Does fund size erode fund performance?

The relationship between fund size and fund performance pre-, during- and post-financial crisis.

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Abstract: In this paper, I attempt to answer whether or not increase in fund size would decrease fund performance. I create five different hypotheses to tackle different aspects of this relationship. The important findings state that there is a negative relationship between fund size and fund performance, but there is not enough evidence to support the positive relationship between a size of a fund within a family and its performance. Moreover, I explore further in later hypotheses on the relationship between fund flow and fund performance, and fund size and fund performance in different periods during and after the financial crisis in 2007. Overall, my findings suggest that fund size play a significant role in detracting fund performance in general.

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1. Introduction

In the past decades, the mutual fund has increasingly become popular among investors around the globe and has grown substantially, for example, from around $150 billion at the end of 1980 to over $4 trillion by the end of 1997 (Pozen, 2002). The fastest growing part of the mutual fund industry comes from equity fund, particularly the actively managed fund. Moreover, some actively managed equity funds have large stakes in corporations, which can, therefore, also have some control power over certain decision-makings (Chen, Hong, Huang and Kubik, 2004). Hence, this shows that mutual funds are important investors in the business world.

There are several benefits to investing in equity mutual funds rather than investing in individual stocks. For example, the mutual fund provides investors an acceptable return with better risk diversification, and it can even be used in certain countries as a tax deduction. However, there are many equity funds with different structures, different styles, and different risks to choose from. Understanding the fundamental theories behind mutual funds is essential to any investors because it can help investors recognize which fund to invest in. Interesting questions have been raised in the past about the relationship between fund size and fund performance.

Some scholars believe that the growth in the size of the fund is an advantage because fund's expense ratio decreases with increasing fund size (Tufano and Sevick, 1997). However, other researchers believe that an increase in fund size negatively affects the performance of the fund. To support this argument, Becker and Vaughan (2001) state that with the increasing asset under management (AUM) of a fund, portfolio managers do not have the same flexibility in buying or selling assets, where it takes longer to execute each attractive trade and produce negative market impact price moves. In addition to the previous argument, Chen et al. (2004) also find that "in large funds with hierarchies in which managers fight to have their ideas implemented, managers may end up expending too much research effort on quantitative measures of a company (i.e., hard information) so as to convince others to implement their ideas than they ideally would if they controlled their own smaller funds. All else equal, large funds may perform worse than small one." Nevertheless, before the financial crisis in 2007, the equity funds appeared to have high return due to rallying in the stock market. During and after the downturn, the attractive return seemed to decrease or disappear.

Moreover, Yan (2008) provides evidence that liquidity, which is an important cause of an increase in fund size, erodes the fund's performance, and also finds that different investment styles such as growth funds and turnover funds produce a strong negative relation between fund size and fund performance. The market impact cost may seem to be a small issue to investors because fund managers can find new investments that have less market impact cost and potentially give similar returns.

Another variable on this topic that many researchers have focused on is fund flow and momentum. They examine how the flows of funds affect the returns on the managers' portfolios. The empirical results illustrate that when a fund performs well in previous month or year, there will be a large cash inflow in the current period from investors since they decide to invest by looking at the past performance of funds (Sirri and Tufano, 1998). However, managers tend not to be able to sustain their above benchmark returns due to the diseconomies of scale, in terms of both fund and organization sizes. Moreover, in order to understand the mechanism of how fund flows affect fund performance, we need to recognize the trading theories behind it. There are two concepts of fund flow in the fund manager's point of view: well-informed trader and noise trader. Many scholars believe that these theories explain which managers actually have the skills to generate abnormal returns or managers who are return chasers. This theory helps to clarify why funds perform well or poorly.

In this paper, I want to challenge and tackle some of the important debates, namely the diseconomies of scale in active fund management. In other words, an increase in fund size inversely affects its performance, not only in the period of the stock market rally but also in the time of the low stock market return. There is extensive research on this topic; however, they are all conducted in the similar period, such as approximately before 1990 to 2005. I want to investigate the most recent data, where it captures funds' activities before, during, and after the financial crisis in 2007. This way I can compare these periods and truly see how various sizes of funds respond in each different period and what their returns are. I believe that large and small funds will have similar returns as their benchmarks in the period of financial crisis and after. It is interesting to see whether the researchers' hypotheses that there are diseconomies of scales in relation to fund size and fund performance would still hold during different economic periods.

2. Literature Review

There has been much research attempted at explaining how or in what ways fund size can have an impact on fund performance. However, most of the research did not analyze or make any comparisons between different time periods regarding economic conditions on fund performance. The key factors that we need to investigate are the following:

2.1 Fund Flows and Momentum

Most of the research articles point out the problems of fund flow and momentum, in that they can potentially have a significant influence on the performance of the fund. However, before we go into detail on these topics, we have to understand the assumptions behind them. Sirri and Tufano (1998) believe that investors like to choose investing in mutual funds based on the past performances. Therefore, those funds with better returns than other funds will receive a higher inflow of money. Jegadeesh and Titman (1993) state that based on investing behaviors of investors and momentum, they also believe that "trading strategies that buy past winners and sell past losers realize significant abnormal returns." In other words, we should expect to see funds with higher levels of inflow perform better than funds with lower levels of inflows.

Moreover, the informed trader theory is one theory that can explain the abnormal return of the portfolio. Zhang and Edwards (1998) believe that if mutual fund investors can be viewed as well-informed traders, their buys and sells of securities might be seen as trading on fundamental information of these securities. Thus, higher or lower fund flows volume of investors can be viewed as a signal of these securities' fundamental values, which causes all investors (informed or uninformed) to trade in the same direction. This results in a positive correlation between mutual fund flows and their performances.

Another theory that helps explain the relationship between fund flows and funds' performances is the noise trader theory (De Long, Shleifer, Summers, and Waldmann, 1990). Noise traders are investors who think they have certain or unique information about underlying securities, where they buy and sell in random ways. Noise traders prevent informed traders from investing in or profiting from securities by putting pressure on the securities' prices to deviate far away from their fundamental values. Therefore, it is clear that, according to the noise trader theory,

it is hard for investors to invest aggressively while there is an existence of noise traders in the market.

However, there are research articles which make a different claim that there is actually a negative relationship between fund flow and fund performance. Blanchett (2012) believes that momentum is a key to determining the effect of fund flows, "given the strong relationship between which funds actually receive new investor monies and the future performance implications associated with momentum investing." His empirical research shows that when the S&P 500 return "reverses" trend those funds that performed well in the year before tend to perform worse and vice versa. This finding suggests that funds that perform well compared to other funds might be taking more risk, "which contributes to the momentum effect."
Jain and Wu (2000) test whether or not advertised mutual funds that have recent high returns in the pre-advertisement year will continue to perform well in the post-advertisement period. Advertised funds have a 20 percent higher rate of inflow of new money than non-advertised funds. Hence, their empirical result suggests that, on average, these funds in the post-advertisement period have significantly lower returns than their benchmarks. Therefore, we can see that the decline in performance is partially due to the large inflows of new money.

2.2 Fund Size

Fund size is another main key affecting the performance of the fund. Fund size can be measured by looking at asset under management (AUM). Most of the research articles agree that there is a negative relationship between fund size and fund performance. Chen et al. (2004) find evidence that fund performance declines with an increase in fund size. They regress many adjusted returns on lagged fund size and also include many observable fund characteristics such as age, turnover, expense ratio, etc. Moreover, they investigate further by observing the primary drivers behind the inverse relationship between fund size and fund performance. They suggest that liquidity plays an important role as well as organizational diseconomies.

Moreover, Indro et al. (1999) support the claim that fund size has a significant influence on fund performance. They found that the actively managed mutual funds need to have minimum fund size in order to generate enough returns to compensate for their costs of acquiring and trading on the information. They also found that "there are diminishing marginal returns to

information activities and that the marginal returns become negative when a mutual fund exceeds its optimal size." However, this does not mean that growth in fund size (AUM) will have an immediate impact on the fund's performance. It is rationalized that when fund managers already have optimal fund size that they can consistently manage to generate desire returns, increase in fund size, in this case, can damage the performance of that fund.

Another research article by Beckers and Vaughan (2001) also agrees that there is a negative relationship between fund size and fund return. They argue that it is more difficult for managers to create more value-added investments when asset under management of a fund grows bigger. This is because when the size of fund increases, managers lose their flexibilities to invest due to transaction costs and market impact costs, where trading will take longer to execute. Longer trading time prevents managers from generating profit from countless opportunities. Therefore, it is unlikely for fund managers to have persistent returns over the years if the asset under management is still increasing.

Nevertheless, some scholars believe that having large asset under management is advantageous for managers because they can hire more managers and more resources of research. Reuter and Zitzewitz (2010) found little evidence on their regression that fund size erodes performances. Also, they conclude that any downward bias in standard estimation, such as OLS estimation, of diseconomies of scale and performance persistence, is likely to be small.

2.3 Transaction costs and Market impact costs

Beckers and Vaughan (2001) exhibit that a fund loses its flexibility when facing higher asset under management as shown in the previous section; it is crucial to inspect more into detail of transaction costs and market impact costs associated with fund size. Chan et al. (2009) find evidence that there is a positive relationship between market impact and fund size. They explain that transaction cost plays a major role in deteriorating fund performance in large funds because large funds will more likely face a higher market impact cost when managers buy and sell securities. Moreover, Chan et al. (2009) state that larger managers construct their portfolios in many different ways to reduce the expected market impact. Larger managers might miss out on great opportunities to invest, and therefore this can have a negative impact on their fund performances.

To support the previous claim about transaction costs, Busse et al. (2016) believe small funds have the advantage to invest in small-cap and less liquidity securities than bigger funds, where small-cap investment pool tends to generate a higher gross return. Moreover, they explain that higher transaction cost is positively correlated with increasing fund size and trades size. The transaction costs of less liquid stocks are likely to be unfavorable for large funds, so large funds are forced to invest and hold more liquid stocks. Thus, large funds incur an opportunity cost for not investing in small-cap, which contribute to a reduction in their performances. Furthermore, Yan (2008) also reinforces that liquidity is a significant factor why an increase in fund size erodes its performance. Yan (2008) uses portfolio and cross-sectional approaches to evaluate the effect of liquidity. He finds that both portfolio and cross-sectional methods provide the same conclusion regarding the relationship between fund size and fund performance.

2.4 The changes in regulations

Many previous studies found that there is a positive relationship between the performance of the mutual fund and the size of the family fund where they belong. However, Bhojraj, Cho, and Yehada (2010) agree with previous studies and point out that the mutual fund return is benefiting from being part of a large family fund because of the quality of their research team and stock-picking ability. However, they argue that the regulations changed during and after 2000, such as Regulation Fair Disclosure (Reg FD), the Global Settlement (GS) and "increased regulatory scrutiny resulting from market timing and late trading scandal," have a negative impact on the family fund. These stricter regulations lead the size of the family fund to become less beneficial toward a mutual fund belonging to that family fund because it limits access to certain firm information, reduces the quality of sell-side analyst research and cuts benefits of the family of being able to trade after the market closes. Hence, the size of the family fund has little or no effect at all on the relationship between fund performance and fund size.

3. Hypotheses

Main research question: Does fund size erode mutual fund performance?

There is extensive research conducted on this topic since the mutual fund is becoming a significant product in the financial service industry. Moreover, according to the literature review, most scholars agree that an increase in fund size destroys fund performance. However, these research articles do not take into account different time periods, for instance, some research papers use the period of 1995 to 2005. Thus, I aim to investigate and compare mutual fund sizes and performance in different economic conditions to relate to the question of whether or not fund size actually erodes mutual fund performance. There are many variables affecting the mutual fund performance in relation to fund size. This paper will examine the key drivers that cause the decline in fund performance. The hypotheses in the next part will contribute to and help answer the central research question.

