STOCKHOLM SCHOOL OF ECONOMICS

Master Thesis in Finance

# Does Size Affect Performance?

## *- A Study of Size-Driven Effects on Performance in Swedish Equity Mutual Funds -*

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**Abstract**

This thesis analyzes the effect of mutual fund size on performance by studying 59 Swedish equity mutual funds over the period July 1998 to June 2008. We argue that size can be seen as a "proxy" for capturing the effects of various factors affecting performance and driven by size. The size-driven factors tested in this thesis include liquidity costs, economies of scale in mutual fund families, extreme net flows and persistence in performance. Using regressions and analyzing these factors by dividing funds into groups based on fund size, we find that there is no significant relation between size and performance between groups over the ten year period, even though small funds appear to earn higher excess returns. Our results indicate that liquidity costs are present in the Swedish equity market and significantly increase with fund size. Our results also show that there are diseconomies to scale from being part of the largest fund complexes in the Swedish market. For the half of smallest funds in the sample belonging to these complexes, we find that they significantly underperform their peers. Bureaucracy and star-phenomenon among complexes are possible explanations for these diseconomies. Our findings for extreme net flows contradict the presented theory. Extreme net flows prove to have a significant positive impact on funds' performance. Our sample of funds also displays significant persistence in underperformance among all funds over the ten year period. Persistence however does little to explain the observed results between size and performance. Over all our results indicate that investors should focus on diversifying amongst small funds not belonging to the largest fund complexes. Fund managers should understand the changing effect of size-driven factors on performance, and develop strategies for how to handle these.

Keywords: Fund Size, Liquidity Costs, Economies of Scale, Extreme Net Fund Flows, Persistence

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# 1. Introduction and Purpose

This thesis aims at examining the relationship between mutual fund size and performance in the Swedish mutual funds market. The impact of size on returns has long been the subject of interest in academic circles, however scholars have to date not managed to reach any consensus as to what the relationship looks like. We add to previous research by studying the dependence of size on performance for a set of Swedish equity mutual funds, over the period July 1998 to June 2008. Our analysis focuses on factors affecting performance that are driven by the size of mutual funds and to what extent they can help explain the impact of size on performance. The factors we examine are liquidity costs, economies of scale, extreme net flows and persistence.

## 1.1 A Model for Optimizing Returns?

Research related to mutual fund size have attributed the mixed evidence found for the impact of size on performance to i.e. liquidity costs, economies of scale and extreme net flows. All these, are important factors that impact fund performance and are affected by fund size. Knowing how they affect the returns of funds, for various fund sizes, is imperative for both investors and fund managers to be aware of.

In this thesis we argue that the relationship between size and performance is complex and difficult to intuitively predict. As size can be viewed as a "proxy" for capturing the often opposing effects of various factors that are drive by size (the ones mentioned amongst others), we are not surprised that evidence stemming from research into the size-performance relationship cannot reach consensus regarding how size relates to performance. As much as size-driven factors such as liquidity costs, economies of scale and extreme net flows are driven by the size of a fund, they are also likely to be interrelated and vary with the characteristics of different markets and over time.

There are numerous factors that are driven by the size of a fund, that have an impact on the fund's performance. Ideally, if all these factors could be captured in a model designed to optimize returns, given the various impact of these factors, an optimal fund size could also be derived that would allow fund managers to maximize their performance.

Despite the conceptually appealing idea of such a tool, capturing all influencing factors in an optimization model is well beyond the scope of this thesis and availability of data. Instead we try to give a flavour for how some factors that could be included in such a model; liquidity costs, economies of scale, extreme net flows and persistence, vary with levels of fund size and ultimately how they impact on fund performance.

## 1.2 Contribution

The thesis aims at making the following contributions. Firstly, and to the best of our knowledge, the thesis is the first of its kind to address the impact of liquidity costs, economies of scale, extreme net fund flows and persistence in performance in relation to fund size, in the Swedish mutual fund market. It will therefore contribute with its results to the international debate regarding the impact of size on performance. Secondly, from a more practical point of view, we hope the study will offer new insights to both investors and fund managers. Investors have an obvious interest in assessing their portfolios. There are however few tools today, ready at hand, to evaluate different mutual funds. Even though numerous factors as manager characteristics, fund style, fund fees and industry policy conditions will impact fund performance, knowing how a key operating characteristics as fund size, and the factors it drive, relate to performance, can hopefully offer some guidance in the pursuit for higher returns. For investment managers, knowing what challenges and opportunities loom depending on the size of her fund help add valuable strategic insight to what course of action to pursue in fund management.

## 1.3 Background

Over the past decade mutual funds have been some of the fastest growing institutions in the world. For the Swedish economy alone, the industry plays an increasingly important role. At the outset of 1998, Swedish mutual funds managed assets of SEK 460 billion. By the end of 2007 this number had grown to SEK 1.2 trillion. As a fraction of household's total savings, mutual funds have over time gained tremendous popularity and today represent nearly 30% of people's financial savings. This is a remarkable increase since 1980, when they were estimated to represent a mere 0.4% of household's total financial savings (Fondbolagens Förening).

Indeed, almost three in four adults in Sweden invest in mutual funds. If savings in the premium pension system (PPM) are included, this number increases to 98%. The explosion of magazines, newsletters and rating services such as Morningstar testify to the fact that investors spend significant resources and time in trying to identify mutual fund success.

In this paper we tackle issues that are fundamental to understanding the role of these mutual funds in the economy. Namely how asset growth has affected fund performance, to what extent economies of scale have been achieved in fund management, and how at larger fund size puts liquidity constraints on mutual funds. That is, how does performance depend on the size of the mutual fund? Many investors have a gut feeling that small funds ought to outperform larger mutual funds. Their flexibility to quickly move in and out of the market, and from stock to stock, without disrupting market prices is believed to be of big advantage resulting in higher performance. Large funds, on the other hand, have more resources available to attract the services of the highest paid (best?) managers. They can use

their importance to negotiate lower commission charges and take advantage of scale economies in mutual fund administration. Since the days of Perold and Salomon (1991) researchers have thus asked the question of "what the right amount of assets under management is" to generate superior returns.

## 1.4 Outline

The thesis proceeds as follows. Section 2 outlines a summary of empirical findings in previous research on the size-performance relationship along with a presentation of relevant economic models. In section 3 we develop our hypotheses and discuss the motives behind them. In section 4 we present the data set used to perform the study. In section 5 we develop the general methodology and regression specifications. In Section 6 empirical findings and analyses of our hypotheses are presented. In section 7 our findings are summarized along with concluding remarks. In section 8 we present suggestions for further research.

# 2. Theoretical and Empirical Background

In the following section we present relevant results from previous studies on the impact of size on performance. We also provide relevant economic theories as to what may drive the findings. The section is structured as follows: In section 2.1 we review previous findings on the size-performance relationship. In section 2.2 we review previous research and discussions relating to the impact of liquidity costs. In section 2.3 we present empirical findings on economies of scale in mutual funds. In section 2.4 we review findings and theory relating to extreme net fund flows. In section 2.5 we present findings on performance persistence in mutual fund returns.

## 2.1 Fund Size and Performance

Two of the earliest US studies investigating the impact of fund size on performance are carried out by Grinblatt and Titman (1989) and Gorman (1991). Both studies find relations between size and both average performance and systematic risk of mutual funds, although their explanation of the results differ. Grinblatt and Titman (1989) examine the size-return relationship on quarterly holdings for a sample of 274 funds divided into five size categories for the period 1975-1984. The study also investigates the relationship of expense ratio, turnover ratio and management fees to fund size. Their results show that, gross of expenses, the smallest funds achieve significantly better risk-adjusted performance (2.5%) over the ten years than larger funds. For net returns, however, no relationship was present. They believed the concentration of aggressive growth funds among the small fund category may have helped explain the inverse relationship between size and gross returns. Controlling for this factor, small funds however still generated higher returns than larger funds. Consequently the authors concluded that both fund size and investment objective are determinants of abnormal performance.

Gorman (1991) divided a data sample of 335 mutual funds into quartiles for the period 1974-1985 and also found that smaller funds achieve higher returns. She tested if higher performance came from running portfolios with higher systematic risk profiles by modelling a fund manager's excess return using the capital asset pricing model, with a size variable added. The results showed that higher risk did not completely explain the superior performance. Even after allowing for time related variations in the funds' beta, the size effect remained. Two main explanations were suggested for the negative size effect. First lower returns for large funds could reflect a liquidity effect. This notion finds strong support in other research (see i.e. Loeb (1983), Indro *et al.* (1999) and Chen *et al.* (2004)). Investing large blocks of capital requires high capitalization stocks to avoid price reaction which increase the individual funds investment cost. Large capitalization stocks are less costly in terms of liquidity impact but may also provide less return per invested dollar in comparison to smaller businesses, which can generate higher returns but significantly increase portfolio risk. Smaller funds were thus believed likely to run portfolios of higher return/higher risk, than large funds. Secondly, the size variable may

be reflecting fund purpose, where size becomes a function of i.e. managerial policies or incentive structures. It was argued that compensation schemes of large and small funds place different weights on investment performance. Additional studies that support the notion of a negative relationship between fund size and returns are Ciccotello and Grant (1996), Arshanapalli *et al.* (1998), Chevalier and Ellison (1999), Beckers and Vaughan (2001), Christopherson *et al.* (2002) and Chan e*t al.* (2005). Studying the Swedish market between 1993 and 1997 Dahlquist *et al.* (2000) find a significant negative relation for funds allowing tax exemption, however no significant relation is found for regular equity funds.

McCrae (1996) extends the study of Grinblatt and Titman (1989) and Gorman (1991) to investigate the effect of portfolio fund size on quarterly excess returns, risk-adjusted returns and systematic risk among Australian superannuation fund managers[1] for the years 1977-1993. No significant relation is found between fund size and either excess returns or risk-adjusted returns. This result is in line with a previous study of Australian superannuation fund managers by Bird *et al.* (1983). McCrae (1996) suggests the absence of a negative relationship, as found in many international studies, may be attributable to the different structure and source of money inflows in the Australian superannuation industry. Investors who predominantly focus on short-term performance drive fund companies to ferociously compete for investors' money. To maintain market share managers have a strong incentive to avoid bad short term performance relative other funds. Given the well documented difficulties of managers to outperform the market index it is believed Australian superannuation managers take the safe route running passive index tracking portfolios. Superior long term performance, however, implies accepting the volatility of short term returns. McCrae also point out that managers with superior performance are likely to increase their size ranking over the periods as they attract more capital relative to managers with lower performance. Relatively large net fund inflows may however lead to managers making suboptimal investment decisions. This issue will be further discussed in section 2.4. For studies of US data finding no significant relation between size and performance see i.e. Gallagher (1988), Grinblatt and Titman (1994) and Droms and Walker (1994). Droms and Walker (1996) also perform a study of international funds findings no significant relation. In the most recent study of the Swedish equity fund market, Bergström and Sundén (2008) find no significant relationship between fund size and performance.

Some studies report positive results for the size-performance relationship. Otten and Bams (2002) survey monthly returns for the European mutual fund industry over the years 1991-1998. Following 506 domestic equity funds from France, Germany, Italy, Netherlands and U.K. they report significant positive relationships between performance and fund size in all countries. They attribute the

[1] Australian pension scheme

significant size-performance finding to indication of economies of scale in European mutual funds. Additional studies reporting positive result between fund size and performance are Chen *et al.* (1992) and Khorana and Servaes (1999).

## 2.2 Liquidity Costs

It is believed that the main advantage of small funds over large funds, in terms of fund size, is the increased ability of small funds to move quickly in and out of positions, without impacting market prices or drawing attention (see i.e. Loeb (1983), Ciccotello and Grant (1996), Indro *et al.* (1999), Christopherson *et al*. (2002), Chen *et al.* (2004), Chan *et al.* (2005) and Edelen *et al*. (2007)). Under the liquidity hypothesis it is argued that performance erosion due to fund size is primarily caused by two factors:

i) Incurred market impact costs: Being large may present difficulties in transacting, which may lead to higher incurred market impact costs

ii) Costs of avoiding market impact costs: Being large may present difficulties in transacting, leading to cost of avoiding market impact costs

Starting with the first argument, market impact costs are defined as costs arising from movement in the bid/ask spread and/or the opportunity costs of delayed trading. Beckers and Vaughan (2001) and Chan *et al.* (2005) show that large managers transact larger trades relative to volume than small managers. Whereas small blocks can be transacted fairly anonymously, large block trades will typically be negotiated with intermediaries. Larger managers incur increased transaction costs, because the purchase/sale of large blocks of stock exacerbates the liquidity and informational asymmetry problem for market makers, increasing the bid-ask spread. Loeb (1983) show that the bid-ask spread rise dramatically with block size. An average change in traded block size from $1million to $2.5million increases the bid-ask spread by 160 basis points (bps) for medium-cap stocks and 70 bps for large-cap stocks. The size effect thus implies that managers must either be willing to accept greater price concessions or to transact over a longer period, the more illiquid a stock generally is. The downside to the first is the higher cost of transacting and to the second that active managers may be unable to successfully exploit information in a timely manner (this is consistent with Beckers and Vaughan's (2001) results who quantify the decline in returns attributable to the slowdown in trade execution time, caused by a larger fund size). Furthermore, the size of a large fund also makes it an obvious target for attention. Outsiders carefully examine the manager's stock selection for clues and insights to the manager's information and market-timing ability. As a consequence, the manager's ability to trade without signalling her intentions is greatly curtailed (see i.e. Ciccotello and Grant (1996) and Indro *et al.* (1999)).

