive track record masking the drawdowns of the crisis. The yearly sum of total net as-

sets across all funds has been clearly exceeding the 3 trillion mark since 2013.

Table 1: Yearly Summary Statistic of the Data Set
This table presents the number of funds, the sum of total net assets (TNA) across all funds, and information on the number of funds included in Morningstar's Star and Analyst Rating by the end of each year using the observations of December. Total net assets are winsorized at the first and ninety-ninth percentile in order to prevent extreme flows from distorting the average results. Hence, all values below (above) the 1st (99th) percentile are replaced by the threshold value of the 1st (99th) percentile. The Column Star Rating Share displays the relative proportion of funds with a Star Rating to the total number of funds in the respective year. For example, in December 2000 the sample comprises 2,625 funds with a sum of USD mn 1,829,345 of total net assets. 1,625 funds were given a Star Rating by Morningstar, accounting for 61.9% of all funds in the year 2000. As Morningstar's Analyst Rating for funds was introduced firstly in 2011, there are no observations up to that year.

Year	Number of Funds	TNA (USD, mn)	Funds with Star Rating	Star Rating Share	Funds with Analyst Rating
1990	704	143,766	423	60.09%	0
1991	775	219,046	463	59.74%	0
1992	901	288,118	497	55.16%	0
1993	1,174	386,027	596	50.77%	0
1994	1,342	432,583	672	50.07%	0
1995	1,478	650,819	810	54.80%	0
1996	1,662	879,610	964	58.00%	0
1997	1,932	1,174,772	1,108	57.35%	0
1998	2,190	1,411,817	1,265	57.76%	0
1999	2,448	1,826,380	1,446	59.07%	0
2000	2,625	1,829,345	1,625	61.90%	0
2001	2,616	1,739,692	1,721	65.79%	0
2002	2,690	1,428,676	1,877	69.78%	0
2003	2,696	1,907,850	2,091	77.56%	0
2004	2,694	2,188,318	2,178	80.85%	0
2005	2,746	2,367,108	2,175	79.21%	0
2006	2,814	2,659,171	2,235	79.42%	0
2007	2,799	2,812,859	2,215	79.14%	0
2008	2,735	1,805,966	2,256	82.49%	0
2009	2,508	2,311,832	2,158	86.04%	0
2010	2,443	2,643,153	2,139	87.56%	0
2011	2,406	2,560,983	2,089	86.82%	160
2012	2,357	2,812,441	2,030	86.13%	370
2013	2,349	3,633,518	2,021	86.04%	400
2014	2,372	3,842,360	2,069	87.23%	372
2015	2,375	3,691,806	2,079	87.54%	322
2016	2,300	3,807,414	2,067	89.87%	386

2.3 Mutual Fund Flows

Using the standard formula in the literature, monthly net dollar flow is defined as the change in total net assets minus appreciation:

$$Flow_{i,t} = TNA_{i,t} - TNA_{i,t-1}\,(1 + R_{i,t}) \quad (1)$$

$TNA_{i,t}$ reports the fund i's total net assets measured in dollar at time t, and $R_{i,t}$ is the fund i's return at time t.

Flow percent stands for the dependent variable of the regressions. Generally,

flow percent is defined as the net dollar flow in month t divided by the total net assets in month t-1:

$$\text{Flow percent}_{i,t} = TNA_{i,t} - TNA_{i,t-1}\,(1 + R_{i,t}) \,/\, TNA_{i,t-1} \quad (2)$$

When referring to fund flows and flow percent in the following analyses, I always consider net data.

Many researchers emphasize the convex relationship of flows and past performance showing that this relationship is strong (weak) for highly (poorly) performing funds in the past (Sirri and Tufano, 1998, Chevalier and Ellison, 1997, and Del Guercio and Tkac, 2002). Contrary to the findings of Del Guercio and Tkac (2008), Sirri and Tufano (1998) do not expose investor penalty in form of withdrawing money from poorly performing funds. Huang et al. (2007) show that the flow-performance relationship has become less convex as a result of declining participation costs due to investors obtaining better information. Ferreira et al. (2012) confirm the aspect of participation costs inducing a less convex flow-performance relationship and add the psychological component of investor sophistication as a further indicator of decreasing convexity. A fund's affiliation to a large successful fund family, often referred to as spillover effect (Sirri and Tufano, 1998, and Massa, 2003), fund-related expenses (Barber, Odean, and Zheng, 2005), advertising of funds (Jain and Wu, 2000), and tax considerations (Ivković and Weisbrenner, 2009) affect fund flows as well.

Moreover, search costs play an important role as a determinant of fund flows and this is a notable point underlining the advantages of the simple-to-understand Morningstar Star Rating. The effects of the Star Rating on average flow data are displayed in Table 2 and Figure 1 (Appendix A).

The last column of Table 2 is consistent with the methodology of the bell-shaped distribution of Morningstar's Star Rating peaking in rating category three with 189,748 observations accounting for 37% of the distribution. However, there are slightly more observations at the fourth and fifth Morningstar Star Rating level compared to the two bottom levels. Average monthly dollar flow and average monthly flow percent is negative for the average fund rated with one, two, or three stars. The average four-star fund receives a positive monthly flow accounting for 5.95 million dollars and 0.85%. Growing rapidly referring to the top rating of five stars, those funds enjoy an average monthly

flow of more than 25 million dollars. Five-star rated funds appear to be relatively large funds comparing their average total net assets with those of lower rated funds. To sum up, the higher the average fund is rated, the higher are the average total net assets and the higher are average monthly flows as well as average monthly flow percent.

Table 2: Effects of Morningstar's Star Rating on Fund Flows and TNA
This table presents average data on monthly fund dollar flows, monthly flow percent, and total net assets of all observations of the respective Morningstar Star Rating level. The sample comprises flow data of a total of 507,389 months and includes data of 4,226 unique funds within a period from 1990 to 2016. Average monthly dollar flow and average monthly flow percent are winsorized at the first and ninety-ninth percentile in order to prevent extreme flows from distorting the average results. Average monthly dollar flow is obtained by generating mean values of monthly dollar flows for all observations that apply to the respective Morningstar Star Rating. Monthly flow percent is calculated by setting the fund dollar flow in the respective month t in relation to the fund's total net assets of the previous month t-1. By averaging these values for each of the five Morningstar Star Rating levels, data on average monthly flow percent is obtained. The same averaging procedure applies to the data on average total net assets. The number of observations accounts for fund month observations. Column Total % shows the share of each MS Star Rating level calculated as the number of observations of the respective rating over the total number of observations.

MS Star Rating	Average Monthly Flow (USD, mn)	Average Monthly Flow Percent	Average TNA (USD, mn)	Number of Observations	Total %
1	-5.81	-1.16%	400.36	34,808	7%
2	-6.90	-0.88%	687.34	109,151	22%
3	-4.95	-0.25%	1,259.93	189,748	37%
4	5.95	0.85%	2,107.61	128,059	25%
5	25.44	2.94%	2,523.72	45,623	9%

2.4 Star Rating Change Events

I observe 69,005 Star Rating changes accounting for 13.6% (69,005/507,389) of all observations of fund months with Morningstar Ratings. A detailed table of the composition of those 69,005 change events can be found in Appendix B.

Rating changes of more than one star are not included in the analysis since they represent slightly more than 1% of all rating changes. Furthermore, changes of more than one star can be biased by changes of a fund's Morningstar Category. If a fund changes its Morningstar Category, it is rated with respect to a different peer group. Hence, it can occur that a fund's performance measures do not improve (deteriorate) significantly, but the fund itself experiences a Star Rating change due to its affiliation to another Morningstar Category. With respect to all Star Rating changes of one star up or down, I find that 1.3% of all upgrades and 1.4% of all downgrades occur simultaneously with a change of Morningstar Category.