3.1 First Hypothesis

H_1: *There is a negative relationship between fund size and fund performance*

This is the first and the general hypothesis that examines the relationship between fund size and fund performance. This hypothesis is the beginning point to investigate. Chen et al. (2004) find this first hypothesis to be accurate, and I expect my result to be similar to their findings. I believe that if this hypothesis were correct, it is easy to classify that increase in fund size contracts the fund performance. However, this hypothesis is too simple to be used to conclude our findings. Thus, different methods will be employed, which will be discussed in the next chapter, for performing many regression benchmarks. One thing to note of this hypothesis is that it only takes into account total net asset (TNA), but it does not include liquidity problems that managers may face for different fund sizes.

3.2 Second Hypothesis

H_2 : *There is a positive relationship between the size of fund within the family and its performance*

Following Chen et al. (2004), they believe that if a fund is part of the family fund, it is more well-positioned than not being part of the family fund. They find that a fund benefits from being part of the family fund because the economics of scale helps lowering marketing and other costs. More importantly, Chen et al. (2004) state that within a family fund, the decisions are decentralized. It means that fund managers within a family fund can invest without coordinating with other fund managers in the family fund and without having to be concerned about their use of resources.

3.3 Third Hypothesis

H_3 : *Fund flow is positively related to lagged-fund performance during and after the crisis.*

The purpose of the third hypothesis is to test the relationship between fund flow and fund performance. In the period where the funds perform well, I expect to see more inflow of new money in the subsequent period and vice versa for the period that the funds do not perform particularly well. If this hypothesis is accepted, it explains that new investors invest their money from looking at funds' past performances. This explanation is known as return chasing behavior and is in line with research paper by Jegadeesh and Titman (1993). This hypothesis helps explain one of the important factors that determine why fund size increases in different periods and therefore affects funds' performances.

3.4 Fourth and Fifth Hypotheses

H_4: Fund size is negatively related to fund performance during and after the crisis

H_5: Large funds tend to generate better returns and alphas than small funds during the crisis, but both funds have similar returns and alphas after the crisis.

The fourth and fifth hypotheses try to examine and understand managers' behaviors in investing during different economic periods. It is accurate to say that on average small funds perform better than large funds according to many scholars, as mentioned in the literature review chapter. However, I expect the result to show that small funds, on average, have better returns than large funds; yet, during and after the financial crisis in 2007, both funds should generate more or less identical performances. The latter claim seems to be reasonable since small and large funds will attempt to minimize their risks and invest in more stable and large companies due to uncertain economic conditions.

4. Data Summary

My data on mutual fund comes from the Center for Research in Security Prices (CRSP) Mutual Fund Database. I only include the data from a total of 10 years, from the beginning of 2003 until the end of 2014. My data variables include Total Net Asset (TNA), Expense ratio, Management fee (MGMTFEE), Turnover ratio, Age and Fund Flow. As I follow Chen et al. (2004), I include the size of a fund family as well. In order for observation of mutual fund to be in my sample, I restrict my sample to only diversified U.S equity mutual fund, which I sort out by eliminating variables that do not contain the starting alphabet "E" in CRSP objective code and investing in common stock less than 70%. Moreover, I also aggregate subclass of each fund into one mutual fund; this cleans out all the redundant observations (Chen et al., 2004). Therefore, I end up with 6.130 different funds.

The data on the equity mutual fund must have at least one-year performance reported since the research model requires forming benchmark portfolios based on past performance (Chen et al., 2004). To see a better relationship between fund size and fund performance, I divide the data into ten deciles (the first decile is the smallest funds and tenth decile is the largest funds) based on their last month total net asset. Moreover, according to Elton et al. (2001), they believe that funds with less than $15 million in AUM have a systematic upward bias in their returns and thus could cause a bias in the results. I need to be extra careful when choosing the data. Thus, I eliminate funds with total net asset less than $15 million.

Table 1A reports the descriptive statistics of the total sample. They have average total net assets (TNA) of $786,68 million, with the standard deviation of $3.293,37 million. There is no surprise with a large number of standard deviation. The next interesting variable is LOGFAMSIZE, which is defined as "the logarithm of one plus the cumulative TNA of the other funds in the fund's family" (Chen et al., 2004). It is a crucial variable in an investigation of the relationship between fund size and fund performance.

Moreover, the average age of fund (AGE) in this sample is 18,76 years, with the maximum age of fund being approximately 30,8 years. Another interest variable is FLOW, which it is defined as the fund’s TNA in month t minus the product of the fund’s TNA at month t-12 times 1 minus net fund return between month t-12 and t, all divided by the fund's TNA at month t-12 times

1-net fund return between month t-12 and t (Chen et al., 2004). The average fund flow in this sample is 12,53 percent per month.

Table 1A: Summary Statistic

Number of funds: 6.130 Variable	Mean	Min	Max
TNA ($ Million)	786,68	15,1	174850
LOGTNA ($ Million)	5,74	2,71	13,58
LOGFAMSIZE ($ Million)	14,91	2,86	15,37
AGE (Years)	18,76	0	30,833
TURNOVER (% per year)	5,91	0	60,25
EXPRATIO (% per year)	0,0065	0	0,0618
MGMTFEE (% per year)	5,02	0	3,74
FLOW (% per year)	12,53	-99,62	402,29

Note: This table reports summary statistic for funds in the sample. Number of funds is the number of the mutual funds that pass our criteria selection. TNA is the total asset under management. LOGTNA is the logarithm of TNA. LOGFAMSIZE is the logarithm of other funds in the family that fund belongs to. AGE is the number of years of the fund and TURNOVER is fund turnover. EXPRATIO is total annual management fees and expenses, and MGMTFEE is annual management fees. FLOW is the new fund flow into the mutual fund over the past year.

Table 1B: Average of the cross-sectional correlation between variables in the sample.

	TNA	LOGTNA	LOGFAM	AGE	TURNOVER	EXPRATIO	MGMTFEE	FLOW
TNA	1							
LOGTNA	0,409	1						
LOGFAMSIE	0,026	-0,102	1					
AGE	0,135	0,365	-0,006	1				
TURNOVER	-0,067	-0,141	-0,023	-0,011	1			
EXPRATIO	-0,110	-0,148	-0,090	0,072	0,408	1		
MGMTFEE	-0,072	-0,056	0,078	0,052	0,376	0,847	1	
FLOW	-0,003	0,116	-0,365	-0,004	-0,013	-0,012	-0,015	1

Table 1C: Average of the cross-sectional correlation between variables in the sample, excluding two smallest deciles.

	TNA	LOGTNA	LOGFAM	AGE	TURNOVER	EXPRATIO	MGMTFEE	FLOW
TNA	1							
LOGTNA	0,450	1						
LOGFAMSIE	0,034	-0,078	1					
AGE	0,121	0,320	0,01	1				
TURNOVER	-0,074	-0,122	-0,037	-0,019	1			
EXPRATIO	-0,114	-0,111	-0,11	0,092	0,438	1		
MGMTFEE	-0,080	-0,072	0,090	0,041	0,414	0,868	1	
FLOW	-0,011	0,099	-0,372	-0,018	-0,008	-0,005	-0,014	1

Table 1B reports the time-series average of cross-sectional correlation between different variables of fund characteristics. There are positive correlations between TNA and LOGFAMSIZE (0,026) and AGE (0,135). However, TURNOVER, EXPRATIO and MGMTFEE have negative correlations with TNA (-0,067, -0,11 and -0,072 respectively). Following a similar method to Chen et al. (2004), I create a correlation table in table 1C, which excludes two smallest deciles. The correlations seem to be akin to the result in table 1B. Thus, it is important to control for fund characteristics when I evaluate the relationship between fund size and performance.

Table 1D: Average gross and net fund returns per decile.

Decile	1	2	3	4	5	6	7	8	9	10	Total
Gross Fund Return	0,35%	0,64%	0,62%	0,76%	0,80%	0,85%	0,82%	0,88%	0,96%	0,88%	0,75%
SD	0,059	0,057	0,057	0,056	0,056	0,055	0,052	0,054	0,052	0,050	0,055
Net Fund Return	0,33%	0,63%	0,61%	0,74%	0,78%	0,84%	0,80%	0,87%	0,95%	0,88%	0,74%
SD	0,059	0,057	0,057	0,056	0,056	0,055	0,055	0,053	0,052	0,049	0,055
Number of Obs	42.433	42.790	42.506	42.417	42.282	42.037	41.755	41.289	41.001	39.952	418.462

Note: This table reports average gross and net fund returns per decile and total sample. Gross fund returns are calculated by adding expense to net fund returns. Net fund returns are fund returns after deducting all the expenses.

Lastly, table 1D shows the average monthly net fund return and gross fund return and their standard deviations in different fund size deciles. Monthly gross fund returns are estimated by "taking year-end expense ratio, diving it by 12, and adding it to the monthly return during the year" (Chen et al., 2004). The average gross fund returns in the smallest fund decile (Decile 1) seems to underperform the largest fund decile (Decile 10) by 0,53%. This result is not in line with other previous studies that there is a diseconomies of scale when it comes to fund size and performance. Moreover, after accounting for fees, the average net fund returns in the smallest decile underperformed the largest decile by 0,55%. This is very interesting result because it is the opposite of what Chen et al. (2004) found. However, looking at this table, it seems that an increase in fund size can help realize a higher return.

5. Methodology

5.1 Part I

This research study uses cross-sectional variation to investigate the relationship between fund performance and fund size. However, using cross-sectional variation causes a major concern. Chen et al. (2004) point out that different fund sizes may have different styles. For example, small fund managers, compared with large fund managers, are likely to invest in small cap stocks, where it had been reported to be riskier than big cap stocks. Thus, small-cap stocks could potentially give small fund managers higher returns. However, it is interesting to see, after accounting for variation in fund style, whether the result will still show that fund size influences fund performance.

In order to account for heterogeneity in fund style, I need to form different benchmarks to adjust for fund performance. I use simple market-adjusted return and return adjusted by the Capital Asset Pricing Model (CAPM) of Willam F. Sharpe (1964). Moreover, I also believe that returns adjusted by the three-factor model of Eugene E. Fama and Kenneth R. French (1993), and the augmented three-factor model with momentum factor by Carhart (1997) can help explain cross-sectional variation in fund performance. These two models have been demonstrated to have explanatory power for the observed cross-sectional variation in fund performance (Carhart 1997).

Table 2A below reports the statistical summary of different variables used to form performance benchmarks. These variables are the return on the CRSP value-weighted stock index net of the one-month Treasury rate (VWRF), the returns to Fama and French (1993) small stocks minus large stocks (SMB) and high book-to-market stocks minus low book-to-market stocks (HML) portfolios, and the returns-to-price momentum portfolio (MOM12), where a portfolio includes long stocks that are past-12 month winners and short stocks that are past-12 month losers and hold for one month.

Table 2A: ***Summary Statistics of the factors***						
			Cross-correlations			
Factor	**Mean**	**SD of return**	**VWRF**	**SMB**	**HML**	**MOM12**
VWRF	0,67%	4,52%	1			
SMB	0,22%	2,20%	0,44	1		
HML	0,02%	2,60%	0,39	0,16	1	
MOM12	-0,06%	5,03%	-0,35	-0,081	-0,38	1

Note: this table reports the summary statistics of the factors. VVRF is the return on the CRSP value-weighted stock index net of the one-month Treasury rate. SMB is the return on small stocks minus big stocks. HML is the return on high book-to-market stocks minus low book-to-market stocks. MOM12 is the return on portfolio long stocks that are past 12-month winners and short stocks that are past 12-month losers.