Continuing with the second argument: Chan *et al*. (2005) test if large managers incur greater market impact costs than small managers. They find large managers incur larger explicit transaction costs (i.e.

brokerage fees), but do unlike Loeb (1983) not find any significant evidence of market impact costs. Upon further examination, they find this result arises because large managers configure their portfolios in such a manner as to mitigate against the adverse effect of market impact costs. This is achieved by larger managers investing in larger capitalization stock, as well as increasing the total number of unique stocks in their portfolio[2] in order to reduce their relative weight in each stock. This strategy preserves liquidity at the individual stock level, which keeps market impact costs from escalating excessively. The downside to this strategy is however that performance may suffer as it limits large funds' investment capabilities in the smallest stocks; a segment that is usually the least efficiently priced. It can also dilute funds' stock selection insights as funds become compelled to invest in more stocks (Indro *et al*., 1999).

Chen *et al.* (2004) argue that while large funds can grow out of their investment style, smaller funds are able to maintain superior performance, as they can put all their money into their best ideas. Growing funds are on the other hand forced to target larger market capitalization businesses relative to the business size that lead to previous success. Additionally, dilution in stock selection likely occurs; because, as the number of fund holdings grow, it becomes increasingly difficult for managers to identify stocks with the same level of expected return as previous investments. Pollet and Wilson (2007) show that funds grow primarily with increased ownership in the companies they already own; further suggesting managers are reluctant to generate additional investment ideas. As funds grow large, more and larger capitalization stocks are added to the portfolio, thus beating the market index becomes increasingly difficult as the fund itself may grow to become a market proxy. This reduction in flexibility suggests that funds can grow too big and there should be a negative relation between fund size and performance.

Under the liquidity theory, performance erosion due to fund size will be most severe for funds targeting small-cap stock, as this segment tends to be notoriously illiquid. This is confirmed by Chen *et al*. (2004) who investigating a sample of US equity funds between 1962 and 1999. To avoid escalating market impact costs, growth in fund size will much sooner lead to an increased number of holdings and an upward drift in terms of market capitalization, than for large or mid-cap funds. Christopherson *et al*. (2002) confirm the results of significant performance erosion due to fund size for US small-cap stocks.

[2] Chen *et al.* (2004) calculate statistics on mutual fund holdings for a set of diversified US equity funds and show that the median fund in the smallest quintile holds about 16 stocks, while the median fund in the largest size quintile holds about 66 stocks

## 2.3 Economies of Scale in Mutual Funds

As mutual fund size grows there is the potential of capitalizing on lower unit costs. It might be more difficult to manage a large portfolio than a small one, but it does not seem likely it costs twice as much to manage a $100 million fund than a $50 million portfolio. Latzko (1999) point out that since many fund expenses are fixed costs, fund growth should reduce the ratio of fund expenses to average net assets (expense ratio). Economies of scale could be achieved i.e. in the areas of computer and software, personnel costs, record keeping, auditing and legal fees, provision of statements and reports, and marketing. As mutual funds typically charge customers a fixed percentage of net assets under management, to cover the fund's expenses, growth in fund size should also bring more resources for research, increased ability to attract top investment talent, better access to companies, and greater bargaining power with brokers.

Latzko (1999) model a translog cost function, measuring the elasticity of the expense ratio, and find that fund expenses increase less than proportionally as fund size grows. That is, it indicates the existence of economies of scale. While he finds that average costs decrease at a diminishing rate over the full range of fund assets, the decrease is exhausted by about $3.5 billion in fund assets, implying there may also be an upper fund size limit to achieving further economies of scale. Indro *et al*. (1999) propose that growth in fund size initially brings economies of scale up to the point when the fund outgrows its existing structure. Then it has to incur costs to accommodate all new money. Ferris and Chance (1987), Baumol *et al*. (1990), McLeod and Malhotra (1994), Zera and Madura (2001) and Walsh (2004) analyze the expense ratios of open-end mutual funds and come to the same conclusion as Latzko (1999), that larger funds have lower expense ratios. The findings are upheld for closed-end mutual funds by Malhotra and McLeod (2000) and Malhotra *et al*. (2001). In another study by Malhotra *et al*. (2001) they examine the presence of economies of scale in Australian superannuation funds between 1999 and 2000. Evidence of scale economies are however only found for funds with a fund size greater than A$30 million.

Arguing against the theory of scale economies, Chen *et al*. (2004) suggest that being big can apart from the disfavouring role of liquidity also include organizational diseconomies. Whereas a small fund can be run by a single manager generating a few stock ideas, the manager of a large fund need co-managers as he does not have the capacity to invest all the money himself. For large funds, stock picks need to be coordinated among many more agents, and as such organizational diseconomies may arise. One set of organizational diseconomies relate to the adverse effect of hierarchies. If the head manager of the fund undercuts the decisions of other managers at the bottom of the hierarchy, the co-managers may not put as much effort into their research. As a result, their attempts to uncover information or new investment ideas will be diminished relative to the situation where they manage their own funds.

The consequence is suffering fund performance. Chen *et al*. (2004) and Pollet and Wilson (2007), however, also point out that if a large fund is organized as a fund family with different managers running small pots of the fund's money, scale need not be bad per say. Chen *et al*. (2004) show this by studying the effect of family size that funds belong to, on their performance. Even though their findings report a negative relation between fund size and return, performance for funds increases with the size of other funds in their family. This adds support to the notion that being part of a mutual fund complex adds some additional extent of economies of scale. I.e. funds in the same family tend to share expenses such as computer, telephone, shareholder accounting systems, marketing and research. Therefore funds that are part of a mutual fund complex should obtain greater economies of scale, than can be explained solely by fund size. Dermine and Röller (1992) study economies of scale in French mutual fund complexes and report significant scale economies for small and mid-sized fund families, while there is no effect of scale economies for the largest fund families.

## 2.4 Extreme Net Fund Flows

Research on the impact of net flows on performance reports mixed results. Gruber (1996) and Zheng (1999) document the effect of "smart money". That is, investors are smart ex ante and move their capital to funds that will perform well in the near future. Both Gruber and Zheng find that newly invested money earn higher returns than the average existing fund. Zheng attribute most of the "smart money" effect to momentum in the underlying stocks. While the "smart money" effect predicts that positive flows earn higher returns, it does not explain what the direct impact of net flows is on performance.

Arguing that fund size erodes performance Chan *et al*. (2005) connect fund inflows with the liquidity hypothesis. Along with Indro *et al*. (1999) they argue that if managers grow through new fund inflows, relatively large cash injections will pressure the manager to invest new money into securities currently not held in their portfolios. If these investment decisions are executed rapidly, such exogenous pressure on the fund manager may lead to transactions being sub-optimal. Chan *et al*. (2005) show that fund inflows represent a disturbance to the investment process, inducing changes in the portfolio design. The proportional change in the number of different securities held in the portfolio is positively related to fund inflows. As the liquidity hypothesis states managers avoid market impact costs by purchasing new stocks rather than existing holdings. The authors argue that without the influence of large net flows, one might expect that the addition of new securities in the portfolio represent a "high" information decision. However, if managers receive large injections of cash, then this buying pressure may cause them to purchase stocks they might not otherwise purchase, resulting in a "low" information decision. They confirm this by showing that the stocks purchased during fund inflows underperform stocks purchased during fund outflows. This suggests that the asset allocation decision to purchase new stocks during inflows is sub-optimal and reduce portfolio performance.

## 2.5 Performance Persistence

In addition to size-driven factors we examine for persistence in mutual fund returns, to see to what extent the skill of individual managers can contribute in explaining the relationship between size and performance. Persistence in fund returns relates to the observation that performance of a particular fund tends to repeat itself in consecutive time periods. When funds over-perform in successive periods, persistence is positive. In opposite, funds which continuously under-perform show negative persistence. Persistence is commonly attributed to superior stock-picking skill and has been well documented in the literature on mutual funds, however, to the best of our knowledge it has not been included in the size-performance debate to examine to what extent individual managers' talent drive the results found for the size-performance relationship.

The efficient market hypothesis states that no fund manager can consistently outperform an average of manager after adjusting her performance for risk. Evidence from the mutual funds industry however tells a different story. The first to study persistence was Sharpe (1996). Using a non-parametric test on the Treynor-indexes for a set of equity funds between 1954 and 1963 he found significant persistence in one-year returns. Some more recent studies finding positive persistence for one to three year periods include Grinblatt and Titman (1992), Hendricks *et al*. (1993), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995), Elton *et al*. (1996), Gruber (1996) and Otten and Bams (2002).

Carhart (1997) study a sample of US equity funds, free from survivorship bias, from 1962 to 1993, using a Fama-French three and four factor model. His analysis shows that a major part of the positive persistence presented in previous studies, can be explained by funds following a momentum strategy in stocks. The only persistence left unexplained was for the worst performing funds, displaying negative persistence. Detzel and Weigand (1998) follow up on the study by Carhart (1997) and manage to explain the negative persistence by using a model including factors that directly relate to the characteristics of the individual stocks held by mutual funds, such as market capitalization, book-to-market ratio and cash flow-to-market ratio.

There are however several studies that either indicate no persistence, or find mixed results. These include Malkiel (1995), Dahlquist *et al*. (2000) and Berk and Green (2004). It is proposed that persistence is likely to be affected by the period in which data is tested, thus results for persistence should be interpreted with caution.

# 3. Hypothesis Development

This thesis explores the impact of fund size on performance for Swedish equity mutual funds. We do so by examining how performance responds to size for different intervals of fund sizes (i.e. if there is a difference in performance between size intervals). In particular, we examine how relevant size-driven factors as liquidity costs, scale economies, extreme net flows and persistence in performance contribute to explaining the relationship between size and performance. Based on previous research on mutual funds and theories presented we formalize these assertions and form our hypothesis.

## 3.1 Hypothesis 1: The Impact of Fund Size on Performance

The empirical evidence presented find mixed results for the direction of the relationship between size and performance (see section 2.1). The main arguments presented to drive the associations found include liquidity costs, scale economies and relative large net flows.

In their cross-sectional study of mutual funds in the Swedish market, Dahlquist *et al*. (2000) find a slight negative, significant, relationship between size and returns for tax-benefited equity funds in their sample while insignificant results for regular equity funds. Bergström and Sundéen (2008) update this study using similar methods as Dahlquist *et al*. (2000). For parts of the sample they find a significant positive relation regressing fund size on performance, however for the full sample the results turn out to be insignificant. These findings lead us to believe that no significant relationship between a fund's size and performance is to expect for the Swedish funds market.

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**Hypothesis 1***: There is no significant relationship between fund size and performance for Swedish equity mutual funds*

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## 3.2 Hypothesis 2: Liquidity Costs

Hypothesis 2 proceeds in an effort to investigate to what extent there are liquidity costs in Swedish equity mutual funds. International evidence is unanimous regarding the notion that the performance of a larger fund is disfavoured by market impact costs and costs of avoiding market impact costs (see i.e. Loeb (1983), Ciccotello and Grant (1996), Indro *et al.* (1999), Chen *et al.* (2004) and Chan *et al.* (2005). In the event of an information release, a desired change in portfolio weight requires a much larger dollar value transaction for larger managers, than an equivalent change in weight for small managers. This gives rise to larger market impact costs for large funds. To avoid these costs large funds incur greater costs of avoiding market impact costs, by being forced to target higher market capitalization stocks. We thus expect to find a positive relationship between liquidity costs and a mutual fund's size.

**Hypothesis 2***: There is a positive relationship between mutual fund size and costs of liquidity*

## 3.3 Hypothesis 3: Economies of Scale in Mutual Fund Families

Most researchers that examine scale economies by studying the expense ratios of mutual funds, find that average expenses increase less than proportionally with fund size, indicating that there are decreasing unit costs in mutual fund administration (see i.e. Ferris and Chance (1987), Baumol *et al*. (1990), Latzko (1999), and Walsh (2004). Unfortunately our data set does not include expense ratios for mutual funds, why this test will not be performed for the data sample.

Hypothesis 3, investigate to what extent being part of a larger mutual fund complex, yield economies of scale as proposed by Chen *et al*. (2004). Being part of a larger fund family opens the opportunity of spreading overhead costs such as computer, telephone, shareholder accounting systems, marketing and research over an even larger asset base, that include all mutual funds belonging to a family. It is thus to be expected that funds that are part of a larger mutual fund complex achieve higher performance, primarily induced by a lower expense ratio, than their individually managed peers and peers belonging to other fund families.

**Hypothesis 3***: Swedish mutual funds belonging to large fund complexes perform better than individually managed peers and peers belonging to smaller fund complexes*

## 3.4 Hypothesis 4: Extreme Net Fund Flows

Our fourth hypothesis concerns how relatively large net fund flows relate to a fund's size. We investigate to what extent extreme net fund flows could provide an explanation for the relationship between fund size and performance. Referring to the arguments of Indro *et al*. (1999) and Chan *et al*. (2005) who investigate the impact of money inflows on performance; if managers are presented with relative large injections of cash, it may pressure them to invest in securities currently not held in their portfolios. If the investment decisions are executed rapidly it may lead to sub-optimal investment decisions. We would under these circumstances expect to find that mutual funds receiving relatively large inflows of capital should display inferior performance, compared to mutual funds receiving little or no inflows at all.

**Hypothesis 4***: Performance responds negatively to extreme net flows*

## 3.5 Hypothesis 5: Performance Persistence

Investigating performance persistence lets us see if there is indication of managerial talent driving the size-performance relationship. If persistence is displayed for parts of the sample while not for others, managerial talent will be part of driving the observed relationship between size and performance.

