UNIVERSITÄT MANNHEIM

Mutual Fund Flow and Rating-induced Price Pressure

(of the master seminar thesis)

Master Seminar Thesis

Chair of Finance

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Abstract

Morningstar mutual fund ratings is an indicator that measures the performance of individual mutual fund. This seminar paper clarifies the relationship between the Morningstar mutual fund ratings, fund flow, and price pressure on individual stocks.

1. Introduction

The reaction of asset prices to demand or supply shock is always a topic worthy to study. A rapidly expanding literature suggests that investor flow can be used as a source of exogeneous price pressure. A report from SIFMA mentioned that $21.3 trillion are invested in mutual fund assets in 2019, and 53% among these assets are allocated in U.S. Equity market.[1] Since the massive amount of equity are held by mutual funds, it is worthy to investigate how the flow of mutual funds brings price pressure on equity. One of the methods is to study the mutual fund flow induced trading.

Several research suggests that mutual fund flow depends highly on its past performance while Morningstar rating system is also a factor aggregates the information of the past history of mutual fund.

Therefore, I focus on the mechanism of Morningstar ratings of funds induce flow and its impact on stock price in this paper. I replicate most of the research method in Ben-David et al. (2020)[2].

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[1] Available at https://www.sifma.org/wp-content/uploads/2021/02/SIFMA-Insights-Who-Owns-Stocks-An-Update-FOR-WEB.pdf. Last visit: 21.08.2022

[2] Itzhak Ben-David et al., "RATINGS-DRIVEN DEMAND AND SYSTEMATIC PRICE FLUCTUATIONS."

First of all, I describe how I acquire the data for my research. Next, I briefly introduce the measurement methodology of Morningstar rating system and the reform of rating methodology in June 2020. Thereafter, I examine the relationship between rating change, fund flow, and price pressure. Finally, I generate an weighted expectation factor by lag rating changes that can predict the future price pressure on equities.

2. Data

In this section, I describe how the data of my research is fetched. Then, I display the methods which I have used to merge datasets from different data. Last but not least, I represent the construction of several important additional variables.

2.1 Mutual Fund Sample

This research focus on U.S mutual funds which invested mostly in domestic equity. The time horizon starts from the beginning of 1991 to the end of 2020. While the pandemic in 2020 could bring concern over the contribution to our result, the information from the summary statistics (see Appendix A) shows that the information of 2020 does not deviate from other years. Therefore, I accept this time interval to exist in my dataset.

The mutual fund data is obtained from two different database. First of all, I acquire total net asset (TNA) and monthly fund return (mret) from the Center of Research in Security Price(CRSP). Then, I download Morningstar ratings and style box data from Morningstar direct. I go through several process, which is mostly aligned with Pástor, Stambaugh, and Taylor (2015) to filter out the specific mutual fund for my need. For both datasets, I drop out observations whose name contains Index, International, Bond, Industrial, Industry, Real Estate, Retirement, and non-Equity to make sure that our data only incorporates equity funds. ETFs and ETNs are eliminated via ETF/ETN flags from CRSP as well. Furthermore,

I eliminate the fund with extreme expense ratio which is low than 0.1%, winsorize fund flow at the 0.5% and 99.5% within each month, and drop the observations with monthly TNA lower than $1 million. Finally, I merge the two data set by fund CUSIP.

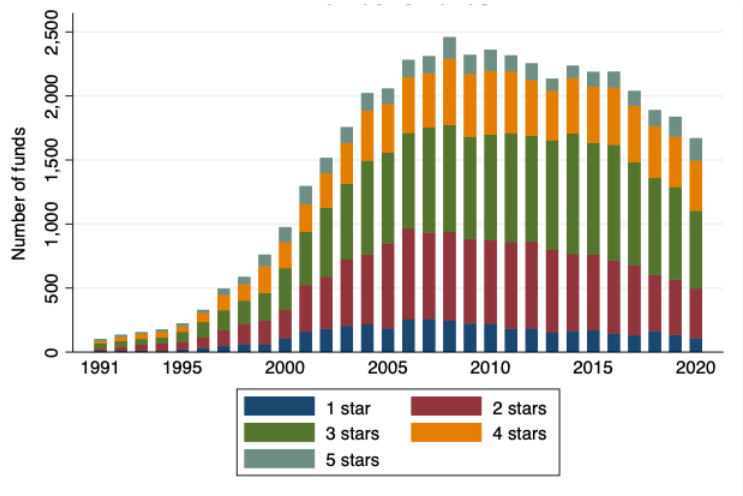
Quarterly mutual fund holding data is downloaded from Thomas Reuters' S12 data. I follow the method from Ben-David et al. (2020), which use the latest holding available in the past three month, therefore I expand the quarterly fund holding data into monthly data then finally merge it with monthly data from CRSP. Since the two databases use different code names to distinguish between different mutual funds, I made use of MFlinks developed by Russ Wermers (UMD) and built up the connection between them.

