STOCKHOLM SCHOOL OF ECONOMICS

Master Thesis in Accounting and Financial Management

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Swedish Equity Funds: A Study of Performance and Return Persistence

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Abstract

Previous research has shown that equity funds tend to not over perform in relation to the market index regardless of the fund's investment strategy. However, academic opinions are ambiguous regarding whether equity funds exhibit persistence in performance and if equity funds' performance can be explained by market timing ability.

This study examines the performance of 99 Swedish equity funds investing domestically during the time period of 1993-2008. We have studied the risk adjusted performance of these funds and if they show signs of performance persistence in their returns using different lengths of sub periods. Furthermore, using the methodology of Treynor and Mazuy we have studied if over performance can be attributed to stock-picking and/or market timing.

The study finds that actively managed Swedish equity funds do not tend to over perform to any great extent. However when isolating small-cap funds, the risk adjusted performance is higher. Regarding performance persistence, we find statistically significant results for certain time periods but persistence using 24 months sub periods is especially strong. With regards to market timing and stock-picking we cannot find evidence of any positive market timing ability within our fund sample.

Key words: Equity funds, Jensen's Alpha, Performance Persistence, Market Timing Ability, Treynor and Mazuy

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Oskar Steneryd and André Löfdahl

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1. Introduction

In this section we will give some background to the paper and list the purpose and main questions of our paper. We will also address the previous research relevant to our study.

1.1 Background

The interest in equity fund saving has increased in Sweden during the last decade and the market for Swedish equity funds has experienced high growth. On December 31, 1993 the Swedish equity fund market was valued at 145.2bn SEK and on December 31, 2008 the value had grown to 542,5bn SEK, an increase of 273% (Fondbolagens Förening$_1$). One important reason for this growth is that since January 2000, 5.4 million Swedes have been able to invest their pensions in PPM[1], and as a consequence, around 30bn SEK is annually invested in the Swedish fund market through this system (PPM). Equity fund saving is widespread amongst Swedish citizens. A survey at the end of 2008 revealed that 98% of all adults invest in funds when PPM savings is included, and 74% invest when PPM savings are excluded (Fondbolagens Förening$_2$). In the past year we can also observe an increase in the savings and in the last quarter of 2008 the net savings in Sweden amounted to 30bn SEK (SCB).

Given the amount of public interest in equity fund saving in Sweden we feel that studying the Swedish fund market and more specifically *how equity funds perform* would be an interesting subject to look deeper into. If we turn to the previous research conducted within the field of fund performance the opinions are ambiguous, however we find some academic consensus that actively managed funds tend to *not* over perform compared to a market index, and thus when including the fees that fund managers charge, the returns for the funds are in many cases worse than just following a passive index strategy (Otten and Bams, 2002). This raises the question of how an investor should act in order to attain the highest possible return from her investment given that she invests in an actively managed equity fund. One answer could be to evaluate the funds' performance based on its historical performance. A survey in fact shows that 30% of all Swedish investors consider the information regarding historical performance as important when choosing a fund to invest in (Fondbolagens Förening$_2$). If persistence were to be found and connected to over performance, this could motivate why a rational investor should choose to invest in certain actively managed equity funds based on their superior historical performance.

We therefore think it would be of interest to explore how actively managed Swedish equity funds investing domestically have performed compared to a market index. Based on this information we then aim to determine if a fund's past performance can be indicative of its future performance with the hypothesis that a fund that has performed better than average in the past will also be more likely to perform better than average in the subsequent period. In modern financial theory a common argument is that the return for a specific time period is not dependent upon historical return. Rather, its development can be described according to a *random walk* theory where historical performance is irrelevant to the future performance (Fama, 1965). However, the existence of performance persistence in consecutive time periods for equity funds would imply the relevance of considering the past performance. Past performance is also an attribute which

[1] The public pension funds system in Sweden

many equity fund managers use to market their funds, whereby we feel that it is important to clarify whether such information is of interest to a rational investor.

Closely connected to this is an assessment of what a fund's over performance in relation to a market index depends on. This leads us on to the last part of the paper where we want to explain if a fund's over performance depends on the fund manager's stock-picking ability[2]. Or if performance can be explained by the manager's market timing ability[3].

1.2 Purpose and Main Question of the Paper

Our aim with this paper is to asses whether Swedish equity funds investing domestically have over performed in the studied time period of 1993-2008, and to evaluate whether performance persistence exists for varying lengths of time. We also aim to explain if over performance can be explained in terms of market timing ability or stock-picking ability. In order to answer this, we have broken down the purpose into three main questions;

1. Can we find Swedish equity funds investing domestically that have produced a statistically significant over performance in the studied time period of 1993-2008?
2. Can we find statistically significant performance persistence amongst Swedish equity funds investing domestically? If so, can we observe difference in persistence between equity funds that have generated over performance, compared to equity funds which have not generated over performance?
3. Can observed over performance in the fund sample be explained by a market timing ability?

The first question will be answered by regressing weekly fund observations against their corresponding market index in order to evaluate the risk adjusted performance for each fund over its observed time period. The risk adjusted performance will be measured using Jensen's Alpha.

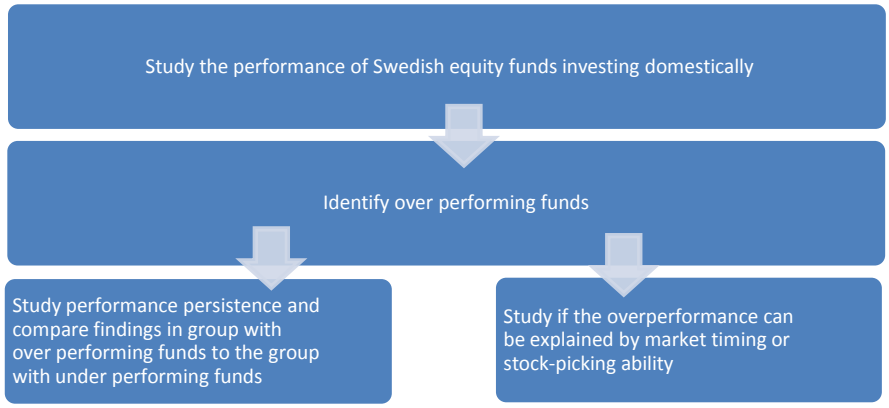
In order to answer the second question we will study the performance persistence for our fund sample with a non-parametric test. This will be done by dividing the whole studied time period of 1993-2008 into shorter sub periods and thereafter compare the performance in two subsequent sub periods in order to determine whether performance persistence exists. We will also perform a parametric test as a complement to the non parametric test, to improve the robustness of our results.

[2] The manager's ability to select stocks with higher than average return given the stocks specific risk

[3] The manager's ability to foresee market movements and correspondingly shift the investment from stocks with high respectively low beta depending on what market conditions are expected

The third question explores the potential reasons for over performance. In order to examine this we will use the methods developed by Treynor and Mazuy (1966) where over performance of funds is explained in terms of market timing ability or stock-picking ability.

Table 1
Structure of the Paper



1.3 Contribution and Added Value of the Paper

Several previous studies have been performed in the area of fund performance and performance persistence. Most of them have a focus on the U.S. fund market and apart from Dalhquist et al (2000) and Engstöm (2004) papers on performance persistence and characteristics of Swedish mutual funds, few studies with a sole focus on Swedish equity funds have been published. In our paper we will study the performance of Swedish equity funds and try to link this to performance persistence. When studying performance persistence of the funds, we will evaluate more lengths of time periods than any previously published paper. With this paper we will also explain if a fund's over performance can be explained according to the theories of Treynor and Mazuy regarding market timing and stock-picking ability, a subject that to our knowledge has not previously been studied on the Swedish equity fund market.

1.4 Previous Research

Fund Performance

The evaluation of mutual fund performance has been a topic of intense academic discussion. Treynor (1965) and Sharpe (1966) concluded that a fund should be evaluated based on its expected return and its expected variability of risk. Using this methodology to evaluate mutual funds in the U.S., Sharpe found that mutual funds in general neither beat the market nor have the ability to anticipate the movements of the market. Following the work of Treynor and Sharpe, Jensen (1968) then developed a method to evaluate fund performance. In the model, Jensen chooses to regress the excess return of the funds against the excess return of a relevant market so that a fund's performance is measured relative to a benchmark. This model has become widely used when evaluating fund performance even though later research has modified the model in order to account for more factors. Using his model, Jensen studied the performance of 115 mutual funds in the U.S. during 1945-1964 and found that mutual funds on average were not able to predict security prices well enough to outperform a buy-and-hold index strategy, net of costs.

In a more recent paper Malkiel (1995) attains the same results when looking at equity funds on the U.S. market during 1971-1991. Even when studying the gross returns (excluding fund fees), Malkiel determined that the funds in general underperformed in relation to the market index. Using a sample of 270 funds and examining them during 1985-1994, Gruber (1996) concludes that active management of mutual funds adds value but since average expenses for holding a fund are greater than the added value by active management, mutual funds underperform relative the market. Wermers (2000) also concludes that mutual funds during 1975-1994 underperformed in relation to a broad market index on a net return level.

The research presented above mostly concerns U.S. data, but studies on European data have also been made, most notably Otten and Bams (2002). They study five major European markets, using a sample which is free from survivorship bias[4]. They find that European funds, on average, deliver positive risk-adjusted returns to investors. The finding is especially strong amongst small-cap funds. Treynor and Mazuy (1966) and Henriksson (1984) come to the same conclusion when evaluating abnormal returns over 6-10 years through managers' market timing ability.

Fund Persistence

A number of papers study the existence of persistence in mutual fund returns and their empirical results vary. Below, empirical studies will be listed according to their findings.
Hendricks et al (1991) find evidence of one-year persistence in the relative performance of equity funds. By examining a sample of 165 U.S. equity funds' returns during 1974-1988 they determine that the persistence of over performance proves to be significant and that persistence is especially significant for evaluation periods of one year. Brown and Goetzmann (1995) examine a sample of 829 equity funds in the period 1976-1988 and their empirical findings also support the existence of one-year persistence in relative performance. While concluding that investing in funds with superior performance is a positive alpha strategy, the authors also determine that the strategy is characterized by a high level of risk. This risk is not diversifiable due to the correlation across funds which over perform. Droms and Walker (2001) test for short-term persistence by examining a sample of 473 international equity funds during 1977-1996. Their empirical findings show statistically significant performance for evaluation periods of one year, but no persistence can be observed for evaluation periods amounting to two, three or four years.

Grinblatt and Titman (1992) study a sample of 279 equity funds during the period 1974-1984 and by dividing the study period into two sub periods, the authors want to examine persistence over a relatively longer time horizon. The authors' results indicate that there is positive persistence in mutual fund performance when the study period amounts to ten years. Elton et al (1996) find evidence of persistence by studying mutual fund performance over the period 1981-1993. The authors empirical results show that both 1-year and 3-year alphas carry information about future performance on a risk-adjusted basis.

Carhart (1997) reports evidence of persistence in underperformance, i.e. funds that underperform in one time period also continue to underperform in the coming time period. In a more recent study, Droms (2006) summarizes and discusses the evidence of persistence for U.S. based funds. He finds evidence of persistence in one-year periods, but evidence of persistence for longer periods is once again weak and that persistence is stronger among underperforming funds.

[4] The tendency for dead funds to be excluded from performance studies because they no longer exist

Furthermore, Droms argues that since persistence is likely to be affected based on the period in which it is tested, the results of persistence studies need to be interpreted with caution, and should not be the only criterion for choosing a mutual fund to invest in.