Analyzing the changes of average monthly flow percent (AMFP) after a Star Rating upgrade (downgrade) show on an aggregated level a positive (negative) response compared to AMFP before the change event. Throughout all upgrade (downgrade) possibilities of one star I find that the magnitude of AMFP in the month of the rating change, t, compared to the month before, t-1, is not exclusively higher (lower). Therefore, investors do realize even before the rating upgrade (downgrade) that other important fund characteristics have recently improved (deteriorated) and place buy (sell) orders. The results of AMFP following rating upgrades and downgrades correspond in terms of percentage factors and algebraic signs with my findings of average monthly flow percent from Table 2.

When assessing the results of AMFP of upgrades from one to two and from two to three stars, I observe an ongoing negative AMFP which, however, declined and developed with a less negative impact after the rating upgrade. For funds upgraded to four stars, the growth of AMFP is nearly twice as high in the months following the change event as in the months before. Regarding four-star funds which are upgraded to five-star funds, AMFP, even before the rating change event, shows a considerably high value of 1.88% on an aggregated level. After being upgraded to five stars, those funds clearly exceed the AMFP mark of 2% in the first months following the change event. The effects of AMFP, considering all upgrades in Column two, are positive developments, highly influenced by the impact from four- to five-star upgrades. The overall effect of the change event on AMFP extends over a longer time horizon showing its peak in month t+4 after the initial change.

Regarding the Star Rating downgrades, I confirm the findings of Del Guercio and Tkac (2008) as a downgrade from five to four stars does not result in a negative flow response. This can be explained by the fact that funds rated with four stars are still advertised as funds of high quality. However, Del Guercio and Tkac (2008) argue that a downgrade from five to four stars appears to be a nonevent, which my findings do not support. Compared to the AMFP of the months preceding the downgrade, AMFP is declining in the months after t, but remains positive at any time within the observation period. The reluctance of selling funds downgraded to four stars can also stem from tax motivations, the so-called tax “lock-in” effect, as those funds have recent-

ly shown a decent track record.[1] In the months before the downgrade from a four- to three-star fund, flows are continuously positive, declining to values closely to 0.00% from month t+1 on. Showing negative AMFP even before the rating change, downgrades from three to two and from two to one stars continuously develop in a further negative direction in the months following the change event.

Table 3: Effects of Star Rating Change Events on Flow Percent
This table displays the results of average monthly flow percent related to the previous month. The time horizon of month t-6 up to month t-1 shows AMFP before the rating change at time t. Month t+1 up to month t+12 present AMFP from the first month up to one year after the rating change. The first columns of the upgrade (downgrade) sections show AMFP across all upgrades (downgrades) of one star, the following columns concretize the impact of each possible rating change of one star on AMFP. The number of observations N relates to the initial change of rating in date t, but remains constant for all following months and calculations of AMFP. AMFP is winsorized at the first and ninety-ninth percentile in order to prevent extreme flows from distorting the average results. The last three rows state summarized information on aggregated average flow percent data. Row t(-) shows aggregated average values of AMFP in the months before the rating change took place (t-6 up to t-1), Row t(+) states the aggregated average value of AMFP from point t up to t+6, Row △ shows the difference in aggregated AMFP of the previous two rows.

	Upgrades					**Downgrades**				
	All	**1 to 2**	**2 to 3**	**3 to 4**	**4 to 5**	**All**	**5 to 4**	**4 to 3**	**3 to 2**	**2 to 1**
N	**33,232**	**3,943**	**11,217**	**12,473**	**5,599**	**35,025**	**5,995**	**13,102**	**11,753**	**4,175**
t-6	0.20%	-1.05%	-0.47%	0.35%	1.83%	0.39%	2.12%	0.59%	-0.44%	-0.82%
t-5	0.18%	-1.00%	-0.57%	0.36%	1.84%	0.35%	2.10%	0.52%	-0.45%	-0.89%
t-4	0.18%	-0.90%	-0.54%	0.29%	1.87%	0.30%	2.12%	0.46%	-0.49%	-0.99%
t-3	0.18%	-0.91%	-0.59%	0.34%	1.86%	0.31%	2.15%	0.45%	-0.48%	-0.91%
t-2	0.16%	-0.99%	-0.54%	0.26%	1.89%	0.29%	2.07%	0.46%	-0.50%	-1.00%
t-1	0.20%	-0.86%	-0.59%	0.32%	2.00%	0.23%	2.08%	0.41%	-0.61%	-1.06%
t	0.22%	-0.89%	-0.58%	0.37%	2.00%	0.18%	2.02%	0.34%	-0.63%	-1.14%
t+1	0.40%	-0.81%	-0.41%	0.51%	2.30%	-0.08%	1.55%	0.06%	-0.83%	-1.14%
t+2	0.50%	-0.66%	-0.40%	0.64%	2.49%	-0.11%	1.45%	0.01%	-0.81%	-1.19%
t+3	0.49%	-0.69%	-0.30%	0.57%	2.43%	-0.14%	1.33%	-0.03%	-0.80%	-1.12%
t+4	0.51%	-0.55%	-0.26%	0.62%	2.25%	-0.16%	1.24%	-0.01%	-0.82%	-1.19%
t+5	0.50%	-0.45%	-0.25%	0.62%	2.13%	-0.11%	1.29%	-0.01%	-0.75%	-1.04%
t+6	0.48%	-0.43%	-0.27%	0.63%	2.02%	-0.18%	1.00%	-0.01%	-0.77%	-1.06%
t+7	0.46%	-0.39%	-0.27%	0.61%	1.95%	-0.14%	1.09%	0.01%	-0.74%	-1.04%
t+8	0.46%	-0.33%	-0.25%	0.63%	1.81%	-0.19%	0.84%	-0.03%	-0.73%	-0.95%
t+9	0.42%	-0.51%	-0.23%	0.61%	1.65%	-0.16%	0.87%	-0.03%	-0.71%	-0.85%
t+10	0.41%	-0.48%	-0.19%	0.59%	1.59%	-0.18%	0.72%	-0.05%	-0.70%	-0.70%
t+11	0.41%	-0.27%	-0.15%	0.54%	1.49%	-0.15%	0.73%	0.00%	-0.63%	-0.81%
t+12	0.37%	-0.34%	-0.14%	0.52%	1.35%	-0.15%	0.69%	-0.07%	-0.55%	-0.79%
Aggregated Average Monthly Flow Percent										
t(-)	0.18%	-0.95%	-0.55%	0.32%	1.88%	0.31%	2.11%	0.48%	-0.50%	-0.95%
t(+)	0.44%	-0.64%	-0.35%	0.57%	2.23%	-0.09%	1.41%	0.05%	-0.77%	-1.13%
△	0.26%	0.31%	0.20%	0.25%	0.35%	-0.40%	-0.69%	-0.43%	-0.28%	-0.18%

[1] Ivković and Weisbrenner (2009) find that investors are reluctant to sell funds showing an appreciation in value and are willing to sell poorly performing funds due to tax motivations. As capital gains are taxed on a realization basis in the U.S., this gives investors the incentive to hold those fund shares in their portfolio whose net asset value per share have appreciated since investing and, as a consequence, delaying the payment of taxes. Consistent with this behavior, investors are motivated to use the losses from selling mutual fund shares whose net asset value has fallen since investing in order to reduce their tax liabilities.