Section 2.5 show that several international studies have found the presence of persistence. For the Swedish market Bergström and Sundén (2008), studying a set of equity mutual funds between 2003 and 2007, also report evidence of persistence. Based on this recent evidence, we would expect to find persistence in our sample as we cover a similar data set partly overlapping in time. We do however not expect there to be a difference in persistence across size intervals as this is not suggested by economic theory nor found in the previous presented research.

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**Hypothesis 5***: Persistence in excess returns does not differ across size intervals*

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# 4. Data

In this section we describe the data that has been used in the thesis. The section will proceed as follows: In section 4.1 a description is given of the data used and how it has been sourced. Section 4.2 deals with the issues of survivorship bias. In section 4.3 we present the selection criteria set out for the funds included in the study. Section 4.4 present adjustments made to the data set. Finally, in section 4.5, selected summary statistics are presented along with a more detailed description of how the sample is structured

## 4.1 Data Description

To make our hypothesis testable we have gathered a unique set of panel data, comprising equity mutual funds investing in the Swedish market during a ten year period, from July 1998 to June 2008. The data has been collected from *Moneymate Investment Data Management*[3]. The information includes fund classifications, quarterly updated total net asset value (TNA) and monthly returns. The fund classification helped us locate funds that at some point in time or over the entire sample period have had a main investment objective in Swedish equities. Initially this provided us with a list of 165 mutual funds.

The total net asset value is the total SEK market value of the securities in a mutual fund's portfolio, less any liabilities, and is commonly referred to as the fund's size. It was obtained as quarterly data. *Moneymate* provided us with monthly returns for all mutual funds in the sample. The returns had been adjusted for dividend-payouts to make sure fund-specific policies on how to distribute funds' wealth do not compromise the comparability of results. Further, monthly returns were adjusted for management and performance fees to make sure that it is the actual net returns to the individual investor that are being compared. Adjustments for any initial or exit charges are however not possible to take into account, as their impact directly depend upon the individual investor's investment strategy, that is at what point in time a fund is entered or exited.

From the *SIX Trust* database an appropriate benchmark index has been collected to accommodate the data. The benchmark index should reflect the performance of the general Swedish equity market. The SIX Portfolio Return index (SIXPRX) has therefore been chosen. It is a market weighted accumulation index, meaning it is weighted by market capitalization and accounts for reinvestment of dividends.

[3] Moneymate Investment Data Management is a specialist provider of investment data management solutions for the asset management industry. Services include collecting, validating and publishing of data for the Swedish mutual fund industry

## 4.2 Survivorship Bias

An important concern is if the data sample suffers from survivorship bias. That is, if funds that have ceased to exist are excluded and the data only hold survivors, performance of the sample may be biased upwards overestimating past returns of mutual funds, as non-survivors have been found more likely to perform disappointingly in relation to surviving peers (Brown, 1992). We find no reason to believe our data set suffers from survivorship bias as the information for funds that have ceased to exist at some point during the ten year period was successfully obtained.

## 4.3 Definition of Swedish Equity Mutual Funds

This study has chosen to focus on funds investing in the general Swedish equity market. Small-cap equity funds have intentionally been left out as it has been shown that the effects of liquidity have a more pronounced impact on these funds than for funds investing over a broad line of equities (see Christopherson *et al*. (2002) and Chen *et al*. (2004)).

To increase the validity of our results, a careful approach has been taken to make sure the level of homogeneity between funds is as high as possible, and that results will not be due to differences in investment style. Only funds fulfilling the following criteria are included in the data sample used to carry out the analysis. All funds, even those that have existed only during a limited time period over the ten years, carry performance data for at least 12 months. We believe this further reduces potential disruptive effects, such as start-up failures. Hereafter when the term "Swedish equity mutual funds" is used, funds complying with the following criteria are referred to

1. Fund is classified as a security fund in accordance with the Swedish law on investment vehicles ("Lag Om Investeringsfonder", 2004:46)[4]
2. At least 75% of TNA is invested in equities and at least 75% of equity assets are invested in Swedish equities[5]
3. Fund must not have an investment objective of targeting small-cap stock, for the reasons brought forward. It can also be assumed small-cap funds follow a different risk profile. Fund must also not have the phrase "small-cap" added to its name, as it is assumed investment flows to small-cap funds will be looking for the particular risk-profile of such a fund
4. The fund's investment objective must not entail to, on a recurring basis, donate a percentage of TNA to charity or non-for-profit associations, as this will render net returns incomparable

[4] Include compliance with the diversification rules according to the UCITS 5/10/40 directive: any single fund is restricted from investing more than 10% of assets under management (AUM) in a single security. Investments over 5% of AUM are at maximum allowed to constitute 40% of AUM. These rules ensures a minimum level of diversification for the individual investor as mutual funds will be required to at minimum hold 16 securities
[5] Morningstar.se's classification of Swedish equity funds

5. Fund must not require a minimum deposit level exceeding SEK 100,000, as it is assumed a representative investor do not have the capabilities of investing in such a fund
6. Fund must not have a main investment objective focusing on a particular sector of the economy, as we wish for volatilities in fund returns to be as comparable as possible
7. Fund must also not have a main investment objective of investing in other mutual funds

No difference has been made between Socially Responsible Investment funds (SRI)[6] and their conventional peers as we assume the majority of Swedish listed companies actively take ethical issues into consideration. Moreover Bauer *et al*. (2002) and Bauer *et al*. (2006) find no performance-related differences between SRI funds and conventional peers.

The study has chosen not to make a distinction between open-end mutual funds and funds closed to new investors, alternatively restricting all new investment. This decision has been made due to the need of studying a sufficiently large sample to make valid interpretations of the data. We do not believe including these funds would distort results on the impacts of liquidity costs or scale economies, as these factors are primarily size driven and should not depend on the fund's ability to attract flows. It is possible including closed-end funds may have some impact for findings on persistence. As Chan *et al*. (2005) point out: if fund inflows represent a disturbance to the investment process, it can be argued that funds not experiencing such as disturbance can be expected to yield higher returns than peers not experiencing the same disturbance. We therefore do not dismiss that the results on persistence could be affected. We recognize that results for extreme net flows in relation to size are likely to be biased for closed-end funds, since hypothesis 4 indicates that funds receiving relatively little net flows should experience higher returns than funds with relatively large net flows. Our data show that the greater majority of closed-end funds are located in the smallest, quartile of the sample with regards to fund size.

## 4.4 Adjustments made to the Data

Performing a visual inspection of the data reveals that for one fund a few data-points for monthly returns are missing. Compromising between completely dropping the fund, further reducing an already limited data set, or keeping the fund, we chose the latter as we do not find any greater reasons to believe that leaving out some data-points will likely bias the results. For two funds TNA for all points in time are unavailable. These funds have for obvious reasons been removed from the sample.

[6]Areas of concern for SRI funds are generally: corporate governance and ethics, workplace practices, environmental concerns, product safety and impact, human rights, community relations and indigenous people's rights

Some funds are listed in foreign currencies. To make sure TNA are comparable over funds, we have extracted monthly exchange rates for the currencies of these funds and converted them into SEK. All exchange rates were extracted from the *SIX Trust* database.

Our data sample reveal some severe outliers regarding net flows, which might distort the results. These outliers are generally found for the two early quarters for start-up funds, and are removed as they are not representative for the full sample of net flows. We thereby inexplicitly make the assumption that net flows as a part of the ordinary business occur from the sixth month of late entrants' business and onwards. Similarly outliers for net flows are frequently found in the last quarter for funds dying away or merging into other funds. These are removed as well.

## 4.5 Descriptive statistics

After adjusting the data in the previous section, we utilize 59 distinct funds in our analysis and obtain a total of 5778 monthly return observations, see Table B1 in the Appendix for an overview of the data. While the SIX PRX during this period returned 64.3%, the average fund yielded 47.3%. This shows to the difficulty of funds to outperform their benchmarks, adjusted for fund fees. On average our sample includes about 48 funds each month, with an average net asset value of SEK 1.2 billion (see Table B2 in the Appendix). Net inflows for the ten year period amount to SEK 20.8 billion. We notice that the growth in the pool of total assets under management has been considerable over the period. At the outset of the sample period, pooled net assets amounted to SEK 45.8 billion. This number had by June 2008 risen to SEK 114.4 billion. This suggests that investors have to some extent successfully put money into funds before up-turns in the market, and managed to withdraw money before market down-turns. During the ten year period, the minimum, mean, and maximum fund sizes rose notably to. In July 2008 the smallest fund was SEK 10.6 million and the largest was SEK 7.3 billion. By June 2008 the smallest portfolio under management was 22.2 million, compared with the largest portfolio of SEK 12.8 billion. Similarly the average net asset value for the smallest, out of four groups in the sample, was SEK 36.6 million compared to SEK 3.9 billion for the largest group of funds in July 1998. At the end of 2008 these number were SEK 64.0 million for the smallest group and SEK 7.3 billion for the largest group.

# 5. Methodology

## 5.1 Definition of Mutual Fund Size

When performing a study of fund size in panel data, it becomes imperative how to define "fund size". Several metrics such as total net assets (TNA), percentile ranking and percentage of market capitalization have been proposed. Bird *et al*. (1983) and Gorman (1991) use TNA in their studies of mutual fund size. However, Chan *et al*. (2005) argue that there are some obvious disadvantages to using TNA as a measure of size. I.e. fund size may double over a number of years, but if the capitalization of the market also doubles over that same period, then compared to the value of shares outstanding, the relative value of the fund has not changed and thus the fund's investment opportunities should not be influenced by its increase in dollar value size. A measure of fund size that scales for changes in the value of the market over time is therefore preferable over the absolute value of the fund.

Grinblatt and Titman (1989) divide funds into size classes, based on percentage rank of fund size. The advantage of measuring fund size as a percentage rank is that any changes in fund size over time due to changes in market capitalization are controlled for. Percentage rank is calculated as the proportion of managers with total net assets at a time *t* less than that of manager *m*. This gives a variable ranging from zero for smallest manager, to one for the largest manager. However, a shortcoming of this method lies in that as new managers enter the sample, a fund's relative position changes even though nothing has changed in its external or internal setting.

Chan *et al*. (2005) propose a third measure to define size. It calculates total net assets at the end of the month as a proportion of total market capitalization. We will use a similar definition where we calculate total net assets at the end of the month as a fraction of total wealth of all active funds that period (total capitalization of the Swedish equity mutual funds segment). In practice this means measuring fund market share (MS). The benefit of this definition is that it scales for dollar value increases over time due to market growth and is fairly insensitive to the addition of new managers, altering the size position of earlier funds in a sample.

To define TNA we similar to Grinblatt and Titman (1989) and Gorman (1991) use beginning of period portfolio TNA. Our sample utilizes TNA on a quarterly basis.

## 5.2 Analyzing Mutual Funds by Groups

We perform the analysis of the relation between fund size and performance by using an approach similar to the one chosen by Grinblatt and Titman (1989), Ciccotello and Grant (1996), Indro *et al*.

(1999) and Christopherson *et al*. (2002). To test if there is a significant difference in the impact of size on performance, we compare funds based on different intervals of fund size. We do this by grouping the funds in each quarter by market share value into one out of four size groups. For each size category excess returns are computed both over the ten year period, July 1998 to June 2008, and by five year intermediate periods, July 1998 to June 2003 and July 2003 to June 2008, to see how the results have varied between groups and if they vary over time. The difference of means t-test is performed to check if there is a significant difference in means between groups.

Ciccotello and Grant (1996) divide their sample into four groups based on percentile rank. We similarly chose four size intervals to try accommodate the opposing needs of studying sufficiently many funds in each size group to make the results statistically valid, and the need of running enough groups to spot any nuances between the groups. Following the discussion in section 5.1 the size intervals are divided by fixed market share levels. The four size groups are rebalanced quarterly based on the market share level funds assume: Group 1, 0% to 0.15%. Group 2, over 0.15% to 0.70%. Group 3, over 0.70% to 3.0%. Group 4, over 3.0%. This means that the breakpoints (0.15%, 0.70% and 3.0%) will vary in absolute values over time (see Table B3 the Appendix) but stay fixed in relative terms. The number of observations in each group will thus also vary over time. The market share levels have been chosen to obtain a similar number of funds in all groups in all time periods. The data did not seem to display any natural grouping by size when studying it in a scatter plot.

The procedure to study fund size more in-depth by using the category-analysis approach is applied throughout the thesis. For all hypotheses groups are formed according to the described procedure. While the category-analysis provides us with a closer estimate of the rough patterns of the sample we use it combination with regression analysis to capture the trends in the data.

## 5.3 Definition of Mutual Fund Performance

It is unclear whether average investors focus on excess returns or risk-adjusted performance when allotting their investment across mutual funds, we therefore measure performance in both ways. Risk-adjusted return accounts for that the risk-profile between mutual funds can vary. Excess returns are calculated monthly. In equation 1, we define excess return ($\alpha_{i,t}$) as actual return generated by fund *i* in time period *t* ($R_{i,t}$), minus the benchmark return in time period *t* ($B_t$):

$$\alpha_{i,t} = R_{i,t} - B_t \qquad [e1]$$

To evaluate to what extent funds achieve higher excess returns by running portfolios of higher risk, we use the Sharpe ratio to evaluate the funds' risk-adjusted performance. The Sharpe ratio is a risk-adjusted measure calculated dividing the risk premium by the standard deviation of the risk premium, to determined reward per unit of risk. The metric is defined in accordance with equation 2

$$S = \frac{E[R_{i,t} - R_{f,t}]}{\sqrt{\sigma^2}} \qquad [e2]$$

where $R_{i,t}$ has the same definition as in equation 1. $R_{f,t}$ is the risk free interest rate at time *t*. This study uses the Stockholm Interbank Offered Rate (STIBOR) as a proxy for the risk-free rate. It has been obtained on a monthly basis from the Swedish Central Bank (Riksbanken). $\sigma^2$ is the variance of excess returns. When the term performance is discussed it is aimed to explain the funds' excess returns. The Sharpe-ratio will be used as a complement to provide flavour as to how the performance was created.