2.2 Stock Sample

Stock samples and characteristics are obtained from CRSP and Compustat. I add them into my data after finishing the merging process mentioned above.

Figure 1. Summary statistics of mutual funds

Figure 1 displays the number of mutual funds and the proportion of the rating of funds across 1991-2020.The number of funds show a steady growth from the beginning and peak at highest point in 2008. Subsequently, there is gradual decline, reaching a 10 years low point in 2020.



2.3 Additional Variables

I generate several lag and additional variables are generated based on the merged data. Firstly, I follow Coval and Stafford (2005) and Ben-David et al. (2020) in order to calculate series of flow of individual mutual fund. The formula is displayed below:

$$Flow_{j,t} = \frac{TNA_{j,t}}{TNA_{j,t-1}} - (1 + Ret_{j,t}) \tag{1}$$

Additionally, the aggregate flow of style *k* is calculated by TNA-weight of fund in the corresponding style. According to the definition from Ben-David et al. (2020), I generate the share holdings-weighted variable which can transmit the effect from rating change of fund *j* to stock *i* in month *t*:

$$Rating_{i,t}^{stock} = \frac{\sum_{fund\ j \in J} SharesHeld_{i,j,t-1} * Rating_{j,t}}{\sum_{fund\ j \in J} SharesHeld_{i,j,t-1}} \tag{2}$$

$$\Delta Rating_{i,t}^{stock} = \frac{\sum_{fund\ j \in J} SharesHeld_{i,j,t-1} * (Rating_{j,t} - Rating_{t-1})}{\sum_{fund\ j \in J} SharesHeld_{i,j,t-1}} \tag{3}$$

3. Introduction of Morningstar Style and Ratings

In this section, I'll briefly introduce the methodology of how Morningstar defines the style of individual equity funds, how Morningstar allocates ratings to mutual funds and what is the reform in its treatment in 2002.

3.1 Morningstar Style Box

Morningstar introduces a 3x3 category scheme, with three investment styles: 'value', 'blend', and 'growth' and three size categories: 'large', 'mid', and 'small'. The size is

decided directly by the market cap of the fund. As for investment style, it is measured separately by mutual funds' characteristics and performance via corresponding weighted measurement. The evaluation will then produce 'value score' and 'growth score'. After subtracting the value score from growth score, investor can use the final score to find out what style does the fund belong to. By combining the result form the two categories mentioned above, the style of fund can be defined.

3.2 Morningstar Ratings

Morningstar rating system initiated in 1985 and was quickly applied by industries as a measurement for mutual fund selection. The assessment of rating is based on Morningstar 3-, 5-, 10year Risk-adjustment Return (MRAR), which is calculated by mathematical expectation of a function of the end value of fund. The final rating is produced from the 50:30:20 combination of 3-, 5-, 10year MRAR, then allocate into five stars system with fixed proportion (10%, 22.5%, 35%, 22.5%, and 10%)[3] in the end of month.

3.3 Reform in June 2002

Before June 2002, the funds are ranked within the entire fund universe. Ratings are distributed across all the styles. In other words, ranking is correlated with the style performance. Appendix B provides the graphical evidence that relatively high-performance funds are concentrated in some specific style such as Large Growth. The ratings of funds prior 2002 shows strong correlation with style performance.