2.5 Persistence of Morningstar Ratings

As Morningstar updates Star Ratings on a monthly basis, it is interesting to examine the persistence of changes in the Star Ratings over a longer time horizon as shown in Table 4 and Table 10 (Appendix C). Only 66%-73% (67%-74%) of upgraded (downgraded) funds maintain their higher (lower) Star Rating in the month after the change event occurred. This percentage share decreases to a minimum value of 14% (15%) for upgrades (downgrades) regarding the one-year period after the initial rating change.

Comparing persistency percentages as well as numbers of upgrades and downgrades of each Star Rating level, a symmetric relation of downgrades and upgrades, indicating the bell-shaped distribution of the Morningstar Rating, can be clearly observed. The fact that a rating change is of quite short duration is similar to the findings of Carhart (1997), who demonstrates that there is rarely performance persistence of funds in the long-term.

Table 4: Persistence of Star Rating Changes
Table 4 presents the persistence of an initial rating change during the following months. The percentage shares are obtained by dividing the number of the remaining observations upholding the initial upgrade (downgrade) one, three, six and twelve months after the change event by the total number of upgrades (downgrades) in point t. The counting mechanism of the months a fund holds the upgraded (downgraded) rating constant stops if one or more than one month of observation is missing in the respective time period. Table 10 (Appendix C) reports a more detailed table.

	Upgrades				Downgrades			
	t+1	t+3	t+6	t+12	t+1	t+3	t+6	t+12
min	66%	43%	27%	14%	67%	43%	29%	15%
max	73%	48%	31%	16%	74%	50%	33%	17%

Following the persistence findings of Star Rating change events, I further analyze in which direction a fund's rating develops after the rating change, e.g. whether the fund moved back to its initial rating or whether the fund was upgraded (downgraded) multiple times. Therefore, I calculate a mean reversion factor as well as factors for further upgrades or further downgrades displayed in Table 5.

The mean reversion factor reports the sum of observations jumping back to their previous Star Rating level over the numbers of all further rating changes. I observe that the marginal upgrades (downgrades) to the top star level of five (bottom star level of one) show the strongest mean reversion factor of 97% (90%). This fact illustrates that a fund's belonging to the top or bottom percentile of a peer group is maintained for a comparably short duration. Regarding upgrades and downgrades situated in the middle part of the Star Rat-

ing distribution, I add the further upgrade (downgrade) factor alongside with the mean reversion factor. The mean reversion factor is still large for rating change events to two, three, or four stars, ranging from 63% to 84%. However, between 11% and 36% funds were further upgraded or downgraded. The highest further upgrade (downgrade) factor is assigned to the change events from one to two (five to four) stars as there is the largest scope to further upside (downside) developments.

Table 5: Developments after the Star Rating Change Event
Table 5 reports detailed information on how a fund's Star Rating developed if the fund has not been able to maintain its initial Star Rating change from month t up to month t+12. Row Observations (t) presents the number of funds affected by the initial Star Rating change event, whereas Row Observations (t+12) reports the number of funds maintaining their upgraded (downgraded) Star Rating level twelve months after the change event occurred. The following rows describe the possible changes a fund can be subject to when being affected by further rating changes within the twelve months' period. Since the counting mechanism of fund months after the change event month stops as soon as an observation of one month or more is missing, there is a certain amount of funds displayed in Row Rest which cannot be assigned to further changes. Consequently, the results of the mean reversion factor and the further upgrade or further downgrade factor do not add up to 100%. The mean reversion factor is computed as described above. The further upgrade (downgrade) factor reports the percentage share of all possible higher (lower) fund rating observations over the number of further rating changes, e.g. the further downgrade factor for 5 to 4-star rating change events is calculated as follows: Further downgrade factor (5to4) = (3+35+1,758)/5,031 = 0.36.

Star Rating Change	**4 to 5**	**3 to 4**	**2 to 3**	**1 to 2**	**5 to 4**	**4 to 3**	**3 to 2**	**2 to 1**
Observations (t)	5,599	12,473	11,217	3,943	5,995	13,102	11,753	4,175
Observations (t+12)	881	1,740	1,744	588	964	2,164	1,733	673
Further Rating Change	4,718	10,733	9,473	3,355	5,031	10,938	10,020	3,502
Change to 1 star	1	5	41	2,168	3	29	1,117	
Change to 2 stars	8	74	7,180		35	2,261		3,149
Change to 3 stars	70	9,061		968	1,758		8,382	58
Change to 4 stars	4,558		1,851	22		8,241	85	1
Change to 5 stars		1,380	40	0	3,157	64	3	0
Sum	4,637	10,520	9,112	3,158	4,953	10,595	9,587	3,208
No further observations	81	213	361	197	78	343	433	294
Mean Reversion Factor	97%	84%	76%	65%	63%	75%	84%	90%
Further Upgrade Factor		13%	20%	30%				
Further Downgrade Factor					36%	21%	11%	

3. Regression Analyses

3.1 General Approach

In this chapter, I test the effects of differently designed independent Morningstar variables on the dependent variable flow percent as defined in Chapter 2.3. The first regression begins by using the variable "Morningstar Star Rating" which states a fund observations' Morningstar Star Rating in month t. In the second regression, I introduce dummy variables for all Star Rating upgrades (downgrades) of one star and dummy variables relating to the Star Rating change over an event window of six months. The third regression re-

ports the effects of the eight possible upgrade (downgrade) change events of one star.

In all regressions, unobserved time effects like macro-economic variables are filtered out and statistics are robust to heteroskedasticity. Besides the measures of a fund's past return, which are designed differently throughout the three regressions, I include in each regression the following independent variables as main drivers of fund flows: A fund's size expressed by its total net assets, a fund's age, a fund's number of share classes as well as determinants of a fund's expenses comprising average net expense ratios, redemption fees, and front loads. In order to focus on the different setup of Morningstar Star Ratings in each regression, an interpretation of the effects of the main drivers of fund net flows on the dependent variable follows.

Regarding the negative impact of a fund's size, expressed by its TNA, on a fund's net flow, the conjectures asserted by Bergstresser and Paterba (2000) and Sirri and Tufano (1998) are confirmed by the underlying data. Throughout the three regressions, the natural logarithm of TNA is always assigned a negatively statistically significant coefficient. I introduce the natural logarithm of TNA for taking into account that an equal dollar flow will have a larger percentage impact on funds showing a smaller size compared to large-sized funds. The same procedure applies to a fund's age. By using the natural logarithm, the differences between younger funds are given more weight than the differences between older funds. Alongside with the findings of Chevalier and Ellison (1997) and Bergstresser and Paterba (2000), a fund's age does show a negatively statistically significant impact on a fund's net dollar flow.

A fund's number of share classes is always assigned a positive, and in two regressions statistically significant, coefficient with regard to its impact on the dependent variable flow percent. In addition, a fund's share classes differ only in the structure of their fees, their underlying portfolios are identical. Thus, the positive sensitivity of flow percent to the number of share classes can be explained by the simple fact that the more share classes a fund offers, the higher is the probability that an investor finds a share class that corresponds to his investment perceptions.

A large amount of academic research refers to the influence of a fund's expenses on its net flows. Detailed definitions of the three expense types in-

cluded in the following analyses are given in the Variable Appendix. In a first step, I analyze the coefficients of the net expense ratio. Throughout the three regressions, the sensitivity of flow percent to the annually paid net expense ratio is negatively statistically significant. From an economic perspective, this result is clearly expectable: The higher a fund's net expense ratio, the higher the yearly costs and the lower the fund flows. The same logical explanation applies to the average redemption fee, showing negative, and in two regressions also statistically significant, coefficients.