Because I want to examine the relationship between fund size and performance, I sort the mutual funds at the beginning of each month based on their previous month TNA into ten deciles. Then, I track these ten portfolios for one month and use the entire times series of their monthly net return to calculate the loadings to different factors (VWRF, SMB, HML, MOMO12) for each of these ten portfolios (Chen et al., 2004). After that, I give these loadings to belonging funds based on their size. Put differently, if a mutual fund remains in the same-size decile for the entire sample period, the loadings stay the same. However, when a mutual fund size moves from one decile to another, "it inherits a new set of loadings with which we adjust its next month's performance" (Chen et al., 2004).

Table 2B below reports the loadings of the ten fund-size (TNA) sorted mutual fund portfolios using the CAPM model.

$$R_{i,t} = \alpha_i + \beta_i VWRF_t + \varepsilon_{i,t} \qquad t = 1, \dots, T \quad (1)$$

In this model, $R_{i,t}$ is (net fund or gross fund) return on one of my ten fund size mutual fund portfolios in month *t* in excess of the one-month T-bill return, α_i is the excess return of that portfolio, β_i is the loading on the market portfolio, and lastly $\varepsilon_{i,t}$ is a generic error term that is not correlated with other independent variables. Chen et al. (2004) find the beta for the average mutual fund is around 0,91; however, my average beta for the mutual fund is slightly higher at 1,07. It means that my sample of equity mutual fund hold little cash and bond in their portfolio during the sample period and seems to invest in more risky assets.

As I follow Chen et al. (2004), I expect the alpha for small fund portfolios to outperform the bigger fund portfolios. My result disagrees with their conclusions; for instance, the alpha of portfolio decile 10 outperform the alpha of first portfolio decile. The result seems to deviate from the conclusion of Chen et al. (2004) that the biggest fund portfolio outperforms the smallest fund portfolio. This is a fascinating point to discuss because the sample in this analysis includes the period of financial crisis in 2007.

One possible explanation of random alpha in different deciles and disagreement of the result is that smaller fund portfolios invest in small cap companies while bigger fund portfolios invest in medium and big cap stocks. With the fact that small cap stocks are more volatile than big cap stocks, small fund portfolio has the ability to realize higher return than large fund portfolio; however, at the same time, it could realize far worse return during the economic downturn. As we all know, the recent financial crisis in 2007 is by far the worst economic downturn since the Great Depression in 1930; small-cap stocks or small companies tend to have problems and go out of business and underperform the bigger companies. This could be the reason that average alpha does not appear to have the diseconomies of scale of fund size and fund performance

Table 2B*: Loading calculated using CAPM*		
Portfolio	CAPM	
	Alpha	VWRF
1	-0,179%	1,07
2	-0,086%	1,07
3	-0,083%	1,07
4	-0,090%	1,07
5	-0,060%	1,07
6	-0,080%	1,08
7	-0,080%	1,07
8	-0,026%	1,06
9	-0,016%	1,05
10	-0,033%	1,04

Note: This table reports the loadings of the ten TNA-sorted fund portfolios calculated using the CAPM model.

Table 2C reports the three-factor model of Fama and French (1993) and this three-factor model augmented by a momentum factor.

$$R_{i,t} = \alpha_i + \beta_{i,1}VWRF_t + \beta_{i,2}SMB_t + \beta_{i,3}HML_t + \varepsilon_{i,t} \qquad t = 1, \dots, T \quad (2)$$

$$R_{i,t} = \alpha_i + \beta_{i,1}VWRF_t + \beta_{i,2}SMB_t + \beta_{i,3}HML_t + \beta_{i,4}MOM12_t + \varepsilon_{i,t} \qquad t = 1, \dots, T \quad (3)$$

In these two models, $R_{i,t}$ is (net fund or gross fund) return on one of my ten fund size mutual fund portfolios in month *t* in excess of the one-month T-bill return, α_i is the excess return of that portfolio, β_i's are loadings on the various portfolios, and $\varepsilon_{i,t}$ is a generic error term that is not correlated with other independent variables. Looking at the data in table 2C, alpha is again showing a strong pattern that larger funds tend to have better alpha than smaller fund; however,

alpha seems to be all negative value for all portfolio deciles. This is consistent with a previous research study by Chen et al. in 2004.

Moreover, the result shows a pattern of smaller portfolios that tend to have higher loading on SMB. For example, the loading on SMB in the three-factor model for a portfolio in the first decile is 0,181, but SMB factor for a portfolio in the tenth decile is 0,025. Another interesting result is that loading of HML and momentum factors seem to suggest a somewhat random pattern throughout all the portfolios in both three-factor and four-factor models. This is not consistent with Chen et al. (2004); however, the reason might point to the different period of the sample and this the financial crisis period included in this data, which influences these factor loadings.

Table 2C: *Loadings calculated using the 3-Factor model and the 4-Factor model*

Portfolio	3-Factor Model				4-Factor Model				
	Alpha	VWRF	SMB	HML	Alpha	VWRF	SMB	HML	MOM12
1	-0,21%	1,049	0,181	-0,0736	-0,21%	1,036	0,188	-0,091	-0,035
2	-0,12%	1,059	0,165	-0,0637	-0,12%	1,048	0,171	-0,079	-0,030
3	-0,11%	1,054	0,173	-0,0632	-0,11%	1,043	0,180	-0,080	-0,032
4	-0,12%	1,052	0,166	-0,0737	-0,12%	1,044	0,172	-0,087	-0,026
5	-0,09%	1,054	0,144	-0,0727	-0,09%	1,043	0,152	-0,092	-0,036
6	-0,10%	1,063	0,147	-0,0713	-0,10%	1,052	0,154	-0,090	-0,035
7	-0,09%	1,064	0,110	-0,0891	-0,09%	1,056	0,116	-0,104	-0,027
8	-0,04%	1,056	0,108	-0,0809	-0,03%	1,048	0,114	-0,097	-0,028
9	-0,02%	1,051	0,082	-0,0860	-0,02%	1,047	0,086	-0,096	-0,016
10	-0,03%	1,057	0,025	-0,1031	-0,03%	1,053	0,027	-0,111	-0,013

Note: This table reports the loadings calculated using Fama-French (1993) 3-Factor model and this model augmented with the momentum factor (4-Factor model)

After I have all the loadings for various benchmarks, I have to adjust returns for each fund.

I calculate not only for the four-factor model adjusted return but also for market-adjusted return. I utilize the following specific regressions:

$$FUNDRET_{i,t} = \alpha_i + \beta_i LOGTNA_{i,t-1} + \gamma X_{i,t-1} + \varepsilon_{i,t} \qquad t = 1, \dots, T \ (4)$$

Where $FUNDRET_{i,t}$ is the return (either gross or net) of fund i in month t, α_i is a constant variable, $LOGTNA_{i,t-1}$ is the measure of fund size, $X_{i,t-1}$ is a group of various control variables that includes $LOGFAMSIZE_{i,t-1}$, $TURNOVER_{i,t-1}$, $AGE_{i,t-1}$, $EXPRATIO_{i,t-1}$, $MGMTFEE_{i,t-1}$, $FLOW_{i,t-1}$ and lastly past year return of the fund

($FUNDRET_{i,t-1}$). $\varepsilon_{i,t}$ is generic error term that is uncorrelated with all other independent variables.

In this model, my interest and the most important coefficient for this paper is β, which shows the relationship between fund size and fund performance when controlling for other fund characteristics (Chen et al., 2004). γ is a vector of loading on the control variables. In order to take into account of cross sectional and time-series variations in the panel data sample, I evaluate the regression (4) with monthly fixed effects, and both monthly fixed effects and firm fixed effects.

Moreover, I use a similar regression equation as the above equation, but it focuses more on the relationship between fund size and fund performance in family fund. Again, I utilize the following specific regression:

$$FUNDRET_{i,t} = \alpha_i + \beta_i LOGTNA_{i,t-1} + \gamma X_{i,t-1} + \varepsilon_{i,t} \qquad t = 1, \dots, T \quad (5)$$

The methodology for this regression model is the same as regression (4); however, in this model, I only include funds that are part of the family fund in the sample. Because by limiting the sample to only funds that are part of the family fund, I can apply fixed effects on monthly and family fund to investigate whether or not there are diseconomies of scale within the family fund.

5.2 Part II

In the second part of the paper, I investigate the impact of fund flow on the fund return, which corresponds to the third hypothesis. I utilize dummy variable and the interaction effect between different periods and flow variables before-, during- and after-crisis. Moreover, I run the regression in two different periods to test the sensitivities of fund flow on fund return. For example, I run interaction effect regression for pre- and during-crisis period and run a similar regression for during- and post- crisis period. From the regressions, we can see the changes and sensitivities of how fund flow influences fund performance. I also divide the sample into ten deciles based on their previous monthly returns, and I summarize the average flow in each decile for three different periods to find the answers of when and which decile has the most fund flow and which decile has the most persistent flow percentage.

Moreover, for the fourth hypothesis, I apply similar mythology from the third hypothesis; however, I focus on the fund size variable (LOGTNA) instead because I want to find out the sensitivities of fund size to fund return in three different periods.

For the last topic of the paper, I summarize the average returns in three different periods (pre-, during- and post-crisis period) for ten different deciles. This way it is clear what the returns in different specific economic periods are. Moreover, in order to test the fifth hypothesis, I apply regression equation (2) and (3) to find alphas in each period and each decile. Importantly, the regression result I produce for this hypothesis can confirm and contribute substantially to the fact that small funds might not always outperform the larger funds. Nevertheless, during specific economic periods, small funds might underperform or have similar performances as large funds because every fund wants to minimize their risks depending on the world economic situations.

6. Result

6.1 First Hypothesis

H_1 : *There is a negative relationship between fund size and fund performance.*

Table 3 reports the estimated result from the regression specific formula (4). In this regression, I use beta-adjusted return and utilize monthly fixed effect and both monthly and firm fixed effect. In this analysis for the first hypothesis, I include both Gross Fund Return and Net Fund Return for all observation samples. I begin with looking at LOGTNA, it seems that fund size has a negative impact on fund performances in both Gross Fund Return and Net Fund Return because the coefficient in front of LOGTNA is negative and significant at 1%. The negative effect means that increase in fund size would lower the fund return. The coefficients obtained from all the benchmarks range from -0,0028 to -0,00011 for Gross Fund Return and -0,0028 to -0,00016 for Net Fund Return. Our magnitude and significant finding are consistent with previous studies of Chen et al. (2004).