## 5.4 Hypothesis 1: The Impact of Fund Size on Performance

To test our first hypothesis we estimate regression 1. It allows us to capture the overall trend in the data. The regression is performed over the full ten year period July 1998 to June 2008. We also separate the data into five year periods, July 1998 to June 2003 and July 2003 to June 2008, to see how the results have varied over the ten year period. $p_{i,t}$ is the performance of fund *i* at time *t*, and the variable $MS_{i,t}$ is the market share of fund *i* at time *t*. As we have monthly data for excess returns and quarterly data for the market share we use the same market share value for all three monthly excess return observations during that quarter.

$$p_{i,t} = \alpha + \beta_1 MS_{i,t} + \varepsilon_{i,t} \qquad [r1]$$

In addition to running regression 1, we perform the category analysis outlined in section 5.2, performing difference of means t-tests between groups to check for significance in difference of mean excess returns.

## 5.5 Hypothesis 2: Liquidity Costs

In this thesis we study liquidity costs arising from costs of avoiding market impact costs. We measure for this by investigating the standard deviation of excess returns (known as tracking error) as a proxy for these costs. Relying on the findings of Chan *et al*. (2005) and the theory behind costs of avoiding market impact cost; if larger managers do indeed configure their portfolio to include more and larger market capitalization stock, we would expect to see large managers holding portfolios that carry heavier weight in the market index, than small fund managers. We would also expect to see that the

volatility of excess returns of such as portfolio decreases the larger the manager grows; as more stock are added to the portfolio and the proportion of stocks carrying high index weight increases it becomes increasingly difficult to deviate from index returns since the fund itself grows to become a market proxy.

We test for these liquidity costs by examining to what extent fund size drives the tracking error. We estimate regression 2 where *std.dev($p_{i,t}$)* represent the standard deviation in excess returns of fund *i* at time *t*, and $MS_{i,t}$ is the market share of fund *i* at time *t*.

$$std.dev(p_{i,t}) = \alpha + \beta_1 MS_{i,t} + \varepsilon_{i,t} \qquad [r2]$$

## 5.6 Hypothesis 3: Economies of Scale in Mutual Fund Families

Chen *et al*. (2004) test for economies of scale in mutual fund complexes by controlling for the size of the mutual fund family a fund belongs to. Their findings show that the size of the mutual fund complex that a fund belongs to positively impacts on the fund's performance suggesting there are additional benefits to performance from being part of a larger complex.

Similarly we test if belonging to a larger fund complex, indicates the presence of additional scale economies. We test if funds belonging to one of the four largest fund complexes in the Swedish market (Handelsbanken, Nordea, SEB and Swedbank) achieve higher returns. Being part of the major banks, these fund complexes are argued to have the highest ability of achieving improved results owing to scale economies. We study the excess returns of the two groups of smallest funds belonging to these fund complexes and compare them to their individually managed peers and peers of other fund complexes.

We use the category-analysis to evaluate if there is a statistically significant difference in excess mean returns between Group 1 (smallest) and Group 2 (next to smallest) funds belonging to one of the four major banks, compared to their peers in the same group. The t-tests are first performed on Groups 1 and 2 jointly and then individually. The test is only performed for the groups of smallest and next to smallest funds, as any effect from scale economies should be most pronounced for these groups. We argue the marginal benefit of shared costs is less for larger funds. The effect on performance should thus become harder to distinguish.

## 5.7 Hypothesis 4: Extreme Net Fund Flows

The literature provides a number of potential explanations for a fund size effect and flow could possibly be one of them. To test if relatively large fund flows negatively impact on mutual fund

performance, we will first provide a definition of fund flows. For open-ended mutual funds their size can grow in two ways:

i) Strong performance of holdings in the fund's portfolio increases the value of underlying assets. This leads to an increase in the fund's size

ii) Inflow of investor's money. This is how fund size can grow even though a fund has negative returns

Net fund flows are calculated as the absolute change in quarterly TNA, not attributable to portfolio securities, as depicted in equation 3. $FLOW_{i,t}$ represent the absolute quarterly net change in TNA of fund *i* at time *t*. $TNA_{i,t}$ is fund *i*'s total net asset value at time *t*. $TNA_{i,t-1}$ is fund *i*'s total net asset value in the previous period and $R_{i,t}$ is the net return to fund *i* at time *t*. Hence $FLOW_{i,t}$ measure the change in a fund's net asset value beyond reinvested capital gains and dividends.

$$FLOW_{i,t} = TNA_{i,t} - [TNA_{i,t-1} * (1 + R_{i,t})] \qquad [e3]$$

To test for the impact of relatively large net flows, we first separate all net flows into positive and negative net flows. It can be assumed that as net flows becomes "relatively large" their impact, no matter if the net flow is positive or negative, become a drag on performance, specially as liquidity costs may easily become an issue for funds, with the size of the net flow. Thus pooling positive and negative flows in a regression is not likely to sufficiently capture their effects.

We use the terms relatively large net flows and extreme net flows interchangeably and defined them as net flows at time *t*, positive or negative, that amount to 20% or more of total net assets for fund *i* at time *t*. In practice this extreme net flow level was chosen to include net flows in the magnitude of the $80^{th}$ and $90^{th}$ percentile of all positive or negative net flows.

In addition to studying the extreme net flows, we control for if net flows per say, carry any significant impact on performance. If so is found to be the case, the impact of net flows in general could be argued to have a larger impact on fund excess returns than predicted by theory on extreme net flows. It could also indicate the presence of "smart money".

Using category-analysis we perform difference of means t-test to see if excess returns generated by funds during periods of extreme net flows differ from excess returns achieved during periods of regular flows. We also estimate regression 3, to examine if absolute net flows per say were to have any significant impact on excess returns. Referring back to section 5.1, we calculate and use a flow-ratio $FLOWR_{i,t}$, (net flow of fund *i* at time *t* divided by the total capitalization of all active funds at time *t*) in

the regression of net flows on excess returns. This adjusts for growth in net flows over time due to growth in the market capitalization.

$$p_{i,t} = \alpha + \beta_1 FLOWR_{i,t} + \varepsilon_{i,t} \qquad [r3]$$

## 5.8 Hypothesis 5: Performance Persistence

To investigate for persistence in a two-period framework we use regression-based (parametric) and contingency table-based (non-parametric) methods. We conduct the tests to examine if performance persistence exists for one month returns. That is examining if there is an interrelation between the performance in time period *t*, and performance in the previous time period, *t-1*. For the regression-based parametric method we follow the procedure of Grinblatt and Titman (1992) who defined $p_{i,t}$ as the excess returns of fund *i* at time *t*, computed in excess of the average excess return of all funds in that period. This lets us test if there are any significant evidence that the winner in period *t-1* (were winners are defined as funds performing in excess of the average monthly excess return) continue to be winners in the following period. To run the parametric test we estimate regression 4 for the whole sample and individually for each of the four size groups over all ten years, between July 1998 and June 2003 and for July 2003 to June 2008. $p_{i,t}$ is the excess return of fund *i* at time *t* above/bellow the average excess return of active funds in that period, and $p_{i,t-n}$ reflect the excess return of fund *i*, 1 period ago above/bellow the average excess return by active funds that period.

$$p_{i,t} = \alpha + \beta_1 p_{i,t-1} + \varepsilon_{i,t} \qquad [r4]$$

A significant positive coefficient in these tests would reject the null hypothesis of no persistence. The next step of interest is then to find out if the significant persistence is attributable to over performers or under performers. We construct a contingency table of winner and losers, where a fund is a winner if the excess return of that fund is greater than the mean excess return of all active funds in that period, otherwise it is a looser. If we see that the probability of being a winner dominate the probability of being a looser, this indicates the presence of persistence is concentrated to positive returns (Agarwal and Naik, 2000).

# 6. Empirical Findings

## 6.1 Hypothesis 1: The Impact of Fund Size on Performance

**Hypothesis 1***: There is no significant relationship between fund size and performance for Swedish equity mutual funds*

As mentioned in section 3.1, we would not expect to find a relation between fund size and performance based on previous evidence from the Swedish equity funds market. International results however vary. To test hypothesis 1, we perform the category-analysis and run our regression model from section 5.3

TABLE A1

*Comparison of accumulated excess returns and Sharpe Ratio for all funds and individual groups. Significance of returns comparisons show if the mean excess return of one group is significantly higher than that of another group. Groups sorted by market share.*

| **Group** | **1** | **2** | **3** | **4** | **Significance of Return Comparisons** | **p-value** |
|---|---|---|---|---|---|---|
| **July 1998 - June 2008** | | | | | | |
| 10 year accumulated | -3.7 | -6.6 | -9.7 | -9.8 | G1 > G2 | 0.328 |
| excess return (%) | | | | | G1 > G3 | 0.185 |
| Standard deviation | 2.2 | 1.8 | 1.6 | 1.2 | G1 > G4 | 0.142 |
| of excess return (%) | | | | | G2 > G3 | 0.306 |
| Sharpe-Ratio | 0.005 | 0.028 | -0.006 | 0.003 | G2 > G4 | 0.245 |
| | | | | | G3 > G4 | 0.448 |
| **July 1998 – June 2003** | | | | | | |
| 5 year accumulated | 1.2 | 9.7 | 3.6 | 1.8 | G1 > G2 | 0.818 |
| excess return (%) | | | | | G1 > G3 | 0.569 |
| Standard deviation | 2.7 | 2.4 | 1.9 | 1.4 | G1 > G4 | 0.446 |
| of excess return (%) | | | | | G2 > G3 | 0.181 |
| Sharpe-Ratio | -0.129 | -0.090 | -0.094 | -0.119 | G2 > G4* | 0.095 |
| | | | | | G3 > G4 | 0.334 |
| **July 2003 – June 2008** | | | | | | |
| 5 year accumulated | -4.9 | -12.5 | -14.3 | -10.6 | G1 > G2** | 0.017 |
| excess return (%) | | | | | G1 > G3*** | 0.005 |
| Standard deviation | 1.5 | 1.0 | 1.0 | 0.9 | G1 > G4 | 0.046 |
| of excess return (%) | | | | | G2 > G3 | 0.260 |
| Sharpe-Ratio | 0.258 | 0.194 | 0.167 | 0.183 | G2 > G4 | 0.764 |
| | | | | | G4 > G3* | 0.087 |

Notes: *, **, and *** connote significance at the 10%, 5%, and 1% levels, respectively

We start by analyzing excess returns of the four size categories over the ten year period. Table A1, in the text, illustrates that investing in a group of smaller funds over the ten year period would not have yielded significantly higher returns than investing in a group of larger funds. These results are consistent with the findings of Grinblatt and Titman (1989) for all size groups, and Ciccotello and

Grant (1996) for growth and income funds; that fund size does not have any significant impact on performance. The excess performance of the size groups indicate that smaller funds have earned higher excess returns. I.e. the group of smallest funds earned an average excess return of 6.1 percentage units over the group of largest funds. However, the difference of means t-test show that the results are not significant at any level, something that is also confirmed when market share for all funds is regressed on excess returns (see Table B4 in the Appendix).

For the first five years of the study, between July 1998 and June 2003, the group of next to smallest funds, Group 2, display the highest excess return among all groups. Noteworthy is also that the group of smallest funds appear to underperform any other group, suggesting that the results found for the entire ten year period are not robust over time. The results, in Table B4 of the Appendix, from running the regression of market share on performance, for the first five years, show no significant trend in the data. The difference of means t-test however find a significant difference in mean excess returns between Group 2 and Group 4, indicating an investor with 90% confidence would have received 7.85 percentage units higher excess returns during this period by following a strategy of holding funds belonging to Group 2, rebalancing his portfolio each quarter, compared to a portfolio only comprising the largest funds in Group 4. For the second half of the sample, between July 2003 and June 2008, it instead becomes noteworthy that the group of smallest funds, on at least a 5% significance level, have outperformed all other group sizes. This adds support to the notion that small fund advantages, such as less impact from liquidity costs, could be dominating during this period.

What is also interesting is that Group 4, comprising the largest funds, performs significantly better, than Group 3, at the 10% level during the second half of the sample. If these results would i.e. be due to economies of scale induced by a large fund size, it could indicate that a minimum amount of assets under management are required before cost benefits become large enough to significantly impact on performance. That we do not see that large equity funds in general outperform smaller ones could be explained by the notion of Dahlquist *et al*. (2000) that large equity funds in the Swedish market might actually be very large in relation to the overall Swedish equity market. Even though economies of scale should exist, these large funds may simply be too large for aggressive trading.

That there are no significant trends present in the data when regressing market share on excess returns, but significant differences appear in mean returns between group for parts of the sample, indicates that the relationship between size an performance is in fact complex, and could perhaps better be captured using non-linear relations. As mentioned in the opening discussion the characteristics of the size-driven factors are likely to vary over time, and thus the influence they exercise on performance will vary as well.