Regarding front loads, the results are ambiguous. The second regression reports a negative impact of front loads on the dependent variable which is consistent with the explanations given in the paragraph above. The remaining two regressions show positive coefficients for front loads. The third regression even states statistically significant positive results on a 10% level. As the front load fee is used to compensate the salesperson, it is directly related to marketing efforts. Hence, some investors might be biased in their fund selection decision-making and support high front loads as a signal of high marketing expenditures. Therefore, they see the fund as a promising investment. Barber, Odean, and Zheng (2005) and Gruber (1996) point out that investors hold significant portfolio positions in high expense mutual funds. Sirri and Tufano (1998) show that a change in loads does not lead to a significant change in a fund's net flow. Bailey, Kumar, and Ng (2011) argue that there are further behavioral biases as the home bias (the tendency of investors to overweight domestic investments in their portfolio) or the narrow framing bias (investment decisions without considering total portfolio effects) affecting investors in their mutual fund selection, thus, leading them to disregarding higher fees as an influential factor.

The general setup of the regressions includes nine dummy variables for the most commonly used Morningstar style-based U.S. stock fund categories. These are displayed in Table 11 (Appendix D). Funds are placed into one of these Morningstar Categories based on their market capitalization and their value or growth orientation, if their underlying investment style cannot be assigned to a particular economic sector (Phillips and Kaplan, 2010). In the underlying sample, more than 95% of the observations in scope can be assigned to one of the mentioned nine categories.

3.2 Piecewise Regression over Five Quantiles of Return

Table 6 shows the effects of various independent variables on a fund's quarterly flow percent using a piecewise regression for the return distribution, following Sirri and Tufano (1998). The coefficients of this piecewise decomposition of fractional ranks represent the slope of the convex flow-performance relationship. I find that the convexity of the Morningstar bell-shaped distribution in Column (B) is considerably higher than the one of the equally sized five quintiles of return in Column (A). The sensitivity of fund flows to the top performance quantile is twice as high for the Morningstar distribution, accounting for the top 10% of the distribution, as it is for the respective quintile in Column (A), accounting for the top 20% of the distribution in the top performer quantile. The results in Column (A) and (B) report that even for low performance quantiles, past performance is positively, and in most cases significantly, associated with fund flows.

I observe that the flow-performance convexity in both columns is not as strong as it is in the sample of Sirri and Tufano (1998) who use an event period from 1971 to 1990. This declining convexity can be explained by the fairly lower participation costs nowadays in the fund market due to investors obtaining information more easily and meaningful than decades ago (Huang et al., 2007). Furthermore, Ferreira et al. (2012) report evidence on declining participation costs leading to a less convex relationship and add the psychological component of investor sophistication as a further indicator of decreasing convexity. They argue that more sophisticated investors are less likely to be influenced by behavioral biases or persuaded by marketing.

The independent variable Morningstar Star Rating shows the effect of each fund observations' Star Rating on flow percent. An increase in the Star Rating by one unit leads to a positively statistically significant increase in flow percent by 3.26 percentage points.

Table 6: Piecewise Regression over Five Quantiles of Return

This table reports coefficient estimates using quarterly flow percent as dependent variable within a sample period from 1990 to 2016. In terms of avoiding a contemporaneous regression, meaning that the dependent and independent variables are measured at the same time, flow percent of the following quarter is applied as dependent variable. In order to ensure that extreme values do not influence the results, flow percent is winsorized at the bottom and top 2% level of the distribution. For TNA, fund age, and net expense ratio natural logarithm values are used to ensure a more reasonably economic interpretation. Each fund observation is given a fractional rank representing its relative performance compared to all fund observations within one quarter. Funds showing the maximum performance of one quarter receive a relative rank equal to one. The fund with the quarter's lowest performance is assigned a value very closely to zero. In Column (A) relative ranks are grouped into five equally sized quintiles. The BOTTOM performance quintile is defined as Min(0.2, Relative Rank), the 2nd performance quintile is defined as Min(0.2, Relative Rank – BOTTOM performance quintile), and so forth, up to the TOP performance quintile. In Column (B) ranks are grouped into five quantiles accordingly to the bell-shaped Morningstar Star Rating distribution. As the five groups are not equally sized as in Column (A), the term quintile is not applicable anymore and, therefore, the more general term quantile is used as row name. The BOTTOM performance quantile is defined as Min(0.1, Relative Rank), the 2nd performance quantile is defined as Min(0.225, Relative Rank – BOTTOM performance quantile), the 3rd performance quantile is defined as Min(0.35, Relative Rank – 2nd performance quantile – BOTTOM performance quantile), and so forth, following the bell-shaped distribution up to the TOP performance quantile. Nine dummy variables for the most commonly used Morningstar style-based U.S. stock fund categories are included. The regression is run quarter-by-quarter, standard errors are double-clustered by fund and quarter. T-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.

Independent Variable	(A)	(B)
Morningstar Star Rating	0.0326***	0.0326***
	(29.13)	(29.16)
LN (TNA)	-0.0105***	-0.0105***
	(-11.20)	(-11.19)
LN (Fund age)	-0.0180***	-0.0180***
	(-14.54)	(-14.56)
Number of share classes	0.0030***	0.0030***
	(4.46)	(4.47)
LN (Net expense ratio average)	-0.0096***	-0.0096***
	(-5.09)	(-5.13)
Redemption fee average	-0.2822**	-0.2852**
	(-2.57)	(-2.60)
Front load average	0.0195	0.0201
	(0.41)	(0.42)
Breakdown of Rank		
BOTTOM performance quantile	0.0383***	0.0348
	(3.63)	(1.20)
2nd performance quantile	0.0406***	0.0400***
	(3.49)	(3.92)
3rd performance quantile	0.0525***	0.0478***
	(6.07)	(7.27)
4th performance quantile	0.0288**	0.0475***
	(2.16)	(3.87)
TOP performance quantile	0.1568***	0.3182***
	(6.03)	(5.85)
Adjusted R^2	0.175	0.175
Number of observations	130,036	130,036

A detailed table of this regression including the coefficients of the dummy variables is shown in Table 12 (Appendix E).

3.3 Flow Sensitivity to Star Rating Change Events

In the second regression, I introduce dummy variables for all Star Rating changes of one star. For each month following the initial rating change within an event window of six months a dummy variable is added in order to observe how the coefficients change over time. For both upgrades and downgrades the coefficients affecting flow percent the most are observed in month t+3, the third month following the initial rating change. For upgrades (downgrades) coefficients are increasing (decreasing) from month t on, showing their peak (trough) in month t+3, and are decreasing (increasing) afterwards.

Consistent with the findings of Del Guercio and Tkac (2008), throughout the whole event window of seven months, Star Rating upgrades (downgrades) are positively (negatively) statistically significant, confirming that investors respond to rating changes not only immediately but also with a considerable time lag. More precisely, month t+3 appears to be the most relevant point of time where most investors react to the rating change. This lag of response can be explained by the fact that not all investors are vigilant when it comes to tracking Morningstar Star Rating changes every month, and might review Star Rating changes on a quarterly basis (Del Guercio and Tkac, 2008). Another explanation can be that investors have learned about the weak Star Rating persistency as described in Chapter 2.5 and postpone their investment decisions. Tax considerations of selling funds experiencing upgrades and behavioral biases as the disposition effect can also lead to lagged reactions to change events.[2]

In this regression, I do not incorporate relative ranks of return into quantiles, but use the relative ranks itself as an independent variable for a fund's past performance. A squared term of relative rank of return accounts for the flow-performance convexity. Since the squared term of relative rank of return is positively statistically significant, the flow-performance convexity is confirmed in this regression.