Table 3: Regression of Fund Performance on Lagged Fund Size

Gross Return	No Fixed Beta-Adj	No Fixed Market-Adj	Monthly Fixed Beta-Adj	Monthly and Firm fixed Beta-Adj
$\boldsymbol{INTERCEPT}$	0,0025***	0,0036***	0,0064***	0,0209***
	(0,00045)	(0,00056)	(0,00058)	(0,00086)
$\mathbf{LOGTNA}_{i,t-1}$	-0,00011	-0,00035***	-0,00016***	-0,0028***
	(0,000024)	(0,00003)	(0,00002)	(0,00006)
$\mathbf{LOGFAMSIZE}_{i,t-1}$	-0,00026***	-0,00023***	-0,00058***	-0,00061***
	(0,00003)	(0,00003)	(0,00004)	(0,00003)
$\mathbf{TURNOVER}_{i,t-1}$	-0,00119***	0,00010	-0,0011	0,0016
	(0,00047)	(0,00058)	(0,00047)	(0,00095)
$\boldsymbol{AGE}_{i,t-1}$	0,000065***	0,00006***	0,00006***	0,00013***
	(0,0000)	(0,0000)	(0,0000)	(0,00003)
$\boldsymbol{MGMTFEE}_{i,t-1}$	0,02438***	0,00261***	0,0237***	0,0270***
	(0,0012)	(0,0014)	(0,0012)	(0,0042)
$\boldsymbol{FLOW}_{i,t-1}$	-0,0030***	-0,00042	-0,00015***	0,00001
	(0,0003)	(0,00004)	(0,00003)	(0,00003)
$\boldsymbol{FUNDRET}_{i,t-1}$	0,0192***	0,0375***	0,0224***	0,0175***
	(0,00062)	(0,00077)	(0,00063)	(0,00062)
Number of Obs	409.833	409.833	409.833	409.833
Adj R-square	0,0048	0,0076	0,0126	0,0011

Net Return	No Fixed Beta-Adj	No Fixed Market-Adj	Monthly Fixed Beta-Adj	Monthly and Firm fixed Beta-Adj
$\boldsymbol{INTERCEPT}$	0,0020***	0,0036***	0,0064***	0,0210***
	(0,00045)	(0,00057)	(0,00058)	(0,00085)
$\mathbf{LOGTNA}_{i,t-1}$	-0,00016***	-0,00035***	-0,00016***	-0,0028***
	(0,000024)	(0,00003)	(0,00002)	(0,00006)
$\mathbf{LOGFAMSIZE}_{i,t-1}$	-0,00025***	-0,00023***	-0,00058***	-0,00061***
	(0,00003)	(0,00003)	(0,00004)	(0,00003)
$\mathbf{TURNOVER}_{i,t-1}$	-0,0018***	0,00098	-0,0011	0,0016
	(0,00047)	(0,00058)	(0,00047)	(0,00095)
$\boldsymbol{AGE}_{i,t-1}$	0,00006***	0,00006***	0,00006***	0,00013***
	(0,0000)	(0,0000)	(0,0000)	(0,00003)
$\boldsymbol{MGMTFEE}_{i,t-1}$	0,0119***	0,0250***	0,0237***	0,0270***
	(0,0012)	(0,0014)	(0,0012)	(0,0042)
$\boldsymbol{FLOW}_{i,t-1}$	-0,0030***	-0,00042***	-0,00015***	0,00001
	(0,0003)	(0,00004)	(0,00003)	(0,00003)
$\boldsymbol{FUNDRET}_{i,t-1}$	0,0191***	0,0375***	0,0224***	0,0175***
	(0,00062)	(0,00077)	(0,00063)	(0,00062)
Number of Obs	409.833	409.833	409.833	409.833
Adj R-square	0,0037	0,0075	0,0126	0,0011

Note: This table shows the regression (4) for the beta-return adjusted and market-return adjusted models. Fund returns are calculated before (gross) and after (net) subtracting expenses and fees. The regressions are shown with no fixed effects, with monthly fixed effects and with both monthly and firm fixed effects. The dependent variable is fund return (FUNDRET). LOGTNA is the natural logarithm of TNA. LOGFAMSIZE is the natural logarithm of one plus the size of the family that the fund belongs to. TURNOVER is fund turnover. AGE is the number of years of the fund and MGMTFEE is management fees of the fund. FLOW is the percentage of new fund flow into the mutual fund. FUNDRET is the fund return of the previous month. The other models of regressions (4) are reported in the appendix at the end of the paper.

Significance Level: ***Significant at 1%. **Significant at 5%. *Significant at 10%. Standard Error is reported in brackets.

Table 3 reveals other interesting findings as well. LOGFAMSIZE is another variable that tries to explain whether or not the size of family fund influences fund performance. The result indicates in both Gross Fund Return and Net Fund Return and confirms that the coefficients in front of LOGFAMSIZE are negative and significant across all the models. These findings for LOGFAMSIZE variable seem to imply that growth in the size of a family fund would lead to decrease in fund return. The magnitudes of LOGFAMSIZE range from -0,00023 to -0,00061 and are significant at 1% level.

TURNOVER is another interesting variable; however, its coefficients show mixed results across all the benchmarks. The positive coefficients for this variable are not significant at any level, but the negative coefficients are significant at 5% and 1% levels in both Net Fund Return and Gross Fund Return for only No-fixed Beta-adjusted and Monthly fixed effect Beta-adjusted. Turnover is the indicator and a proxy for whether a fund is active or passive (Chen et al., 2004); hence, the significance of negative coefficient suggests that the funds are active trading fund and further infer that the positive shock in turnover would decrease the fund return. However, high turnover does not always mean it is bad for a fund if a fund manager can generate high enough return to counterbalance those trading costs. The problem will only arise when a fund has high turnover but does not produce a better return to compensate for it. The result seems to justify because while TURNOVER might have on average a negative relationship with fund performance, but on average fund generates alpha to counterbalance the trading costs in both Net Fund Return and Gross Fund Return.

FLOW appears to be negative and significant for all benchmark models except monthly fixed and firm fixed effect, where the coefficient shows a minimal effect anyway. The coefficients of FLOW range from -0,00015 to -0,0030 and significant at high levels. This means if there is a growing number of inflows of money into a fund, the return of that fund on average will decrease. This result is consistent with the recent research paper by Blanchett (2012), where he suggests that investors are better off with investing in funds that are past winners but receive a small inflow of new monies. Furthermore, I will look into more depth for this variable in the later hypotheses.

Another important variable that I look at is management fee (MGMTFEE). MGMTFEE reveals mixed signs; however, only monthly and firm fixed effect model provide a

significant at 5% level and a positive sign. This result comes as a surprise because the higher management fee in a fund would affect the return of a fund and likely lead to lower return. The positive coefficient means that increase in management fee leads to higher fund return. This case could happen in certain funds because sometimes managers need a higher incentive to compensate for higher returns or alpha. Moreover, I also look at the age of fund; however, even though all the coefficients across benchmark models in Net Fund Return and Gross Fund return are positive and significant at 1% and 5% levels, it seems to have only little influence or no effect at all on fund return.

Another important and last variable in this table is FUNDRET, which measures to what extent past fund performance influences current fund return. The coefficients of past fund return are positive and significant at 1% across all benchmark models. This result suggests and hints that past positive fund return will most likely generate positive performance in the future. This is in line with the previous research study of Jegadeesh and Titman (1993), stating that buying past winners and selling past losers could potential lead to realize a higher return.

By looking at this table, it strongly suggests that there is a negative relationship between fund size and fund performance. Additionally, when we look at various benchmark models and regressions methods in table 3, we can see that there are slight differences in each model results. The size effect (LOGTNA) still exists after utilizing monthly fixed and both monthly and firm fixed effect. It is also important to emphasize that size effect seems to be higher in monthly and firm fixed regression compared to only monthly fixed regression. This demonstrates that the size of the fund can help explain the different returns regarding different fund size.

Next, I provide analysis of different deciles regression using CAPM-adjusted and Beta-adjusted models in order to see a clear view of decreasing return to scale and to confirm whether or not the above analysis holds true. I pick CAPM model to be used in the following analysis since it is well known and accepted throughout the economic world, and in addition, I apply the Beta-adjusted model to reflect better or more accurate return.

The tables 4A and 4B show the results of the regressions similar to the above table, but I estimate each decile to show a clear pattern. However, it seems that both models do not

display a clear pattern of diseconomies of scale between fund size and fund performance. Looking at Beta-Adjusted and CAPM model, fund size variable (LOGTNA) shows mixed patterns of diseconomies of scale. However, if we look closely at the given pattern, we can see that the size effect has increased from the first decile to the sixth deciles, and the effect of fund size seems to decrease after that. This result suggests that there is still a decreasing return to scale in the equity mutual fund, but it might due to the other factors that might make funds in higher deciles to be more efficient than funds in other lower deciles. Moreover, even though the table does not display a perfect result for this hypothesis, it provides us a promising pattern of negative relationship between fund size and fund performance. Therefore, we can conclude that the growth in fund size has a negative effect on fund performance.

Table 4A: Beta-Adjusted with month and firm fixed effects

Decile	1	2	3	4	5	6	7	8	9	10
INTERCEPT	0,0334***	0,0479***	0,0553***	0,0527***	0,0619***	0,0717***	0,0756***	0,0618***	0,0625***	0,039***
	(0,00355)	(0,00341)	(0,004)	(0,0054)	(0,0064)	(0,0042)	(0,0042)	(0,0048)	(0,0047)	(0,0064)
$LOGTNA_{i,t-1}$	-0,0066***	-0,0083***	-0,0106***	-0,0089***	-0,0074***	-0,0097***	-0,0096***	-0,0078***	-0,0068***	-0,0047***
	(0,00043)	(0,00041)	(0,00046)	(0,00045)	(0,00037)	(0,00045)	(0,00042)	(0,0004)	(0,0003)	(0,0002)
$LOGFAMSIZE_{i,t-1}$	-0,00106***	-0,0013***	-0,00091***	-0,00082***	-0,0014***	-0,00117***	-0,0013***	-0,001***	-0,0014***	-0,0011***
	(0,0001)	(0,0001)	(0,0001)	(0,0001)	(0,0001)	(0,00012)	(0,00012)	(0,00013)	(0,00012)	(0,00011)
$TURNOVER_{i,t-1}$	0,00421	0,00289	-0,00322	0,00444	0,0074	0,00997**	0,0032	-0,0059	-0,0002	-0,0058
	(0,0023)	(0,0025)	(0,0035)	(0,0039)	(0,0043)	(0,0049)	(0,0049)	(0,005)	(0,0037)	(0,0032)
$AGE_{i,t-1}$	0,00014	0,00013	0,00021	0,00091	-0,0000	0,00018	0,00008	0,0002	0,0001	0,00041
	(0,00019)	(0,00015)	(0,00017)	(0,00027)	(0,00032)	(0,00012)	(0,00008)	(0,00013)	(0,00011)	(0,00021)
$MGMTFEE_{i,t-1}$	-0,00691	0,0205	0,0317**	0,0183*	-0,0453**	-0,0047**	0,0217	0,048	0,117***	0,165***
	(0,00198)	(0,0121)	(0,0154)	(0,0168)	(0,0201)	(0,0229)	(0,0254)	(0,029)	(0,030)	(0,0297)
$FLOW_{i,t-1}$	0,00071***	0,00082***	0,0028***	0,0022***	0,00058***	0,0025***	0,0018***	0,00085***	0,00026***	0,0001***
	(0,00012)	(0,00011)	(0,00023)	(0,00023)	(0,0001)	(0,00023)	(0,00019)	(0,00016)	(0,0001)	(0,0001)
$FUNDRET_{i,t-1}$	0,01203***	0,014***	0,0082***	0,0113***	0,00843***	0,0151***	0,0061**	0,0128***	0,0133***	0,018***
	(0,00198)	(0,00192)	(0,00194)	(0,00198)	(0,00195)	(0,00202)	(0,0021)	(0,0022)	(0,021)	(0,0020)
Number of ob	39.384	40.796	41.166	41.289	41.332	41.353	41.302	41.041	41.113	41.057
Overall R-Square	0,0087	0,0127	0,0114	0,0110	0,007	0,0085	0,0095	0,0086	0,0070	0,0020

Note: This table shows the regression (4) for the beta-return adjusted for each size decile. Fund returns are calculated before (gross) and after (net) subtracting expenses and fees. The regressions are shown with no fixed effects, with monthly fixed effects and with both monthly and firm fixed effects. The dependent variable is fund return (FUNDRET). LOGTNA is the natural logarithm of TNA. LOGFAMSIZE is the natural logarithm of one plus the size of the family that the fund belongs to. TURNOVER is fund turnover. AGE is the number of years of the fund and MGMTFEE is management fees of the fund. FLOW is the percentage of new fund flow into the mutual fund. FUNDRET is the fund return of the previous month.
Significance Level: ***Significant at 1%. **Significant at 5%. *Significant at 10%. Standard Error is reported in brackets.

