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SWEDISH MUTUAL EQUITY FUND PERFORMANCE

A COMPARATIVE STUDY OF SWEDISH FUNDS INVESTING IN SWEDEN & THE U.S.

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ABSTRACT

The purpose of this thesis is to investigate the performance of Swedish mutual equity funds that primarily invest in either the Swedish or the U.S. market. Complementing prior research, we emphasis the relative performance differences between two markets and compare different portfolios with domestic indices. Studying data from 2006 to 2016, we observe that the U.S. portfolio managed to produce higher, but statistically insignificant alphas. Implying no difference in performance between our portfolios. Further, testing the Sharpe and Treynor ratio for significance we find that the U.S. portfolio has a higher significant mean Sharpe ratio. Evidence that opposes our underlying assumption that the Swedish market is less efficient than the U.S. market. The regression results are in line when partitioning the sample into groups based on the market capitalization. In conclusion, we find no evidence suggesting that outperforming the Swedish market is more apparent than outperforming the U.S. market.

Keywords: Performance Evaluation, Mutual Equity funds, Actively Managed Funds, Risk-Adjusted Return, Sharpe Ratio, Treynor Ratio, Carhart Four-Factor Model, Swedish Fund Performance, U.S. Fund Performance.

JEL Classifications: G11, G12, G15

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1 Introduction

Fund performance is an extensively researched area in financial academia. Within the field of fund performance, a popular subject is to question the value creation of active management in mutual funds. A vast number of published papers find that actively managed funds, on average, underperform the market and are inferior to index funds. The underperformance and the persistence of funds have been examined on various markets, like the U.S. Jensen (1968), the Swedish, Flam and Vestman (2014), and internationally, Ferreira, Keswani, Miguel and Ramos (2013), all reaching similar conclusions. There are also evaluations made on the Swedish and the U.S. market suggesting that active management does in fact outperform the market, Wremers (2000). The performance of mutual equity funds varies across international borders, which depends on several aspects. Less efficient markets should according to theory create a wider range of variance in performance, meaning that mutual equity funds in more efficient markets should perform closer to the market index, Fama (1969). The mainstream of fund performance studies, however, tend to find that underperformance is persistent.

With research concluding that actively managed funds, on average, are underperforming the market, it is remarkable to find that the market for this type of investments is today larger than ever before, and still growing. Observing the figure below, illustrating the development of the total net asset value for the Swedish equity market the last ten years, a significant increase in value and number of funds can be seen.

Figure I - The Swedish Equity Fund Market

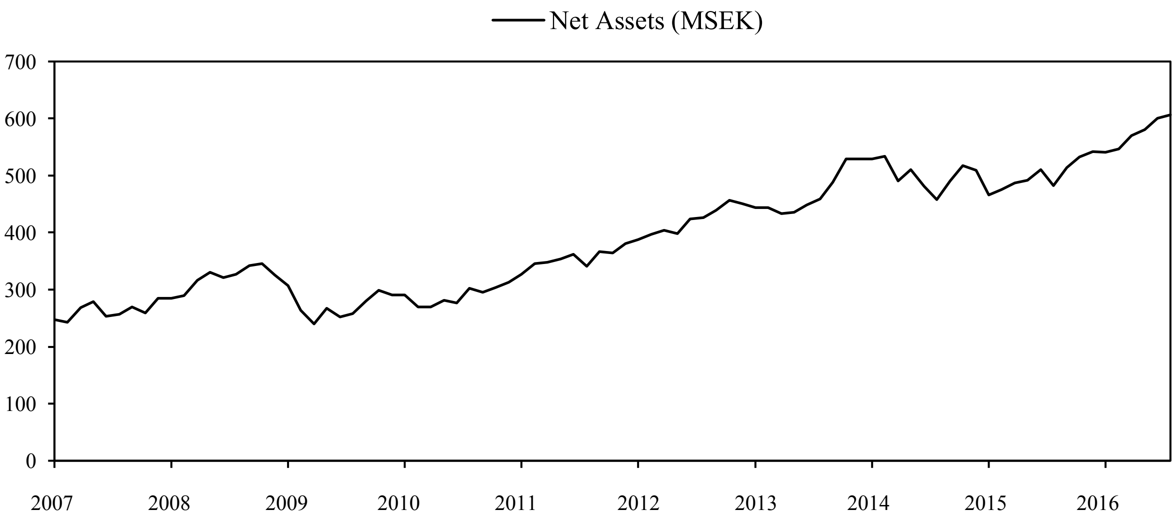


Figure I: Show the total net asset value for the Swedish equity fund market from 2007 – 2017, noted in million SEK.
Source**:** Swedish Investment Association (2017).

Continuing previous research on the performance of equity mutual funds, we are to investigate if performance between Swedish equity mutual funds investing in Sweden and in the U.S. differ. Based on the fact that numerous of studies conclude that both the Swedish and the U.S. market display negative alphas we are to test if there is a significant difference between investing in the markets, from the Swedish investor's point of view.