Swedish Research

Dalhquist et al (2000) study fund performance and specific fund characteristics on the Swedish market during 1993-1997. They find that small funds tend to over perform to a larger extent than their larger comparables. Also funds with low fees and high trading activity tend to have a better relative performance. However, the majority of the Swedish equity funds used in the sample produced an alpha close to, or below zero. With regards to performance persistence they do not find any significant performance persistence in equity funds but they do find one-year persistence for some of the money market funds.

Engstöm (2004) addresses the question whether active management creates value. In the paper, Engstöm studies 112 Swedish equity funds during 1996-2000. He finds that small-cap equity funds tend to have a higher return than large-cap equity funds, supporting the results presented by Dahlquist et al (2000). Once again, performance persistence can be found for money market funds to some degree but not for the funds investing in equities.

Market Timing Ability

There are several studies that evaluate the market timing ability of mutual fund managers. A majority of these studies find little evidence of fund managers possessing such an ability. Treynor and Mazuy (1966) derived a model in order to test for fund managers' market timing ability. They were only able to find significant market timing ability in one out of a sample of 57 U.S. mutual funds during 1953-1962. Thus their findings indicate that fund managers do not have such an ability. Henriksson (1984) concludes that market timing is rare when evaluating performance in a sample of 116 mutual funds on the U.S. market. Out of the 116 actively managed funds, only 3 funds' performance could be explained by a significant market timing ability. Daniel et al (1997) also confirm the findings mentioned above. They are not able to find any contribution of the market timing ability to the fund performance when studying a sample including 2500 funds existent during 1974-1994. Graham and Harvey (1996) make a slightly different analysis of market timing ability. They look at investment newsletters' suggested allocations between equity and cash and neither they are able to find any evidence of market timing. Bauer et al (2006) use a sample of 143 New Zeeland mutual funds for the period of 1990-2003 and once again are not able to find any evidence of market timing ability.

However, not all studies dismiss the existence of market timing. Bollen and Busse (2005) study the performance of 230 U.S. mutual funds during 1985-1995 and the authors show that roughly 40% of the funds exhibit significant positive market timing ability. Jan et al (2004) are also able to demonstrate that market timing ability is significant amongst U.S. mutual fund managers. They conclude that equity funds with an aggressive growth strategy are more active in timing the market than income funds or balanced funds.

1.5 Delimitation

Purpose of Paper

In this paper, we will concentrate on evaluating Swedish equity funds investing domestically according to their performance and to study if a fund's past performance is indicative of its

future performance. Finally we will evaluate whether performance can be explained in terms of market timing or stock-picking ability. We will not try to explain the consequences of following an investment strategy where the investor considers the previous performance of a fund when choosing which funds to invest in. Although this is an interesting area, we feel that this lies outside the scope of the paper.

Delimitation of Data

We have chosen to study Swedish equity funds investing domestically and disregard non-equity funds such as obligation funds and hybrids of equity and obligation funds. The reason for this delimitation is the availability of data through the SIX Trust database and the scope of the paper.

Time Frame of Study

Similar studies made on other equity fund markets, foremost on the U.S. equity fund market, were able to have a longer time frame than the time frame used in our paper spanning from 1993-2008. This is in part due to the fact that the Swedish equity fund market differs from its U.S. counterpart in terms of the number of funds offered and when the fund market was first established. In Sweden, there are few funds available before 1993 why we feel that the statistical relevance would be less meaningful. A natural end of the study is December 31, 2008, where we have the data for the complete year of 2008.

1.6 Disposition

After this initial section a *Theoretical Framework* section will follow where theories relevant to our paper are presented and where we will look deeper into some of the prior research that has been discussed above. The purpose with the section is to form an understanding regarding the questions of our study as well as our empirical results. The *Data* section will then allow us to present what criteria the gathered data must meet, how this data has been gathered and a description of its characteristics. Under the section *Method* we will describe how the theoretical framework will be applied upon our data in order to reach our empirical results. Under *Analysis* we will present the results and then a discussion of these results will follow in *Conclusion*. Here we will also sum up the paper and look upon our made assumptions and potential areas of improvement for the paper.

2. Theoretical Framework

Below we will present our hypothesis, theories and prior research relevant to form an understanding of the main question of the study and our empirical results.

2.1 Overview

In order to study the funds' performance in relation to a benchmark we must first choose a model with which we can perform such an evaluation. There are many ways to do this and we will use Jensen's Alpha as a measure of a fund's risk-adjusted returns.

To test for performance persistence we will conduct two statistical tests. One non-parametric test where we will rank the funds according to their performance in relation to the median performance of the fund sample for a specific time period, and one parametric test, an auto regression where we will examine how well a fund's performance in a period correlates with the performance in the following period. It is important to note that these two tests will give answers to two different questions. Although both tests evaluate persistence in performance they do not define over and under performance in the same way. The non-parametric test will give an insight into how a specific fund has performed in relation to other funds, whereas the parametric test disregards other funds performance when evaluating a specific fund's persistence.

In order to answer our third question, whether a fund's over performance can be explained by the fund manager's market timing ability, we will use a method based on the theories developed by Treynor and Mazuy (1966), where they conduct a quadratic regression in order to study how a fund's over performance can be explained by market timing ability. If no market timing can be found, the conclusion is that a fund's over performance depends on stock-picking ability alone.

2.2 Measuring Fund Performance through Jensen's Alpha

To conduct a risk-adjusted evaluation of a fund's performance it is necessary to use a model that considers the performance of a benchmark and the performance of a risk-free investment. Also, in order to compare our study with previous research within the field, Jensen's Alpha is a good method since it is has been widely used when evaluating risk-adjusted returns.

The term *alpha* was defined by Jensen in 1968. Jensen followed the works of Sharpe, Lintner, Treynor and Mossin on the Capital Asset Pricing Model (CAPM)[5]. They concluded that a security's expected return (R_{it}) will increase if its systematic risk, *beta (*β_i), increases.

$$R_{it} = R_{ft} + \beta_i (R_{Mt} - R_{ft})$$

Jensen wanted to see if an equity fund manager could outperform the market over a longer period. In order to do so, Jensen added a term to the CAPM formula, *alpha (*α_i).

$$R_{it} = \alpha_i + R_{ft} + \beta_i (R_{Mt} - R_{ft})$$

The alpha term captures the fund manager's ability to perform above the market and thus a positive alpha implies that the fund has outperformed in relation to its expected return which is based on the chosen benchmark.

Equation 1

Fund Performance through Jensen's Alpha

$$R_{it} - R_{ft} = \alpha_{it} + \beta_i(R_{Mt} - R_f) + \varepsilon_{it}$$

R_{it} = the return for fund i in period t
R_{ft} = the risk-free rate in period t
R_{Mt} = the return of the market portfolio in period t
α_{it} = the risk-adjusted return for fund i in period t
β_i = the systematic risk for fund i
ε_{it}= the random term for fund i during period t.

In order to use this simple regression model the following assumptions must hold;

1. The average value of $(R_{it} - R_{ft})$ given each value of $(R_{Mt} - R_{ft})$ is given by the linear regression, $R_{it} - R_{ft} = \alpha_{it} + \beta_i(R_{Mt} - R_{ft}) + \varepsilon_{it}$
2. The expected value of the random term, $E(\varepsilon_{it}) = 0$
3. The variance of the random term is $var(\varepsilon_{it}) = \sigma^2 = var(R_{it} - R_{ft})$
4. The covariance between two random terms, ε_{it} and ε_{jt} is $cov(\varepsilon_{it,}; \varepsilon_{jt}) = cov(R_{it} - R_{ft}; R_{jt} - R_{ft}) = 0$
5. The independent variable, $(R_{Mt} - R_{ft})$, is not random and must assume at least two different values
6. The random errors are normally distributed around their expected value

[5] CAPM is one method to determine a theoretically appropriate required rate of return for an asset

2.3 Testing Performance Persistence

We have chosen to test performance persistence using two different methods. The cross product ratio test is a non-parametric test which identifies funds as winners or losers based on a fund's return in relation to the median of all funds' returns reported during the equivalent period. Then we will evaluate the performance in the following period in the same way and thereafter group the funds based on their performance in the two periods.

In the auto regression, the alphas in the first period will be regressed against the alphas in the subsequent period. A significant positive slope coefficient indicates a positive persistence in the fund performance, whereas a significant negative slope coefficient would indicate negative persistence in the fund performance. The regression model is displayed under *Equation 2*.

Equation 2

Performance Persistence Regression Model

$$r_t = \alpha_0 + \alpha_1 r_{t-1} + \varepsilon_{it}$$

r_t = the risk adjusted return in period t
r_{t-1} = the risk adjusted return in period t-1
α_0 = intercept
α_1 = slope coefficient
ε_{it} = the random error term in period t

The equation above must meet the same criteria stated for the simple regression model displayed in *Equation 1*.

2.4 Measuring Fund Performance through Treynor and Mazuy Ranking

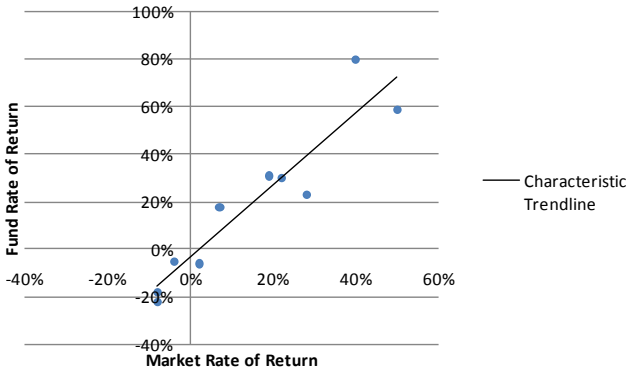
In order to test whether a fund's risk adjusted return can be explained by market timing or stock-picking ability, we will apply the Treynor and Mazuy's model which allows for a differentiation between market timing and stock-picking.

Treynor and Mazuy's quadratic model accounts for the possibility that a portfolio manager can have certain expectations regarding the market development, and that she thereafter will adjust the portfolio's beta accordingly. If the fund manager anticipates a positive development on the market, she will increase the portfolio's beta in order to earn higher returns. The fund manager will on the other hand reduce the portfolio's beta by increasing holdings in equities with low volatility, if market conditions are expected to be poor.

The Treynor and Mazuy model can be explained by a characteristic line which is based on a fund's return in relation to an index. If the slope is constant in both market conditions, the characteristic line will be straight as shown in *Table 2*. In this case, the volatility of a fund is simply determined as the tangent of the line. Returns exhibiting this sort of characteristic line have constant volatility regardless of market conditions.

Table 2

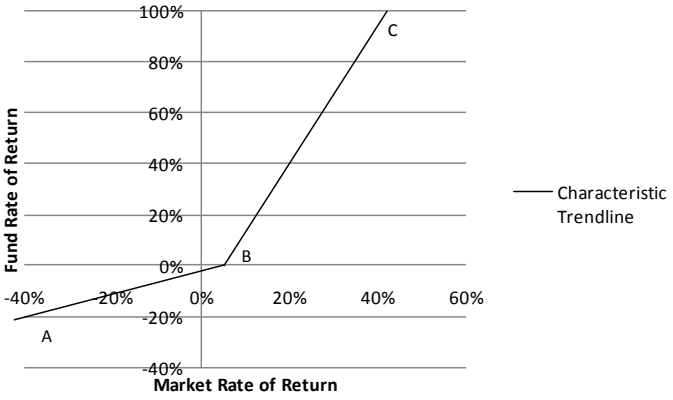
Funds with Constant Volatility



If a fund manager is continuously able to outguess the market, the characteristic line will behave like in *Table 3*. When market conditions are expected to be better, management elects a highly volatile composition of equities as shown by the characteristic line between B-C and when worse market conditions are predicted, the low volatility composition forms the characteristic line observed between points A-B.