Table 4B: CAPM with month and firm fixed effects

Decile	1	2	3	4	5	6	7	8	9	10
INTERCEPT	0,0704***	0,0974**	0,1053***	0,099***	0,101***	0,1196***	0,1164***	0,0955***	0,0625***	0,0553***
	(0,0045)	(0,0044)	(0,0051)	(0,0068)	(0,0082)	(0,0053)	(0,005)	(0,0056)	(0,0047)	(0,0076)
$LOGTNA_{i,t-1}$	-0,0142***	-0,0167**	-0,0201***	-0,0172***	-0,013***	-0,0167***	-0,0149***	-0,0101***	-0,0068***	-0,0062***
	(0,0006)	(0,00053)	(0,00059)	(0,00057)	(0,0005)	(0,00056)	(0,005)	(0,00039)	(0,0003)	(0,0003)
$LOGFAMSIZE_{i,t-1}$	-0,00183***	-0,0023**	-0,00373***	-0,0014***	-0,0022***	-0,0017***	-0,00183***	-0,0021***	-0,0014***	-0,0015***
	(0,00012)	(0,0001)	(0,0044)	(0,00014)	(0,00013)	(0,00015)	(0,00015)	(0,00014)	(0,00012)	(0,00013)
$TURNOVER_{i,t-1}$	-0,00036	0,00524	-0,0037	0,0123	0,0185**	0,00992	0,0074	0,00741	-0,0002	-0,0023
	(0,0029)	(0,0033)	(0,0044)	(0,0049)	(0,0054)	(0,0061)	(0,0058)	(0,0044)	(0,0037)	(0,0038)
$AGE_{i,t-1}$	0,0002	0,0002	0,00042	0,00027	0,0003	0,00025	0,00015	0,00017	0,0001	0,00056**
	(0,00024)	(0,00019)	(0,00022)	(0,0003)	(0,0004)	(0,00015)	(0,0001)	(0,00013)	(0,00011)	(0,00025)
$MGMTFEE_{i,t-1}$	0,0171	0,0213	0,0562**	0,052	-0,0465	-0,0245	0,0315	0,1419***	0,117***	0,140***
	(0,0133)	(0,0157)	(0,0196)	(0,021)	(0,0256)	(0,0287)	(0,0303)	(0,0364)	(0,030)	(0,0352)
$FLOW_{i,t-1}$	0,0014***	0,0016***	0,0052***	0,0044***	0,0010***	0,0042***	0,0030***	0,0005***	0,00026***	0,00012*
	(0,00015)	(0,00015)	(0,0003)	(0,00029)	(0,00012)	(0,00029)	(0,00023)	(0,00011)	(0,0001)	(0,0001)
$FUNDRET_{i,t-1}$	0,0288***	0,031***	0,0263***	0,019***	0,0233***	0,0278***	0,0202***	0,0273***	0,0133***	0,0325***
	(0,0025)	(0,0025)	(0,0025)	(0,0025)	(0,0025)	(0,0025)	(0,00253)	(0,0025)	(0,021)	(0,0024)
Number of obs	39.384	40.796	41.166	41.289	41.332	41.353	41.302	41.041	41.113	41.057
Overall R-Square	0,0193	0,0291	0,0216	0,0184	0,0137	0,0164	0,0148	0,0109	0,0116	0,0027

Note: This table shows the regression (4) for CAPM model for each size decile. Fund returns are calculated before (gross) and after (net) subtracting expenses and fees. The regressions are shown with no fixed effects, with monthly fixed effects and with both monthly and firm fixed effects. The dependent variable is fund return (FUNDRET). LOGTNA is the natural logarithm of TNA. LOGFAMSIZE is the natural logarithm of one plus the size of the family that the fund belongs to. TURNOVER is fund turnover. AGE is the number of years of the fund and MGMTFEE is management fees of the fund. FLOW is the percentage of new fund flow into the mutual fund. FUNDRET is the fund return of the previous month.
Significance Level: ***Significant at 1%. **Significant at 5%. *Significant 10% Standard Error is reported in brackets.

6.2 Second Hypothesis

H_2 : *There is a positive relationship between the size of fund within the family and its performance.*

Contrast to the first hypothesis, the second hypothesis begs the question that there is a positive relationship between the size of a fund within the family and its performance. Hence, I need to sort out and include only funds that belong to their family funds. Similar to the first hypothesis, I use regressions (5) and apply the monthly fixed effect and firm fixed effect.

Looking at table 5, it can be seen that size effect (LOGTNA) in both Gross Fund Return and Net Fund Return across all the models has negative coefficients and is significant at 1% and 5% levels. This reveals that there is a negative relationship between a fund that is part of a family fund and that funds' return. In other words, increase in fund size of a fund within a family fund leads to lower fund performance.

Another important variable which needs to be investigated in order to help explain this hypothesis is LOGFAMSIZE. Similar to the previous variable, LOGFAMSIZE seems to show negative signs and have highly significant levels across all the models. This, again, suggests that the family fund size potentially impacts funds belonging to that family fund in a negative way. Next, the coefficients of the TURNOVER variable show mixed signs; however, it seems that the only negative coefficients are highly significant. It confirms that active equity mutual fund is an active trading fund, in which fund returns are likely to decrease in the long run. However, again, it is also important to point out that high turnover need not be bad for the funds and family funds if managers can compensate for the trading costs by generating high returns. Moreover, the AGE variable seems to be positive and significant, but the magnitudes are very small. Age of funds has a positive attribute to fund returns; it predicts that the longer the fund is in the market, the better return that fund will generate.

Another interesting result is the coefficient of management fee (MGMTFEE). From the table, it shows positive coefficient across all models and significance at high-levels. This is unexpected since the cost side of a fund should reduce fund return. However, this might

be due to the fact that higher management fee in a fund that is part of family fund provides more incentives for managers to carefully pick securities and reach a higher level of performance.

The last variable is fund return from the previous period (FUNDRET). Looking at the table, the coefficients of FUNDRET are positive and significant at high-levels across all the models. This result is similar to the previous analysis in the first hypothesis, and it signifies momentum as one of the key variables that positively affects the future fund return. From careful analysis and result in the table above, I found that there is a negative relationship between the size of a fund within the family and its returns. Therefore, I reject this hypothesis because there is not enough evidence to support the proposition above; this result is inconsistent with Chen et al. (2004).

Table 5: Regression of Fund Performance on Lagged Fund Size (Family Fund)

Gross Return	No Fixed Beta-Adj	No Fixed Market-Adj	Monthly Fixed Beta-Adj	Monthly and Firm fixed Beta-Adj
$\boldsymbol{INTERCEPT}$	0,0050***	0,0067***	0,0088***	0,0236***
	(0,00064)	(0,00079)	(0,0008)	(0,0013)
$\mathbf{LOGTNA}_{i,t-1}$	-0,00016***	-0,00031***	-0,0002***	-0,0032***
	(0,00003)	(0,00004)	(0,00003)	(0,0001)
$\mathbf{LOGFAMSIZE}_{i,t-1}$	-0,00045***	-0,00043***	-0,00073***	-0,00078***
	(0,00004)	(0,00005)	(0,00005)	(0,00004)
$\mathbf{TURNOVER}_{i,t-1}$	-0,00144**	0,0094	-0,0015	0,00261
	(0,00062)	(0,0008)	(0,0006)	(0,0014)
$\boldsymbol{AGE}_{i,t-1}$	0,0001***	0,0001***	0,0001***	0,0002**
	(0,0000)	(0,0000)	(0,0000)	(0,0001)
$\boldsymbol{MGMTFEE}_{i,t-1}$	0,0200***	0,0140***	0,0188***	0,0403***
	(0,0019)	(0,0024)	(0,00192)	(0,0060)
$\boldsymbol{FLOW}_{i,t-1}$	-0,00081***	-0,0009***	-0,00056***	-0,0003***
	(0,0001)	(0,00008)	(0,00007)	(0,0001)
$\boldsymbol{FUNDRET}_{i,t-1}$	0,0232***	0,0444***	0,0260***	0,0200***
	(0,0009)	(0,0012)	(0,00096)	(0,0009)
Number of Obs	210.407	210.407	210.407	210.407
Adj R-square	0,0058	0,0090	0,012	0,0012

Net Return	No Fixed Beta-Adj	No Fixed Market-Adj	Monthly Fixed Beta-Adj	Monthly and Firm fixed Beta-Adj
$\boldsymbol{INTERCEPT}$	0,0044***	0,0066***	0,0082***	0,0239***
	(0,0006)	(0,0008)	(0,0005)	(0,0013)
$\mathbf{LOGTNA}_{i,t-1}$	-0,00010**	-0,00031***	-0,0001***	-0,0031***
	(0,00003)	(0,00004)	(0,00003)	(0,0001)
$\mathbf{LOGFAMSIZE}_{i,t-1}$	-0,00043***	-0,00043***	-0,00072***	-0,00077***
	(0,00004)	(0,00005)	(0,00005)	(0,00004)
$\mathbf{TURNOVER}_{i,t-1}$	-0,00187**	0,0009	-0,0019**	0,0024
	(0,0006)	(0,0008)	(0,0006)	(0,0014)
$\boldsymbol{AGE}_{i,t-1}$	0,0001***	0,0001***	0,0001***	0,00016***
	(0,0000)	(0,0000)	(0,0000)	(0,0001)
$\boldsymbol{MGMTFEE}_{i,t-1}$	0,0087***	0,0130***	0,0790***	0,0324***
	(0,0019)	(0,0024)	(0,0019)	(0,0060)
$\boldsymbol{FLOW}_{i,t-1}$	-0,0008***	-0,0009***	-0,0006***	-0,0003***
	(0,0001)	(0,00008)	(0,00007)	(0,0001)
$\boldsymbol{FUNDRET}_{i,t-1}$	0,0232***	0,0444***	0,0260***	0,0198***
	(0,0009)	(0,0012)	(0,001)	(0,0009)
Number of Obs	210.407	210.407	210.407	210.407
Adj R-square	0,0051	0,0090	0,013	0,0006

Note: This table shows the regression (5) for the beta-return adjusted and market-return adjusted models. Fund returns are calculated before (gross) and after (net) subtracting expenses and fees. The regressions are shown with no fixed effects, with monthly fixed effects and with both monthly and firm fixed effects. The dependent variable is fund return (FUNDRET). LOGTNA is the natural logarithm of TNA. LOGFAMSIZE is the natural logarithm of one plus the size of the family that the fund belongs to. TURNOVER is fund turnover. AGE is the number of years of the fund and MGMTFEE is management fees of the fund. FLOW is the percentage of new fund flow into the mutual fund. LAGFUNDRET is the fund return of the previous month.
Significance Level: ***Significant at 1%. **Significant at 5%. Significant at 10%. Standard Error is reported in brackets.

6.3 Third Hypothesis

H_3 : *Fund flow is positively related to lagged-fund performance during and after the crisis.*

After I obtain the overall result and see to what extent each fund's characteristics influence fund performance, in this hypothesis, I want to look into detail whether or not fund flow is positively related to fund performance. Table 6A below shows the average percentage of flow in each decile based on previous month return in different time periods. It is important to note that usually investors look at the historical returns of funds before choosing where to invest. Hence, the higher decile of fund return should have the higher percentages of fund flow.

In other words, with the higher previous fund returns, funds are more likely to receive a greater flow of fund. However, the result table shows the opposite, and it is an unexpected result because the lower fund return deciles, on average, have a higher level of fund flow than higher decile except for the second decile. Thus, this shows that investors potentially invest based on their own valuations or other factors rather than being return chasers during the ten years sample that includes pre-, during- and post-crisis in 2007.

Moreover, looking at table 6A, we can see the flow in pre-crisis, during-crisis and post-crisis periods. It is an interesting result, particularly when compared the during-crisis period with the post-crisis period. The fund flow level shows that the lower decile receives larger fund flows than higher decile during-crisis period. However, in the post-crisis period, there are jumps and mixed signs of fund flows across all deciles and it does not indicate a clear fund flow pattern. For example, the second decile shows -11,71% of fund flow, but the third decile indicates a large fund flow of 21,31%.