To prevent fund from pursuing specific style and exhibit the dedication of fund management, Morningstar introduced a new way of rating assignment in 2002, which is the

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[2] Available at https://www.morningstar.com/ RatingMethodology_Factsheet.pdf Last visit: 19.08.2022

performance of funds are compared against each other within the style category. The consequence of this reform can be also seen in Appendix B.

4. Rating-Driven Flow and Stock Price Impact

In this section, I examine the mechanism of price fluctuation on individual stocks by the change of the rating of mutual funds. To begin with, I clarify that the investors rely on ratings regardless of the reform in June 2002 and the reason why I use rating change instead of rating. Secondly, I investigate the impact of rating change on fund flow and stock price by doing an impulse-response analysis. Lastly, I introduce the predicator and check its predictability.

4.1 Rating-Chasing Behavior of Investors

According to Panel (a) of Figure 2, funds with higher ratings can on average receive higher flow. By contrast, when the rating is low, a fund can face lower inflow or even outflow. I also regress fund flows on ratings to examine if there is a change in this pattern after the reform in June 2002. From Panel (b) of Figure 2, the coefficient does not show an extreme deviation from usual. By the results shown above, the behavior of investors chasing Morningstar ratings is confirmed. Moreover, the reform of the methodology in June 2002 do not change this phenomenon.

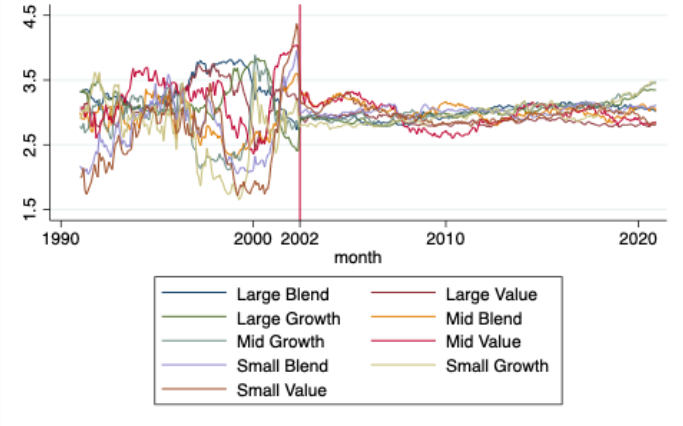
However, if the fund flows are aggregated into style levels. The impact of the reform is obvious. It is shown in Panel (c) of Figure 2 that the original dispersed style level flows suddenly clustered after June 2002, when the reform was implemented.

Since the discrete change of rating is easily observed and has validated causal relation with fund flow (Guercio and Tkac 2007), I use the change of Morningstar rating instead of pure rating in the following research.

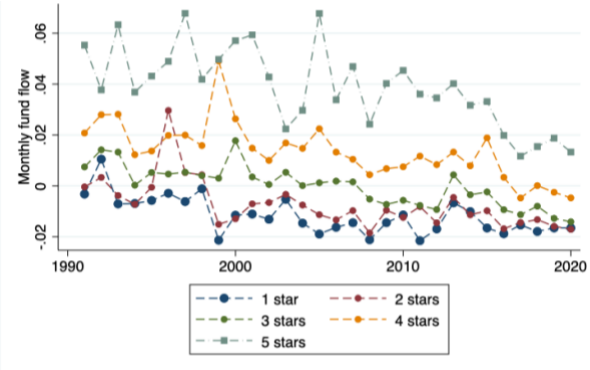
Figure 2. The Relationship between Fund Flow and Morningstar Rating

This figure displays the relationship between mutual fund flow and Morningstar ratings. Panel (a) graphs the style level flow across sample period. Panel (b) plots the monthly average fund flow among every rating. Panel (c) exhibits the stability of the coefficient of Rating on fund flow across the sample period with the shaded area of two standard error bands. The time horizon starts from 1994 because I control for 36 months lag fund flows.