The methodology is built on econometric regression analysis using acknowledged models such as the CAPM, Fama-French's three-factor model and Carhart's four-factor model. To make the evaluation more complete we add two different performance measurements calculating the risk-adjusted return for each portfolio, explicitly the Sharpe ratio and the Treynor ratio.

2 Purpose & Hypothesis Statement

The purpose of our research is to compare mutual equity fund performance and evaluate if Swedish equity mutual funds investing in the Swedish market perform statistically different from Swedish equity mutual funds investing in the U.S. market. Dividing funds into subgroups we examine potential performance differences between funds mainly investing in Large-Cap or Mid/Small–Cap companies. The econometric work is done by mainly using the Carhart four-factor model when doing regressions for the Swedish, U.S. and difference portfolio. The difference portfolio helps us to look at the relative performance between the groups. Additionally, using a two sided t-test we check both the Sharpe and the Treynor ratio for significance.

The motive behind using the U.S. as the comparative market is due to the large amount of previous research made on the U.S. market. The U.S. market is also recognized as one of the most important markets and it has recently increased in popularity for Swedish fund investors Bratt (2016). The majority of research previously conducted focus on funds in one specific market or funds from different countries investing in the same market. Observing how Swedish funds perform in Sweden versus the U.S. is to our knowledge a novel approach and the number of studies focused on both the Swedish and the U.S. market is limited. Furthermore, using recent data in our thesis we make the evaluation up to date. Nevertheless, our method is based on a similar approach used by Otten and Bams (2003), who evaluate fund performance between domestic and foreign funds investing in the U.S. market.

Continuing our research, we base our underlying hypothesis on the fundamentals behind the efficient market hypothesis. Ferreira, Keswani, Miguel and Ramos (2013) find support for the idea that fund performance in different markets varies depending on market liquidity and how strong the legal institutions are. Implying that it might differ between our chosen portfolios. The assumption is that the Swedish portfolio will generate higher alphas, partially as the market is considered to be less liquid and less efficient than the U.S. market. Supported by the fact that the market is both smaller and has fewer participants, causing slower information dissemination.

Table I – Hypothesis Statements

Hypothesis No. I

H_{null} = There is no statistically significant difference in performance between the Swedish portfolio compared to the U.S. portfolio.

$H_{Alt.}$ = There is a statistically significant difference in performance between the Swedish portfolio compared to the U.S. portfolio.

Hypothesis No. II

H_{null} = There is no statistically significant difference in performance between the Swedish and U.S. market investing funds compared to their domestic benchmark indices.

$H_{Alt.}$ = There is a statistically significant difference in performance between the Swedish and U.S. market investing funds compared to their domestic benchmark indices.

Hypothesis No. III

H_{null} = The Swedish portfolio do not have statistically significant different Sharpe and Treynor ratios from the U.S. portfolio.

$H_{Alt.}$ = The Swedish portfolio have statistically significant different Sharpe and Treynor ratios from the U.S. portfolio.

3 Literature Review

In the following section, we explain central theories and concepts within our field and cover important previous empirical studies focused on mutual fund performance. The literature on mutual fund performance is extensive, and we have considered some of the most central theories and research within this field.

3.1 Theoretical Framework

A central concept of finance, is the Modern Portfolio Theory developed by Markowitz (1952). By investing in different industries and combining securities operating in different geographic areas, investors can reduce the total standard deviation of a portfolio and thereby the risk. The Efficient Frontier, another theory by Markowitz is built upon the idea of investing in an optimal portfolio. The frontier is a curved line, illustrating the idea that a portfolio increases in value through increased diversification. That smaller companies are associated with higher expected returns can be explained by the fact that they usually have larger volatility in stock prices and are more sensitive to market movements, Bauman, Conover and Miller (1998). To maximize the expected return given a determined amount of risk, the portfolio should be as close to the frontier as possible. Observing how the funds differ in performance and by investment target market capitalization, we divide the funds into different investment styles.

Extensively used in fund performance evaluations for its simplicity is the Sharpe ratio. The ratio is used as a measurement and a tool for investors to predict, evaluate and to compare portfolios by making an adjustment for the taken risk, appropriate when comparing different funds and entire portfolios of funds, Sharpe (1994). The Treynor ratio (1973) also known as the reward-to-volatility ratio, relates excess return over the risk-free rate to additional risk taken, whereby Treynor includes beta in the calculation rather than standard deviation used in the Sharpe ratio. The beta captures the volatility of a portfolio against the market, the steepness of the beta justifies the trade-off between risk and return. As the ratios differ in how they calculate the risk-adjusted return, it is advantageous to calculate both the Sharpe and Treynor ratio.

Jensen (1968) extends earlier portfolio performance measurements when covering multiple periods, resulting in a model known as CAPM, which by us is used to obtain the Jensen's Alpha for our portfolios. A method that has been used by a majority of researchers when estimating fund performance. Using Jensen's Alpha as a measurement, Jensen finds that the performance of actively managed funds is on average inferior to that of passively managed funds, Jensen (1968).