Table 3

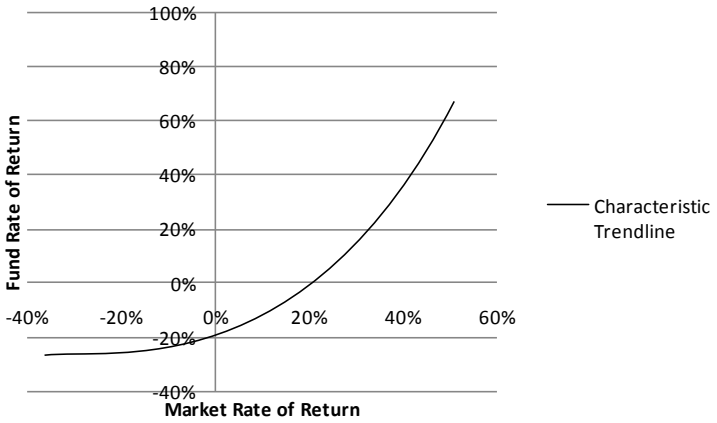
Funds That Have Consistently Outguessed the Market



However, finding a fund manager that has the ability to consistently outguess the market is not very likely. A more likely scenario is that predictability of market fluctuations improves the higher these fluctuations are. This would entail a fund volatility which gradually shifts from a flat slop in very poor market conditions to a steep slope in very good market conditions, resulting in a curved characteristic line, displayed in *Table 4*.

Table 4

Funds that has Outguessed the Market with Better-Than-Average Success



Treynor and Mazuy (1966) developed a model in order to assess if a mutual fund manager has the ability to over perform through market timing or stock-picking ability. In order to evaluate the fund's success in anticipating turns in the market we will utilize Treynor and Mazuy's quadratic model displayed under *Equation 3*.

Equation 3

Treynor and Mazuy quadratic model

$$R_{it} - R_{ft} = \alpha_{it} + \beta_1(R_{Mt} - R_{ft}) + \beta_2(R_{Mt} - R_{ft})^2 + \varepsilon_{it}$$

R_{it} = the return for fund i during period t
R_{ft} = the risk-free rate in period t
α_{it} =the estimated selectivity performance in period t
β_1= the mutual fund's estimate of systematic risk
R_{Mt} = the return of the market portfolio in period t
β_2= the estimated indicator of market timing performance
ε_{it}= the residual excess return for mutual fund i in period t.

Treynor and Mazuy argued that a positive value for α_{it} implies an ability to successfully select equities that produce a positive return, also called stock-picking ability. Moreover they argued that a positive value for β_2 implies market timing ability since this term allows the characteristic line to become steeper as excess returns on the market index, R_{Mt} increase. A negative value of β_2 implies that the fund manager makes the incorrect predictions regarding market conditions and shifts fund volatility the incorrect way. If β_2 equals zero, this implies either a lack of market timing ability or that there is no attempt to time the market.

Following the work of Treynor and Mazuy, later academic studies have verified their conclusions. For example, Admati et al (1986) show that the rather simple quadratic model developed by Treynor and Mazuy is a valid measure of market timing performance and can be used to identify the quality of timing ability.

2.5 Hypothesis

In order to see how Swedish equity funds investing domestically have performed compared to the market index we have defined the following hypothesis.

Hypothesis 1: *There are Swedish equity funds investing domestically which yield a statistically significant positive alpha*

The effective market hypothesis states that given that fund managers have access to similar information, funds should not over nor underperform the market for consecutive periods. However, as addressed in previous research, several studies show the existence of performance persistence. With this in mind, we aim to study the performance persistence in Swedish equity funds investing domestically, and study if there is a difference in performance persistence when comparing funds with positive alphas to funds with negative alphas. This is the base for our second hypothesis.

Hypothesis 2: *Swedish equity funds investing domestically exhibit performance persistence*

Since we study the correlation between performance in two consecutive periods, we also want to examine what determines this performance. Is it the fund manager's ability to select equities that yield the return (stock-picking ability), or is it the ability to foresee market movement and accordingly move in and out of equities with different risk (market timing ability)? This leads us to our final hypothesis.

Hypothesis 3: *Over performing Swedish equity funds investing domestically exhibit market timing ability*

3. Data

Within this section we will address which data we have chosen to include in the study and how this data has been collected. The collected data will thereafter be used in the analysis in order to evaluate fund performance, performance persistence and fund managers' market timing ability.

3.1 Selection of Time Period

We have chosen to collect weekly net asset value (NAV) observations from Swedish equity funds investing domestically in the time period of January 1993 to December 2008. This gives us 16 years of data for the Swedish fund market.

3.2 Collection of Data

The NAV observations were collected from the SIX Trust Database. This database is a database where SIX, an organization founded by the Stockholm Stock Exchange in 1987, provides market data from the Nordic exchanges and from other international markets (Six Trust).

Since SIX Trust accounts for capital gains and subtracts the administrative fees when calculating fund NAVs, these are aspects which we do not have to account for separately.

In order to determine the beta and the risk-premium for the funds we have used the Swedish STIBOR interbank 30-day rate, for the observed time period. This data is collected from *The Riksbank Database*, provided by Sweden's Central Bank (Sveriges Riksbank).

3.3 Selection of Data

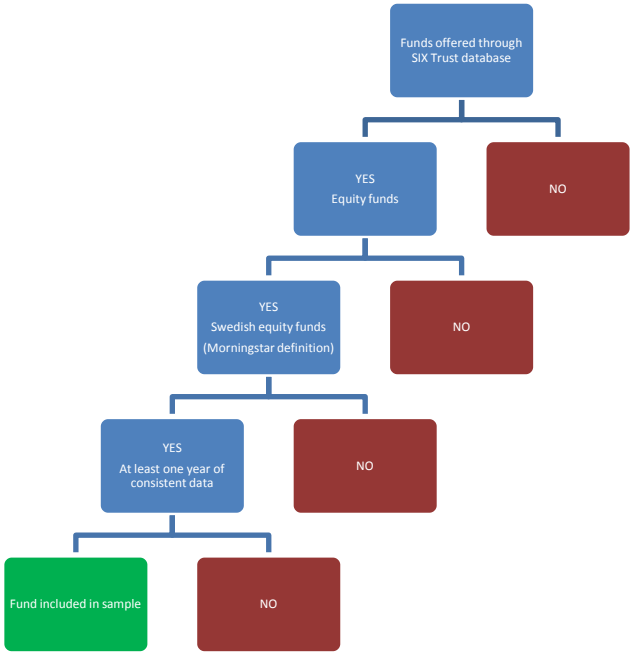
By conducting a cross-check analysis between the funds offered through the SIX Trust database and those funds which are defined as Swedish equity funds by Morningstar, we have selected the funds used in our sample. The funds must have at least one year of consistent data since this is the shortest amount of time over which persistence will be evaluated[6]. We have used the Morningstar definition of a Swedish equity fund, where the fund must invest at least 75% of its total assets in equities and invest at least 75% of equity assets in Swedish equities. Small-cap equity funds primarily invest in equities of small-cap Swedish companies. These companies fall in the bottom 30% of the capitalization of the Swedish equity market (Morningstar).

After choosing the funds based on the criteria above, we ended up with weekly NAVs from 99 Swedish equity funds. 83 of these funds invest primarily in the equities of Swedish medium- and large-cap companies and the remaining 16 funds invest primarily in Swedish small-cap companies. By focusing on the Swedish fund market, we will be able to continue in the steps of previous research on the market, most notably Dalhquist et al (2000) with their study of the Swedish mutual fund market.

[6] Analyzing persistence in 6 month periods implies a selection period of 6 months and an evaluation period of 6 months which in turn requires in total one year of data

Table 5

Fund sample selection process



3.4 Descriptive Statistics

In *Table 6* follows a description of the gathered data where the main characteristics will be listed for the fund sample. All the regressions will be tested with a T-test which assumes that the data is normally distributed. Therefore we will evaluate the skewness and kurtosis of the excess returns in order to determine whether a normal distribution is a reasonable assumption to make. Furthermore, we will also perform a Jarque-Bera (JB) Normality Test and test the null hypothesis that excess returns follow a normal distribution. The formulas for skewness, kurtosis and the JB test can be found in *Appendix C*. The obtained JB coefficient follows a chi-square distribution with two degrees of freedom. The hypothesis will be tested on a significance level of 5%. The results are listed below.

Table 6

Data Description

Excess return (annual)					JB Test
Mean	**Median**	**Std dev**	**Skewness**	**Kurtosis**	**H_0 rejected**
10.34%	11.63%	30.33%	-0.77	4.90	78 (out of 99 tests)

The skewness coefficient is equal to zero and the kurtosis coefficient is three in a normally distributed sample. The average skewness coefficient for the data series for all Swedish equity funds is -0.77 and the kurtosis equals 4.90. The negative skewness implies that the distribution's right tail is shorter than the left tail and the relatively high kurtosis implies that the distribution is characterized by long tails.

The results from the JB-test show that the null hypothesis is rejected for 78 out of 99 funds' excess returns. In other words, only 21 funds passed the normality test. The fact that a majority of the Swedish funds do not pass the normality test limits the robustness of our results since our analysis is based on the assumption of normally distributed data.

4. Method

The Method section includes a description of the methodologies applied in order to examine and fulfill the purpose of the paper. The methods used are either parametric or non-parametric regression models based on the theories described under the Theoretical framework section. The methodology section will in more detail explain the methods used in order for the reader to conduct a similar study.

4.1 Measuring Fund Performance through Jensen's Alpha

Equation 1(Section 2.2) displays the calculation of Jensen's alpha. The regression is based on the fund's return R_{it}. In order to calculate the raw returns, the weekly log-return has been calculated for each fund by using their NAVs in two consecutive periods. As previously mentioned, the NAVs are calculated net of fees but we have adjusted them in order to account for reinvested dividends in those cases where the funds are distributed. In order to obtain the total return the following calculation has been made.

$$R_{it} = ln\left[\frac{NAV_t}{NAV_{t-1}}\left[1 + \frac{D_{it}}{NAV_t}\right]\right]$$

R_{it} = the return in fund i during period t
D_{it} = the sum of dividends for fund i in period *t*

There is no unanimous choice of frequency when calculating returns but we have chosen weekly data since this frequency is the most commonly used in prior research.

The risk free rate of return will be determined by the STIBOR 30-day interbank rate[7]. The STIBOR 30-day interbank rate is defined as an annual interest rate and in order to match R_{it} and R_{Mt}, the STIBOR rate has been converted into weekly rates.