[2] The disposition effect has been proved oftentimes in the literature. Following Weber and Camerer (1998), the disposition effect is defined as "the tendency to sell assets that have gained value ('winners') and keep assets that have lost value ('losers')." This behavioral anomaly is due to investors valuing losses relatively more than gains following the prospect theory.

Table 7: Flow Sensitivity to Star Rating Change Events
This table reports coefficient estimates using monthly flow percent as dependent variable within a sample period from 1990 to 2016. In terms of avoiding a contemporaneous regression, flow percent of the following month t+1 is applied as dependent variable. In order to ensure that extreme values do not influence the results, flow percent is winsorized at the bottom and top 2% level of the distribution. There are seven upgrade dummy variables and seven downgrade dummy variables over an event window of seven months included, ranging from month t, when the rating change occurred, up to month t+6. Each fund observation is given a fractional rank representing its relative performance compared to all fund observations within one month. Funds showing the maximum performance of one month receive a relative rank equal to one. For TNA, fund age, and net expense ratio natural logarithm values are used to ensure a more reasonably economic interpretation. Nine dummy variables for the most commonly used Morningstar style-based U.S. stock fund categories are included. The regression is run month-by-month, standard errors are double-clustered by fund and month. T-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variable	Coefficient	T statistic
Upgrade month t	0.0019***	(5.57)
Upgrade month t+1	0.0057***	(14.94)
Upgrade month t+2	0.0068***	(15.65)
Upgrade month t+3	0.0074***	(17.78)
Upgrade month t+4	0.0073***	(18.60)
Upgrade month t+5	0.0066***	(17.93)
Upgrade month t+6	0.0051***	(14.91)
Downgrade month t	-0.0031***	(-9.35)
Downgrade month t+1	-0.0063***	(-16.42)
Downgrade month t+2	-0.0075***	(-19.79)
Downgrade month t+3	-0.0080***	(-20.36)
Downgrade month t+4	-0.0074***	(-21.07)
Downgrade month t+5	-0.0075***	(-20.72)
Downgrade month t+6	-0.0056***	(-16.58)
Relative rank of return	-0.0017	(-1.06)
(Relative rank of return)²	0.0126***	(7.58)
LN (TNA)	-0.0011***	(-4.70)
LN (Fund Age)	-0.0086***	(-21.40)
Number of share classes	0.0006***	(3.29)
LN (Net expense ratio average)	-0.0036***	(-7.40)
Front load average	-0.0097	(-0.71)
Redemption fee average	-0.0527	(-1.59)
Adjusted R^2	0.066	
Number of observations	392,482	

A detailed table of this regression including the coefficients of the dummy variables is shown in Table 13 (Appendix F).

3.4 Star Rating and Analyst Rating Impact on Fund Flows

To examine the effects of the different Star Rating change events on fund flows, I introduce eight dummy variables for all possible upgrades and downgrades of one star in the third regression displayed in Table 8. With regard to the Morningstar Analyst Rating, four dummy variables for the most relevant Analyst Ratings are included. Table 15 (Appendix G) reports detailed information on the Analyst Rating observations in this sample. The sample period starts in 2011 when the Analyst Rating was first implemented. Due to obser-

vations accounting for less than 0.1% of the sample, the Analyst Ratings "Negative" and "Under Review" are not included.

Regarding all eight Star Rating change dummy variables, the algebraic signs and the magnitude of the coefficients are consistent with my findings on the average monthly flow percent of event month t in Table 3. Rating changes from one to two stars, from two to three stars, from three to two stars, and from two stars to one star are negatively statistically significant. Upgrades to a four- or five-star level and downgrades to a four- or three-star level are assigned a positively statistically significant coefficient. The attainment of a five-star rating as well as the downgrade from a five-star fund to four-star fund stand out as overwhelmingly positive events in the month of the rating change. Funds assigned the Analyst Rating "Gold" show a positively statistically significant effect on fund net flows, whereas funds rated "Neutral" affect fund net flows negatively.

Relative rank and relative rank squared are again included as determinants for past performance. The squared term of relative rank is positively statistically significant, thus, confirming the flow-performance convexity. However, the coefficient of convexity is with 0.81% considerably lower than the coefficient of 1.26% from the second regression. This fact is leading back to the decreasing convexity of the flow-performance relationship over time as in the underlying regression the sample period starts in 2011, whereas the sample period of regression two starts in 1990.

Table 8: Star Rating and Analyst Rating Impact on Fund Flows
This table reports coefficient estimates using monthly flow percent as dependent variable within a sample period from 2011 to 2016. In terms of avoiding a contemporaneous regression, flow percent of the following month t+1 is applied as dependent variable. In order to ensure that extreme values do not influence the results, flow percent is winsorized at the bottom and top 2% level of the distribution. There are four upgrade dummy variables and four downgrade dummy variables for each Star Rating change of one star included, stating the coefficients of the month when the change event occurred. The four Analyst Rating dummy variables report coefficients for the funds assigned one of these four Analyst Ratings. Each fund observation is given a fractional rank representing its relative performance compared to all fund observations within one month. Funds showing the maximum performance of one month receive a relative rank equal to one. For TNA, fund age, and net expense ratio natural logarithm values are used to ensure a more reasonably economic interpretation. Nine dummy variables for the most commonly used Morningstar style-based U.S. stock fund categories are included. The regression is run month-by-month, standard errors are double-clustered by fund and month. T-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variable	Coefficient	T statistic
Upgrade 1 ★ to 2 ★★	-0.0109***	(-7.76)
Upgrade 2 ★★ to 3 ★★★	-0.0052***	(-7.53)
Upgrade 3 ★★★ to 4 ★★★★	0.0014**	(2.37)

Upgrade 4 ★★★★ to 5 ★★★★★	0.0163***	(13.82)
Downgrade 5 ★★★★★ to 4 ★★★★	0.0132***	(11.66)
Downgrade 4 ★★★★ to 3 ★★★	0.0015**	(2.24)
Downgrade 3 ★★★ to 2 ★★	-0.0067***	(-8.84)
Downgrade 2 ★★ to 1 ★	-0.0106***	(-8.46)
Analyst Rating: Gold	0.0030**	(2.36)
Analyst Rating: Silver	0.0015	(1.19)
Analyst Rating: Bronze	-0.0001	(-0.09)
Analyst Rating: Neutral	-0.0075***	(-8.31)
Relative rank of return	0.0010	(0.39)
(Relative rank of return)²	0.0081***	(3.00)
LN (TNA)	-0.0006***	(-3.01)
LN (Fund age)	-0.0059***	(-11.17)
Number of share classes	0.0001	(1.07)
LN (Net expense ratio average)	-0.0037***	(-6.26)
Front Load average	0.0311*	(1.74)
Redemption fee average	-0.1024**	(-2.19)
Adjusted R^2	0.038	
Number of observations	142,907	

A detailed table of this regression including the coefficients of the dummy variables is shown in Table 14 (Appendix G).