Fama and French (1992) evaluate U.S. stock returns and risk, based on CAPM. Distinguishing Fama and French is their development of the Fama-French three-factor model. The model is constructed by first including the beta variable reflecting the market risk, similar to CAPM. Adding two additional variables, Fama and French's model increase the statistical power by explaining more of the performance in a portfolio. The additional variables cover the effect of a company's size and book-to-market ratio (B/M) on performance. As Fama and French find, there is a positive correlation between companies' mean return and the book-to-market ratio. Suggesting that value stocks with high book-to-market ratios tend to outperform those with lower (B/M) ratios, known as growth stocks.

A subsequent model developed by Carhart (1997) is the Carhart four-factor model, used in our thesis as the main regression model. With its roots in the Fama and French's three-factor model the model adds a risk premium variable, which enables the model to capture the effect of momentum. The model includes the propensity for stock prices to keep on carrying positive returns if the stock has performed well in the past and likewise if the stock has declined in previous years. The model is widely used within empirical finance research, such as in studies written by Malkiel (1995), Dahlquist (2000), Otten and Bams (2003), who all make analyses of mutual fund managers performance.

Furthermore, Eugene Fama (1969) states that financial markets inherently are efficient. Meaning that the stock prices always fully reflect all available information, known as Efficient Market Hypothesis. The theory describes three different types of accessible information. From the records of previous prices to publicly available reports like annual earnings data and to non-public information only available to a select few, what we today call insiders. The hypothesis states that in an efficient market it should not be possible to increase the expected returns of an investment without simultaneously increasing the risk.

3.2 Previous Research

Malkiel (1995) evaluates performance from 1971 to 1991 of all mutual equity funds on the U.S. market. Using CAPM with quarterly time series data Malkiel find that funds have an average alpha of (-0.06%) compared to the benchmark. The data also display a significant variance in performance amongst individual investment strategies. However, in aggregate the funds perform worse than the benchmark. Observing the years 1970 to 1980, he concludes that some specific investment strategies can be used to increase the chance of generating excess returns. More importantly, Malkiel finds no evidence for these performance differences amongst investment styles, looking at the whole period.

Banz (1981) evaluates performance differences depending on company size and finds that Small-Cap companies have higher expected returns than Large-Cap companies, an occurrence Fama and French (1992) also observe. Fama and French also find evidence supporting the small-firm effect discovered by Banz (1981). Fama and French additionally find co-movement between stock returns adjusted for its risk and the book-to-market values. Firms with higher book–to-market values have greater yields.

Carhart (1997) evaluates mutual funds, including 1,852 funds on the U.S. market, both active and dead funds to eliminate survivorship bias. Using the Carhart four-factor model with the additional MOM factor, Carhart demonstrates the importance of momentum as an explanatory variable of stock returns. With monthly data, the returns are concluded, to some extent, to depend on the past performance of stocks. Further, Carhart (1997) finds that funds underperform the market with (-1.2%) per year.

Fama and French (2010) also use the four-factor model when evaluating mutual fund performance, this time using U.S. funds from 1984 to 2006. They report alphas, before deducting expenses and fees, very close to zero. Removing costs, evidence suggests underperformance by nearly the same amount of the expenditures and fees. Contradictory to previous research Wremers (2000) find that fund managers can make active management advantageous for investors, depending on their ability. He also finds dependence between risk taking and the performance of the funds. Looking at the performance of mutual funds investing in the U.S. he finds opposing results to what earlier studies mentioned find.

Expanding our view, we look at previous analyses made on fund performance in both the U.S. and in Europe. What we find is that historically, performance differ when investing in various investment areas. Ferreira, Keswani, Miguel and Ramos (2013) evaluate mutual fund performance, using multiple markets including Sweden, and find evidence for a relation between performance and country characteristics. The authors find that performance differs significantly between countries and regions, that funds based in regions with liquid stock markets and strong legal institutions have managed to perform better than funds located in less liquid markets. They also find that performance is not the same when comparing mutual equity funds located in Europe and in the U.S.

Dahlquist (2000), finds that Swedish mutual funds have positive but non-significant alphas of 0.5% when benchmarked against the Swedish market. Similarly, Flam and Vestman (2014) compare Swedish mutual equity funds from 1993 to 2013. They find evidence for both under- and over-performance. From 1993 to 2001 their funds outperformed the Swedish market.

Analyzing 2002 to 2013, they find that Swedish mutual funds have produced negative gross and net excess returns of (-0.18%) and (-1.47%). Suggesting that during recent years' Swedish equity funds have underperformed the market.

Outside the U.S. market, the aforementioned small-firm effect has mixed support. Dahlquist (2000) observe that small equity funds, in Sweden, outperform larger equity funds. Ferreira, Keswani, Miguel and Ramos (2013), use 27 different countries in their sample and claim that performance is higher for large funds compared to smaller funds.