The differences between excess returns are often insignificant, however, the Sharpe-ratio gives some clue to how well reward per unit of risk has been managed in achieving these excess returns. As can be seen in Table A1 the group of second to smallest funds achieved the highest risk-reward ratio during the ten year period. It is also worth noticing that the Sharpe-ratios are highest for the groups of smallest and next to smallest funds, even though the difference is not major between the group of smallest funds and the group of largest funds. Looking at the standard deviation of excess returns in Table A1 we see that even though the small segments take on more risk, this is something that has paid off for the 10 year period. We also note that even though the two largest categories yielded similar excess returns, the group of largest funds managed to do so taking with less risk.

**Main Findings: The Impact of Fund Size on Performance**

- Insignificant relation between size and performance for all funds over 10 years and 5 year periods
- The smallest funds performs significantly better than other groups between 2003 and 2008
- The Sharpe-ratio is higher for the group of smallest and second to smallest funds over the ten year period, than for the group of largest and next to largest funds

## 6.2 Hypothesis 2: Liquidity Costs

**Hypothesis 2***: There is a positive relationship between mutual fund size and costs of liquidity*

The results from regression 2 are presented in Table B5 in the Appendix. As can be seen, fund size has a significant negative impact on the volatility of excess returns for all time periods. Analysing the results by size groups and testing for significance in volatility of excess returns between the four groups, the difference of means t-test display that three "liquidity-formations" are present in the sample over the ten year period (see Table A2 bellow). The group of smallest funds displays significantly higher volatility in excess returns than any other group. There is no significant difference in the volatility of excess returns between groups 2 and 3. Finally group 4 displays significantly lower volatility in excess returns than any other size group.

That category-analysis and regression results provide us with strong evidence of the presence of liquidity costs for Swedish equity mutual funds. Smaller Swedish fund managers deviate more from the market index, which indicate they to a larger extent seek returns in companies not constituting heavy weight in the market index. By making smaller absolute investments in individual stocks than their larger counterparties, smaller funds have a wider investment universe. That there is no significant difference in the volatility of excess returns between Group 2 and 3 over ten years, or for the last five years of the sample, is indicative of that there is a large mid-ranged segment of stock in the Swedish market offering similar liquidity opportunities, and that these stocks are to a great extent traded indifferently between funds in Groups 2 and 3.

TABLE A2

*Comparison of volatility of excess returns (tracking error) for all funds and individual groups. The significance of volatility comparisons show if the tracking error of one group is significantly larger than that of another group. Groups sorted by market share.*

| **Group** | **All Funds** | **1** | **2** | **3** | **4** | **Significance of Volatility Comparisons** | **p-value** |
|---|---|---|---|---|---|---|---|
| **July 1998 – June 2008** | | | | | | | |
| Standard deviation | 1.7 | 2.2 | 1.8 | 1.6 | 1.2 | G1 > G2*** | 0.000 |
| of accumulated | | | | | | G1 > G3*** | 0.000 |
| excess returns (%) | | | | | | G1 > G4*** | 0.000 |
| | | | | | | G2 > G3 | 0.367 |
| | | | | | | G2 > G4*** | 0.000 |
| | | | | | | G3 > G4*** | 0.000 |
| **July 1998 – June 2003** | 2.1 | 2.7 | 2.4 | 1.9 | 1.4 | | |
| Standard deviation | | | | | | G1 > G2** | 0.028 |
| of accumulated | | | | | | G1 > G3*** | 0.000 |
| excess returns (%) | | | | | | G1 > G4*** | 0.000 |
| | | | | | | G2 > G3** | 0.027 |
| | | | | | | G2 > G4*** | 0.000 |
| | | | | | | G3 > G4*** | 0.001 |
| **July 2003 – June 2008** | 1.1 | 1.5 | 1.0 | 1.0 | 0.9 | | |
| Standard deviation | | | | | | G1 > G2*** | 0.000 |
| of accumulated | | | | | | G1 > G3*** | 0.000 |
| excess returns (%) | | | | | | G1 > G4*** | 0.000 |
| | | | | | | G2 > G3 | 0.651 |
| | | | | | | G2 > G4** | 0.042 |
| | | | | | | G3 > G4** | 0.018 |
| All Funds July 1998- June 2003 > All Funds July 2003- June 2008*** | | | | | | | 0.000 |
| SIX PRX July 1998- June 2003 > SIX PRX July 2003- June2008*** | | | | | | | 0.000 |

Notes: *, **, and *** connote significance at the 10%, 5%, and 1% levels, respectively

Comparing the data over the two five year periods July 1998 to June 2003 and July 2003 to June 2008, show that the ten year findings for liquidity costs, are more or less robust over time. Liquidity costs are present and significant for both halves of the sample. However, for the first five years of the sample, we notice that there is also a significant difference in volatility of excess returns between Groups 2 and 3, unlike for the second half of the sample. That liquidity costs are significantly different between these two groups for the period July 1998 to June 2003, but not for the following five years, could be indicative of that a structural change has taken place in the market. That is between July 2003 and June 2008, the structure of the market provided greater possibilities for funds in Group 3 to target stocks usually targeted by Group 2, with insignificantly different liquidity costs.

Comparing the absolute level of volatility over all groups between the first five years of the sample and the last five years, Table A2 in the text shows that there has been a nearly 50% drop in volatility

for the last five years that is significant. The lower volatility observed for July 2003 to June 2008 points to that costs of avoiding market impact costs have increased for all funds. I.e. if general liquidity where to fall in the equity market, the bid/ask spreads would increase faster with large trade blocks. If funds were to continue pursuing the same trading ideas as previously, the expected gains would be eroded by the increased bid/ask spreads. Under these circumstances one expect to see funds to a greater extent diverge their holdings to larger stocks than they hold on average during times of good market liquidity.

The results for the lower volatility between the two periods in time could also coincide with the general market movement we have seen. Between July 1998 and June 2003 SIX PRX delivered a return of -21%, while for the period July 2003 to June 2008 its return was 108%. It is possible that investors favour funds that do not underperform the average fund during market downturns more than they disfavour funds underperforming the average fund during market upturns. On these premises it would be wise for funds to take on more risk during market downturns, than they have to in market upturns.

Further comparing liquidity cost between the first and the second half of the sample, Table A2 shows liquidity costs seem to linearly increase with group size during the first period. Between July 2003 and June 2008, Group 1 display proportionally higher volatility than any of the groups of larger funds. This would, as mentioned earlier in the section, suggest that market conditions may have changed during the sample period, allowing small funds to trade more actively which could explain why their excess returns for that period also deviate positively to those of the larger funds.

**Main Findings: Liquidity Costs**

- Regression finds a positive and significant relation between liquidity costs and size over all time periods measured for
- No significant difference in volatility of excess returns between the group of next to smallest and next to largest funds, during the entire period and between July 2003 and June 2008
- Significantly higher liquidity costs, for all funds, in the second half of the sample compared to the first

## 6.3 Hypothesis 3: Economies of Scale in Mutual Fund Families

**Hypothesis 3***: Swedish mutual funds belonging to large fund complexes perform better than individually managed peers and peers belonging to smaller fund complexes*

In this section we investigate for economies of scale from being part of fund family. We compare the mean excess performance of funds belonging to one of the four major banks, in Group 1 and 2, to the

mean excess performance of their standalone peers and peers belonging to other mutual fund complexes for Groups 1 and 2. Over the ten year period July 1998 to June 2008, as well as for the second half of the sample, Table A3 show that funds belonging to one of the four major banks, for Group 1 and Group 2 combined, yield significantly lower excess returns than their peers. The group of smallest funds belonging to one of the four major banks also perform significantly worse for the second half of the sample than its peers. Surprisingly, and contradictory to theory, these findings would suggest the presence of diseconomies to scale from fund families amongst Swedish equity mutual funds. Comparing Groups 1 and 2 independently to their peers does however not yield any significant differences in mean excess returns over the ten year period.

TABLE A3

*Comparison of mean excess returns between groups of funds belonging to one of the major four banks and their individually managed peers and peers belonging to other fund complexes. P-value show if funds part of one of the four major banks performs significantly better (worse) than their peers. Groups sorted by market share.*

| **Group** | **Funds Belonging To One of the Major Four Banks (FF)** | | **Peers (P)** | **p-value (FF<P)** | **p-value (FF>P)** |
|---|---|---|---|---|---|
| **July 1998 – June 2008** | G1 & G2 | vs. | G1 & G2* | 0.090 | 0.910 |
| | G1 | vs. | G1 | 0.103 | 0.897 |
| | G2 | vs. | G2 | 0.258 | 0.742 |
| **July 1998 – June 2003** | G1 & G2 | vs. | G1 & G2 | 0.240 | 0.760 |
| | G1 | vs. | G1 | 0.325 | 0.675 |
| | G2 | vs. | G2 | 0.197 | 0.803 |
| **July 2003 – June 2008** | G1 & G2 | vs. | G1 & G2* | 0.076 | 0.925 |
| | G1 | vs. | G1*** | 0.006 | 0.994 |
| | G2 | vs. | G2 | 0.820 | 0.180 |

Notes: *, **, and *** connote significance at the 10%, 5%, and 1% levels, respectively

We believe that the indications of diseconomies to scale from fund families may be explained by the work of Williamson (1988). He propose that organizational diseconomies such as bureaucracy costs ought to be more pronounced in huge fund complexes, where there are several decision layers and many agents are involved in managing the fund.

As proposed by Guedj and Papastaikoudi (2003) there may also be conflicting interests between fund families and the mutual funds they own. While the individual funds are expected to want to maximize performance, it may instead be in a fund complex's interest to selectively promote a few of its funds, channelling a proportionally larger part of its resources to these funds. I.e. Gruber (1996), Chevalier and Ellison (1997), Sirri and Tufano (1998), Lynch and Musto (2003) and Berk and Green (2004) document the existence of a convex relationship between lagged fund performance and fund flows on

period ahead. The convex relationship means that abnormal positive returns generate disproportionally more inflows to funds than abnormal negative returns cause outflows. This implies that if a fund family has to choose between owning two mediocre performing funds, and one well performing and one poorly performing fund, the family would prefer the latter combination to receive more fund flows. The convexity of the flow-performance relationship would translate into an increase in the net amount of assets under the family's management, meaning larger absolute management fees. Thus it is reasonable to believe that if a family has some large well performing funds, it will consciously choose to promote these star funds to maintain their good track record, even if it comes at the expense of other funds in the family, i.e. the smallest ones.

Developing a similar theoretical concept, as the one just explained for, Kohrana and Servaes (2002) and Nanda et al. (2004) observe that there exist a "flow spill-over" effect within funds belonging to families that possess at least one fund with an excellent record. Fund belonging to families that have at least one star performer receive proportionally more inflows, than standalone peers. The implication of this observation is equivalent to that of the convex flow-performance relationship. It is sufficient for a fund complex to have at least some well performing funds in order to experience a large net inflow to its assets under management. If it is the largest funds among complexes that perform best, the families may choose not to provide its other funds with the same amount of resources.

As proposed by Gorman (1991) compensation schemes may also differ among funds. If large fund complexes place lower weights on investment performance than small complexes and standalone funds, one could potentially expect to see their funds underperform their peers.

**Main Findings: Economies of Scale in Mutual Fund Families**

- Combined, funds belonging to one of the four major Swedish banks significantly underperform their peers between July 1998 and June 2008 and July 2003 to June 2008
- The group of smallest funds, belonging to one of the four major banks, significantly underperform their peers between 2003 and 2008
- Bureaucracy and Conflicting interests between funds and fund families are plausible explanations

## 6.4 Hypothesis 4: Extreme Net Fund Flows

**Hypothesis 4***: Performance responds negatively to extreme net flows*

Chan *et al*. (2005) shows that the impact of relatively large fund flows on performance represent a disturbance to the investment process. If managers grow through new fund inflows, relatively large

cash injections may put pressure on the manager to invest the new money rapidly, leading to transactions being sub-optimal.

We start examining hypothesis 4 by interpreting the results for net flows and extreme net flows shown in Tables B6 and B7 in the Appendix. Unlike Chan *et al*. (2005) we find some puzzling results. For the full ten year period all positive extreme net flows prove to have a significant positive effect on performance. We believe these results could be linked to signalling theory in combination with sub-optimal investing. If the market, by examining a manager's transactions, cannot separate the potentially sub-optimal investments made due to positive extreme net flows, from transactions made due to the manager's superior insights, the market may interpret the transactions stemming from positive extreme net flows for "high" information decisions. If they follow the managers lead and invest in the same shares, this will put upward pressure on stock prices, ultimately resulting in higher excess returns for the fund.

At the individual group level, Group 1 significantly benefits from positive extreme net flows. However Table B7 in the Appendix also show the group yield significantly lower excess returns, at the 10% level, over the ten year period and for the last five years of the sample, when presented with negative extreme net flows. We believe signalling theory may also explain the positive impact on excess returns from positive extreme net flows. If the relatively large positive net flows causes funds in Group 1 to take major positions in small companies, that lack any previous track record of institutional investors, this could be interpreted by the market as a signal of quality for that stock and other investors may follow. On the other hand, negative excess performance stemming from negative extreme net flows could indicate that small managers hold the smallest stocks available on the market. The market liquidity for these stocks may vary over time. If a manager is forced to sell large positions to finance relative large net outflows at times of low liquidity, this inevitably means underperformance in excess returns.