Going further into detail, I examine the effects of Star Rating upgrades and downgrades of funds being analyst rated as well. Therefore, the sample is restricted to funds which simultaneously possess an Analyst Rating and a Star Rating, resulting in 21,340 observations of which 1,352 are Star Rating upgrades and 643 are Star Rating downgrades. One might expect that a "Gold" analyst rated fund experiencing a Star Rating upgrade shows a highly positive significant coefficient, but this cannot be confirmed. "Gold" rated funds which are downgraded show a positively statistically significant coefficient, raising the question if investors value the Analyst Rating in this specific case more than the Star Rating. However, taking into consideration the small number of observations in scope and that there has been little academic research on the economic relevance of Morningstar's Analyst Rating so far, it would require further examinations to provide a profound interpretation. Table 16 (Appendix G) displays the results of this additional regression.

4. Conclusion

This bachelor thesis analyzes the impact of Morningstar's Star Rating on U.S. mutual fund flows. I find evidence that an upgrade (downgrade) of Morningstar's Star Rating has a positively (negatively) statistically significant impact on mutual funds flows in the months following the change event. My results also prove that investors' reactions to Star Rating change events are

strongest about a quarter after the change event occurred, underlining the fact that investors response to rating changes with a considerable time lag. By using a piecewise regression over five quantiles of return, I observe that the bell-shaped distribution of the Morningstar Star Rating confirms the proposition of a convex flow-performance relationship, which has been often identified in the literature. In addition, I investigate the persistence of Star Rating changes and find that the number of fund observations maintaining their newly assigned Star Rating is quite weak, drastically decreasing from quarter to quarter within in an event window of twelve months. My results show that most of the funds follow a mean reversion process back to their previous Star Rating. However, the overall conclusion of my investigations is that Morningstar's Star Rating stands out as a salient determinant regarding mutual fund flows in the U.S., highly influencing investors' decision making. By using a simple-to-understand five-tier scale and offering freely available and monthly updated information on mutual funds, Morningstar is the undisputed market leader regarding independent assessments of mutual funds.

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Appendix

Appendix A: Average Monthly Dollar Flow of the Five Star Ratings

Appendix A refers to Chapter 2.3 Mutual Fund Flows.

Figure 1: Average Monthly Dollar Flow of the Five Star Ratings
This figure shows the average monthly dollar flow for each of the five Morningstar Star Ratings on a monthly basis. The underlying data and methodology complies to the description of Table 1 as this figure visualizes the results of Column two.

Appendix B: Star Rating Changes of One Star and Greater than One Star

Appendix B refers to Chapter 2.4 Star Rating Change Events.

Table 9: Star Rating Changes of One Star and Greater than One Star
This table reports the number of observations of all Star Rating change possibilities that occur within the sample period from 1990 to 2016. The total number of observations with a Star Rating within this period accounts for 507,389. The numbers of each Star Rating change possibility are counted by comparing the Star Rating of one month with the Star Rating of the previous month, adjusting the formula for each of the Star Rating changes.

	Upgrades	Downgrades
All Star Rating changes	33,589	35,416
1-star change	33,232	35,025
2-star change	345	365
3-star change	11	25
4-star change	1	1
Sum of 2-,3-,4-star changes	357	391
Percentage share of Star Rating changes > 1 star	1.06%	1.10%

Appendix C: Persistence of Morningstar Ratings

Appendix C refers to Chapter 2.5 Persistence of Morningstar Ratings.

Table 10: Persistence of Star Rating Changes - Detailed
Table 10 reports the persistence of an initial rating change during the following twelve months. Column N counts the number of the remaining fund observations within the event window of 12 months after the month of the change event. The percentage shares in Columns N in % are obtained by dividing the number of the remaining observations N upholding the initial upgrade (downgrade) in the respective month by the number of observations in month t. The counting mechanism of the months a fund holds the upgraded (downgraded) rating constant stops if one or more than one month of observation is missing in the respective time period.

Upgrades										
	ALL		1 to 2		2 to 3		3 to 4		4 to 5	
	N	N in %	N	N in %	N	N in %	N	N in %	N	N in %
t	33,232	100%	3,943	100%	11,217	100%	12,473	100%	5,599	100%
t+1	23,149	66%	2,872	69%	8,015	68%	8,546	65%	3,716	62%
t+2	18,292	52%	2,294	55%	6,419	55%	6,684	51%	2,895	48%
t+3	15,200	43%	1,912	46%	5,372	46%	5,536	42%	2,380	40%
t+4	12,893	37%	1,607	38%	4,584	39%	4,679	36%	2,023	34%
t+5	11,033	32%	1,360	33%	3,925	33%	3,998	31%	1,750	29%
t+6	9,619	27%	1,203	29%	3,418	29%	3,466	26%	1,532	26%
t+7	8,504	24%	1,044	25%	2,994	25%	3,073	23%	1,393	23%
t+8	7,492	21%	907	22%	2,657	23%	2,690	21%	1,238	21%
t+9	6,746	19%	832	20%	2,377	20%	2,405	18%	1,132	19%
t+10	6,094	17%	753	18%	2,148	18%	2,149	16%	1,044	17%
t+11	5,505	16%	662	16%	1,942	17%	1,929	15%	972	16%
t+12	4,953	14%	588	14%	1,744	15%	1,740	13%	881	15%
Downgrades										
	ALL		5 to 4		4 to 3		3 to 2		2 to 1	
	N	N in %	N	N in %	N	N in %	N	N in %	N	N in %
t	35,025	100%	5,995	100%	13,102	100%	11,753	100%	4,175	100%
t+1	24,764	71%	4,458	74%	9,343	71%	8,159	69%	2,804	67%
t+2	19,773	56%	3,616	60%	7,503	57%	6,459	55%	2,195	53%
t+3	16,417	47%	3,004	50%	6,318	48%	5,297	45%	1,798	43%
t+4	14,098	40%	2,577	43%	5,433	41%	4,533	39%	1,555	37%
t+5	12,215	35%	2,196	37%	4,726	36%	3,924	33%	1,369	33%
t+6	10,775	31%	1,950	33%	4,168	32%	3,456	29%	1,201	29%
t+7	9,577	27%	1,700	28%	3,732	28%	3,055	26%	1,090	26%
t+8	8,561	24%	1,497	25%	3,348	26%	2,732	23%	984	24%
t+9	7,698	22%	1,351	23%	3,006	23%	2,446	21%	895	21%
t+10	6,867	20%	1,214	20%	2,665	20%	2,168	18%	820	20%
t+11	6,166	18%	1,081	18%	2,404	18%	1,939	16%	742	18%
t+12	5,534	16%	964	16%	2,164	17%	1,733	15%	673	16%

Appendix D: Morningstar Categories

Appendix D refers to Chapter 3.1 General Approach.

Table 11: Morningstar Style-based U.S. Stock Fund Categories
This table presents the number of fund month observations belonging to each of the nine most commonly used Morningstar Categories within this sample. 95.2% of all 507,385 observations with a Star Rating within the observation period from 1990 to 2016 can be assigned to one of these nine categories. The classifications Large, Mid-Cap, and Small are based on the market capitalization of a fund. Value, Grow, and Blend reflect the fund's investment style. Following Phillips and Kaplan (2010), value investors hold funds that are detected as undervalued, whereas growth investors hold funds that are perceived as overvalued. Blend funds are diversified investments, holding both value and growth positions. Nine dummy variables corresponding to each of these nine categories are included in each of the regressions of the main part.

	Value	**Growth**	**Blend**
Large	Large Value (71,476)	Large Growth (86,565)	Large Blend (106,480)
Mid-Cap	Mid-Cap Value (22,377)	Mid-Cap Growth (53,072)	Mid-Cap Blend (31,731)
Small	Small Value (25,160)	Small Growth (48,848)	Small Blend (37,101)

Appendix E: Piecewise Regression over Five Quantiles of Return

Table 12 shows more detailed information on the piecewise regression over five quantiles of return than Table 6 in Chapter 3.2.