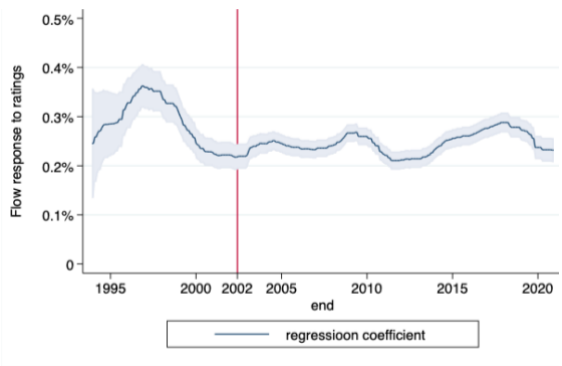
(a) Style level fund flow



(b) Fund flow among Morningstar Ratings



(c) Regression coefficient of fund flows on ratings



4.2 The impact of Stock-Level Rating on Stock Price

Based on the previous investigation, we can conclude that when a fund faces an upgrade/ downgrade, the fund will receive a capital inflow/outflow. According to Coval and Stafford (2007), equity fund managers tend to initiate a new position and expand an existing position when receiving inflow and sell a position when facing outflow. Therefore, I verify the rating influences stock price through flow-induced trade in this part. The examination follows the

concept of Ben-David et al. (2020), which is divided into two sequential parts: First, the response of fund flow to Morningstar rating change. Second, the impact of flow-induced trading on individual stock returns.

Starting from estimating the first part, I use fund flow regress on 36 monthly lags of rating changes with 36 monthly lags of fund flow, decile indicators of previous three-year cumulative returns, and benchmark-adjusted returns as fund control variables mentioned by Ben-David et al. (2020). The benchmark-adjusted returns are the fund returns in excess of AUM-weighted average returns in the same Style Box (e.g., large-growth):

$$Flow_{j,t} = \alpha + \beta 1 * \Delta Rating_{j,t-1} + \cdots + \beta 36 * \Delta Rating_{j,t-36} + \gamma X_{j,t} + u_{j,t} \quad (4)$$

I plot the cumulative coefficients ($\beta 1, \beta 1 + \beta 2, \ldots$) in Panel (a) of Figure 3. In average, funds receive 15 % additional flows in the following 30 months.

In the next step, I estimate the impact flow-induced trading on individual stock returns by doing similar regression between log stock return and flow-induced trading (FIT). I use the definition from Lou (2012) and Ben-David et al. (2020) to calculate FIT:

$$FIT_{i,t} = \frac{\sum_{fund\ j \in J} SharesHeld_{i,j,t-1} * Flow_{j,t}}{\sum_{fund\ j \in J} SharesHeld_{i,j,t-1}} \quad (5)$$

$Flow_{j,t}$ is the capital flow fund in month t. $\sum_{fund\ j \in J} SharesHeld_{i,j,t-1}$ captures the amount of individual stock that held by the entire fund universe in month t.

$$Ret_{i,t} = \alpha + \omega 0 * FIT_{i,t} + \cdots + \omega 36 * FIT_{i,t-36} + u_{j,t} \quad (6)$$

Panel (b) of Figure 3 displays the cumulative response ($\omega 0, \omega 0 + \omega 1, \ldots$). An increase closely to 0.1% is appeared immediately in t = 0 through 1% of FIT.

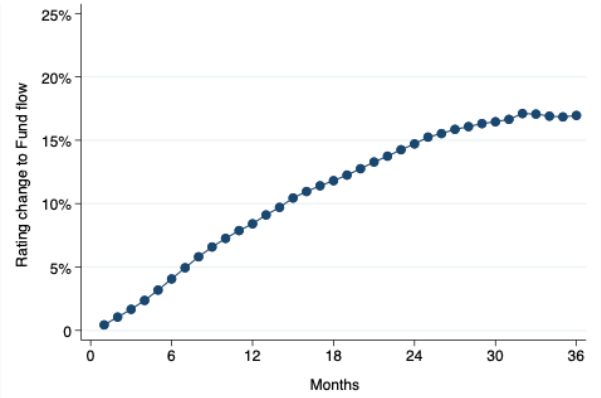
The impact of rating change on individual stock returns can be confirmed by combining the two estimations above.

According to the result in Panel (c) of Figure 3, which I regress log stock returns directly on stock-level rating change with the same fund-level and stock-level controls in Appendix C.1. The rating change shows a recessive impact on stock return across time.