There are a few explanations for this result. In leading up to the crisis period, smaller funds tend to outperform larger funds; it automatically puts them in the higher bracket of decile in this case. Thus, during the crisis period, investors tend to invest in bigger funds (lower deciles), where the funds invest in less volatile equities to minimize their risks in the equity market.

Moreover, in the post-crisis period, investors still have some concerns and do not have confidence in the equity market. The table confirms that the fund flow spreads throughout all the deciles, but mostly large fund flow is concentrated in the higher deciles. It can somewhat be concluded that in this period investors tend to invest based on mutual funds' historical returns. Yet, it is understandable since there is uncertainty in the market and it is wise to use track record as a key measuring which fund to invest.

Table 6A: Fund Flow table

Decile	1	2	3	4	5	6	7	8	9	10
Pre-Crisis (2004-2007)										
Mean	-3,59%	-5,87%	19,73%	38,17%	23,03%	9,37%	4,13%	2,92%	5,58%	9,76%
SD	0,5562	0,5104	0,8982	0,3817	0,9321	0,6804	0,5047	0,4617	0,4820	0,5022
During-Crisis (2007-2009)										
Mean	29,32%	21,77%	32,71%	35,16%	27,06%	9,53%	5,31%	3,62%	-4,34%	-15,29%
SD	0,9522	1,010	1,174	1,12864	1,035	0,6842	0,4678	0,6113	0,3720	0,3965
Post-Crisis (2009-2013)										
Mean	0,303%	-11,71%	21,31%	3,76%	-3,86%	5,27%	13,94%	25,63%	35,03%	15,29%
SD	0,2878	0,6647	1,129	0,7278	0,9590	0,8205	1,642	1,197	2,149	0,6079
All periods (2004-2013)										
Mean	20,08%	8,12%	21,42%	22,94%	16,04%	8,56%	8,32%	11,21%	11,37%	-4,59%
SD	0,8175	0,8326	1,2623	0,9911	1,006	0,757	1,105	0,854	1,319	0,495

Note: This table shows the means and standard deviations of fund flow of the ten FUNDRET-sorted per deciles for different time periods and total sample.

Next, table 6B illustrates the effect of fund flow on fund performance in different periods, where I utilize monthly and firm fixed effects and interaction effect. The result shows that fund returns and fund flows during pre-crisis and during-crisis periods move differently. The interaction term during the crisis period indicates that the fund flow and fund performances are more inversely related than in the normal period and it is highly significant. The coefficient for during crisis is negative and significant at 1% and 5% levels; hence, during the crisis, the funds on average generate less return than the normal period. Moreover, the highly significant and negative coefficient of FLOW term means the higher the fund flow, the lower the returns.

Nevertheless, the coefficient of interaction term variable after the crisis shows a positive sign. It implies that the fund flows and fund performances are more positively related in the post-crisis period than the normal period. The coefficient of the post-crisis period is negative and highly significant. It can be interrupted that during post-crisis the return of the fund is less than that during the crisis period. This result is inconsistent with the work of Jegadeesh and Titman (1993). There is not enough evidence to support this hypothesis, and therefore I reject this hypothesis.

Table 6B: Flow table with interaction effects for during- and post-crisis

Interaction Effects		Monthly and Firm fixed Beta-Adj	Monthly and Firm fixed Market-Adj
During-crisis			
	Intercept	0,0022***	0,0047***
		(0,0001)	(0,0001)
	During-Crisis	-0,0015***	-0,0026***
		(0,0001)	(0,0001)
	$FLOW_{t-1}$	-0,0003***	-0,0006***
		(0,0001)	(0,0001)
	During-Crisis*$FLOW_{t-1}$	-0,0023***	-0,0009***
		(0,0001)	(0,0001)
Number of Obs		176.391	176.391
Overall R-Square		0,0097	0,0046
Post-crisis			
	Intercept	0,0008***	0,0016***
		(0,0001)	(0,0001)
	Post-Crisis	-0,0034***	-0,0024***
		(0,0001)	(0,0001)
	$FLOW_{t-1}$	-0,0025***	-0,0015***
		(0,0001)	(0,0001)
	Post-Crisis*$FLOW_{t-1}$	0,0031***	0,0017***
		(0,0001)	(0,0001)
Number of Obs		235.209	235.209
Overall R-Square		0,0087	0,0030

Note: This table shows interaction regressions for beta-adjusted and marker-adjusted models for during and post crisis periods. In both models, FLOW variable interacts with a dummy variable During-Crisis (Post-Crisis), which takes value 0 for the period of 2004-2007 and takes value 1 for the period of 2008-2009 (which takes value 0 for the period of 2007-2009 and takes value 1 for the period of 2010-2013).
Significance Level: ***Significant at 1%. **Significant at 5%. *Significant at 10%.
Standard Error is reported in brackets.

6.4 Fourth Hypothesis

H_4: Fund size is negatively related to fund performance during and after the crisis.

Even though the first hypothesis shows that there is a negative relationship between fund size and fund performance, I have not tested the effect of fund size before and after a major crisis if the earlier claim still holds true. Moreover, it is important to note that the financial crisis in 2007 brought dramatic changes to the global financial system and how investors and fund managers see the equity market. In this hypothesis, I, again utilize monthly and firm fixed effects and interaction effect to show how fund size corresponds with fund return before and after the crisis. The result of regression is shown in table 7 below. The coefficient of the interaction effect variable during-crisis is negative significant at 1%. This result signifies that during the crisis the relationship between fund size and fund performance moves to different directions. This means that LOGTNA and fund performance during the crisis period is more negatively related than the normal period. There is no surprise of the effect of the fund size (LOGTNA) variable that seems to be negative and highly significant.

However, when we look at the post-crisis period, the interaction term seems to provide negative signs and magnitude. This means that after the crisis fund size and fund performance are more positively related or less negatively related than the normal period. The coefficient of LOGTNA is negative and highly significant. Again, this shows that when there is growth in fund's total net asset value, fund return would decline. Post-crisis coefficient is negative and significant, which indicates that funds during the post-crisis period do not generate as much return as the during-crisis period.

Table 7: LOGTNA table with interaction effects for during- and post-crisis

Interaction Effects		Month and Firm fixed Beta-Adj	Month and Firm fixed Market-Adj
During-crisis			
	Intercept	0,0259***	0,0285**
		(0,0005)	(0,0007)
	During-Crisis	0,0051***	0,0038***
		(0,0004)	(0,0005)
	LOGTNA_{t-1}	-0,0042***	-0,0043***
		(0,0001)	(0,0001)
	During-Crisis*LOGTNA_{t-1}	-0,0010***	-0,0009***
		(0,0001)	(0,0001)
Number of Obs		181.402	181.402
Overall R-Square		0,0005	0,0006

Post-crisis			
	Intercept	0,0171***	0,0258***
		(0,0006)	(0,0008)
	Post-Crisis	-0,0092***	-0,0031***
		(0,0005)	(0,0006)
	$LOGTNA_{t-1}$	-0,0032***	-0,0050***
		(0,0001)	(0,0001)
	Post-Crisis*$LOGTNA_{t-1}$	0,0014***	0,0008***
		(0,0001)	(0,0001)
Number of Obs		235.209	235.209
Overall R-Square		0,0002	0,0005

Note: This table shows interaction regressions for beta-adjusted and marker-adjusted models for during and post crisis periods. In both models, LOGTNA variable interacts with a dummy variable During-Crisis (Post-Crisis), which takes value 0 for the period of 2004-2007 and takes value 1 for the period of 2008-2009 (which takes value 0 for the period of 2007-2009 and takes value 1 for the period of 2010-2013).
Significance Level: ***Significant at 1%. **Significant at 5%. *Significant at 10%
Standard Error is reported in brackets.

There are several explanations for this outcome, especially the interaction effect variable during the crisis period. The negative coefficient shows small funds have advantages to potentially generate a better return than bigger funds. To support the previous statement, Chan et al. (2009) find that in large funds, fund managers are concerned with transaction cost and market impact cost when they try to invest or sell securities because large funds are most likely to incur higher market impact cost than smaller funds since large funds buy and sell in larger amounts. Therefore, fund managers need to organize their portfolios in such a way that reduces these costs, where they lose flexibility to invest in small-cap or certain medium-cap equities and other opportunities. In additional to literature explanation, I believe that during and after the crisis small-cap equities become very cheap and have high potential upside, but these equities are also highly volatile and, therefore, only smaller funds would invest in them. With giving the duration of 10 years in the sample, it provides a good length of time for companies affected by the financial crisis in 2007 to recover their businesses. Thus, these companies should be able to become profitable again and turn their businesses around; it reflects remarkably in the U.S. stock market. [1] Based on the results, previous literatures and assumptions above, I reject the fourth hypothesis that there is not enough evidence showing that fund size erodes fund performance in the post-crisis period. Despite the table result agree

[1] Table 9 in the appendix shows the graphs between small-cap U.S. stock index and large-cap U.S. stock index.

with this hypothesis for the during-crisis period, but it does not support the claim in the post-crisis period.

6.5 Fifth Hypothesis

H_5: *Large funds tend to generate better returns and alphas than small funds during the crisis, but both funds have similar returns and alphas after the crisis.*

In this hypothesis, I will discuss the nature of funds' returns and funds' alphas for different fund decile in pre-, during- and post-crisis periods. Despite many previous studies showing that there is decreasing return to scale in mutual funds and therefore small funds are better than bigger funds, I want to test their findings and make an opposing argument that both small and large funds would generate more or less the same performances during- and post-crisis. The statistical result table 8A shows the average return per decile in different periods. In the pre-crisis period, it does not demonstrate that there are diseconomies of scale between fund size and fund performance.

Moreover, the returns spread around when we look at average return during-crisis period in different deciles, where the higher deciles tend to have better returns than smaller deciles. However, the post-crisis period appears to demonstrate similar fund returns across all deciles, except the first decile. I expect this result for post-crisis since after the financial crisis, investors or fund managers (either small or large funds) tend to try to minimize their risks in the equity market, where they likely want to hold on to mostly big-cap equities.

Table 8A: Net Fund Return in different deciles

Decile	1	2	3	4	5	6	7	8	9	10
Pre-Crisis (2004-2007)										
Mean	0,77%	0,91%	0,94%	0,95%	0,99%	0,97%	0,98%	1,05%	1,06%	0,93%
SD	0,035	0,034	0,035	0,035	0,035	0,035	0,036	0,035	0,034	0,032
During-Crisis (2007-2009)										
Mean	-1,05%	-0,67%	-0,62%	-0,25%	-0,32 %	-0,15%	-0,30%	-0,28%	0,04%	-0,10%
SD	0,084	0,084	0,084	0,081	0,082	0,083	0,082	0,081	0,078	0,075
Post-Crisis (2009-2013)										
Mean	0,78%	1,12%	1,04%	1,08%	1,15%	1,20%	1,15%	1,25%	1,27%	1,27%
SD	0,054	0,053	0,052	0,052	0,051	0,051	0,051	0,050	0,050	0,050

Note: This table reports the means and standard deviations of fund return of the ten TNA-sorted deciles for different time periods.