Table 12: Piecewise Regression over Five Quantiles of Return - Detailed
This table reports coefficient estimates using quarterly flow percent as dependent variable within a sample period from 1990 to 2016. In terms of avoiding a contemporaneous regression, meaning that the dependent and independent variables are measured at the same time, flow percent of the following quarter is applied as dependent variable. In order to ensure that extreme values do not influence the results, flow percent is winsorized at the bottom and top 2% level of the distribution. For TNA, fund age, and net expense ratio natural logarithm values are used to ensure a more reasonably economic interpretation. Each fund observation is given a fractional rank representing its relative performance compared to all fund observations within one quarter. Funds showing the maximum performance of one quarter receive a relative rank equal to one. The fund with the quarter's lowest performance is assigned a value very closely to zero. In Column (A) relative ranks are grouped into five equally sized quintiles. The BOTTOM performance quintile is defined as Min(0.2, Relative Rank), the 2nd performance quintile is defined as Min(0.2, Relative Rank – BOTTOM performance quintile), and so forth, up to the TOP performance quintile. In Column (B) ranks are grouped into five quantiles accordingly to the bell-shaped Morningstar Star Rating distribution. As the five groups are not equally sized as in Column (A), the term quintile is not applicable anymore and, therefore, the more general term quantile is used as row name. The BOTTOM performance quantile is defined as Min(0.1, Relative Rank), the 2nd performance quantile is defined as Min(0.225, Relative Rank – BOTTOM performance quantile), the 3rd performance quantile is defined as Min(0.35, Relative Rank – 2nd performance quantile – BOTTOM performance quantile), and so forth, following the bell-shaped distribution up to the TOP performance quantile. Nine dummy variables for the most commonly used Morningstar style-based U.S. stock fund categories are included. The regression is run quarter-by-quarter, standard errors are double-clustered by fund and quarter. T-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.

Independent Variable	(A)	(B)
Morningstar Star Rating	0.0326***	0.0326***
	(29.13)	(29.16)
LN (TNA)	-0.0105***	-0.0105***
	(-11.20)	(-11.19)
LN (Fund age)	-0.0180***	-0.0180***
	(-14.54)	(-14.56)
Number of share classes	0.0030***	0.0030***
	(4.46)	(4.47)
LN (Net expense ratio average)	-0.0096***	-0.0096***
	(-5.09)	(-5.13)
Redemption fee average	-0.2822**	-0.2852**
	(-2.57)	(-2.60)
Front load average	0.0195	0.0201
	(0.41)	(0.42)
Breakdown of Rank		
BOTTOM performance quantile	0.0383***	0.0348
	(3.63)	(1.20)
2nd performance quantile	0.0406***	0.0400***
	(3.49)	(3.92)
3rd performance quantile	0.0525***	0.0478***
	(6.07)	(7.27)
4th performance quantile	0.0288**	0.0475***
	(2.16)	(3.87)
TOP performance quantile	0.1568***	0.3182***
	(6.03)	(5.85)
MS Category US OE Large Value	0.0059	0.0059
	(1.66)	(1.65)
MS Category US OE Large Growth	0.0045	0.0045
	(1.31)	(1.31)
MS Category US OE Large Blend	-0.0032	-0.0032
	(-0.98)	(-0.99)
MS Category US OE Mid-Cap Value	0.0102**	0.0102**
	(2.19)	(2.19)
MS Category US OE Mid-Cap Growth	0.0003	0.0004
	(0.09)	(0.11)
MS Category US OE Mid-Cap Blend	0.0017	0.0019
	(0.43)	(0.47)
MS Category US OE Small Value	0.0110**	0.0110**
	(2.45)	(2.44)
MS Category US OE Small Growth	-0.0041	-0.0042
	(-1.07)	(-1.11)
MS Category US OE Small Blend	0.0022	0.0022
	0.60	0.60
Adjusted R^2	0.175	0.175
Number of observations	130,036	130,036

Appendix F: Flow Sensitivity to Star Rating Change Events

Table 13 shows more detailed information on the second regression than Table 7 in Chapter 3.3.

Table 13: Flow Sensitivity to Star Rating Change Events - Detailed
This table reports coefficient estimates using monthly flow percent as dependent variable within a sample period from 1990 to 2016. In terms of avoiding a contemporaneous regression, flow percent of the following month t+1 is applied as dependent variable. In order to ensure that extreme values do not influence the results, flow percent is winsorized at the bottom and top 2% level of the distribution. There are seven upgrade dummy variables and seven downgrade dummy variables over an event window of seven months included, ranging from month t, when the rating change occurred, up to month t+6. Each fund observation is given a fractional rank representing its relative performance compared to all fund observations within one month. Funds showing the maximum performance of one month receive a relative rank equal to one. For TNA, fund age, and net expense ratio natural logarithm values are used to ensure a more reasonably economic interpretation. Nine dummy variables for the most commonly used Morningstar style-based U.S. stock fund categories are included. The regression is run month-by-month, standard errors are double-clustered by fund and month. T-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variable	Coefficient	T statistic
Upgrade month t	0.0019***	(5.57)
Upgrade month t+1	0.0057***	(14.94)
Upgrade month t+2	0.0068***	(15.65)
Upgrade month t+3	0.0074***	(17.78)
Upgrade month t+4	0.0073***	(18.60)
Upgrade month t+5	0.0066***	(17.93)
Upgrade month t+6	0.0051***	(14.91)
Downgrade month t	-0.0031***	(-9.35)
Downgrade month t+1	-0.0063***	(-16.42)
Downgrade month t+2	-0.0075***	(-19.79)
Downgrade month t+3	-0.0080***	(-20.36)
Downgrade month t+4	-0.0074***	(-21.07)
Downgrade month t+5	-0.0075***	(-20.72)
Downgrade month t+6	-0.0056***	(-16.58)
Relative rank of return	-0.0017	(-1.06)
(Relative rank of return)²	0.0126***	(7.58)
LN (TNA)	-0.0011***	(-4.70)
LN (Fund Age)	-0.0086***	(-21.40)
Number of share classes	0.0006***	(3.29)
LN (Net expense ratio average)	-0.0036***	(-7.40)
Front load average	-0.0097	(-0.71)
Redemption fee average	-0.0527	(-1.59)
MS Category US OE Large Value	0.0030***	(2.82)
MS Category US OE Large Growth	0.0030***	(2.98)
MS Category US OE Large Blend	0.0001	(0.12)
MS Category US OE Mid-Cap Value	0.0042***	(2.98)
MS Category US OE Mid-Cap Growth	0.0018*	(1.65)
MS Category US OE Mid-Cap Blend	0.0019	(1.60)
MS Category US OE Small Value	0.0041***	(3.01)
MS Category US OE Small Growth	0.0008	(0.71)
MS Category US OE Small Blend	0.0022**	(2.01)
Adjusted R^2	0.066	
Number of observations	392,482	

Appendix G: Star Rating and Analyst Rating Impact on Fund Flows

The tables of appendix G refer to Chapter 3.4 Star Rating and Analyst Rating Impact on Net Flows. Table 14 shows more detailed information on the third regression than Table 8.