In order to account for the fact that some funds in the sample primarily invest in small-cap companies, we have chosen to adjust the benchmark accordingly. For funds investing in large- and medium cap equities, market return will be calculated using the Six Portfolio Return Index (SIXPRX) which is a weighted index consisting of Swedish equity funds listed in the SIX Trust database. SIXPRX is adjusted for reinvested dividends and accounts for equity fund restrictions, such as no company can weigh more than 10% of the entire portfolio. If funds on the other hand primarily invest in small-cap equities, the market return will be based on the MSCI Sweden small-cap index[8] which also accounts for reinvested dividends. The weekly log-return has been calculated by using the index value from two consecutive periods.

$$R_{Mt} = ln\left[\frac{Market\ index_t}{Market\ index_{t-1}}\right]$$

[7] The STIBOR 30-day interbank rate is a reference rate based on the average interest rate at which banks offer to lend unsecured funds to other banks in the money market
[8] The MSCI Sweden small-cap index was accessed through Thomson Datastream

In order to calculate Jensen's alpha, we must calculate betas for the selection period over which we want to measure performance. The beta that corresponds to each fund will be calculated using CAPM and correspond to the same time period for which we measure alpha. The regression for the different sub periods will be based on the number of weekly observations in that specific sub period. For example, when evaluating performance in a selection period of six months we perform the regression on 26 weekly observations.

4.2 Testing Performance Persistence

4.2.1 Selection of Time Frame

We have chosen to examine persistence by dividing our studied time period into sub periods of different lengths. Most previous studies have used a sub period of 24 months where they use a selection period of 12 months and an evaluation period of 12 months. Apart from this sub period, we will also introduce three other sub periods, a shorter sub period of 12 months and two longer sub periods of 48 and 72 months, displayed in *Table 7*. The reason for this is to evaluate whether potential persistence within our fund sample varies across different time periods.

Table 7

Time Periods Tested for Performance Persistence

Sub Period	Selection period	Evaluation period
12 Months	6 Months	6 Months
24 Months	12 Months	12 Months
48 Months	24 Months	24 Months
72 Months	36 Months	36 Months

Selection period – initial period where the fund's performance is observed
Evaluation period – performance is observed and compared to the performance in the preceding selection period.
Sub period – consists of one selection period and the consecutive evaluation period

4.2.2 Non-parametric test - Cross Sectional Analysis

The cross sectional analysis identifies funds as winners or losers based on a fund's performance in relation to the median of all funds' performance in the selection period. We will then evaluate the performance in the evaluation period in the same way and thereafter group the funds based on their performance in the two periods. A Winner-Winner (WW) is a fund which has outperformed the median of all funds in both selection and evaluation period. For a given sub period funds will be grouped into the following four categories;

1. *WW*: Winner-Winner
2. *WL*: Winner-Loser
3. *LL*: Loser-Loser
4. *LW*: Loser-Winner

Thereafter we have calculated the Cross-Product Ratio (CPR) which reports the odds ratio of the number of repeat performers, WW and LL, to the number of those funds which are not repeat performers, WL and LW. WW and LL are those funds which indicate that persistence exists for a specific study period.

$$CPR = \left|\frac{WW * LL}{WL * LW}\right|$$

In order to test for our second hypothesis we will calculate the CPR for each sub period as well as the CPR for the sum of all sub periods. In order to test for statistical significance, we first determine the standard error for the natural logarithm of the CPR, which is defined as;

$$\sigma_{ln(CPR)} = \sqrt{\frac{1}{WW} + \frac{1}{WL} + \frac{1}{LL} + \frac{1}{LW}}$$

We assume that the natural logarithm of the CPR follows a normal distribution. With the help of a Z-statistic, we will therefore determine whether the CPR-statistic is statistically significant. The Z-statistic can be obtained by dividing the natural logarithm of the CPR by its standard error, calculated above;

$$Z - statistic = \frac{\ln(CPR)}{\sigma_{\ln(CPR)}}$$

4.2.3 Parametric test – Regression Analysis

In the parametric test we conduct a regression analysis on the alphas that each fund generates in the selection period against the alphas that the same fund generates in the consecutive evaluation period.

In order to compare our results from the regression analysis with the results from the non-parametric test we will run the regression using the same length of sub periods. For example, for the sub period of 12 months, we will regress the estimated alpha in the 6 months selection period against the estimated alpha in the following evaluation period of 6 months. A regression will also be run where we add all the sub periods together in order to study the performance persistence for the entire study period. If we find that the alpha in one period can be explained by the alpha in the prior period the slope coefficient, α_1[9] in *Equation 2* (Section 2.3) will be positive.

4.3 Testing Market Timing

In order to study the existence of market timing in our fund sample we will evaluate fund performance using Treynor and Mazuy's quadratic model displayed in *Equation 3* (Section 2.4). This regression is in many ways similar to the simple regression model displayed in *Equation 2* (Section 2.3). To capture how both β_1, the fund's estimated systematic risk, and β_2, the estimated indicator of market timing ability affect over performance, we will run the quadratic regression stated in Section 2.4. Since our aim is to determine the significance of market timing in over performance, we will only run the regression on the funds which have yielded a significant positive return over the entire study period.

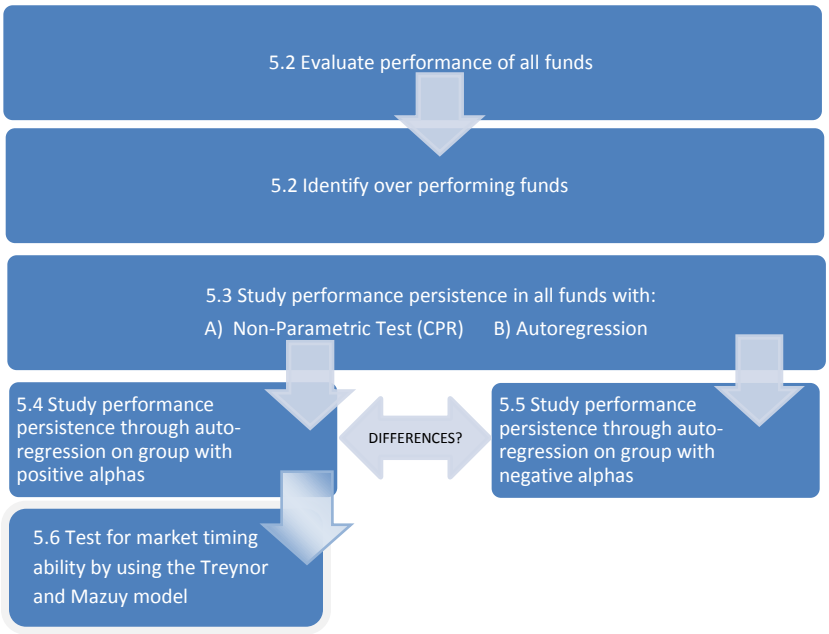
[9] Not to mix up with Jensen's Alpha. This is the slope coefficient for our linear regression to test performance

5. Analysis

Within this section we will first present our empirical findings of our study. These results will then form the base for the discussion in Section 6.

5.1 Overview

Table 8
Structure for Data Analysis



As displayed in *Table 8*, we will separate our analysis into six different sections. The findings within each section are presented below.

5.2 Fund Performance

Table 9 displays a performance summary of all 99 Swedish equity funds in our fund sample, where the alpha has been calculated over each funds lifetime as well as on an annual basis. A small majority of the funds produced a positive alpha in the studied period. When looking at the average annual alpha, it is very close to 0 for the whole fund group. We can also see that small-cap equity funds have produced a slightly higher average annual alpha but it remains close to 0.

Table 9

Performance based on risk-adjusted returns

Fund type	Small-cap	Large-cap/Mid-cap	Complete sample
N	16	83	99
Funds with positive alpha	14	38	52
of which statistically significant (%)	14%	5%	8%
Funds with negative alpha	2	45	47
of which statistically significant	0%	4%	4%
Average annual alpha	0.09%	0.00%	0.01%
Median annual alpha	0.16%	0.05%	0.06%

The data in *Table 9* suggest that the Swedish equity funds used in our sample where *not able* to produce any significant over performance in relation to the SIXPRX or the MSCI Swedish small-cap benchmark. This is in line with previous research in the field of fund performance. Among others Jensen (1968) concluded that actively managed equity funds are not able to over perform in relation to their corresponding index. More relevant to the Swedish fund market is the paper by Dahlquist et al (2000) where the authors conclude that the majority of the Swedish equity funds used in the sample have produced an alpha close to or below zero.

In order to determine whether these results are significant, we have performed a two-tailed T-test on a 5% significance level. The null hypothesis is that alpha[10] equals zero and the alternative hypothesis is that the alpha does not equal zero. Only when the null hypothesis is rejected, can we state that active management in Swedish equity funds does display over or under performance in relation to its corresponding index. The hypothesis will be tested on a significance level of 5%.

H_0: $\alpha = 0$
H_1: $\alpha \neq 0$

When performing this statistical test on the funds' alphas, the null hypothesis can only be rejected for six funds. Two funds have negative alphas and four funds have positive alphas that are statistically significant. The funds which have produced a statistically significant positive alpha make up for 4% of the entire fund sample whereas the funds with statistically significant negative alphas make up for 2%. These funds are presented in *Table 10*.

[10] Jensen's alpha

Table 10
Summary of significant alphas

Fund	Alpha	p-value
Odin Sverige	0.67%	0.019
AMF Pension Aktiefond Sverige	0.62%	0.014
SEB Sverige Småbol Chans/Risk	0.60%	0.025
Carlson Småbolagsfond	0.50%	0.042
SHB SBC Bofonden	-0.32%	0.011
Alfred Berg Sverige	-0.56%	0.035

In the coming sections we will first study performance persistence for the whole fund group and thereafter separately study potential differences between the groups with positive alphas and the group with negative alphas. Finally we will study market timing ability on the group with significantly positive alphas.

5.3 Performance Persistence for Whole Fund Sample

Below we will present our findings on performance persistence from the cross sectional analysis as well as the auto regression for the entire fund sample. The results will be presented following the different lengths of sub periods used to evaluate performance persistence.

5.3.1 Non-parametric Test - Cross Sectional Analysis

In this section we will describe the formulation of the hypothesis[11] and the results. Within the framework of the hypothesis we have stipulated a null hypothesis, H_0, that there is no persistence among the selection and evaluation period. Under H_0 all four outcomes (WW, LL, WL, LW) should be evenly distributed, implying that there is no correlation between relative performances in two consecutive periods. Even distribution would imply a CPR equal to 1, and if there is an overweight for consistency in WW and LL it would imply a CPR of >1.
Based on this we have formulated our null hypothesis;

$$H_0: E(CPR) = 1$$
$$H_1: E(CPR) > 1$$

Table 11 displays the different significance levels for which we have tested the hypothesis and their corresponding value on Z.

Table 11
Overview of values on Z given different statistical significance

Level of statistical significance	Value on Z
1 % significance	**2.575**
2.5 % significance	**2.24**
5 % significance	**1.96**

There is also a possibility that there exists negative persistence in the form of an overweight in the number of funds being grouped as WL and LW. However this is not the type of persistence we aim to evaluate. If such a tendency would occur, this would imply a negative value of Z.

[11] As help when constructing the hypothesis tests, we have used the methodology by Gujarati, 2003.

If, however, funds that perform better than the median in the selection periods will continue to perform better than the median in the evaluation period and vice versa this would imply a positive value for Z.

12 months sub period

Table 12 displays the results from the cross sectional analysis with a 12 months sub period. 1993 H1-H2, 1996 H1-H2, 1997 H1-H2 and 2008 H1-H2 are the sub periods where we find statistically significant persistence in the funds' performance. We have not been able to find statistically significant persistence on a 5% level or less for any other sub periods. Also, from *Table 12*¸ we can see that only 4 out of 16 sub periods in fact showed a tendency for performance persistence, and that the majority of the sub periods did not show any signs of exhibiting performance persistence. However, when summing all sub groups together, the CPR for the sum of all sub periods equals 1.28 and with a corresponding value of Z equal to 1.96 we find performance persistence on a 5% significance level. As a consequence the null hypothesis can be rejected and we can conclude that our fund sample exhibits performance persistence when evaluating the funds using 6 months periods.