Table 8B: Loading calculated using 3-Factor model

Decile	1	2	3	4	5	6	7	8	9	10
Pre-crisis										
ALPHA	0,057%	0,136%	0,164%	0,184%	0,192%	0,211%	0,244%	0,283%	0,297%	0,303%
MKTRF	1,018	1,018	1,002	1,025	1,032	1,013	1,021	1,023	1,013	0,987
SMB	0,255	0,228	0,269	0,267	0,241	0,268	0,245	0,205	0,187	0,119
HML	0,061	0,076	0,079	0,055	0,093	0,075	0,073	0,035	0,008	-0,054
During-crisis										
ALPHA	-0,057%	-0,053%	0,008%	-0,007%	0,044%	0,006%	0,004%	0,126%	0,189%	0,079%
MKTRF	1,091	1,107	1,106	1,096	1,106	1,132	1,137	1,112	1,107	1,128
SMB	0,206	0,196	0,188	0,160	0,161	0,153	0,078	0,076	0,025	-0,019
HML	-0,117	-0,114	-0,114	-0,117	-0,128	-0,135	-0,163	-0,131	-0,141	-0,153
Post-Crisis										
ALPHA	-0,482%	-0,319%	-0,356%	-0,357%	-0,318%	-0,332%	-0,303%	-0,314%	-0,288%	-0,240%
MKTRF	1,041	1,045	1,043	1,048	1,049	1,048	1,036	1,048	1,042	1,028
SMB	0,132	0,133	0,119	0,125	0,083	0,087	0,085	0,082	0,066	0,031
HML	-0,101	-0,102	-0,105	-0,100	-0,109	-0,107	-0,101	-0,121	-0,096	-0,114

Note: This table reports loading calculated using Fama-French 3-Factor model per decile for different time periods

Next, the table 8B shows the average alphas per decile in different time periods. I regress excess net fund return on Fama-Fench three-factor and Carhart four-factor. The result table indicates that during-crisis period large funds typically generate higher alphas than small funds. This result is expected because large funds usually invest more in larger market cap-equities than smaller funds. The impact of a sudden financial crisis on big companies (big-cap equities) is generally less severe than on small companies (small-cap equities). Nevertheless, there are no positive alphas shown in the post-crisis period, but, again, the alphas seem to be more or less identical across all deciles except the first decile. Therefore, I accept this hypothesis since there is enough evidence to verify that larger funds tend to have better returns and alphas during the financial crisis period than smaller funds, but both funds tend to have similar returns and alphas after the crisis period.

7. Conclusion

In this paper, I inspect the relationship between fund size and fund performance in the active equity mutual fund. Because most of the previous research was conducted before the financial crisis in 2007, I try to test the hypotheses from previous studies whether or not these hypotheses still hold true in my sample and recent time frame. With the mutual fund becoming more and more popular in the recent time, it is vital for investors to understand the mechanism behind the performance of the mutual fund. The central research question is as follows:

Are there diseconomies of scale between fund size and fund performance in the mutual fund?

Researching through previous studies, most scholars agree that there is an inverse relationship between fund size and fund performance citing different explanatory factors such as fund flow and momentum, fund size, transaction cost and market impact cost, management fee, and new regulations. However, I mainly focus on the effect of fund size and fund flow variables.

In my analysis, I come up with five different hypotheses in order to have a full understanding and a clear view on the research question, where each hypothesis tackles different aspects of either fund characteristics or time periods. I start with looking at the relationship between fund characteristics and fund performance in both gross and net fund returns for the entire sample without splitting the periods or deciles. I apply different benchmark models such as Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor model, and Carhart Four-Factor model, where I also employ monthly and firm fixed effects in the regression. The result shows highly significant, and all agree that there is diseconomies of scale in relation to fund size and fund performance, and leads to acceptance of the first hypothesis.

After obtaining the overview picture of the research question, I want to find out more about the relationship of the fund belonging to family fund and family fund regarding the effect of fund sizes on their performances. I use a similar method as employed for the previous hypothesis, but in this regression I include only funds that are part of family fund**s**. The outcome again shows the negative relationship between fund size within the family fund and its performance; this points to the rejection of the second hypothesis.

The third hypothesis is very interesting because it looks at the flow of funds before and after the crisis periods, and its relationship with lagged 1-month fund performance. I apply

interaction effect and monthly and firm fixed effects in the regression for this hypothesis. The result shows highly negative significance between pre- and during-crisis period and positive significance between during- and post-crisis period. Therefore, I rejected the third hypothesis.

Following the first hypothesis, I continue to explore the relationship between fund size and fund performance, but in the fourth hypothesis I try to answer whether or not during and after the crisis fund size still has a negative relationship with fund performance. I utilize interaction effect and monthly and firm fixed effects for regression results. It shows that fund size and fund performance are negatively related during the crisis, but it shows that they are positively related during the post-crisis period. This leads me to reject the fourth hypothesis.

The last hypothesis, I inspect funds' returns and funds' alphas before, during and post-crisis in different fund deciles. The result tables show that there is no diseconomies of scale in fund return during the financial crisis in 2007, but it does not show the linear relationship between fund returns and fund size. After the crisis, fund returns show a similar range of returns across all deciles. Moreover, larger funds have better alphas than smaller funds during and after the crisis period, but the result shows there are no positive alphas after the crisis.

After I test all the hypotheses, I can conclude that an increase in fund size erodes fund performance for entire sample period, but, after the financial crisis period, the negative effect of fund size seems to diminish or become less effective. The highly significant results showing the negative effect of fund size are seen in particular in the first and second hypotheses. There are many implications for researchers and investors regarding my findings from this paper. Funds' performances are the most crucial factor when choosing which fund to invest in. However, investors might forget that returns are usually volatile and there are other important factors influencing the returns that need to be taken into consideration. The fund size factor plays an essential role in determining the fund performance because once fund size increases to a certain level, it restricts the flexibility of fund managers and incurs more transaction and market impact costs. Therefore, investors indeed should also look at the asset under management of the fund in comparison to its return and adding to that, investors might want to look at past winner funds because the momentum factor is proven to be a good indicator to predict future performance. Moreover, according to my findings in this paper, it is suggested to choose investing in a fund that is not too small, but also not too big to avoid the sudden major crisis and to be able to take more risk for higher return.

There are a few limitations and drawbacks to this research paper. The time frame of the observation sample might not be an accurate generalized idea for the relationship between fund size and fund performance because the time frame includes the period where the worst financial crisis since the Great Depression occurred. The timing of observation sample might have a bigger impact on return and other fund characteristics than normal period. Moreover, the sample data is restricted specifically to US active equity mutual funds. This means that regulations and cultures in different countries are dissimilar. Therefore, using results from this paper to apply to other nations might not be useful. Lastly, even though my research paper tries to use the well-known benchmark models to precisely capture the returns and other fund characteristics, it will never be perfectly accurate. Hence, there might be some biases in each model and result tables.

Essentially, this paper contributes to the previous studies of Chen et al. (2004) by using more recent data sets and establishing new hypotheses to seek confirmation of the relationship between fund and fund performance before, during and after the crisis period. Additionally, for future research regarding this topic, it is interesting to see to what extent the recent crisis in 2007 has impacted the mutual fund industry compared to other crisis periods that mutual fund investment as an investment product was not as widespread as in the recent time. Some of my results are consistent with previous studies; on the other hand, some findings are contrasting. This might signal that in different periods the fund characteristics have different effects to fund performance.

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9. Appendix

Table 3: Regression of Fund Performance on Lagged Fund Size

Gross Return	3-Factor No Fixed	4-Factor No Fixed	Monthly Fixed 3-Factor	Monthly Fixed 4-Factor
INTERCEPT	0,0040***	-0,0566***	0,0086***	-0,0495***
	(0,0014)	(0,0014)	(0,0018)	(0,0017)
LOGTNA	-0,0011***	0,0000	-0,0008***	0,0005***
	(0,00001)	(0,00007)	(0,00007)	(0,0001)
LOGFAMSIZE	0,0009***	-0,0044***	-0,0009**	0,0009***
	(0,0001)	(0,0001)	(0,0001)	(0,0001)
TURNOVER	-0,00224	-0,0056***	-0,0018	-0,0048**
	(0,0014)	(0,0015)	(0,0014)	(0,0014)
AGE	0,0000**	-0,0000***	0,0000*	-0,0000***
	(0,0000)	(0,0000)	(0,0000)	(0,0001)
MGMTFEE	-0,0708***	-0,00006	-0,0750***	-0,0103**
	(0,0037)	(0,0036)	(0,0035)	(0,0034)
FLOW	-0,0009***	-0,0021***	0,0003**	-0,0001
	(0,0001)	(0,0001)	(0,0001)	(0,0001)
LAGFUNDRET	0,2042***	0,0828***	0,2330**	0,1535***
	(0,0020)	(0,0019)	(0,0019)	(0,0019)
Number of Obs	409.833	409.833	409.833	409.833
Adj R-square	0,0277	0,0161	0,110	0,131

Net Return	3-Factor Model	4-Factor Model	Monthly Fixed 3-Factor	Monthly Fixed 4-Factor
INTERCEPT	0,0039***	-0,0566***	0,0085***	-0,050***
	(0,0014)	(0,00143)	(0,0018)	(0,0017)
LOGTNA	-0,0011***	0,00002***	-0,00079***	0,0005***
	(0,0001)	(0,0001)	(0,0001)	(0,0001)
LOGFAMSIZE	0,00089***	0,0044***	-0,00088***	0,0009***
	(0,0001)	(0,00009)	(0,0001)	(0,0001)
TURNOVER	-0,0023	-0,0057***	-0,0019***	-0,0048***
	(0,0015)	(0,0015)	(0,0014)	(0,0001)
AGE	0,00003**	-0,00004***	0,00002*	-0,0001***
	(0,00001)	(0,0000)	(0,0000)	(0,0000)
MGMTFEE	-0,0718***	-0,0011	-0,0759***	-0,0112**
	(0,0037)	(0,0036)	(0,0035)	(0,0034)
FLOW	-0,00089**	-0,0021***	0,0003**	-0,0001**
	(0,0001)	(0,0001)	(0,0001)	(0,0001)
LAGFUNDRET	0,0232***	0,0828***	0,233***	0,1535***
	(0,0020)	(0,0019)	(0,0019)	(0,0019)
Number of Obs	409.833	409.833	409.833	409.833
Adj R-square	0,0277	0,0161	0,110	0,131

Note: This table shows the regression (4) for the beta-return adjusted and market-return adjusted models. Fund returns are calculated before (gross) and after (net) subtracting expenses and fees. The regressions are shown with no fixed effects, with monthly fixed effects and with both monthly and firm fixed effects. The dependent variable is fund return (FUNDRET). LOGTNA is the natural logarithm of TNA. LOGFAMSIZE is the natural logarithm of one plus the size of the family that the fund belongs to. TURNOVER is fund turnover. AGE is the number of years of the fund and MGMTFEE is management fees of the fund. FLOW is the percentage of new fund flow into the mutual fund. LAGFUNDRET is the fund return of the previous month.
Significance Level: ***Significant at 1%. **Significant at 5%. *Significant at 10%. Standard Error is reported in brackets.