Otten and Bams (2003) evaluate how funds domiciled in the U.S. and the UK perform relative to each other when investing on the American market. They observe that people seem to know less about the stock markets in foreign countries. With the expectation that foreigners under-perform compared to domestic funds they do not find any statistical significance supporting this claim.

Arugaslan, Edwards and Samant (2007) evaluate risk-adjusted performance of 50 U.S. domiciled equity funds between 1994 to 2003. Included in their performance metrics are Sharpe and Treynor ratios and the Jensen's Alpha. They find that, after including the degree of risk for a fund, the attractiveness of said fund may change. Using this approach, we have in addition to our regression models calculated ratios to capture the risk-adjusted return, calculated in different ways to further support our findings.

If a market is inefficient, assets are not correctly priced at all times, a stock could either be under- or overpriced on the specific stock market, Fama (1969). Previous research such as Metghalchi, Chang and Marucci (2007), find evidence that contradicts the efficient market hypothesis on the Swedish market. They observe that an investor can through technical trading make excessive returns on the Swedish stock market, implying that the Swedish market is considered to be inefficient. Potential market inefficiencies behind their findings are factors such as unfair competition, lack of transparency on the market, irrational behavior and regulatory actions.

In conclusion, several previous studies focus on mutual fund performance in the U.S. or in Sweden. Studies observing fund performance across countries have mainly concentrated on the performance of funds domiciled in different countries, which invests in the same market. Thereby, comparisons between funds investing on different markets are rather scarce.

4 Data

In the process of data assembly, we have used Bloomberg, Morningstar Direct and the AQR database. Using the Morningstar Direct we have gathered the historical fund return for all funds on a monthly basis. Focusing on the relative performance differences between the Swedish and U.S. investing funds, we have used the same currency (USD), return type, regression factors, benchmark index and risk-free rate of return as it enables us to make a direct comparison between the funds. For our evaluation we use equally weighted portfolios for the Swedish and the U.S. portfolio as well as a difference portfolio. The choice of using (USD) is well supported as Fama and French as well as Carhart have both calculated their factors in (USD).

The return is specified as the total return for each fund, obtained from the Morningstar Direct. Commonly used in research, like Otten and Bams (2003), the selected timeframe for our performance evaluation is ten years, resulting into a total of 120 months. The monthly return data has been collected from 30/12/2006 to 30/12/2016 to make the comparison of our portfolios up to date.

The risk-free rate of return is assumed to be the 1-Month Treasury Bill, which has also been the case for Fama and French (2010) and by Frazzini and Pedersen (2013) in their calculations of their proxy for the risk-free rate of return. The annualized data is collected from the Federal Reserve and has been transformed to monthly data by using formula (1).

$$\text{Monthly Risk} - \text{Free Rate of Return} = \left[(1+r_f)^{\left(\frac{1}{12}\right)} - 1\right] \times 100 \tag{1}$$

From the formula we find an average risk-free rate of return of 0.053% for the years 2006 to 2016. The factor loading data used in our regressions have, like Ivarsson and Olofsson (2016), been collected from the database AQR. The AQR gives an updated and extended dataset of the factors used in the Carhart four-factor model, Frazzini and Pedersen (2013). Furthermore, AQR is used instead of the R. Kenneth French Data Library as it offers data specified for several countries', including the Swedish market. We find it more suitable to proceed with Swedish data when looking at the domestic market, rather than using factors based on all common stocks available on the European market, accessible through the R. Kenneth French website. Being consistent in our data gathering, the U.S. and the global factors are gathered from the AQR database as well.

Using different market indices and different four-factor loadings for the Swedish and the U.S. market separately, we specify the market effect on each market, needed to obtain accurate alphas from our regressions. The four-factor loadings are the same as the ones existing in the R. Kenneth French Data Library, where the monthly market return is based on value-weighted portfolios of all available common stocks on the markets. Further, we use the global factors from the AQR database for the direct comparison. The factors are based on all available common stocks on the Compusstat/XpressFeed Global database for 23 developed market.

4.1 Delimitations

Limitations are necessary to make, however, as these might affect the validity of the results, we will mention them ahead for the sake of transparency. The number of funds in our sample is limited by our screening criteria, as we only focus on Swedish actively managed funds excluding all types of index funds. Further, the chosen time period might affect the findings as well. Including data for a longer period than 10 years might be desirable in further studies as it might affect the results. At the same time, using too narrow of a window will make any inference drawn from our results questionable since small datasets are affected by economical conjunctures.

Selecting mutual equity funds we include funds that invest in single markets since this is what we seek in our comparison. If the selection is based on an e.g. industry, a lot of funds invest in that industry all over the world. That is not what we are interested in evaluating. Since we are running linear regressions, we try to limit potential econometric problems that might arise by using various of statistical test, explained further below. An econometric problem would be to include too many or few variables, which might lead to biases. Further mention of these biases and the plan to approach them will be made below.