Significant on a 1% level Significant on a 2.5% level Significant on a 5% level

Table 12
Results from Cross Sectional Analysis (12 months sub period)

Observed time period	1993 H1-H2	1994 H1-H2	1995 H1-H2	1996 H1-H2	1997 H1-H2	1998 H1-H2	1999 H1-H2	2000 H1-H2	2001 H1-H2	2002 H1-H2	2003 H1-H2	2004 H1-H2	2005 H1-H2	2006 H1-H2	2007 H1-H2	2008 H1-H2	Σ
WW	7	4	2	13	14	14	13	9	21	17	22	25	23	27	20	33	264
LL	7	5	5	14	16	13	14	10	22	18	23	26	23	28	21	34	279
WL	2	6	12	5	8	11	16	23	16	22	18	18	21	20	28	15	241
LW	2	5	10	5	7	13	16	23	16	22	17	18	21	20	28	16	239
Sum	18	20	29	37	45	51	59	65	75	79	80	87	88	95	97	98	1023
CPR	12.25	0.67	0.08	7.28	4.00	1.27	0.71	0.17	1.80	0.63	1.65	2.01	1.20	1.89	0.54	4.68	1.28
Standard Error	1.13	0.90	0.94	0.74	0.63	0.56	0.52	0.55	0.47	0.45	0.45	0.44	0.43	0.42	0.41	0.43	0.13
Z	2.21	-0.45	-2.64	2.68	2.19	0.43	-0.65	-3.24	1.26	-1.01	1.12	1.60	0.43	1.53	-1.52	3.55	1.96

24 months sub period

Table 13 displays the results from the cross sectional analysis with a 24 months sub period. Here we find statistically significant persistence in the funds' alphas on a 5 % significance level for the sub period of 1995-1996. For the sub periods of 2001-2002 and 2005-2006 we find that the cross product ratio is statistically significant at the 1% level. We have not been able to find statistically significant persistence on a 5% level or lower for any other sub periods in the tested time period. We find the same strong indication of persistence when evaluating the sum of all sub periods. In this case we obtain a cross product ratio of 3.59 which is statistically significant at 1% according to the Z-test.

The results imply that the null hypothesis can be rejected and we can draw the conclusion that there is evidence for persistence in performance when the sub period amounts to 24 months.

Table 13
Results from Cross Sectional Analysis (24 months sub period)

Observed time period	1993-1994	1995-1996	1997-1998	1999-2000	2001-2002	2003-2004	2005-2006	2007-2008	∑
WW	5	9	9	17	27	17	31	21	136
LL	5	11	12	17	29	19	35	21	149
WL	4	5	13	12	10	23	13	27	107
LW	4	4	11	13	9	20	9	28	98
Sum	18	29	45	59	75	79	88	97	490
CPR	1.56	4.95	0.76	1.85	8.70	0.70	9.27	0.58	1.93
Standard Error	0.95	0.81	0.60	0.53	0.53	0.45	0.50	0.41	0.18
Z	0.47	1.98	-0.47	1.17	4.07	-0.78	4.46	-1.32	3.59

48 months sub period

Table 14 displays the results from the cross sectional analysis with a sub period of 48 months. Using this sub period, we cannot find any evidence of persistence for any of the sub periods. The same results are obtained when evaluating the sum of all sub periods and therefore we cannot reject the null hypothesis for sub periods of 48 months.

Table 14
Results from Cross Sectional Analysis (48 months sub period)

Observed time period	1993-1996	1997-2000	2001-2004	2005-2008	∑
WW	5	10	17	24	56
LL	7	13	19	22	61
WL	4	12	20	20	56
LW	2	10	18	22	52
Sum	18	45	74	88	225
Cross Product Ratio	4.38	1.08	0.90	1.20	1.17
Standard Error	1.05	0.60	0.47	0.43	0.27
Z	1.41	0.13	-0.23	0.43	0.60

72 months sub period

Table 15 displays the results from the cross sectional analysis with a sub period of 72 months. The cross product ratio amounts to 5.81 for the sub period of 1999-2004. The result is statistically significant on a 1% level. When we sum up the sub periods we obtain a cross product ratio of 6.04, which is statistically significant at a 1% level and we can therefore reject the null hypothesis.

Table 15
Results from Cross Sectional Analysis (72 months sub period)

Observed time period	1993-1998	1999-2004	∑
WW	6	19	25
LL	7	22	29
WL	3	9	12
LW	2	8	10
Sum	18	58	76
Cross Product Ratio	7.00	5.81	6.04
Standard Error	1.07	0.58	0.51
Z	1.82	3.04	3.54

5.3.2 Parametric test – Regression Analysis

Below we will describe the formulation of the hypothesis and the results. Within the framework of the hypothesis we have stipulated a null hypothesis, H_0, that there is no persistence among the selection and evaluation period. Our tested regression is displayed in *Equation 2* (Section 2.3). We will test the following hypothesis on significance level of 5%;

$$H_0: \alpha_1 = 0$$
$$H_1: \alpha_1 \neq 0$$

In order to construct the test we will assume that the samples are independent and randomly chosen and that they follow a normal distribution.

12 months sub period

Table 16 displays the results of persistence tests with a 12 months sub period. The data indicates the existence of performance persistence statistically significant in the sub periods of 1993, 1999, 2000, 2001, 2003, 2004, 2007 and 2008. As for the whole time period we can also find statistically significant performance persistence.

Table 16
Results from OLS regression (12 month sub period)

Observed time period	1993 H1-H2	1994 H1-H2	1995 H1-H2	1996 H1-H2	1997 H1-H2	1998 H1-H2	1999 H1-H2	2000 H1-H2	2001 H1-H2	2002 H1-H2	2003 H1-H2	2004 H1-H2	2005 H1-H2	2006 H1-H2	2007 H1-H2	2008 H1-H2	∑
slope coefficient	0.68	0.24	-0.35	0.98	0.15	0.27	-1.06	-0.36	0.32	-0.05	0.81	0.64	-0.35	0.07	-0.36	1.53	**0.33**
p-value	0.00	0.27	0.10	0.51	0.27	0.16	0.00	0.00	0.00	0.63	0.00	0.00	0.09	0.46	0.00	0.00	**0.00**
R^2	0.69	0.07	0.10	0.01	0.03	0.04	0.31	0.23	0.23	0.00	0.20	0.20	0.03	0.01	0.11	0.54	**0.06**
n	18	20	29	37	45	51	59	65	75	79	80	87	88	95	97	98	**1023**

24 months sub period

Using a sub period of 24 months we find statistically significant performance persistence in the sub periods of 1993-1994 and 2001-2002. As for the whole period we also obtain results that indicate performance persistence which is significant. The results are displayed in *Table 17*.

Table 17
Results from OLS regression (24 month sub period)

Observed time period	1993-1994	1995-1996	1997-1998	1999-2000	2001-2002	2003-2004	2005-2006	2007-2008	∑
slope coefficient	0.28	2.30	-0.45	0.22	0.55	0.13	0.13	0.24	**0.81**
p-value	0.00	0.17	0.05	0.14	0.00	0.08	0.13	0.45	**0.00**
R^2	0.41	0.07	0.09	0.04	0.39	0.04	0.03	0.01	**0.28**
n	18	29	45	59	75	79	88	97	**490**

48 months sub period

Using a sub period of 48 months we find statistically significant persistence for the sub period of 2005-2008 as well as for the whole study period. The slope coefficient is however negative for the entire study period, indicating that persistence is negative. The results are displayed in *Table 18*.

Table 18
Results from OLS regression (48 month sub period)

Observed time period	1993-1996	1997-2000	2001-2004	2005-2008	∑
slope coefficient	0.47	0.09	0.02	0.31	**-0.31**
p-value	0.25	0.59	0.66	0.04	**0.00**
R^2	0.08	0.01	0.00	0.05	**0.15**
n	18	45	74	88	**225**

72 months sub period

Using a sub period of 72 months we find statistically significant persistence in the sub period of 1999-2004 as well as for the whole time period. The results are displayed in *Table 19*.

Table 19
Results from OLS regression (72 month sub period)

Observed time period	1993-1998	1999-2004	∑
slope coefficient	0.29	0.57	**0.71**
p-value	0.11	0.00	**0.00**
R^2	0.15	0.35	**0.35**
n	18	58	**76**

5.4 Performance Persistence in Funds with Positive Alphas

In our analysis of the funds' performance we found that 52 out of a total of 99 studied Swedish equity funds exhibit a positive alpha over the entire study period of 1993-2008. In this section we will study the performance persistence for this group separately by performing an auto regression test under the same forms as the auto regression conducted for the whole fund sample in Section 5.3.2. The following hypothesis will be tested on significance level of 5%;

$$H_0: \alpha_1 = 0$$
$$H_1: \alpha_1 \neq 0$$

The obtained results will be compared to performance persistence within the under performing fund group. In order to get a statistically sufficient number of observations we have chosen to compare *all* funds with positive alpha (52 funds) to *all* funds with negative alpha (47 funds). In *Table 20* we can observe that when only including funds with a positive alpha, we get a positive, statistically significant, slope coefficient implying performance persistence when evaluating fund performance in 12, 24 and 72 months sub periods. The slope coefficient for 48 months is also statistically significant but negative.

Table 20
Results from OLS regression (funds with positive alphas)

Length of subperiod	12 months	24 months	48 months	72 months
slope coefficient	**0.35**	**0.71**	**-0.25**	**0.60**
p-value	**0.0%**	**0.0%**	**0.0%**	**0.0%**
R2	**0.05**	**0.24**	**0.09**	**0.29**
n	**619**	**300**	**141**	**54**

5.5 Performance persistence in Funds with Negative Alphas

In this section we have separated all funds which obtain a negative alpha value when alpha is measured through the entire study period (47 funds). We have thereafter studied performance persistence using the same methodology regarding hypothesis testing as used in Section 5.3.

From *Table 21* we can observe that when including funds with negative alpha for the entire study period, we get a positive, statistically significant, slope coefficient implying performance persistence when evaluating fund performance based on 12, 24 and 72 months sub periods. As for the funds with a positive alpha, the slope coefficient for 48 months sub periods is negative and statistically significant.

Table 21
Results from OLS regression (funds with negative alphas)

Length of subperiod	12 months	24 months	48 months	72 months
slope coefficient	0.29	1.07	-0.57	0.75
p-value	0.0%	0.0%	0.0%	0.0%
R2	0.13	0.33	0.56	0.21
n	404	190	84	22

If we look at the differences between the slope coefficient for the two fund groups of positive and negative alphas by comparing *Table 20* and *Table 21*, we can first conclude that we find that the same lengths of sub period yield performance persistence for both fund groups. Furthermore, in the sub period of 12 months the slope coefficient is slightly higher for the group with positive alphas. This would indicate a higher tendency for performance persistence for the group with positive alpha values when evaluating on 12 month sub periods. However, if we look at the slope coefficient for the other sub periods (24, 48 and 72 months) we can observe an opposite trend, where the slope coefficient is higher for the fund group with negative alphas. This would indicate a higher tendency for performance persistence in the group with negative alphas when evaluating on these three longer sub periods. These results suggest that persistence is stronger for underperforming funds (negative alphas) when persistence is evaluated over a longer period of time. This is in line with foremost research on the U.S. fund market where among others Carhart (1997) found that persistence is stronger among underperforming funds.