Table 3: Regression of Fund Performance on Lagged Fund Size

Gross Return	Monthly and Firm fixed 3-Factor	Monthly and Firm Fixed 4-Factor	Monthly and Firm fixed Market-Adj	Net Return	Monthly and Firm fixed 3-Factor	Monthly and Firm Fixed 4-Factor	Monthly and Firm fixed Market-Adj
INTERCEPT	0,0336***	-0,0777***	0,0300***	**INTERCEPT**	0,0335***	-0,0777***	0,0300***
	(0,0027)	(0,0027)	(0,0010)		(0,0027)	(0,0027)	(0,0010)
LOGTNA	-0,0051***	0,0029***	-0,0042***	**LOGTNA**	-0,0051***	0,0030***	-0,0042***
	(0,0002)	(0,0001)	(0,0001)		(0,0002)	(0,0002)	(0,0001)
LOGFAMSIZE	0,0001***	0,0049***	-0,0007***	**LOGFAMSIZE**	0,0001	0,0049***	-0,0007***
	(0,0001)	(0,0001)	(0,0000)		(0,00009)	(0,0001)	(0,0000)
TURNOVER	0,0116***	-0,0179***	0,0020*	**TURNOVER**	0,0115***	-0,0179***	0,0020*
	(0,0031)	(0,0030)	(0,0012)		(0,0031)	(0,0030)	(0,0012)
AGE	-0,0001	-0,0001	0,0002***	**AGE**	-0,0001	-0,0001	0,0002***
	(0,0001)	(0,0001)	(0,0000)		(0,0001)	(0,0001)	(0,0000)
MGMTFEE	0,0523***	-0,0114***	0,0326***	**MGMTFEE**	0,0520***	-0,0121	0,0319***
	(0,0136)	(0,0001)	(0,0053)		(0,0138)	(0,0136)	(0,0053)
FLOW	-0,0005***	-0,0024***	-0,0000	**FLOW**	-0,0005***	-0,0024***	0,0000
	(0,0001)	(0,0001)	(0,0000)		(0,0001)	(0,0001)	(0,0000)
LAGFUNDRET	0,2020***	0,0786***	0,0347***	**LAGFUNDRET**	0,2020***	0,0786***	0,0347***
	(0,0020)	(0,0019)	(0,0008)		(0,0020)	(0,0020)	(0,0008)
Number of Obs	409.833	409.833	409.833	**Number of Obs**	409.833	409.833	409.833
Adj R-square	0,0176	0,127	0,0022	**Adj R-square**	0,0176	0,127	0,131

Note: This table shows the regression (4) for the beta-return adjusted and market-return adjusted models. Fund returns are calculated before (gross) and after (net) subtracting expenses and fees. The regressions are shown with no fixed effects, with monthly fixed effects and with both monthly and firm fixed effects. The dependent variable is fund return (FUNDRET). LOGTNA is the natural logarithm of TNA. LOGFAMSIZE is the natural logarithm of one plus the size of the family that the fund belongs to. TURNOVER is fund turnover. AGE is the number of years of the fund and MGMTFEE is management fees of the fund. FLOW is the percentage of new fund flow into the mutual fund.FUNDRET is the fund return of the previous month.

Significance Level: ***Significant at 1%. **Significant at 5%. *Significant at 10%. Standard Error is reported in brackets.

Table 6B: Flow table with interaction effects for during- and post-crisis

Interaction Effects		No Fixed Market-Adj	Monthly Fixed Beta-Adj	No Fixed Beta-Adj
During-crisis				
	INTERCEPT	0,0046***	0,0041***	0,0020***
		(0,0001)	(0,0002)	(0,0001)
	During-Crisis	-0,0024***	-0,0015***	-0,0012***
		(0,0001)	(0,0001)	(0,0001)
	$FLOW_{t-1}$	-0,00052***	0,00011***	-0,00023**
		(0,0001)	(0,0001)	(0,0001)
	During-Crisis*$FLOW_{t-1}$	-0,0001***	-0,0017***	-0,0022**
		(0,0001)	(0,0001)	(0,0001)
Number of Obs		176.391	176.391	176.391
Overall R-Square		0,0046	0,0296	0,0097
Post-crisis				
	INTERCEPT	-0,0014***	-0,0017**	-0,00002
		(0,0001)	(0,0002)	(0,0001)
	Post-Crisis	0,00036	-0,0025**	-0,0026**
		(0,0002)	(0,0001)	(0,0001)
	$FLOW_{t-1}$	-0,0030***	-0,0065**	-0,0059**
		(0,0002)	(0,0001)	(0,0001)
	Post-Crisis*$FLOW_{t-1}$	0,0031***	0,0069**	0,0065**
		(0,0002)	(0,0001)	(0,0001)
Number of Obs		235.209	235.209	235.209
Overall R-Square		0,0014	0,0219	0,0092

Note: This table shows interaction regressions for beta-adjusted and marker-adjusted models for during and post crisis periods. In both models, FLOW variable interacts with a dummy variable During-Crisis (Post-Crisis), which takes value 0 for the period of 2004-2007 and takes value 1 for the period of 2008-2009 (which takes value 0 for the period of 2007-2009 and takes value 1 for the period of 2010-2013).
Significance Level: ***Significant at 1%. **Significant at 5%. *Significant at 10%
Standard Error is reported in brackets.

Table 7: LOGTNA table with interaction effects for during- and post-crisis

Interaction Effects		No Fixed Market-Adj	Monthly Fixed Beta-Adj	No Fixed Beta-Adj
During-crisis				
	INTERCEPT	0,0047***	0,0030***	0,0016***
		(0,0003)	(0,0003)	(0,0003)
	During-Crisis	0,0007***	0,0014***	0,0024***
		(0,0004)	(0,0004)	(0,0003)
	$LOGTNA_{t-1}$	-0,00004***	0,00022***	0,0001
		(0,0001)	(0,00004)	(0,00004)
	During-Crisis*$LOGTNA_{t-1}$	-0,0006***	-0,0005***	-0,0007**
		(0,0001)	(0,0001)	(0,0001)
Number of Obs		176.391	176.391	176.391
Overall R-Square		0,0028	0,0266	0,0022
Post-crisis				
	INTERCEPT	0,0054***	0,0038***	0,0055***
		(0,0005)	(0,0004)	(0,0004)
	Post-Crisis	-0,0052***	-0,0088***	-0,0088***
		(0,0006)	(0,0004)	(0,0004)
	$LOGTNA_{t-1}$	-0,0013***	-0,0011***	-0,0011***
		(0,0001)	(0,0001)	(0,0001)
	Post-Crisis*$LOGTNA_{t-1}$	0,0011***	0,0013***	0,0013***
		(0,0001)	(0,0001)	(0,0001)
Number of Obs		235.209	235.209	235.209
Overall R-Square		0,0010	0,0140	0,0015

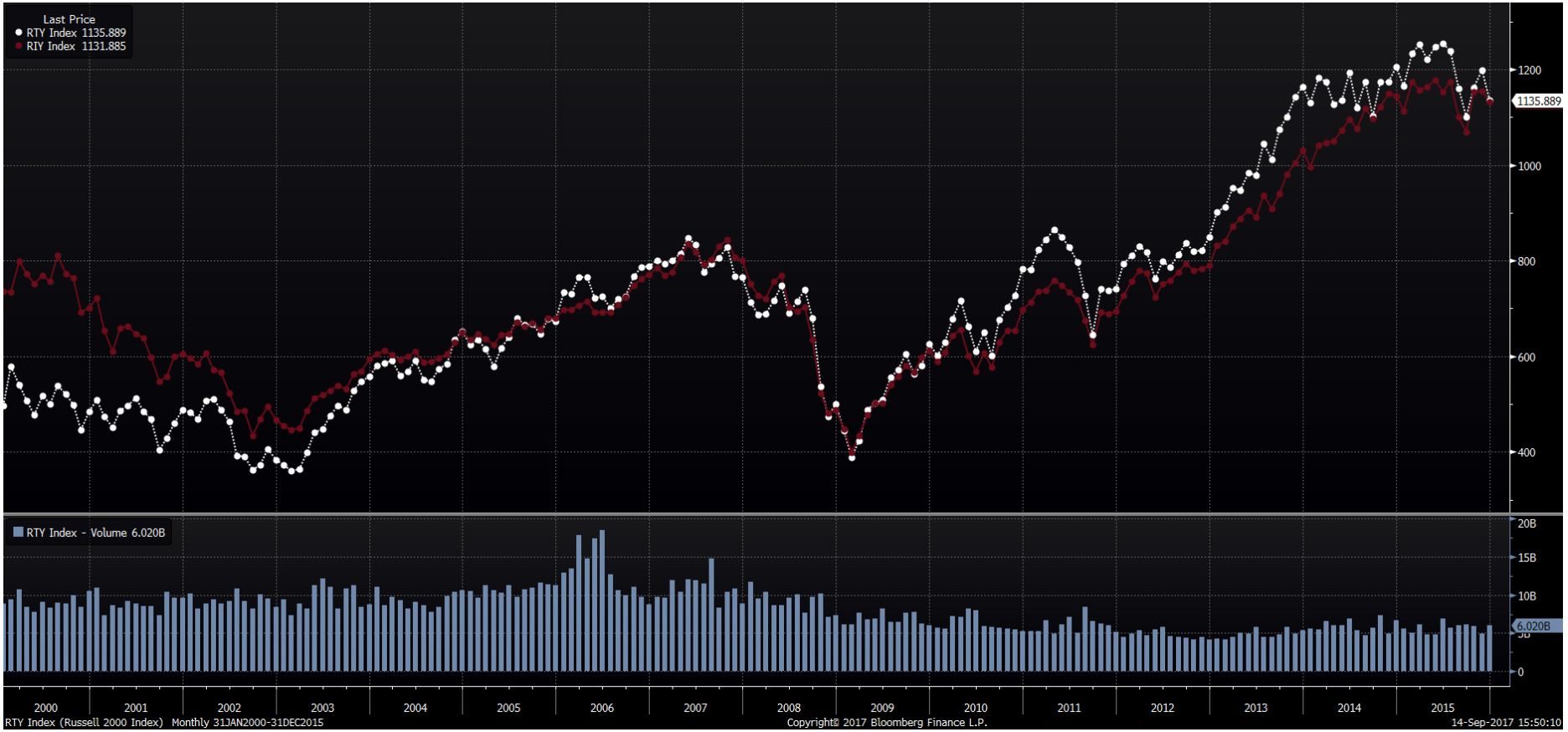
Note: This table shows interaction regressions for beta-adjusted and marker-adjusted models for during and post crisis periods. In both models, LOGTNA variable interacts with a dummy variable During-Crisis (Post-Crisis), which takes value 0 for the period of 2004-2007 and takes value 1 for the period of 2008-2009 (which takes value 0 for the period of 2007-2009 and takes value 1 for the period of 2010-2013).
Significance Level: ***Significant at 1%. **Significant at 5%. *Significant at 10%
Standard Error is reported in brackets.

Table 8B: Loading calculated using 4-Factor model

Decile	1	2	3	4	5	6	7	8	9	10
Pre-crisis										
ALPHA	0,006%	0,069%	0,085%	0,100%	0,092%	0,120%	0,139%	0,164%	0,184%	0,188%
MKTRF	1,011	1,012	0,996	1,022	1,030	1,012	1,020	1,025	1,017	0,996
SMB	0,218	0,185	0,220	0,217	0,189	0,217	0,191	0,151	0,135	0,073
HML	0,049	0,069	0,075	0,054	0,099	0,082	0,084	0,054	0,030	-0,018
MOM12	0,102	0,120	0,141	0,139	0,156	0,142	0,155	0,165	0,152	0,134
During-crisis										
ALPHA	-0,166%	-0,156%	-0,100%	-0,103%	-0,092%	-0,031%	0,050%	0,025%	0,140%	0,050%
MKTRF	1,067	1,082	1,079	1,071	1,071	1,107	1,110	1,082	1,090	1,116
SMB	0,199	0,191	0,183	0,155	0,155	0,150	0,075	0,075	0,026	-0,017
HML	-0,136	-0,135	-0,136	-0,138	-0,156	-0,135	-0,189	-0,160	-0,159	-0,167
MOM12	-0,035	-0,035	-0,038	-0,035	-0,050	-0,036	-0,041	-0,047	-0,027	-0,021
Post-Crisis										
ALPHA	-0,453%	-0,292%	-0,326%	-0,326%	-0,285%	-0,298%	-0,276%	-0,279%	-0,251%	-0,210%
MKTRF	1,029	1,037	1,035	1,040	1,042	1,040	1,032	1,042	1,038	1,026
SMB	0,167	0,161	0,147	0,151	0,110	0,112	0,104	0,103	0,084	0,039
HML	-0,095	-0,098	-0,100	-0,096	-0,105	-0,104	-0,100	-0,121	-0,096	-0,115
MOM12	-0,091	-0,075	-0,081	-0,080	-0,080	-0,081	-0,063	-0,077	-0,074	-0,053

Note: This table reports loading calculated using Fama-French 3-Factor model per decile for different time periods

Table 9: Russell 1000 Index and Russell 2000 Index



Note: This is the graphs between Russell 1000 index (Large U.S. capitalization index) in red and Russell 2000 index (Small U.S. capitalization index) in white.