4.2 Potential Biases

Eliminating the risk of survivorship bias, both active and inactive funds are included in the sample. Meaning that we include all funds, meeting our criteria, disregarding if they have survived the period or not. If only surviving funds are included, we might end up with inflated results since the funds available for selection exclusively would be funds that have survived; winners, which might bias the evaluation of the fund performance in the sample, compared to the mutual equity fund market, Brown (1992). Funds that have a been active for at least 12 months, within our period, are also included in our sample to get as many observations as possible.

Additionally, selection bias can pose a problem since the data gathering method is not randomized. However, being consistent in the sample selection, including the largest amount of actively managed funds possible after screening for our criteria, we minimize this risk. When screening for funds we include as many actively managed funds as possible that meet our criteria.

During 2007 to 2009 a financial crises occurred. As we have observations from 2006 to 2016, the impact of the financial crisis will be contained in our results. We want to disclose that the crisis can have an impact on the performance of the funds in our sample and that we are aware of the potential bias the financial crisis can have on our research.

4.3 Return Data

Mutual fund performance can be examined in several ways. Some focus on the gross return of a fund, and some examine the net return, clear of fees and expenses that might be included in the purchase price. We have collected the total return in (USD) expressed in percentage. The calculation of the return is made by taking the change in the asset price, reinvest all income and capital gains during the period and then divide it by the previous starting price. The return data accounts for and is calculated after deducting for the expense ratio, management fees, administrative fees and other expenditures, making the total return a preferable and frequently used type of return, Morningstar Investing Glossary (2017).

4.4 Fund Selection

In our fund selection, we have screened for actively managed funds, that have been operating for a minimum of 12 months, invests primarily in one of the chosen markets and is classified as an open-equity fund. Using Morningstar Direct we screen for open-equity funds, inactive and active, the investment area the funds operate in and the country of domicile. We obtain a total of 97 funds investing primarily in the Swedish market, 18 of whom are inactive, and 14 funds primarily investing in the U.S. market, 2 of whom are inactive. The low number of funds included in the U.S. portfolio is due to the limited number of Swedish funds investing in the U.S. market. Adjusting our list by removing index funds, we observe a smaller market for actively managed funds than for Swedish funds investing in the Swedish market. The sample of the U.S. funds, even though limited, represents the entire market for Swedish funds investing in the U.S. who satisfy our criteria. With this in mind we argue that the sample is of satisfying size.

We have also partitioned the funds after the market capitalization of the companies they invest in. The funds are divided into the subgroups Large-Cap and Mid/Small-Cap. By grouping the funds this way, observing the potential statistically significant differences of the funds with different investment styles is possible. The reasoning behind having two subgroups rather than three, if we were to separate Mid/Small-Cap, has to do with our selection of the U.S. portfolio. A partition into three different market capitalizations results in two Small-Cap U.S. focused funds. We questioned the value of potential empirical findings from this group and concluded to combine Mid-Cap and Small-Cap into one subgroup to keep the sample size as large as possible.

For determination of investment style for each fund the Morningstar Style Box has been used as it is tool of assisting advisors to determine and classify securities held by a portfolio into nine different categories, Morningstar, (2004). The Style Box is applicable in all equity markets and captures size, security valuation, and security growth.

4.5 Index Selection

The chosen indices are suitable for the U.S. portfolio and the Swedish portfolio, separately and in aggregate. First, an American and a Swedish index is selected for the single market regressions. The SIX RX has been chosen for the Swedish portfolio and CRSP Total Market Index for the U.S. portfolio. These total market indices are suitable since the sample include funds investing in Small, Mid and Large-Cap companies. The SIX RX Index display the average return on the Stockholm Stock Exchange including dividends, which matches our fund return data collected from Morningstar Direct, Swedish Investment Fund Association (2017).

The CRSP TMI is previously used in research including Carhart (1997). As the CRSP Total Market Index captures nearly 4,000 constituents and represents almost 100% of the U.S. investable equity market, we find it an appropriate benchmark. For our comparison of the U.S. and the Swedish portfolio, the MSCI World Index has been selected as benchmark. The MSCI World Index represents mainly the Large and Mid-Cap equity performance across 23 developed markets including the U.S. and the Swedish market. From the AQR database we also use the global market index to increase robustness in our findings.

5 Methodology

The excess returns are composed into equally weighted portfolios and benchmarked against the chosen indices. Using the monthly excess return we calculate the Sharpe ratio as well as the Treynor ratio. Further, the ratios are tested for statistical significance using a two sided t-test for differences in mean. The regressions have been made using Stata IC 14. In line with previous studies such as, Otten and Bams (2003), a difference portfolio between Swedish and U.S. investing funds has been constructed to observe the relative performance between the portfolios. Comparing the two portfolios, global Carhart factors have been used instead of country specific factors when using MSCI World Index as benchmark. Seeking to determine performance differences, these factors are preferred as country specific data would differ between the groups when constructing the difference portfolio. Looking at performance in the domestic markets, different indices described before have been used with Swedish and U.S. specified data. Which enables us to compare the performance with the market they primarily invest in.