Proceeding by testing if net flows per say have any significant impact on performance, we confirm that net flows generally do not have any significant impact on excess returns and that no "smart money" effect is generally to be found. However, we do find some more interesting results. Over the ten year period July 1998 to June 2008 and for the two five year periods, negative net fund flows for Group 3 prove to have a significant and positive impact on excess returns. For the most recent five years of the sample we also notice that positive net fund flows going into Group 3 funds have a significant and positive impact on excess returns. In practice these results mean that any type of flow, including negative extreme net flows (for the ten year period, and the second half of the sample) that induce some type of change in the portfolio design of Group 3 managers, significantly benefits excess returns. It could be that Group 3 funds are very successful at findings new investment ideas, as well as

at selling old holdings that would soon have become poor performers. However, for some reason it could be that these portfolios are managed to passively, meaning that managers don't exercise their stock-insights enough. Thus, net flows that forces the manager to take any type of action yield positive excess returns. This would as well help explain the poor returns we see for Group 3 over the ten year period as well as between July 2003 and July 2008. Notably we see that the suggested problems occurring in Group 3 have worsened between the first and the second half of the sample, as negative extreme net flows and positive net flows both have started to exercise a positive impact on excess returns in the latter period.

At the individual group level we also find that negative extreme net flows have a significant positive impact on the excess returns of Group 4 over the period July 2003 to June 2008. We also find that any type of extreme net flow has a significant positive impact on the excess performance of Group 4 over the same time period. These results are likely driven by the negative extreme net flow observations, as the group of largest funds did not register any extreme positive net flows in any period. Without knowing how extreme positive net flows impact on the group of largest funds it is difficult to find plausible explanations for the results of the negative extreme net flow. We thus simply conclude that the group of largest managers are good at handling relative large outflows from their funds.

**Extreme Net Fund Flows: Main Findings**

- All funds show positive excess returns related to positive extreme net flows over ten years
- Managers of funds in the second to largest group benefit from receiving ordinary positive and negative net flows as well as positive and negative extreme net flows
- The group of smallest funds benefits from positive extreme net flows, but suffer from negative extreme net flows

## 6.5 Hypothesis 5: Performance Persistence

**Hypothesis 5***: Persistence in excess returns does not differ across size intervals*

Our results from the parametric and non-parametric tests presented in Tables B8 and B9 in the Appendix, indicate that for all funds in the sample, there is a significant persistence effect at the 5% level over ten years. The non-parametric test show that the persistence effect is primarily concentrated to losers, which were in section 5.7 defined as funds who's excess return is less than the mean excess return of all active funds in the period the excess return is observed. In practice this means that we see significant indications of underperformance among all funds over 10 years. At the individual group level persistence in underperformers is confirmed for the group of smallest funds during the first five years of the sample and for all groups of funds, except the largest one, for the second half of the

sample. Relating these results to the excess returns for the individual groups suggest persistence has a small impact on the overall results.

That we observe strong persistence in underperformance between July 2003 and June 2008 could be explained by that the market volatility fell during this period (see Table A2). Connecting these results: if higher liquidity costs lead to managers trading less and are unable to generate excess returns, the persistence in underperformance may come from some managers having such high fixed costs of providing active management that performance suffers in period on period.

Studying Table B9 in the Appendix, no size group deviate much from the other group in showing underperformance. This indicates that even though there are underperforming managers in the sample, their distribution among groups do not vary much. That we do not find any persistence effect for Group 4, comprising the largest managers, indicates that separating your performance from the market index, as well as from other large managers, may become increasingly difficult with fund size as managers in the extreme are forced to hold the market index itself.

**Performance Persistence: Main Findings**

- Significant persistence in underperforming funds over ten years
- Significant persistence in underperformance among all size groups, except for the largest one, between July 2003 and June 2008

# 7. Conclusion

Does size affect performance? The title of this thesis raises the question of the relation between fund size and fund performance. It has been argued that size as a variable is a proxy for capturing the different impacts of size-driven factors. I.e. liquidity costs can prevent trading-ideas if the fund becomes too large while scale economies on the other hand allows for cost-benefits. This thesis has shown that there is no significant relation between fund size as a variable and performance over a ten year period. However we show that the size-driven factors significantly differ between groups, and in the end help contribute in explaining some of the findings for the size performance relationship. Our results also present some new, innovative, insights that are not in line with previous findings or what theory foretells.

The value of understanding the impact of size on performance is to understand how size affects the factors it drives, and ideally to ultimately be able to derive an optimum fund size that allows for optimum returns given the current market conditions. Since the size-driven factors will vary in importance and effects across markets, it means than any model optimizing fund size will probably need to be decided on a local basis. Furthermore the optimal fund size will need to be recalculated over time as it only remains optimal as long as the underlying characteristics of the market do not change: something which rarely holds for long in modern financial markets.

Our results have several important implications for investors. They do not give a quick fix for choosing the best performing fund, instead they inform how size relates to performance, and to what extent a certain fund size interval has performed well in the past and the impact of size-driven factors. For the individual investor some of the main takeaways are that large funds incur higher liquidity costs, forcing them to target higher capitalization stock, whereas small managers will have a wider investment universe of stocks to target. Unlike size driven factors that might be hard to measure, true manager skill for example, a fund's size is simple to attain. During our studied period the groups of smallest and next to smallest funds have shown the highest excess and risk-adjusted return, suggesting investors that had diversified among funds with a market share of up to 0.70%, of all active Swedish equity funds pooled assets, would have benefited over choosing a portfolio of larger funds. Investors should however be wary of investing in small funds belonging to one of the four major bank complexes in Sweden. Our results have indicated significant diseconomies of scale during the period studied, suggesting that any cost-sharing benefits due to being part of a large mutual fund family are outweighed by factors such as i.e. bureaucracy and conflict of interests in mutual fund complexes. Investors should be aware attempting to improve performance by picking what they believe to be a strong manager is difficult as persistence is concentrated to underperformers. If investors would want to chose any random fund, and minimize the probability of choosing a manager that consistently

underperform their peers, her preferred option should be among the group of largest funds. Accounting for high volatility in excess returns amongst small funds, investors seeking to attain their high returns should diversify their investments amongst several funds.

For fund managers our results should be of interest as managers should always strive to maximize their performance. They should also be mindful of the value of managing the size of their fund, so as to attain the opportunity of capturing the highest possible excess returns. Finding excess returns by evaluating size-driven factors should be welcomed help. As we have shown in the thesis, costs of liquidity have been lowest for small funds which have allowed them to increase their risk taking. This is a strategy that has paid off during the ten years of this study. For larger funds, the relatively large liquidity costs mean they do not gain access to the same universe as stocks as small funds, without incurring cost that may outweigh any stock-selection insight from the manager. Being aware of this, managers of large funds could i.e. alter the investment strategy of their fund, splitting it into several smaller funds that can run pots of the money independently, but still be marketed to the public as one investment product. This internal fund-of-funds structure allows large managers to obtain lower liquidity costs by increasing the investment universe and lowering the effects on bid/ask spreads, as managers act independently. The structure is not without drawbacks and total risks need to be monitored, but the structure could still provide improved results. Being aware of how funds are affected by extreme net flows is also an important knowledge in enhancing the structure and operations of the funds. Surprisingly we have seen a significant positive impact of extreme net flows on performance, something that could indicate that the market misinterprets trades that could likely lead to sub-optimal investment decisions for “high” information decisions. For the group of second to largest funds, extreme net flows as well as regular net flows proved to have a significantly positive impact on returns. This should ring an alarm with these managers, as results could indicate they manage their funds too passively and any type of forced trading, incurred by net flows, increases excess returns.

We hope that this study and the results it has obtain provide both investors, managers and scholars with a deeper understanding of the size performance relationship, and its characteristics in the Swedish equity mutual fund market.

# 8. Further Research

This thesis has aimed to give a flavour for how some of the size-driven factors: liquidity costs, economies of scale in mutual fund families, extreme net flows and persistence in performance impact on funds' excess returns. There is however much research left to be done in fully being able to capture the relationship between size and performance.

This thesis has presented the idea of a size driven optimization model for returns. The notion is highly appealing. By including all factors that in theory will be driven by the size of a fund, the optimal size that maximizes performance can be derived. What all the factors included in such as model should be, how to measure for them, and their relative impact in different markets however remain a question for further and extensive research.

Of further interest would be examining the expense-ratios of Swedish equity mutual funds, to study to what extent efficiency gains are present with increased fund size. Of interest would be to know to what extent economies of scale, or possibly diseconomies of scale, exist among funds of larger size belonging to the largest Swedish fund complexes.

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# 10. Appendix

## Table B1. Sample of Funds

| Mutual Fund Name | Avg. AuM (MSEK) | Rank | Monthly Mean Excess Return | Rank | Sharpe Ratio | Rank | Std. Dev. Excess Return | # of Quarters | # of Q in Group 1 (Smallest) | # of Q in Group 2 | # of Q in Group 3 | # of Q in Group 4 (Largest) | Late Start (after Jul-98) | Early End (before Jun-08) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ABN AMRO Sverige | 449 | 31 | -0.33% | 52 | 0.000 | 45 | 1.16% | 120 | *33* | *36* | *51* | *0* | - | - |
| Aktie-Ansvar Sverige | 858 | 24 | 0.16% | 7 | 0.086 | 10 | 1.31% | 120 | *0* | *0* | *120* | *0* | - | - |
| Alfred Berg Pension Sverige | 15 | 59 | -0.48% | 56 | -0.141 | 55 | 1.13% | 45 | *45* | *0* | *0* | *0* | Oct-00 | Jun-04 |
| AMF Pension Aktiefond Sverige | 6 093 | 4 | 0.44% | 2 | 0.145 | 5 | 1.46% | 111 | *3* | *18* | *12* | *78* | Apr-98 | - |
| Banco Alleman | 3 207 | 12 | -0.24% | 48 | -0.033 | 50 | 1.64% | 72 | *0* | *0* | *12* | *60* | - | Jun-04 |
| Banco Etisk Sverige | 1 754 | 16 | -0.25% | 50 | 0.011 | 42 | 1.39% | 120 | *0* | *24* | *78* | *18* | - | - |
| Banco Etisk Sverige Special | 262 | 39 | -0.25% | 49 | 0.014 | 41 | 1.83% | 108 | *0* | *108* | *0* | *0* | Jul-99 | - |
| Banco Etiska Sverige | 44 | 51 | -0.55% | 58 | -0.151 | 57 | 2.01% | 48 | *48* | *0* | *0* | *0* | Jul-00 | Jun-04 |
| Banco Etiska Sverige Pension | 102 | 47 | -0.40% | 54 | 0.035 | 33 | 1.43% | 81 | *54* | *27* | *0* | *0* | Oct-00 | May-04 |
| Banco Svenska Miljöfond | 105 | 46 | -0.08% | 29 | 0.040 | 30 | 2.22% | 120 | *93* | *27* | *0* | *0* | - | - |
| Banco Sverige Pension | 17 | 58 | -0.45% | 55 | -0.131 | 53 | 1.85% | 45 | *45* | *0* | *0* | *0* | Oct-00 | Jun-04 |
| Carlson Sweden | 114 | 44 | -0.04% | 24 | 0.049 | 23 | 1.25% | 120 | *63* | *57* | *0* | *0* | - | - |
| Carlson Sverige | 784 | 25 | 0.00% | 17 | 0.055 | 20 | 1.03% | 120 | *24* | *12* | *84* | *0* | - | - |
| Carnegie Sverige | 314 | 33 | -0.03% | 23 | 0.044 | 27 | 1.69% | 120 | *0* | *111* | *9* | *0* | - | - |
| Catella Reavinst | 2 971 | 13 | 0.26% | 6 | 0.083 | 11 | 2.27% | 120 | *0* | *3* | *36* | *81* | - | - |
| Cicero Sverige | 28 | 55 | 0.05% | 13 | 0.075 | 13 | 1.28% | 84 | *84* | *0* | *0* | *0* | Jul-01 | - |
| Danske Sverige | 893 | 21 | 0.06% | 12 | 0.067 | 15 | 1.41% | 120 | *0* | *27* | *93* | *0* | - | - |
| Danske Sverige Fokus | 286 | 37 | -0.07% | 27 | 0.048 | 25 | 1.74% | 33 | *9* | *24* | *0* | *0* | Oct-05 | - |
| Didner & Gerge Aktiefond | 5 186 | 5 | 0.36% | 3 | 0.108 | 7 | 2.16% | 120 | *0* | *0* | *30* | *90* | - | - |
| Eldsjäl Sverigefond | 29 | 54 | -0.06% | 26 | 0.041 | 29 | 1.40% | 120 | *120* | *0* | *0* | *0* | - | - |
| Enter Sverige | 298 | 35 | -0.02% | 20 | 0.000 | 43 | 1.32% | 99 | *39* | *42* | *18* | *0* | Apr-00 | - |
| Erik Penser Sverigefond | 24 | 56 | -0.22% | 47 | -0.318 | 59 | 1.08% | 18 | *18* | *0* | *0* | *0* | Jan-07 | - |
| Etix Fonder Etix 50 | 50 | 49 | -0.29% | 51 | -0.149 | 56 | 1.40% | 12 | *12* | *0* | *0* | *0* | Jan-01 | Dec-01 |
| Folksam LO Sverige | 4 756 | 7 | -0.04% | 25 | 0.063 | 17 | 0.64% | 111 | *0* | *15* | *21* | *75* | Apr-99 | - |
| Folksam LO Väst | 307 | 34 | -0.02% | 21 | 0.067 | 14 | 0.65% | 111 | *30* | *81* | *0* | *0* | Apr-99 | - |
| Folksam Sverige | 2 745 | 14 | -0.03% | 22 | 0.048 | 26 | 0.55% | 120 | *0* | *0* | *12* | *108* | - | - |
| Folksam Tjänstemanna Sverige | 469 | 30 | -0.08% | 28 | 0.000 | 44 | 0.54% | 102 | *12* | *78* | *12* | *0* | Jan-00 | - |
| Förenade Liv Sverige | 165 | 41 | -0.13% | 37 | 0.513 | 1 | 0.50% | 54 | *6* | *48* | *0* | *0* | Jan-03 | Jun-07 |
| Gustavia Sverige | 291 | 36 | 0.29% | 4 | 0.231 | 3 | 2.65% | 54 | *18* | *36* | *0* | *0* | Jan-04 | - |
| HQ Swedish Equity A | 715 | 27 | -0.53% | 57 | -0.008 | 46 | 2.86% | 114 | *0* | *39* | *75* | *0* | Jan-99 | - |