5.6 Treynor and Mazuy Market Timing Model

In order to test for market timing ability, we have performed quadratic regressions on the funds which have generated a positive risk adjusted return (*Table 10*, Section 5.2) using the Treynor and Mazuy model displayed in *Equation 3* (Section 2.4). Note that we have chosen to study market timing in funds with significant positive alphas, since we only want to study the cause of positive risk adjusted returns.

We will first test whether the variables in the Treynor and Mazuy model have any explanatory power with an F-test. The F-test will be performed on a significance level of 5%. Within the framework of the hypothesis we have stipulated a null hypothesis, H_0, that β_1 and β_2 have no explanatory power for fund performance, and a corresponding hypothesis that B_1 and B_2 have explanatory power for fund performance.

H_0: No variables affect the return
H_1: A minimum of one variable affects the return

Table 22 summarizes the results from the F-test and as we can see, H_0 can be rejected for all tested funds. Therefore we can draw the conclusion that one or both variables have explanatory power for the funds' over performance.

Table 22
Summary of results from F-test

F-Test	F	p-value	R^2
AMF Pension Aktiefond Sverige	**505.326**	**0.000**	**0.842**
Carlson Småbolagsfond	**233.757**	**0.000**	**0.712**
Odin Sverige	**117.081**	**0.000**	**0.584**
SEB Sverige Småbolag Chans/Risk	**196.696**	**0.000**	**0.710**

The β_2 displayed in *Table 23* will evaluate whether portfolio managers have a timing ability. Similar to Jensen's Alpha, the obtained alpha from the quadratic regression, a_i, will evaluate the stock-picking ability (selectivity performance).

Table 23 summarizes the results from the quadratic regression. T-tests have been performed on the same sample of funds which generate a positive return. In order to test for timing ability, the following hypotheses have been formed;

$$H_0: \beta_2 = 0$$
$$H_1: \beta_2 \neq 0$$

Table 23
Summary of results from Treynor and Mazuy quadratic regression

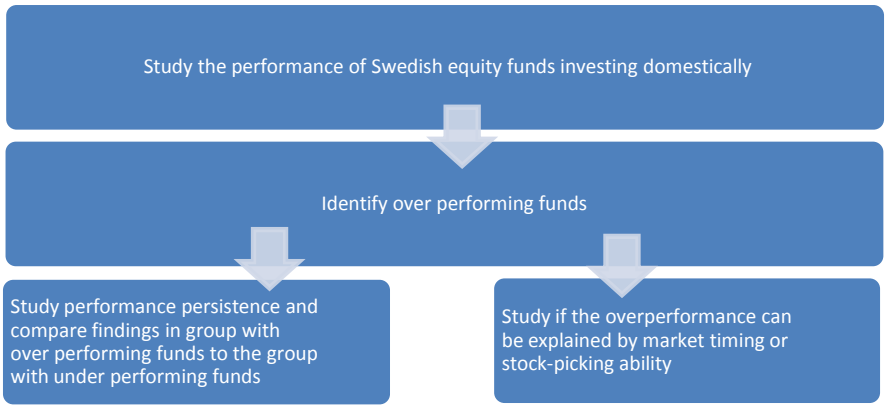
Quadratic test	α_i	p-value	β_1	p-value	β_2	p-value
AMF Pension Aktiefond Sverige	**0.000**	**0.888**	**0.940**	**0.000**	**-0.425**	**0.164**
Carlson Småbolagsfond	**0.005**	**0.084**	**0.873**	**0.000**	**0.037**	**0.913**
Odin Sverige	**0.013**	**0.000**	**0.622**	**0.000**	**-1.655**	**0.000**
SEB Sverige Småbolag Chans/Risk	**0.006**	**0.072**	**0.890**	**0.000**	**0.127**	**0.747**

The T-tests have been performed on a 5% significance level. β_2, the explanatory variable for timing ability, is not significantly different from 0 when evaluating the performance of AMF Pension Aktiefond Sverige, Carlson Småbolagsfond and SEB Sverige Småbolag Chans/Risk. Therefore H_0 cannot be rejected for any of these funds. However when looking at the performance of Odin Sverige we find timing ability which is negative and statistically significant. It is difficult to draw any general conclusions regarding the timing ability in Swedish equity funds since we get mixed results. Furthermore, it is important to note that the p-values for β_2 are relatively high for the funds which do not display any timing ability, which in turn reduces the reliability of any conclusions regarding timing ability. Therefore, we have not been able to find evidence of any positive timing ability amongst any of the Swedish equity funds which have generated a positive risk adjusted return. This is in line with Treynor and Mazuy's (1966) findings on the U.S. equity funds.

6. Conclusions

Within this section we discuss our empirical findings and then make a comparison with previous research. We will also have a concluding discussion regarding our study and give suggestions for future research.

Table 1
Structure of the Paper



Let us return to *Table 1* (first displayed in Section 1.2) in order to review the structure of the paper and the structure of our analysis. First we performed a test on the whole fund sample in order to identify over performing funds. Thereafter we studied performance persistence on the whole fund sample by using two tests, one non-parametric test and one parametric test[12]. Following these tests, we separated the funds into two groups according to whether they exhibited a positive or negative alpha over the entire study period. On these two groups we now once again performed a regression analysis in order to see if the two fund groups exhibited any differences. Finally, in order to see whether statistically significant over performance can be attributed to market timing ability, we used the methodology of Treynor and Mazuy (1966).

6.1 Fund Performance

Table 9 (Section 5.2) gives an overview of the fund performance in our fund sample. In the table we can see that out of 99 studied funds we find 52 funds with a positive alpha over the whole studied time period. 14 out of these funds can be found in the small-cap funds. When comparing the fund group of small-cap to the large-cap/mid-cap fund sample we can observe that in the small-cap fund group there is a much larger proportion of funds with a statistically significant positive alpha (14%) compared to only 5% in the large-cap/mid-cap fund group. The entire sample of Swedish equity funds investing domestically have an average annual alpha of 0.01% per year which implies that funds have outperformed the market to a very small degree. This is in line with the findings of Dahlquist et al (2000) who estimate an average annual alpha of 0.5% for Swedish equity funds investing domestically. Since the underperforming funds deviate more than the over performing ones, the median of annual alphas amounts to 0.06%. Note that only 4% of the entire fund sample show statistically significant alphas.

[12] In form of an auto-regression analysis

Thus we can, based on our observations, conclude that Swedish small-cap funds have performed better than large-cap/mid-cap funds during the studied time period. These finding are also in line and supports previous studies on Swedish equity funds most notably Engström (2004) where the author determines that over performance is more common amongst Swedish small-cap funds. These results are also in line with what among others Jensen (1968) observed in his study, that actively managed equity funds are not able to over perform to any large extent relative a benchmark. Otten and Bams (2002) also found similar results in their study of the European market, where they identify a small over performance within the fund sample and that the trend once again is higher for small-cap funds.

When testing the funds' alpha on a significance level of 5% with the null hypothesis that the funds' alpha equals zero, we find six funds for which the null hypothesis can be rejected. This small proportion of the fund sample equals 6.1% of the total fund sample.

Let us now return to *Question 1* of the paper and its corresponding hypothesis:

Question 1: Can we find Swedish equity funds investing domestically that have produced a statistically significant over performance in the studied time period of 1993-2008?

Hypothesis 1: There are Swedish equity funds investing domestically which yield a statistically significant positive alpha

Based on our findings, we can now say that in our fund sample there exist funds that have produced a statistically significant positive alpha over the entire study period. These funds are however few in number and constitute a small share of the entire sample, whereby we conclude that some funds yield a statistically significant over performance and that this tendency is higher for small-cap funds. However, the majority of funds do not perform better than its benchmark.

6.2 Performance Persistence

We started off by studying performance persistence for the whole fund group using a non-parametric test. We find that our fund sample exhibits performance persistence for the entire study period when evaluating fund performance over 12, 24 and 72 months. The non-parametric test points to the strongest results of performance persistence when evaluating performance persistence using 24 month sub periods. These results are in line with the findings of Droms and Walker (2001) where they find persistence when looking at 24 month sub periods in their study of international equity funds. Furthermore, we find specific sub periods which exhibit statistically significant performance persistence. However, it is important to point out that not all sub periods exhibit performance persistence.

As a complement to the non-parametric test, we also performed a parametric regression analysis. The results from this study are in line with the results from the non-parametric test, namely that we can observe statistically significant performance persistence for the whole studied time period when using sub periods of 12, 24 and 72 months. The actual sub periods do not match each other perfectly between the two tests and we find some differences between the results from the regression analysis and the non-parametric test.
As a conclusion to our findings regarding performance persistence, we determine that Swedish equity funds exhibit persistence in their performance when fund performance is evaluated over 12, 24 and 72 months.

Following this we performed separate studies on performance persistence amongst the fund groups with positive and negative alphas. Based on our results we can observe a tendency for *stronger* performance persistence in the fund group with negative alphas. These findings are in line with previous research in the field, among others Carhart (1997) reports evidence of stronger persistence amongst underperforms and Droms (2006) also find similar results in his study for U.S. based funds.
Let us review *Question 2* of our study with its corresponding hypotheses:

Question 2: Can we find statistically significant performance persistence amongst Swedish equity funds investing domestically? If so, can we observe any difference in persistence between equity funds that have generated over performance, compared to equity funds which have underperformed?

Hypothesis 2: Swedish equity funds investing domestically exhibit performance persistence

Based on our findings we can now conclude that *we find statistically significant performance persistence* among Swedish equity funds for certain lengths of sub periods and most notably in the sub period of 24 months. However, we agree with the reasoning by Droms (2006), since persistence is likely to be affected by the periods over which it is tested, the results of persistence need to be interpreted with caution, and should not be the only criterion for choosing an equity fund to invest in.

6.3 Market timing ability

Based on the study of our fund sample's performance we could in *Table 10* (Section 5.2) identify four funds with a significant positive alpha over the entire study period. In order to see whether this positive alpha could be yielded from market timing or stock-picking ability we thereafter studied these four funds using the methodology developed by Treynor and Mazuy (1966). First we conducted a F-test in order to test the explanatory power of the variables in the model and here we found that the variables do have an explanatory power. Thereafter we tested the market timing ability variable using a T-test we could not find any indications of positive market timing ability. This is in line with Treynor and Mazuy's (1966) findings on U.S. equity funds.
Finally, let us now review *Question 3* of our study with its corresponding hypotheses:

Question 3: Can observed over performance in the fund sample be explained by a market timing ability?

Hypothesis 3: Over performing Swedish equity funds investing domestically exhibit market timing ability

Based on our findings we can now conclude that the over performing funds in our fund sample do not exhibit a market timing ability and we therefore attribute over performance to stock-picking ability.

6.4 Robustness and Generalizations

6.4.1 Robustness

We have made several assumptions through the course of this study. All of the assumptions have an impact on the obtained results and we therefore deem it appropriate to discuss the reasoning behind these assumptions.

In order to test the robustness of our results, we have performed normality tests on our data samples. These normality tests give an indication of whether the conducted regressions are based on reasonable assumptions. As previously mentioned in Table 6 (Section 3.4), the excess returns' skewness and kurtosis do not witness of a perfect normal distribution, however the data samples can be seen as approximated estimates of a normal distribution. The data samples were then tested with a Jarque-Bera (JB) Normality test. Results from the JB test indicate that the excess returns for 21 out of 99 funds follow a normal distribution. The fact that roughly 20% of the funds included in the sample pass the normality test limits the reliability of our results since estimated alphas could potentially be inaccurate for the remaining funds which have not passed the normality test. One could on the other hand argue that our samples of data fulfill the requirements for normal distribution given the size of samples. The central limit theorem states that a sample with 30 observations or more can be approximated according to a normal distribution. All our samples of data fulfill this requirement and this is the reasoning behind why we have assumed a normal distribution in our samples.