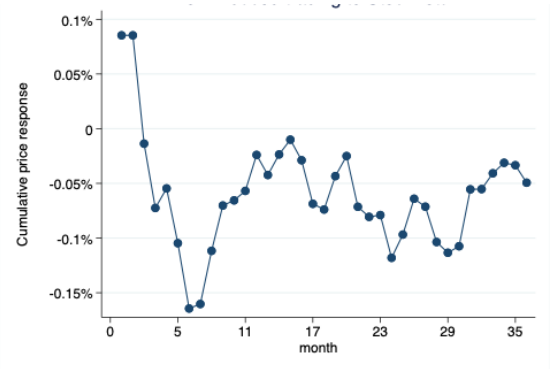
Figure 3. Rating change impact on Flow and Price

This figure shows the two steps I use to confirm the fund rating change impact on individual stock price. Panel (a) displays the cumulative response of fund flows to changes in fund ratings. Panel (b) shows the cumulative response of log stock return to FIT. Panel (c) plots the discrete coefficient of log stock returns to 24 lags of stock-level rating change.

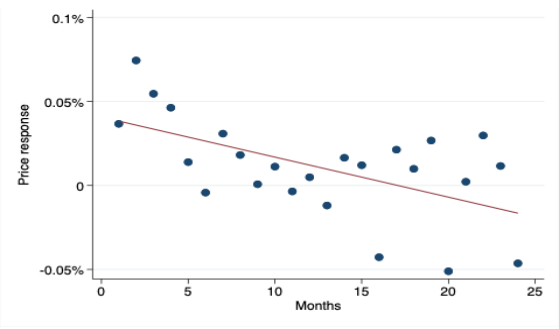
(a) Rating change to Fund flow



(b) FIT to stock return



(c) Rating change to Stock Return



After acquiring these useful results, I exploit them into a factor which introduced by Ben-David et al. (2020). Since more recent rating change is more impactful and take place mostly over the first 12 months, they summarize the past rating change with a weighted sum:

$$ExpSum(\Delta Rating)_{i,t-1} = \sum_{k=1}^{12} \tau_k * \Delta Rating_{i,t-k} \quad (7)$$

$\tau_k = \frac{12*(1-\delta)}{1-\delta^{12}} * \delta^{k-1}$ and $\sum_{k=1}^{12} \tau_k = 12$.T he weight of decay δ I estimated=0.89[4].

4.3 Return Predictability in the Cross-Section of Stock Returns

I regress the log stock return on $ExpSum(\Delta Rating)_{i,t-1}$ with standardized stock-level and fund-level controls like Ben-David et al. (2020) to measure its predictability. The description of controls is shown in Appendix 3. The regression result is displayed in Panel Table 1. In column (1), I regress the stock return on stock characteristic, only the momentum and size factor appear with a statistically significant coefficient. I add in fund level control and $ExpSum(\Delta Rating)_{i,t-1}$. The sum of the rating changes factor is positive and significant at 5% level while momentum and size factors remain a strong predictor of stock return. I then multiply rating changes by the fraction of the market cap held by mutual funds. The result is robust to this change.

In Table C.2. I display more robustness tests by changing the time horizon and restricting the fund size. The result is robustness throughout time modification and cap restriction.

[4] The decay factor estimated by Ben-David et al. (2020) is 0.76

Table 1. Price Response to lagged Rating Changes

This table reports the result of the Fama-Macbeth(Fama and Macbeth,1973) regressions. In column (A), I regress log return on fundamental stock predictors without controlling fund-level factors. Column (b) shows the result of the similar regression but with $ExpSum(\Delta Rating)_{i,t-1}$ and fund-level controls. In Column (c), $ExpSum(\Delta Rating)_{i,t-1}$ is multiplied by fraction of market cap held by mutual funds.