Table B1 is continued on the following page

| **Mutual Fund Name** | **Avg. AuM (MSEK)** | **Rank** | **Monthly Mean Excess Return** | **Rank** | **Sharpe Ratio** | **Rank** | **Std. Dev. Excess Return** | **# of Quarters** | **# of Q in Group 1 (Smallest)** | **# of Q in Group 2** | **# of Q in Group 3** | **# of Q in Group 4 (Largest)** | **Late Start (after Jul-98)** | **Early End (before Jun-08)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HQ Sverige | 1 960 | 15 | 0.14% | 9 | 0.082 | 12 | 1.72% | 120 | *0* | *0* | *96* | *24* | - | - |
| Invit Aktiefond | 30 | 53 | -0.78% | 59 | -0.078 | 52 | 3.61% | 69 | *69* | *0* | *0* | *0* | - | Dec-01 |
| Kaupthing Bas | 32 | 52 | -0.10% | 33 | 0.121 | 6 | 1.72% | 93 | *93* | *0* | *0* | *0* | Oct-98 | Jun-06 |
| Kaupthing Swedish Growth | 110 | 45 | 0.07% | 11 | 0.058 | 18 | 4.04% | 120 | *81* | *39* | *0* | *0* | - | - |
| Lannebo Sverige | 877 | 22 | 0.15% | 8 | 0.048 | 24 | 1.55% | 81 | *6* | *33* | *42* | *0* | Oct-00 | - |
| Länsförsäkringar Sverigefond | 4 574 | 8 | -0.09% | 30 | 0.037 | 31 | 1.01% | 120 | *0* | *0* | *0* | *120* | - | - |
| Michael Östlund Sverige | 19 | 57 | -0.38% | 53 | -0.044 | 51 | 2.63% | 96 | *96* | *0* | *0* | *0* | Jul-00 | - |
| Nordea Etiskt Urval | 199 | 40 | -0.13% | 39 | -0.018 | 48 | 1.10% | 99 | *15* | *84* | *0* | *0* | Apr-00 | - |
| Nordea Portföljinvest Sverige | 76 | 48 | -0.09% | 31 | 0.094 | 9 | 1.54% | 96 | *84* | *12* | *0* | *0* | Jul-99 | Jun-07 |
| Nordea Sweden | 333 | 32 | -0.18% | 43 | 0.022 | 40 | 1.23% | 120 | *0* | *105* | *15* | *0* | - | - |
| Nordea Sverigefonden | 4 977 | 6 | -0.20% | 44 | 0.024 | 38 | 1.21% | 120 | *0* | *0* | *0* | *120* | - | - |
| Odin Sverige | 1 257 | 19 | 0.57% | 1 | 0.161 | 4 | 4.00% | 120 | *66* | *15* | *24* | *15* | - | - |
| Robur Sverigefond | 3 454 | 10 | 0.01% | 15 | -0.139 | 54 | 1.46% | 54 | *0* | *0* | *0* | *54* | - | Dec-02 |
| SEB Etisk Sverige Lux Utd | 728 | 26 | -0.21% | 45 | -0.031 | 49 | 0.72% | 99 | *0* | *36* | *63* | *0* | Apr-00 | - |
| SEB Premiefond Sverige | 48 | 50 | -0.11% | 34 | -0.306 | 58 | 1.01% | 24 | *24* | *0* | *0* | *0* | Jan-01 | Dec-02 |
| SEB Stiftelse Sverige | 642 | 29 | -0.18% | 41 | 0.025 | 37 | 1.43% | 120 | *0* | *33* | *87* | *0* | - | - |
| SEB Sverige Chans/Risk | 1 282 | 18 | -0.10% | 32 | 0.037 | 32 | 1.17% | 120 | *0* | *6* | *114* | *0* | - | - |
| SEB Sverigefond I | 10 409 | 1 | -0.13% | 38 | 0.031 | 35 | 0.65% | 120 | *0* | *0* | *0* | *120* | - | - |
| SEB Sverigefond Stora Bolag | 7 558 | 2 | -0.13% | 35 | 0.032 | 34 | 0.77% | 120 | *0* | *0* | *0* | *120* | - | - |
| SHB Reavinst | 7 175 | 3 | -0.13% | 36 | 0.030 | 36 | 0.95% | 120 | *0* | *0* | *0* | *120* | - | - |
| SHB SBC Bofond | 710 | 28 | -0.18% | 42 | 0.023 | 39 | 0.99% | 120 | *0* | *51* | *69* | *0* | - | - |
| SHB SSF Swedish Eq | 142 | 42 | -0.21% | 46 | -0.012 | 47 | 2.14% | 120 | *63* | *57* | *0* | *0* | - | Dec-04 |
| Skandia Aktiefond Sverige | 3 448 | 11 | 0.00% | 18 | 0.055 | 21 | 0.90% | 120 | *0* | *0* | *0* | *120* | - | - |
| Spiltan Aktiefond Sverige | 137 | 43 | 0.27% | 5 | 0.288 | 2 | 2.60% | 66 | *51* | *15* | *0* | *0* | Jan-03 | - |
| SPP Aktiefond Sverige | 871 | 23 | 0.07% | 10 | 0.064 | 16 | 0.88% | 120 | *0* | *30* | *90* | *0* | - | - |
| SPP Aktieindex Sverige | 1 295 | 17 | -0.15% | 40 | 0.041 | 28 | 1.57% | 111 | *12* | *9* | *90* | *0* | Apr-99 | - |
| Swedbank Robur Sverigefond | 4 217 | 9 | 0.03% | 14 | 0.057 | 19 | 1.45% | 120 | *0* | *0* | *33* | *87* | - | - |
| Trevise Tillväxtfond | 933 | 20 | -0.01% | 19 | 0.107 | 8 | 1.33% | 108 | *12* | *24* | *63* | *9* | - | Jun-07 |
| Öhman Sverige | 285 | 38 | 0.00% | 16 | 0.051 | 22 | 1.42% | 120 | *3* | *117* | *0* | *0* | - | - |
| Average | 1 544 | | -0.09% | | 0.030 | | 1.54% | 98 | *24* | *25* | *25* | *24* | | |

Table B1 shows the 59 Swedish equity funds in the sample. The descriptive set indicates average assets under management, monthly average excess returns and the Sharpe Ratio. The ranking indicates, relative other funds, which fund has obtained the highest value (1) and which fund has displayed the lowest value (59). The descriptive further shows the number of quarters that a fund has been in the sample and further in which specific groups it has been. Also displayed are the dates of funds entering the dataset late or exiting early.

## Table B2. Data Descriptives

| Years | Group | Accumulated Excess Returns | Monthly Average Excess Returns | Std. Dev. Excess Returns | Sharpe Ratio | Years | Accumulated SIX PRX Return | Monthly Std. Dev. SIX PRX |
|---|---|---|---|---|---|---|---|---|
| **1-10** | All Funds | -7.5% | -0.065% | *1.70%* | 0.008 | **1-10** | 64.26% | 5.96% |
| | 1 (Smallest Funds) | -3.7% | -0.031% | *2.18%* | 0.005 | | | |
| | 2 | -6.6% | -0.057% | *1.77%* | 0.028 | | | |
| | 3 | -9.7% | -0.085% | *1.57%* | -0.006 | | | |
| | 4 (Largest Funds) | -9.8% | -0.086% | *1.15%* | 0.003 | | | |
| **1-5** | All Funds | 4.0% | 0.065% | *2.14%* | -0.107 | **1-5** | -21.20% | 7.12% |
| | 1 (Smallest Funds) | 1.2% | 0.020% | *2.70%* | -0.129 | | | |
| | 2 | 9.7% | 0.154% | *2.37%* | -0.090 | | | |
| | 3 | 3.6% | 0.060% | *1.89%* | -0.094 | | | |
| | 4 (Largest Funds) | 1.8% | 0.030% | *1.41%* | -0.119 | | | |
| **6-10** | All Funds | -10.8% | -0.190% | *1.10%* | 0.200 | **6-10** | 108.46% | 4.45% |
| | 1 (Smallest Funds) | -4.9% | -0.084% | *1.45%* | 0.258 | | | |
| | 2 | -12.5% | -0.223% | *1.04%* | 0.194 | | | |
| | 3 | -14.3% | -0.258% | *1.03%* | 0.167 | | | |
| | 4 (Largest Funds) | -10.6% | -0.187% | *0.85%* | 0.183 | | | |

| Years | Group | Average Group Size (mSEK) | Average Fund Size (mSEK) | Number of Observations | Average Number of Funds per Month | Accumulated Net Fund Flows (mSEK) | Monthly Average Net Fund Flows (mSEK) |
|---|---|---|---|---|---|---|---|
| **1-10** | All Funds | 85 515 | 1 776 | 5 778 | *48* | 20 821 | *11.3* |
| | 1 (Smallest Funds) | 656 | 55 | 1 431 | *12* | -299 | *-0.7* |
| | 2 | 4 050 | 329 | 1 479 | *12* | -452 | *-0.9* |
| | 3 | 14 067 | 1 165 | 1 449 | *12* | 9 898 | *20.9* |
| | 4 (Largest Funds) | 66 742 | 5 644 | 1 419 | *12* | 11 674 | *25.3* |
| **1-5** | All Funds | 59 979 | 1 284 | 2 802 | *47* | 32 771 | *38.0* |
| | 1 (Smallest Funds) | 428 | 37 | 702 | *12* | 432 | *2.2* |
| | 2 | 2 291 | 211 | 651 | *11* | 1 999 | *9.8* |
| | 3 | 11 150 | 848 | 789 | *13* | 12 315 | *48.7* |
| | 4 (Largest Funds) | 46 119 | 4 193 | 660 | *11* | 18 025 | *85.8* |
| **6-10** | All Funds | 111 051 | 2 239 | 2 976 | *50* | -11 949 | *-12.1* |
| | 1 (Smallest Funds) | 883 | 73 | 729 | *12* | -731 | *-3.1* |
| | 2 | 5 809 | 421 | 828 | *14* | -2 450 | *-8.9* |
| | 3 | 16 984 | 1 544 | 660 | *11* | -2 417 | *-11.0* |
| | 4 (Largest Funds) | 87 374 | 6 907 | 759 | *13* | -6 351 | *-25.2* |

Overview of the total sample's and individual groups' performance, size, number of observations and flows. All findings displayed for the full ten years (July 1998 to June 2008) and divided into two five year periods (July 1998 to June 2003 and July 2003 to June 2008). Also in Table B2 are the accumulated returns for the SIX PRX (a market weighted accumulation index, meaning it is weighted by market capitalization and allows for reinvestment of dividends) and its monthly standard deviation for our sample time periods.

## Table B3. Market Share Breakpoints

| Quarter | Pooled Total Net Assets (mSEK) | Between Groups 1 & 2 (0.15%) (mSEK) | Between Groups 2 & 3 (0.7%) (mSEK) | Between Groups 3 & 4 (3.0%) (mSEK) |
|---|---|---|---|---|
| 1 (July 1998) | 45 839 | 69 | 321 | 1 375 |
| 2 | 35 413 | 53 | 248 | 1 062 |
| 3 | 41 350 | 62 | 289 | 1 241 |
| 4 | 45 068 | 68 | 315 | 1 352 |
| 5 (July 1999) | 50 302 | 75 | 352 | 1 509 |
| 6 | 54 497 | 82 | 381 | 1 635 |
| 7 | 72 965 | 109 | 511 | 2 189 |
| 8 | 80 543 | 121 | 564 | 2 416 |
| 9 (July 2000) | 77 273 | 116 | 541 | 2 318 |
| 10 | 74 754 | 112 | 523 | 2 243 |
| 11 | 72 693 | 109 | 509 | 2 181 |
| 12 | 61 241 | 92 | 429 | 1 837 |
| 13 (July 2001) | 74 617 | 112 | 522 | 2 239 |
| 14 | 59 152 | 89 | 414 | 1 775 |
| 15 | 73 204 | 110 | 512 | 2 196 |
| 16 | 74 278 | 111 | 520 | 2 228 |
| 17 (July 2002) | 59 629 | 89 | 417 | 1 789 |
| 18 | 44 818 | 67 | 314 | 1 345 |
| 19 | 51 236 | 77 | 359 | 1 537 |
| 20 | 50 702 | 76 | 355 | 1 521 |
| 21 (July 2003) | 60 593 | 91 | 424 | 1 818 |
| 22 | 65 622 | 98 | 459 | 1 969 |
| 23 | 73 320 | 110 | 513 | 2 200 |
| 24 | 81 308 | 122 | 569 | 2 439 |
| 25 (July 2004) | 84 523 | 127 | 592 | 2 536 |
| 26 | 83 244 | 125 | 583 | 2 497 |
| 27 | 89 370 | 134 | 626 | 2 681 |
| 28 | 95 154 | 143 | 666 | 2 855 |
| 29 (July 2005) | 102 956 | 154 | 721 | 3 089 |
| 30 | 112 269 | 168 | 786 | 3 368 |
| 31 | 120 395 | 181 | 843 | 3 612 |
| 32 | 135 583 | 203 | 949 | 4 068 |
| 33 (July 2006) | 121 880 | 183 | 853 | 3 656 |
| 34 | 133 087 | 200 | 932 | 3 993 |
| 35 | 146 220 | 219 | 1 024 | 4 387 |
| 36 | 154 477 | 232 | 1 081 | 4 634 |
| 37 (July 2007) | 161 064 | 242 | 1 127 | 4 832 |
| 38 | 152 559 | 229 | 1 068 | 4 577 |
| 39 | 133 023 | 200 | 931 | 3 991 |
| 40 | 114 377 | 172 | 801 | 3 431 |

The table displays the total net assets size of all funds in our sample. The market share breakpoint values separating the four groups during each quarter of the sample are 0.15%, 0.7% and 3.0%.