There are several ways of estimating risk-adjusted returns, some of which are more complex and account for more factors than the Jensen's alpha. However, when estimating CAPM we obtain adequate R^2 measures and this motivates our choice of solely using Jensen's alpha when evaluating fund performance. The average R^2 for the studied time period amounts 0.78, which in turn indicates that CAPM could explain a majority of the variability in excess returns. The R^2 measures for the individual funds are listed in Appendix A.

Kosowski et al (2006) argue that the cross section of mutual fund alphas has a complex non normal distribution due to heterogeneous risk-taking by funds. We therefore chose to complement the auto regression with a non-parametric test in the form of a Cross Product Ratio (CPR) test, when evaluating persistence. The CPR test does not make any assumptions regarding the probability distribution of alphas and is therefore not as sensitive to the alphas' possible non normality. Consequently one could argue that by utilizing these two methods of evaluating performance persistence, the results are more robust.

6.4.2 Generalizations

The reliability of this study's findings would improve if data from non surviving funds had been included. Previous research shows that survivor bias overstates the performance since the relatively low returns of dead funds are not included in the evaluation. Also, it is hard to dismiss the possibility for improving the study and that alternative ways to conduct the study would yield different results. It would be desirable to have access to data from an even longer time period, however that would require conducting the study on another market, such as the U.S. fund market. Regarding the generalization of our result to other markets the possibilities are limited. Due to the nature of our study on a specific market (Sweden) the results are only applicable to the Swedish fund market. Thus based on this study one cannot draw any conclusions on fund

performance on foreign fund markets and the existence of performance persistence on these markets. Also worth mentioning is that one can draw conclusions from the actual studied time period of 1993-2008 and one cannot based on our study draw any conclusions on time periods outside this span.

As model to measure over performance and market timing we have chosen the model developed by Jensen (1968) respectively Treynor and Mazuy (1966). These models are rather simple and there are other more complex models to measure funds performance and market timing in use. It is hard to comment on the outcome if we would have used other models to estimate over performance and market timing, however the frequent use of these models in academic publications is at least a sign that the models are relevant for our purpose.

6.5 Future Research

One of the studied topics concerns the over performance of Swedish equity funds. We have only tried to explain over performance in terms of stock selection and timing ability but other attributes could possess explanatory power. Fund fee and fund age are examples of attributes which would have been interesting to link to performance.

Our results suggest that funds exhibit performance persistence when performance is evaluated over certain lengths of time. An interesting topic would be to look deeper into the consequences of following a strategy where you first identify potential over performing funds in each period and thereafter construct a portfolio consisting of these funds. Once this portfolio has been constructed, one could compare its return to the return of a passive index fund. We would also find it interesting to examine whether performance persistence could be linked to certain attributes of an equity fund such as fund size or a fund manager's professional experience.

As for market timing ability, we only had access to a minor sample of funds which displayed significant over performance. One could therefore include over performing funds from a greater amount of markets in order to strengthen the conclusions regarding the effect of market timing ability on over performance.

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Appendix A – Fund sample

The table includes all Swedish equity funds evaluated in the study. The alpha has been calculated over the entire study period 1993-2008 and third column shows the first year from which fund data is available.

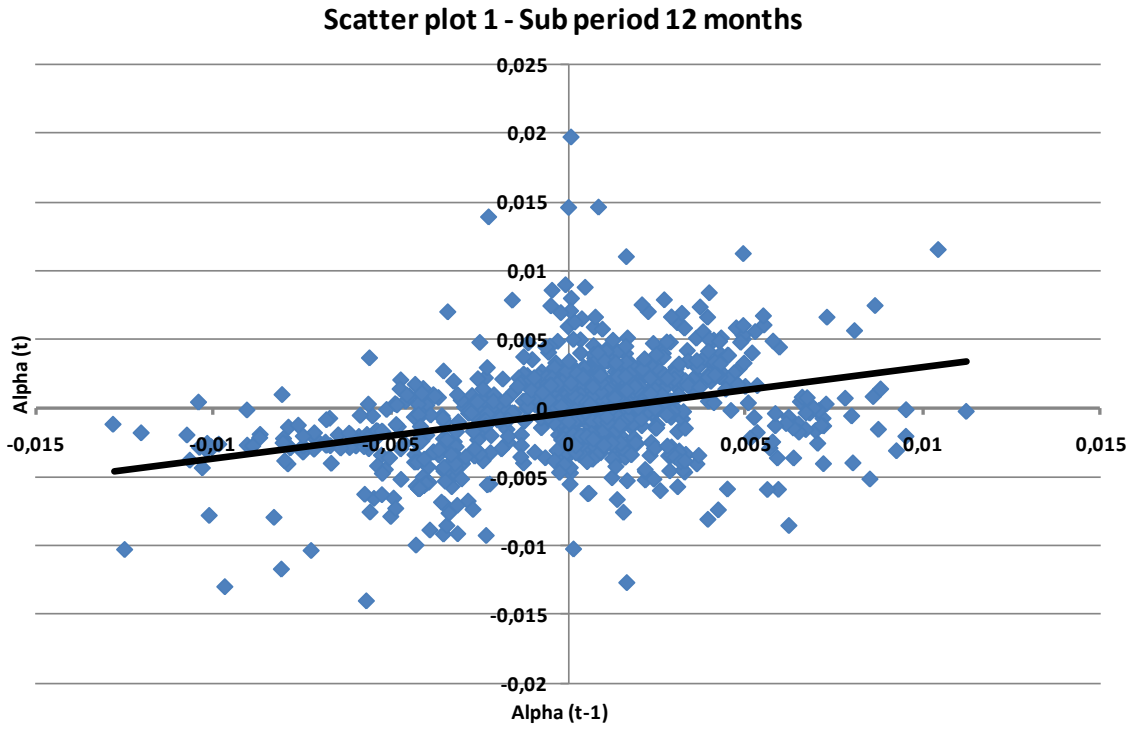
Fund	Alpha	p-value	R^2	Year
ABN AMRO, Sverige	-0.12%	0.51	0.85	1994
Aktie-Ansvar Sverige	0.18%	0.31	0.82	1993
Aktiespararna Topp Sverige	-0.21%	0.43	0.82	1999
Alfred Berg, Sverige	-0.56%	0.03	0.84	2000
AMF Pension Aktiefond - Småbolag	0.07%	0.81	0.57	1993
AMF Pension Aktiefond Sverige	0.62%	0.01	0.79	1999
Ancoria / HQ Sverigefond	0.20%	0.41	0.70	1995
Ancoria Utdelningsaktier Sverige	-0.16%	0.78	0.70	2005
Banco Etisk Sverige	-0.14%	0.46	0.84	1993
Banco Etisk Sverige Special	-0.28%	0.30	0.83	1999
Banco Hjälp	-0.17%	0.45	0.82	1995
Banco Human Pension	-0.43%	0.12	0.82	2000
Banco Humanfonden	-0.14%	0.46	0.83	1993
Banco ideell miljö	-0.05%	0.80	0.84	1993
Banco Kultur	-0.22%	0.33	0.83	1996
Banco Samarit Pension	-0.43%	0.12	0.82	2000
Banco Samaritfonden	-0.12%	0.53	0.83	1994
Banco Småbolag	0.18%	0.63	0.57	1993
Banco Svensk Miljö	-0.07%	0.76	0.76	1994
Carlson Småbolagsfond	0.50%	0.04	0.71	1993
Carlson Sweden Micro Cap	0.27%	0.43	0.61	1997
Carlson Sverige Nationell	-0.13%	0.63	0.81	2000
Carlson Sverigefond	-0.04%	0.86	0.82	1997
Carlson Sverige Koncis	0.12%	0.55	0.76	1993
Carnegie Småbolag	0.25%	0.54	0.63	1995
Carnegie, Sverige	0.00%	0.99	0.86	1996
Catella Reavinst	0.21%	0.46	0.80	1998
Catella Trygghet	0.21%	0.36	0.78	1998
Cicero Sverige	-0.12%	0.67	0.79	2000
Danske Fonder SRI Sweden	-0.07%	0.79	0.84	2001
Danske Fonder Sverige	0.07%	0.75	0.83	1998
Danske Fonder Sverige Fokus	-0.06%	0.88	0.82	2005
Eldsjäl Gåvofond	-0.10%	0.63	0.85	1997
Eldsjäl Sverigefond	-0.08%	0.71	0.85	1997
Enter Select	-1.36%	0.21	0.66	2007
Enter Sverige	-0.12%	0.59	0.83	2000
Erik Penser Sverigefond	-0.35%	0.62	0.76	2006
Folksam LO Sverige	-0.05%	0.82	0.86	1999
Folksam Tjänsteman Sverige	-0.14%	0.54	0.85	2000
Folksam, Sverige	0.10%	0.59	0.84	1994
Guide Aktiefond Sverige	-0.10%	0.77	0.78	2003
Guide Allokering	0.07%	0.78	0.88	2003
Gustavia Sverige	0.28%	0.52	0.68	2003