	(1)	(2)	(3)
Momentum	-.00135***	-.00137***	-.00138***
	(.00038)	(.00038)	(.00038)
Profitability	-.00029	-.00028	-.00028
	(.00021)	(.00021)	(.00021)
Size	.00172***	.00171***	.0017***
	(.00037)	(.00037)	(.00038)
Value	.00024	.00022	.00022
	(.00036)	(.00036)	(.00036)
Investment	-.00016	-.00018	-.00018
	(.0002)	(.00021)	(.00021)
cons	.0001	.00011	.00011
	(.0002)	(.0002)	(.0002)
$ExpSum(\Delta Rating)_{i,t-1}$		.00068*	
		(.00029)	
$ExpSum(\Delta Rating)_{i,t-1}$*%Held			.0006*
			(.00025)
Fund-Level Controls	No	Yes	Yes
Observations	1633040	1616641	1616641
R-squared	.122	.13202	.13179

Standard errors are in parentheses

*** p<.001, ** p<.01, * p<.05

5. Conclusion

The result of my research threw light on the mechanism of rating change-induced stock price pressure. However, compared to the work done by Ben-David et al. (2020), my result somehow deviates. The problem may be stemmed from the set of control variables, the scale of the math unit, or the failure in data merging. Nevertheless, this paper still produces useful results to clarify the research question.

My study displays that the change of rating induces investors to invest or require redemption when facing corresponding rate movement. The flow is then transmitted into the equity market and causes fluctuation in stock price. This effect is stable through

the entire sample period and was not affected by the reform of Morningstar methodology in June 2002.

Although the incorporation of the fundamental price factor does not affect the explanation of rating change, we can conclude that rating change can be an extra predictor which cannot be explained by other factors. This statement requires more evidence to become validated. In summary, the change in rating is a good exogenous way to approach demand and supply pressure on an individual stock.

Reference

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3. https://admainnew.morningstar.com/directhelp/FactSheet_StarRating.pdf. Last visit:19.08.2022

Appendix A Summary Statistics

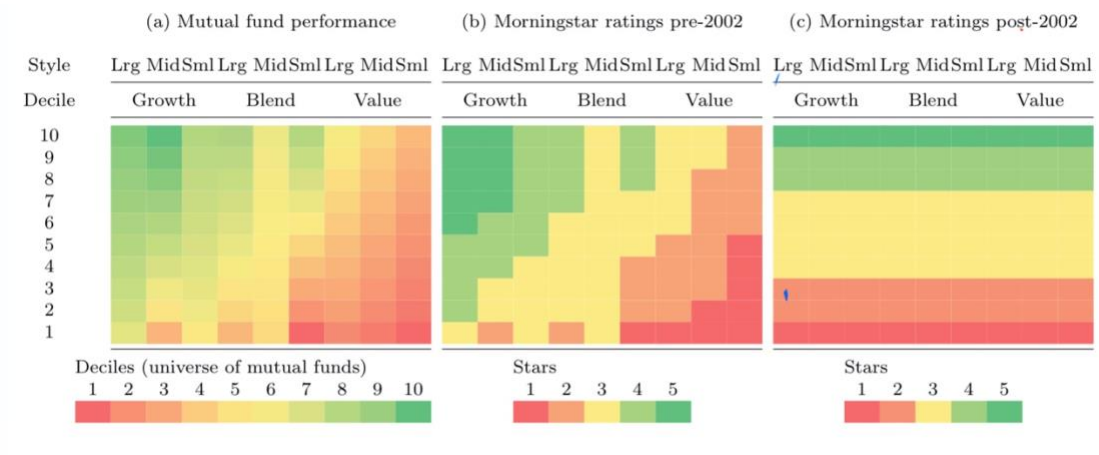
The table displays the general information include numbers of fund percentage of funds among ratings, and percentage of funds across styles.

Year	Number of funds	% of 1star	% of 2stars	% of 3stars	% of 4stars	% of 5stars	% of Large style	% of Small style	% of Growth style	% of Value style
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1991	118	9	20.000	35	15	22	63	15	47	27
1992	206	9	9.000	26	37	19	67	14	46	24
1993	295	9	18.000	24	33	16	66	15	49	25
1994	378	5	21.000	22	30	21	64	16	48	25
1995	503	13	14.000	30	26	17	64	17	49	23
1996	625	14	14.000	30	27	16	63	19	49	21
1997	902	8	20.000	28	28	17	63	20	50	21