5.1 Determining Statistical Significant Ratios

Since the data differs between funds, as some have been merged, liquidated and some funds are younger than other, we have used the most recent 12 months available of each fund in our calculations of the ratios as this is the longest time span we have available data on for all funds. As we have computed the Sharpe and Treynor ratios for all funds in both markets using an equally weighted portfolio, we adjusted our data for their separate weights in each portfolio. The standard deviation is calculated using the function below and is computed for each fund over the 12 months' period.

$$\text{Standard Deviation} = \sqrt{\frac{\sum(x-\overline{x})^2}{(n-1)}} \tag{2}$$

Correspondingly the market beta has been estimated by calculating the sample covariance of the return and MSCI World index returns divided by the sample variance for the market. Using the U.S. Treasury bill and the MSCI World Index for all funds enables a fair comparison between the funds based on the risk-free adjusted return.

Determining if the Sharpe and Treynor ratios are statically significant the two sided t-test for differences in mean is used. This is also an alternative way of evaluating the potential performance differences between the portfolios. The formula holds under the assumption that the test follows the Student's t-distribution, where data is considered to be normally distributed, (See Appendix), Pandis (2015). The two sided t-test is used to test the null hypothesis, to test if there are differences in risk-adjusted performance. The p-values suggests the level of significance.

$$\mathrm{t-test_{df}} = \frac{(\overline{x_1}-\overline{x_2})-d_0}{\sqrt{\left(\frac{var_1}{n_1}+\frac{var_2}{n_2}\right)}} \quad \& \quad \mathrm{df} = \frac{\left(\frac{var_1}{n_1}+\frac{var_2}{n_2}\right)^2}{\frac{\left(\frac{var_1}{n_1}\right)^2}{(n_1-1)}+\frac{\left(\frac{var_2}{n_2}\right)^2}{(n_2-2)}} \tag{3}$$

The t-test is calculated using formula (3) where (df) is the corresponding degrees of freedom, (var) the variance and (n) representing the number of observations. In the formula, ($\overline{x_1}$) represents the mean value for the Swedish portfolio while ($\overline{x_2}$) represent the mean value for the U.S. ratios. The stated null hypothesis suggests no differences, meaning that (d_0) is zero.

Sharpe Ratio

Calculating the Sharpe ratio, the risk-adjusted return is obtained for the funds, Sharpe (1994). The Sharpe ratio is included as it is commonly used for mutual fund evaluations. A high Sharpe ratio is preferable, indicating a high return with a low amount of risk, DeFusco, McLeavey, Pinto, Runkle and Andson (2015). The Sharpe ratios are calculated for both markets using the 1–Month U.S. Treasury Bill as a proxy for the risk-free rate of return. By using the Sharpe ratio, it is possible to determine if the U.S. or Swedish portfolios have higher risk-adjusted returns than the other group, indicating performance.

$$\text{Sharpe ratio (SR)} = \frac{R_{p,i} - R_{f,i}}{SD_{p,i}} \tag{4}$$

$\boldsymbol{R_{p,i}}$ = *The Realized Return of the Portfolio at time i.*
$\boldsymbol{R_{f,i}}$ = *Proxy for the Risk-Free Rate of return at time i.*
$\boldsymbol{SD_{p,i}}$ = *Standard Deviation of the Portfolio Return at time i.*

Treynor Ratio

The Treynor ratio is an additional approach for comparing the performance of funds. Like the Sharpe ratio, a high Treynor ratio indicates good performance. Created by Jack L. Treynor in 1966, the ratio has been commonly used in studies to rank fund managers of actively managed portfolios. The Treynor ratio calculates the risk-adjusted return by using beta in the calculation instead of using the standard deviation. Both measurements are included in the evaluation as they help rank portfolios per the portfolio risk-adjusted return. Moreover, they are also of importance since they differ in how they are calculated, which might result into different conclusions of performance.

$$\text{Treynor ratio (TR)} = \frac{R_{p,i} - R_{f,i}}{\beta_{p,i}} \qquad (5)$$

$R_{p,i}$ *= The Realized Return of the Portfolio at time i.*
$R_{f,i}$ *= Proxy for the Risk-Free Rate of return at time i.*
$Beta_{p,i}$ *= Beta of the Portfolio Return at time i.*

5.2 Regression Models

Following Otten and Bams (2003) we use three different regression models. This increases robustness and assists to observe whether the result differ and if the statistical power increases when including additional variables. Running a regression using CAPM the Jensen's Alpha is obtained. Additional to CAPM, regressions are run using the Fama–French three-factor model and the Carhart four–factor model. The Carhart model is most commonly used and superior due to the fourth variable.