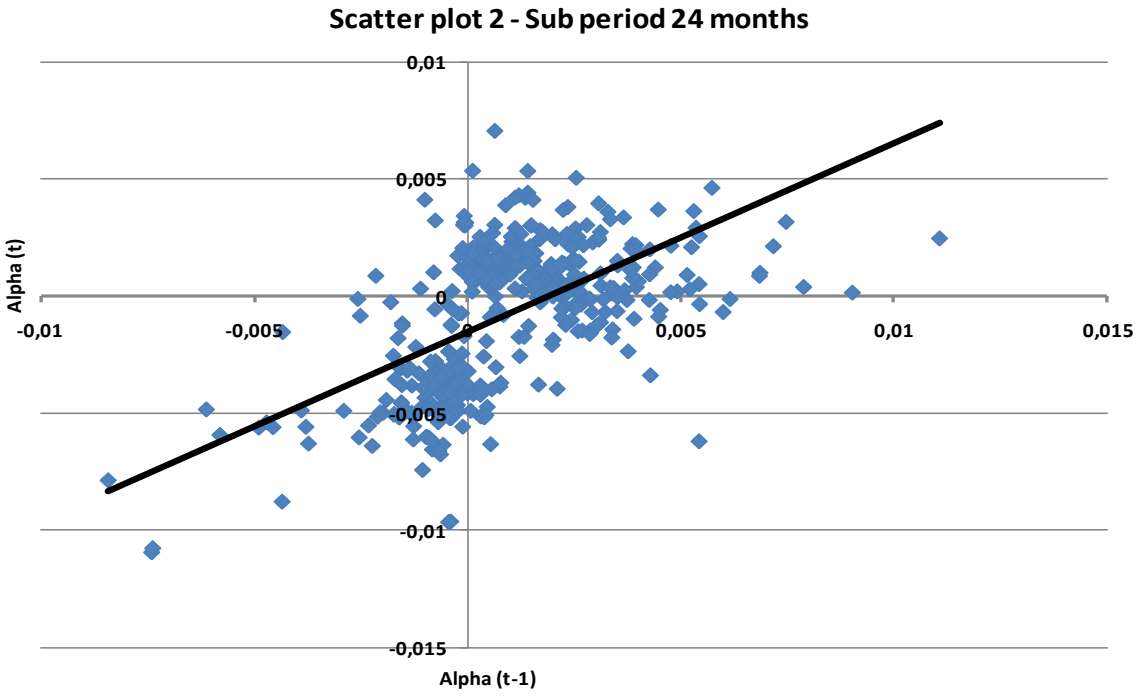
Continued

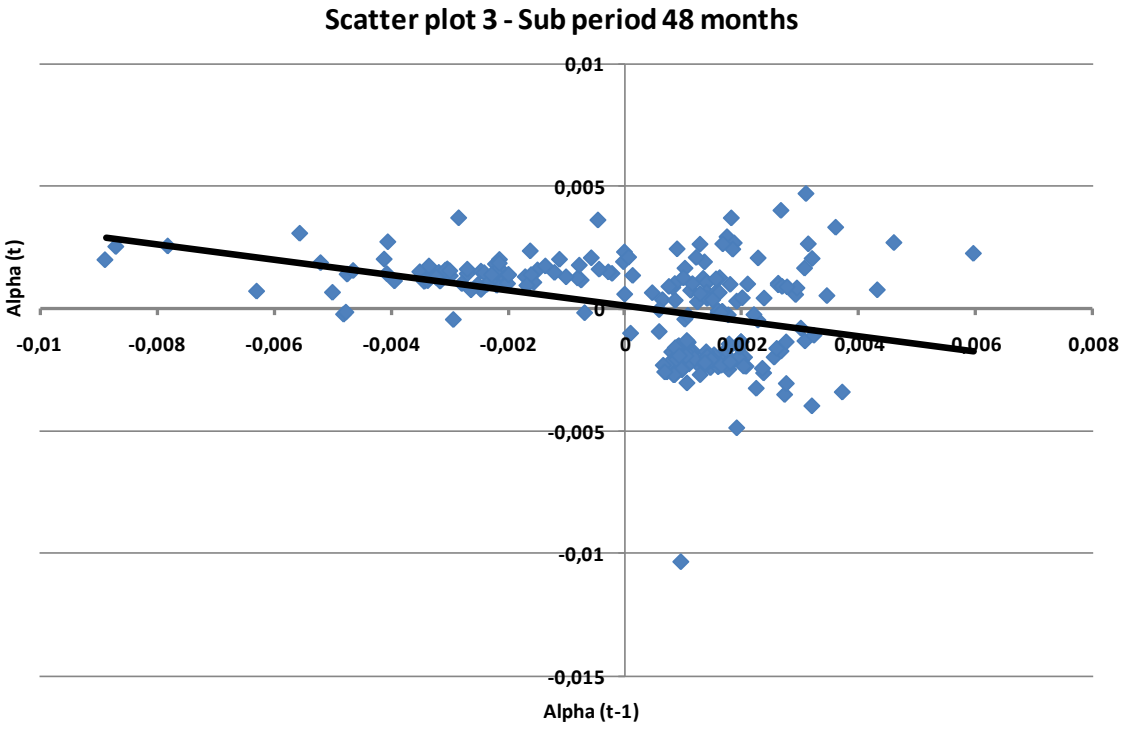
Fund	Alpha	p-value	R^2	Year
Gustavia Sweden	0.44%	0.24	0.76	2003
Handelsbanken Svenska Småbolag	0.29%	0.25	0.72	1994
HQ Strategi	0.24%	0.19	0.76	1993
HQ Svea Aktiefond	-0.05%	0.91	0.80	2005
HQ Sverige	0.31%	0.09	0.80	1993
Kaupthing Småbolag	-0.20%	0.58	0.59	1994
Kaupthing Swedish Growth	-0.19%	0.64	0.74	2000
Kaupthing Sverige Index 30	-0.03%	0.89	0.82	1997
Lannebo Småbolag	0.41%	0.16	0.73	2000
Lannebo Sverige	0.18%	0.51	0.79	2000
Länsförsäkringar MegaSverige	-0.50%	0.39	0.86	1993
Länsförsäkringar Småbolagsfond	0.31%	0.43	0.66	1997
Länsförsäkringar Sverigefond	0.00%	0.98	0.86	1993
Moderna Fonder, Sverige Topp 30	-0.24%	0.41	0.75	1999
Nordea Etiskt Urval	-0.13%	0.59	0.84	1999
Nordea Inst. Aktiefonden Sverige	-0.06%	0.80	0.84	1998
Nordea Selekta Sverige	-0.30%	0.26	0.84	2000
Nordea Sverigefonden	-0.13%	0.45	0.86	1993
Odin Sverige	0.67%	0.02	0.55	1994
Robur Ethica Miljö Sverige	-0.21%	0.30	0.80	1996
Robur Ethica Sverige MEGA	0.08%	0.73	0.85	2003
Robur Hockeyfond	-0.07%	0.80	0.83	2001
Robur Småbolagsfond Sverige	0.15%	0.61	0.68	1995
Robur Sverige	0.01%	0.94	0.84	1996
Robur Sverigefond MEGA	0.08%	0.65	0.84	1995
Robur Vasaloppsfond	-0.02%	0.95	0.84	2001
SEB Etisk Sverigefond Lux Utd	-0.02%	0.87	0.87	1993
SEB Life Ethical Sweden	-0.13%	0.46	0.81	1995
SEB Life Sverige Småbolagsfond	-0.05%	0.91	0.81	2006
SEB Stiftelsefond Sverige	-0.09%	0.65	0.85	1998
SEB Swedish Value Fund	0.05%	0.93	0.83	2006
SEB Sverige Småbol Chans/Risk	0.60%	0.03	0.71	1995
SEB Sverige Småbolag	0.41%	0.06	0.75	1993
SEB Sverigefond	-0.07%	0.68	0.86	1993
SEB Sverigefond Chans/Risk	0.08%	0.68	0.84	1995
SEB Sverigefond Stora Bolag	-0.01%	0.96	0.86	1993
SHB Astrazeneca Allemansfond	-0.41%	0.27	0.58	2002
SHB Radiohjälpsfonden	-0.07%	0.70	0.85	1995
SHB Reavinstfond	0.13%	0.48	0.83	1993
SHB SBC Bofonden	-0.32%	0.01	0.71	1993
SHB Sverige Selektiv	-0.26%	0.44	0.82	2005
Skandia Aktiefond Sverige	-0.08%	0.62	0.86	1994
Skandia Småbolag Sverige	0.21%	0.52	0.71	1999
SkandiaLink H&Q Aktief. Sverige	0.28%	0.20	0.80	1997
SKF Aktiefond Sverige	0.16%	0.41	0.85	1996
SKF Allemansfond	-0.13%	0.64	0.82	2003
Spiltan Aktiefond Dalarna	-1.02%	0.17	0.70	2007
Spiltan Aktiefond Stabil	0.19%	0.53	0.62	2003
Spiltan Aktiefond Sverige	0.06%	0.89	0.65	2002
SPP Aktiefond Sverige	-0.06%	0.81	0.81	1999
Swedbank Robur Exportfond	0.05%	0.82	0.77	1993
Swedbank Robur Småbolagsfond	0.25%	0.37	0.71	1995
Swedbank Robur Svensk Aktieporfölj	0.09%	0.86	0.81	2005
Team Catella Tennisfond	0.07%	0.89	0.71	2005
Västernorrlandsfonden	0.08%	0.77	0.81	2003
Öhman Sverige	0.29%	0.60	0.82	1996

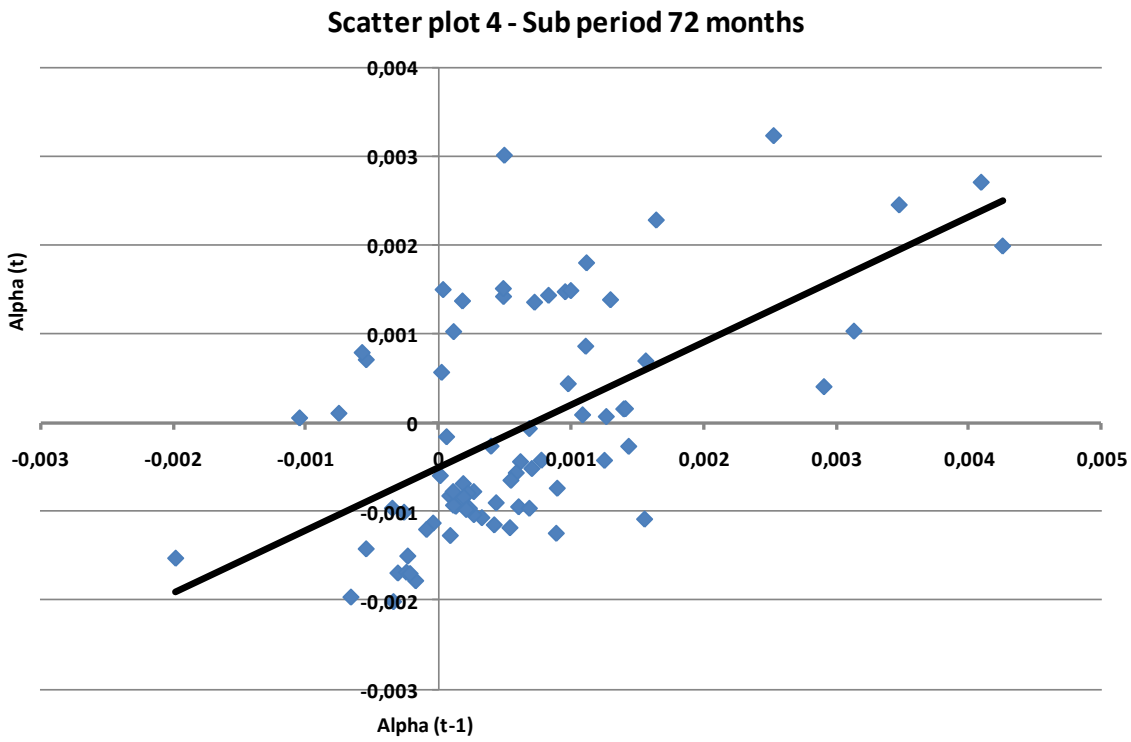
Appendix B – Scatter plots

The Scatter plots below show the performance in period t against the performance in the period t-1, for all studied sub periods.






Scatter plot 3 - Sub period 48 months
0,01
0,005
0
-0,005
-0,01
-0,015
-0,01
-0,008
-0,006
-0,004
-0,002
0
0,002
0,004
0,006
0,008
Alpha (t)
Alpha (t-1)


Scatter plot 4 - Sub period 72 months
0,004
0,003
0,002
0,001
0
-0,001
-0,002
-0,003
-0,003
-0,002
-0,001
0
0,001
0,002
0,003
0,004
0,005
Alpha (t)
Alpha (t-1)

Appendix C – Formulas

Equation 4
Skewness

$$Skewness = \frac{\sum_{i=0}^{n}(\mathrm{Y_i} - \overline{\mathrm{Y}})^3}{(N-1)s^3}$$

$\overline{\mathrm{Y}}$ = sample mean
N = number of data points
s = standard deviation

Equation 5
Kurtosis

$$Kurtosis = \frac{\sum_{i=0}^{n}(\mathrm{Y_i} - \overline{\mathrm{Y}})^4}{(N-1)s^4}$$

$\overline{\mathrm{Y}}$ = sample mean
N = number of data points
s = standard deviation

Equation 6
Jacque-Bera Normality Test

$$JB\ coefficient = \frac{n}{6}\left[S^2 + \frac{(\mathrm{K}-3)^2}{4}\right]$$

n = number of observations
S = Skewness coefficient
K = Kurtosis coefficient