1998	1163	7	34.000	24	22	13	62	21	49	20
1999	1364	8	26.000	27	28	12	62	20	50	20
2000	1702	7	18.000	31	27	17	62	19	53	18
2001	2126	6	15.000	31	23	26	61	19	53	20
2002	2206	7	17.000	28	29	19	60	20	53	21
2003	2372	5	20.000	34	25	17	58	21	53	22
2004	2592	5	16.000	35	31	13	57	22	51	23
2005	2593	4	23.000	37	26	11	55	24	49	24
2006	2780	4	22.000	37	27	10	55	24	48	26
2007	2849	5	22.000	38	25	9	53	25	46	26
2008	2824	6	19.000	36	29	10	53	25	46	26
2009	2643	6	19.000	36	28	11	53	25	45	26
2010	2615	6	21.000	36	27	11	55	25	44	27
2011	2513	4	23.000	36	29	7	53	26	44	27
2012	2466	4	23.000	38	27	8	52	26	44	27
2013	2360	4	23.000	44	23	6	52	28	43	28
2014	2472	4	21.000	45	25	5	50	28	41	29
2015	2415	5	21.000	42	26	7	50	29	41	29
2016	2347	5	20.000	44	25	7	49	29	41	29
2017	2185	4	23.000	41	26	7	47	31	42	28
2018	2008	6	21.000	42	24	7	46	31	42	28
2019	1934	5	21.000	41	24	9	45	32	41	28
2020	1716	6	22.000	36	24	11	46	32	42	27

Appendix B The Impact of Morningstar Methodology on Mutual Fund Returns and Style Returns, Graph from Ben-David et al. (2020), Ratings-Driven Demand and Systematic Price Fluctuation

The figure presents the distribution of style return and fund return and distribution of ratings across styles pre- and post-2002. Panel (a) shows that good performance funds concentrate on Growth style. Panel (b) displays that the rating allocation across styles is like the spread shown in Panel (a). After the reform of methodology in June 2002, the ratings are distributed equally within each style, which is shown in Panel (c).



Appendix C Return Predictability in the Cross-Section of Stock Returns

In this section I display the regression equation defined by Ben-David et al. (2020) and robustness check table.

Equation C.1.

I regress return of stock I in month t on $ExpSum(\Delta Rating)_{i,t-1}$ with stock-level and fund-level controls. According to Ben-David et al. (2020), the stock-level controls include Fame-French value, size, profitability, investment and investment factor, the lagged one-month return, momentum (i.e., stock return from month t-12 to month t-2), and long-term reversal (i.e., stock return from month t-36 to month t-2). The fund-level controls include the fraction of outstanding shares of stock held by mutual funds, share-weighted average three-year fund return, and benchmark-adjusted returns. The benchmark-adjusted returns are generated from fund returns in excess of AUM-weighted returns of funds in the same Style box. All the controls are standardized into mean=0 and standard error=1 in order to compare with each other easily.

$$Return_{i,t} = d1 * ExpSum(\Delta Rating)_{i,t-1} + \gamma^{s} * X^{s}_{j,t} + \gamma^{f} * X^{f}_{j,t} + u_{j,t}$$

Table C.2. Robustness Check

This table shows the result of the robustness test on the rating change factor. On the left-hand side of the first part, I check the robustness with respect to the time horizon. Rating change is robust across different time horizons. On the right-hand side, I restricted my sample with additional rules such as including only stocks that are held by at least three firms and

excluding the micro-cap stock from the sample. The explanatory of $ExpSum(\Delta Rating)_{i,t-1}$ is not affected by this extra restriction. In the second part, benchmark-adjusted returns and lagged stock returns are transferred into 10 decile indicators to control the potential non-linearity between the past fund return and fund flow. The result shows robustness to the modification.

Linear Control			
	All stocks	**Min 3 funds**	**Exclude micro-cap**
$ExpSum(\Delta Rating)_{i,t-1}$	.00068* (.00029)	.00074* (.0003)	.00068* (.00028)
3-month $\Delta Rating$	.00074* (.0003)		
6-month $\Delta Rating$	.00377*** (.0005)		
12-month $\Delta Rating$	.00219*** (.00041)		
Non- Linear Control			
$ExpSum(\Delta Rating)_{i,t-1}$	.00068* (2.37212)		
3-month $\Delta Rating$	.00309*** (8.01582)		
6-month $\Delta Rating$	**.00194***** (5.93342)		

12-month $\Delta Rating$	.00134***	
	(5.30917)	

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