CAPM: Jensen's Alpha

The Jensen's Alpha, commonly referred as the ex-post alpha, is used in empirical finance as a measurement of the risk-adjusted excess return. CAPM is a statistical method of predicting and identifying the required return of an investment and is used when comparing mutual fund and portfolio managers' performance, similar to the Sharpe and Treynor ratios, Sharpe (1964), Lintner (1965), Treynor (1961) and Mossin (1966). The second variable, the MKT (Rm-Rf) variable, also known as beta, representing the market return minus the proxy for the risk-free rate of return. The last variable in the regressions, the unobserved component that does not have a risk premium as it contains all the unexplained components. The unobserved variable is expected to have no conditional mean or correlation with the other variables used, Wooldridge (2012).

If Jensen's Alpha is significant and positive, the constant indicates that a certain portfolio manage to outperform the benchmarked index, Jensen (1968). A positive and significant MKT signifies that the investments of the portfolio move in the same direction as the market. If the portfolio displays a beta less than one, investments tend to move less than the market. Further, a value higher than one implies the opposite, that a certain portfolio move more than the market does, equals a higher volatility.

$$R_i - R_f = \alpha_i + \beta_i^1 (R_m - R_f)_i + u_i \quad (6)$$

R_i *= Return on the individual portfolio at time i.*
$R_{f,i}$ *= The proxy for the risk-free rate at time i.*
α_i *= The Jensen's Alpha (Ex-post alpha)– The risk-adjusted return for portfolio i.*
MKT_i $(R_m - R_f)_i$ *= The market return minus the risk-free rate of return at time i.*
u_i*= The unobserved component/error term for the portfolio at time i.*

The Fama–French Three-Factor Model

Originating from W.F. Sharpe´s CAPM, the Fama-French model (1992) includes two additional factors capturing the effects of company size and the book-to-market value of stocks. Introducing the SMB (small minus big) factor, representing the returns from equal dollar amounts in long positions in three small portfolios, financed by equal dollar amounts in short positions in three big portfolios, the SMB variable accounts for the size effect of a company. The HML (high minus low) variable captures the effect of investing in value versus growth stocks, representing the returns from equal dollar amounts in long positions in Small Growth/Value and Big Growth/Value portfolios.

A positive and significant beta for the SMB implies that the portfolio focus more on investments in smaller firms, indicating higher expected returns and higher risks. A negative SMB, therefore, suggests that a portfolio is more focused on Large-Cap companies, indicating lower risk, Fama (1995).

The third factor, the HML, gives an intuition of the investment style of the fund managers since it tells us whether the fund mainly invests in growth or value stocks. Higher book-to-market stocks should on average suggest higher returns than stocks with low book-to-market ratios. Value stocks, high book-to-market ratios, are considered to be less risky than growth stocks, Fama and French (1998). Furthermore, a positive and significant HML indicates that the fund managers concentrate the portfolio on value stocks over growth stocks while a negative HML suggests that the portfolio focus more on growth stocks.

$$R_i - R_f = \alpha_i + \beta_i^1 (R_m - R_f)_i + \beta_i^2 (SMB)_i + \beta_i^3 (HML)_i + u_i \quad (7)$$

R_i *= Return on the individual portfolio at time i.*
$R_{f,i}$ *= The proxy for the risk-free rate at time i.*
α_i *= The Fama-French Three-Factor alpha – The risk-adjusted return for portfolio i.*
MKT_i $(R_m - R_f)_i$ *= The market return minus the risk-free rate of return at time i.*
SMB_i *= The Fama-French risk premium capturing size effects at time i.*
HML_i *= The Fama-French risk premium capturing book-to-market effects at time i.*
u_i *= The unobserved component/error term for the portfolio at time i.*

The Carhart Four-Factor Model

The Carhart four-factor model is a development of the Fama-French three-factor model with momentum as an added factor. As stated earlier the Carhart four-factor model is widely used in studies as the last variable, MOM, captures the relationship that funds earn higher returns by investing in stocks that have performed well in the past as they tend to keep doing so in the future, determined by Jegadeesh and Titman (1993). A positive and significant momentum factor indicates that the portfolio follows an investment style of buying winners and selling losers while a negative MOM indicates the opposite, selling past winners and buying losers. Including the variable in the model we are able to account for the short-term effect of momentum. Formula (8) below includes all variables explained above for the Fama-French three factor model plus momentum.

$$R_i - R_f = \alpha_i + \beta_i^1 (R_m - R_f)_i + \beta_i^2 (SMB)_i + \beta_i^3 (HML)_i + \beta_i^4 (MOM)_i + u_i \qquad (8)$$