Table 14: Star Rating and Analyst Rating Impact on Fund Flows - Detailed
This table reports coefficient estimates using monthly flow percent as dependent variable within a sample period from 2011 to 2016. In terms of avoiding a contemporaneous regression, flow percent of the following month t+1 is applied as dependent variable. In order to ensure that extreme values do not influence the results, flow percent is winsorized at the bottom and top 2% level of the distribution. There are four upgrade dummy variables and four downgrade dummy variables for each Star Rating change of one star included, stating the coefficients of the month when the change event occurred. The four Analyst Rating dummy variables report coefficients for the funds assigned one of these four Analyst Ratings. Each fund observation is given a fractional rank representing its relative performance compared to all fund observations within one month. Funds showing the maximum performance of one month receive a relative rank equal to one. For TNA, fund age, and net expense ratio natural logarithm values are used to ensure a more reasonably economic interpretation. Nine dummy variables for the most commonly used Morningstar style-based U.S. stock fund categories are included. The regression is run month-by-month, standard errors are double-clustered by fund and month. T-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variable	Coefficient	T statistic
Upgrade 1 ★ to 2 ★★	-0.0109***	(-7.76)
Upgrade 2 ★★ to 3 ★★★	-0.0052***	(-7.53)
Upgrade 3 ★★★ to 4 ★★★★	0.0014**	(2.37)
Upgrade 4 ★★★★ to 5 ★★★★★	0.0163***	(13.82)
Downgrade 5 ★★★★★ to 4 ★★★★	0.0132***	(11.66)
Downgrade 4 ★★★★ to 3 ★★★	0.0015**	(2.24)
Downgrade 3 ★★★ to 2 ★★	-0.0067***	(-8.84)
Downgrade 2 ★★ to 1 ★	-0.0106***	(-8.46)
Analyst Rating: Gold	0.0030**	(2.36)
Analyst Rating: Silver	0.0015	(1.19)
Analyst Rating: Bronze	-0.0001	(-0.09)
Analyst Rating: Neutral	-0.0075***	(-8.31)
Relative rank of return	0.0010	(0.39)
(Relative rank of return)²	0.0081***	(3.00)
LN (TNA)	-0.0006***	(-3.01)
LN (Fund age)	-0.0059***	(-11.17)
Number of share classes	0.0001	(1.07)
LN (Net expense ratio average)	-0.0037***	(-6.26)
Front Load average	0.0311*	(1.74)
Redemption fee average	-0.1024**	(-2.19)
MS Category US OE Large Value	0.0023*	(1.81)
MS Category US OE Large Growth	0.0012	(1.01)
MS Category US OE Large Blend	0.0007	(0.63)
MS Category US OE Mid-Cap Value	0.0045**	(2.36)
MS Category US OE Mid-Cap Growth	0.0012	(0.85)
MS Category US OE Mid-Cap Blend	0.0010	(0.66)
MS Category US OE Small Value	0.0053***	(2.66)
MS Category US OE Small Growth	-0.0004	(-0.27)
MS Category US OE Small Blend	0.0022	(1.51)
Adjusted R^2	0.038	
Number of observations	142,907	

Appendix G: Star Rating and Analyst Rating Impact on Fund Flows

Table 15: Allocation of Analyst Ratings across Star Rated Funds

This table reports the allocation of Morningstar's Analyst Rating combined with the Star Rating within the sample period from 2011 to 2016. This table should be read as follows: From all five-star rated fund month observations, 709 are Analyst "Gold"-rated, 1,072 are Analyst "Silver"-rated, 658 are Analyst "Bronze"-rated, and 172 are Analyst "Neutral"-rated. The last Row Σ reports the sum of Analyst Ratings, e.g. 5,252 funds with a Star Rating are Analyst "Silver"-rated. Four dummy variables corresponding to the total amount of each of the four Analyst Ratings are included in the third regression (Chapter 3.4). This table comprises slightly more observations than there are finally included in the regression displayed in Table 13. This is due to the fact that some observations with both Star and Analyst Rating are excluded when generating other variables of interest of the regression.

Morningstar Star Rating	Gold	Silver	Bronze	Neutral
1	14	79	124	400
2	104	438	859	1,706
3	596	1,458	2,647	2,635
4	1,977	2,205	2,388	1,111
5	709	1,072	658	172
Σ	3,400	5,252	6,676	6,024

Appendix G: Star Rating and Analyst Rating Impact on Fund Flows

Table 16: Analyst Rated Funds Experiencing Star Rating Changes
This table reports coefficient estimates using a fund's monthly flow percent as dependent variable within a sample period from 2011 to 2016. In terms of avoiding a contemporaneous regression, flow percent of the following month t+1 is applied as dependent variable. In order to ensure that extreme values do not influence the results, flow percent is winsorized at the bottom and top 2% level of the distribution. For each Analyst Rating an upgrade dummy as well as a downgrade dummy are included. For example, Gold + Upgrade means that a fund which is rated Analyst "Gold" experiences a Star Rating upgrade. Each fund observation is given a fractional rank representing its relative performance compared to all fund observations within one month. Funds showing the maximum performance of one month receive a relative rank equal to one. For TNA, fund age, and net expense ratio natural logarithm values are used to ensure a more reasonably economic interpretation. Nine dummy variables for the most commonly used Morningstar style-based U.S. stock fund categories are included. The regression is run month-by-month, standard errors are double-clustered by fund and month. T-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variable	Coefficient	T statistic
Gold + Upgrade	0.0020	(1.46)
Silver + Upgrade	0.0027*	(1.76)
Bronze + Upgrade	0.0015	(1.35)
Neutral + Upgrade	-0.0048***	(-3.67)
Gold + Downgrade	0.0040**	(2.28)
Silver + Downgrade	0.0022	(1.48)
Bronze + Downgrade	0.0031**	(2.38)
Neutral + Downgrade	-0.0057***	(-3.91)
Relative rank of return	0.0132***	(3.11)
(Relative rank of return)^2	-0.0051	(-1.32)
LN (TNA)	0.0011**	(2.34)
LN (Fund age)	-0.0057***	(-5.89)
Number of share classes	0.0002	(1.11)
LN (Net expense ratio average)	-0.0054***	(-6.39)
Front load average	0.0059	(0.17)
Redemption fee average	-0.1133	(-1.15)
MS Category US OE Large Value	-0.0020	(-0.30)
MS Category US OE Large Growth	-0.0038	(-0.58)
MS Category US OE Large Blend	-0.0037	(-0.57)
MS Category US OE Mid-Cap Value	-0.0019	(-0.26)
MS Category US OE Mid-Cap Growth	-0.0050	(-0.74)
MS Category US OE Mid-Cap Blend	-0.0055	(-0.84)
MS Category US OE Small Value	-0.0043	(-0.63)
MS Category US OE Small Growth	-0.0015	(-0.21)
MS Category US OE Small Blend	-0.0035	(-0.52)
Adjusted R^2	0.083	
Number of observations	20,842	

Variable Appendix

Variable name	Description	Source
Front load average	Initial sales charge that is deducted one time from an investment made into the fund to compensate the broker or financial planner for providing professional investment advice. For each fund month observation, the average front load over the share classes with front loads is used.	Morningstar variable description
Monthly return	The monthly return is calculated by taking the change in monthly net asset value, reinvesting all income and capital gains distributions during that month, and dividing by the starting net asset value.	Morningstar variable description
Net expense ratio average	Yearly paid percentage of fund assets used to pay for operating expenses and management fees. For each fund month observation, the equal weighted average of historical net expense ratios across share classes is used.	Morningstar variable description
Redemption fee average	An annual amount charged when assets are withdrawn from some funds. For each fund month observation, the average redemption fee over the share classes with redemption fee is used.	Morningstar variable description