## Table B4. Hypothesis 1: Regression Results

*Explanatory Variable: Market Share*
*Independent Variable: Excess Returns*

| Years | Coefficient | p-value | $R^2$ |
|---|---|---|---|
| **1-10** | -0.00006 | 0.451 | 0.000 |
| **1-5** | -0.00008 | 0.493 | 0.000 |
| **6-10** | -0.00003 | 0.661 | 0.000 |

Table B4 shows the results for hypothesis 1. Market share is regressed on excess returns for the entire sample period (July 1998 to June 2008) and the two halves of the sample (July 1998 to June 2003 and July 2003 to June 2008). The table also displays the results for regressing market and market share raised to the power of two on excess returns. As explained in section 6.1 a significant squared coefficient would show that a relation caring non-linear properties better captures the impact of fund size on performance. For all regressions coefficients, p-values and $R^2$ values are accounted for.

Notes: *, **, and *** connote significance at the 10%, 5%, and 1% levels, respectively

## Table B5. Hypothesis 2: Regression Results

*Explanatory Variable: Market Share*
*Independent Variable: Standard Deviation of Excess Returns*

| Years | Group | Coefficient | | p-value | $R^2$ |
|---|---|---|---|---|---|
| **1-10** | All Funds | -0.053 | ** | 0.020 | 0.020 |
| | 1 (Smallest Funds) | -0.006 | *** | 0.000 | 0.000 |
| | 2 | -0.008 | ** | 0.014 | 0.014 |
| | 3 | 0.000 | *** | 0.000 | 0.000 |
| | 4 (Largest Funds) | 0.000 | *** | 0.004 | 0.004 |
| **1-5** | All Funds | -0.071 | ** | 0.030 | 0.030 |
| | 1 (Smallest Funds) | -0.002 | *** | 0.000 | 0.000 |
| | 2 | -0.009 | *** | 0.010 | 0.010 |
| | 3 | -0.001 | *** | 0.001 | 0.001 |
| | 4 (Largest Funds) | -0.000 | ** | 0.019 | 0.019 |
| **6-10** | All Funds | -0.034 | ** | 0.018 | 0.018 |
| | 1 (Smallest Funds) | 0.019 | *** | 0.008 | 0.008 |
| | 2 | -0.003 | *** | 0.007 | 0.007 |
| | 3 | 0.001 | *** | 0.006 | 0.006 |
| | 4 (Largest Funds) | 0.000 | *** | 0.006 | 0.006 |

Table B5 presents the result from regressing market share on the standard deviation of excess returns (tracking error). Results are displayed for the periods July 1998 to June 2008 and the two periods of time July 1998 to June 2003 and July 2003 to June 2008, along with a subdivision of all data into each size group. The table includes all coefficients, p-values and $R^2$ values.

Notes: *, **, and *** connote significance at the 10%, 5%, and 1% levels, respectively

## Table B6. Regression Results: Net Fund Flows on Performance

*Explanatory Variable: Net Fund Flows*
*Independent Variable: Excess Returns*

| Years | Group | Flows | Coefficient | | p-value | $R^2$ |
|---|---|---|---|---|---|---|
| **1-10** | 1 (Smallest Funds) | All | 1.527 | | 0.623 | 0.001 |
| | | Positive | 4.758 | | 0.351 | 0.004 |
| | | Negative | -0.218 | | 0.963 | 0.000 |
| | 2 | All | 0.437 | | 0.581 | 0.001 |
| | | Positive | -0.099 | | 0.951 | 0.000 |
| | | Negative | -0.076 | | 0.940 | 0.000 |
| | 3 | All | 0.077 | | 0.683 | 0.000 |
| | | Positive | 0.333 | | 0.210 | 0.006 |
| | | Negative | -1.141 | *** | 0.003 | 0.041 |
| | 4 (Largest Funds) | All | 0.074 | | 0.215 | 0.003 |
| | | Positive | 0.075 | | 0.306 | 0.005 |
| | | Negative | -0.251 | | 0.226 | 0.006 |
| **1-5** | 1 (Smallest Funds) | All | 7.524 | | 0.264 | 0.007 |
| | | Positive | 7.281 | | 0.346 | 0.008 |
| | | Negative | 15.833 | | 0.351 | 0.012 |
| | 2 | All | -0.229 | | 0.886 | 0.000 |
| | | Positive | -0.643 | | 0.811 | 0.001 |
| | | Negative | -1.564 | | 0.484 | 0.007 |
| | 3 | All | 0.038 | | 0.889 | 0.000 |
| | | Positive | 0.027 | | 0.935 | 0.000 |
| | | Negative | -1.533 | * | 0.096 | 0.026 |
| | 4 (Largest Funds) | All | 0.057 | | 0.498 | 0.002 |
| | | Positive | 0.019 | | 0.844 | 0.000 |
| | | Negative | -0.472 | | 0.276 | 0.011 |
| **6-10** | 1 (Smallest Funds) | All | -1.981 | | 0.465 | 0.003 |
| | | Positive | 1.533 | | 0.807 | 0.001 |
| | | Negative | -3.414 | | 0.270 | 0.010 |
| | 2 | All | 0.308 | | 0.621 | 0.001 |
| | | Positive | -0.060 | | 0.957 | 0.000 |
| | | Negative | 0.874 | | 0.361 | 0.005 |
| | 3 | All | -0.246 | | 0.320 | 0.005 |
| | | Positive | 1.482 | *** | 0.008 | 0.063 |
| | | Negative | -1.135 | *** | 0.000 | 0.115 |
| | 4 (Largest Funds) | All | 0.042 | | 0.686 | 0.001 |
| | | Positive | 0.214 | | 0.235 | 0.013 |
| | | Negative | -0.149 | | 0.433 | 0.005 |

The table presents the result from regressing net fund flows on excess returns. Results are displayed for the periods July 1998 to June 2008 and the two periods of time July 1998 to June 2003 and July 2003 to June 2008, along with a subdivision of all data into each size group. Flows are measured by total quarterly net fund flows and are tested for all flows and divided by positive and negative net fund flows separately. The table includes all coefficients, p-values and $R^2$ values.
Notes: *, **, and *** connote significance at the 10%, 5%, and 1% levels, respectively

## Table B7. Hypothesis 4: t-Test Results

| Years | Variable 1 Extreme Net Fund Flows | Variable 2 All Net Fund Flows | All Net Flows Variable 1: Extreme Net Fund Flows Variable 2: All Net Fund Flows p-value | | Positive Flows Variable 1: Extreme Positive Net Fund Flows Variable 2: All Positive Net Fund Flows p-value | | Negative Flows Variable 1: Extreme Negative Net Fund Flows Variable 2: All Negative Net Fund Flows p-value | |
|---|---|---|---|---|---|---|---|---|
| | **Group** | | **p(V1<V2)** | **p(V1>V2)** | **p(V1<V2)** | **p(V1>V2)** | **p(V1<V2)** | **p(V1>V2)** |
| **1-10** | All Funds | | 0.950 | 0.050 ** | 0.348 | 0.652 | 0.920 | 0.080 * |
| | 1 (Smallest Funds) | | 0.925 | 0.076 * | 0.087 * | 0.913 | 0.577 | 0.423 |
| | 2 | | 0.580 | 0.420 | 0.477 | 0.523 | 0.639 | 0.361 |
| | 3 | | 0.781 | 0.219 | 0.976 | 0.024 ** | 0.960 | 0.040 ** |
| | 4 (Largest Funds) | | 0.788 | 0.212 | No extreme observations | | 0.866 | 0.134 |
| **1-5** | All Funds | | 0.702 | 0.298 | 0.474 | 0.527 | 0.792 | 0.209 |
| | 1 (Smallest Funds) | | 0.897 | 0.103 | 0.240 | 0.760 | 0.665 | 0.335 |
| | 2 | | 0.432 | 0.568 | 0.668 | 0.332 | 0.618 | 0.382 |
| | 3 | | 0.419 | 0.581 | 0.853 | 0.147 | 0.704 | 0.296 |
| | 4 (Largest Funds) | | 0.405 | 0.595 | No extreme observations | | 0.654 | 0.346 |
| **6-10** | All Funds | | 0.888 | 0.112 | 0.352 | 0.648 | 0.773 | 0.227 |
| | 1 (Smallest Funds) | | 0.756 | 0.244 | 0.070 * | 0.930 | 0.373 | 0.627 |
| | 2 | | 0.654 | 0.346 | 0.366 | 0.634 | 0.523 | 0.477 |
| | 3 | | 0.817 | 0.183 | 0.978 | 0.022 ** | 0.966 | 0.034 ** |
| | 4 (Largest Funds) | | 0.975 | 0.025 ** | No extreme observations | | 0.973 | 0.027 ** |

Table B7 shows the results for the difference of means t-test, testing if there is a significant difference in the excess returns between funds experiencing extremely large net fund flows (over 20 % of TNA) during a quarter against the returns of all funds. Results are displayed for the periods July 1998 to June 2008 and the two periods of time July 1998 to June 2003 and July 2003 to June 2008, along with a subdivision of all data into each size group. The t-Tests are shown for all flows and additionally for positive and negative net fund flows separately. No results are shown for positive flows as no extreme positive fund flows occurred during the sample period for the group of largest funds, Group 4. The table includes p-values indicating the significance for variable 1 being smaller than variable 2 and for variable 1 being greater than variable 2.

Notes: *, **, and *** connote significance at the 10%, 5%, and 1% levels, respectively

## Table B8. Hypothesis 5: Regression Results

| Years | Group | Coefficient | | p-value | $R^2$ |
|---|---|---|---|---|---|
| **1-10** | All Funds | 0.033 | ** | 0.014 | 0.001 |
| | 1 (Smallest Funds) | 0.056 | ** | 0.041 | 0.003 |
| | 2 | -0.014 | | 0.613 | 0.000 |
| | 3 | 0.019 | | 0.468 | 0.040 |
| | 4 (Largest Funds) | 0.006 | | 0.828 | 0.000 |
| **1-5** | All Funds | 0.007 | | 0.719 | 0.000 |
| | 1 (Smallest Funds) | 0.020 | | 0.610 | 0.000 |
| | 2 | -0.058 | | 0.156 | 0.003 |
| | 3 | 0.007 | | 0.854 | 0.000 |
| | 4 (Largest Funds) | -0.004 | | 0.922 | 0.000 |
| **6-10** | All Funds | 0.127 | *** | 0.000 | 0.017 |
| | 1 (Smallest Funds) | 0.196 | *** | 0.000 | 0.040 |
| | 2 | 0.144 | *** | 0.000 | 0.022 |
| | 3 | 0.076 | ** | 0.041 | 0.007 |
| | 4 (Largest Funds) | 0.027 | | 0.452 | 0.001 |

Table B8 presents the result from regressing excess returns from the previous month on the present month's excess return. Results are displayed for the periods July 1998 to June 2008 and the two periods of time July 1998 to June 2003 and July 2003 to June 2008, along with a subdivision of all data into each size group. The table includes all coefficients, p-values and $R^2$ values.

Notes: *, **, and *** connote significance at the 10%, 5%, and 1% levels, respectively

## Table B9. Contingency Table of Winners and Losers

| Period | Years | Group | | Period: t Winner | Loser |
|---|---|---|---|---|---|
| **t – 1** | **1-10** | **All Funds** | Winner | **23%** | 25% |
| | | | Loser | 25% | **27%** |
| | | **1** | Winner | **25%** | 24% |
| | | | Loser | 23% | **29%** |
| | **6-10** | **All Funds** | Winner | **24%** | 25% |
| | | | Loser | 25% | **27%** |
| | | **1** | Winner | **26%** | 22% |
| | | | Loser | 21% | **31%** |
| | | **2** | Winner | **25%** | 24% |
| | | | Loser | 23% | **28%** |
| | | **3** | Winner | **24%** | 26% |
| | | | Loser | 23% | **27%** |

Table B9 show the contingency table for the outcomes in Table B8 that were significant. A fund is classified as a winner if the excess return of that fund is greater than the mean excess return of all active funds in that period, otherwise it is a looser. The contingency table shows if persistence is predominantly concentrated to winners or losers based on the concentration of winner to winner periods being greater or smaller than loser to loser periods.