R_i *= Return on the individual portfolio at time i.*
$R_{f,i}$ *= The proxy for the risk-free rate at time i.*
α_i *= The Carhart Four-Factor alpha – The risk-adjusted return for portfolio i.*
MKT_i ($R_m - R_f$)$_i$ *= The market return minus the risk-free rate of return at time i.*
SMB_i*= The Fama-French risk premium capturing size effects at time i.*
HML_i *= The Fama-French risk premium capturing book-to-market effects at time i.*
MOM_i *= The momentum effect for the portfolio at time i.*
u_i *= The unobserved component/error term for the portfolio at time i.*

6 Statistical Tests

Before running the ordinary least square regressions (OLS), the underlying assumptions must be tested for and met. First off, estimators have to be to consistent as they then are exogenous and linearly unbiased, meaning that the errors have no problem with heteroscedasticity and serial correlation. Data being heteroscedastic or serially correlated might negatively affect the outcome of the regressions, giving us false values. Another important assumption is to test the data for normal distribution, Bickel (1978) and Koenker (1981).

Further, testing for correlation in our sample we construct a correlation matrix, (See Appendix). The matrix enables investigation of whether the regression variables are dependent on each other. If no coefficients in the Carhart four-factor model are highly correlated, multicollinearity will not be a problem, Farrar and Glauber (1967). Hence, various tests are conducted to examine the presence of autocorrelation and heteroscedasticity. Testing for robustness in the findings different benchmarks and three different economical methods (CAPM, Fama-French and Carhart) are used.

6.1 Inactive Funds & Outliers

An issue that can affect the results when including inactive funds is that the relative number of inactive funds differ substantially between the portfolios. Having too many, or few, inactive funds in one portfolio would increase the risk for biasedness. Observing the descriptive statistic table below, the percentage of inactive funds is comparable between the portfolios. The Swedish portfolio contains a total of 18 inactive funds while the U.S. portfolio has two. Looking at the relative number of dead funds, there is a deviation of 4% between the two portfolios. Since the number of Swedish actively managed funds investing in the U.S. is limited, it is problematic to include more dead funds in the U.S. portfolio. Further, we assume that the small deviation between our portfolios is of negligible importance and not large enough for us to adjust the data for the potential bias that might occur from having a substantially larger sample of inactive funds in one of the portfolios.

Table II – Descriptive Statistics

Funds	Swedish Portfolio	U.S. portfolio	Difference
Average return (%)	0.65	0.61	0.04
Median return (%)	0.545	0.94	-0.39
Max (%)	37.42	17.66	19.76
Min (%)	-29.68	-20.81	-8.87
Standard Deviation (%)	7.40	4.62	2.78
Number of funds	97	14	83
Number of inactive funds	18	2	16
Percentage of inactive funds	18.56 %	14.29 %	4.27 %
Index	**MSCI World Index**	**SIX RX Index**	**CRSP TM Index**
Average return (%)	0.48	0.63	0.69
Median return (%)	0.665	0.75	1.26
Max (%)	11.32	25.11	11.44
Min (%)	-18.94	-26.38	-17.65
Standard Deviation (%)	4.77	7.13	4.54

Table II: Standard deviation as proxy for the risk for the portfolio and index returns. The difference portfolio shows the deviations between the samples groups for all variables. The table shows the statistics for all the indices and funds used in our sample.

Screening for outliers, the Swedish portfolio is found to have a higher average standard deviation, meaning higher volatility, and a significantly higher monthly maximum return than the U.S. portfolio which might be due to extreme observations in the sample. Outliers are a statistical problem arising when extreme observations affect the results, Hawkins (1980). Possibly affecting the results and the standard deviations in the sample. However, the average and median return for the Swedish market do not differ substantially even with the presence of the extreme observations. Hence, all funds in the sample are kept after concluding that they do not affect the sample in any meaningful way.

6.2 Normality Distribution

Testing if the data is normally distributed, a graphical illustration is used where the monthly excess return is plotted for each fund group in a frequency table, (See Appendix). The test for normality distribution is conduced in Excel where the returns are plotted against the calculation for normal distribution. Furthermore, observing the figures, it is assumed that the sample is approximately normally distributed as the normal distribution curve follows the shape of a bell and the values are centered towards zero. Under the assumption that the data is normally distributed we use the normal way of calculating the standard deviation when calculating our Sharpe and Treynor ratios. Important to keep in mind is that a graphical illustration is constructed of the return distribution, thereby no p-values are received to test for statistical significance.

6.3 Serial Correlation & Heteroscedasticity

The main assumption of unbiasedness in the regressions is homoscedasticity, the Breusch–Pagan test for heteroscedasticity is used in Stata to account for the potential presence of homoscedasticity. The Breusch–Pagan test is used in linear regression models as it tests whether the variance of the errors computed from the regression is dependent on the unobserved variable, pointing towards heteroscedasticity. The Breusch–Pagan test is calculated for the portfolios to make sure that the bias is not present. Further, the White statistical test is also used to test the estimator for heteroscedastic consistent standard errors, (See Appendix). The tests suggest that there are no significant effects of heteroscedasticity in the sample.

If the assumption of homoscedasticity is violated and if there are autocorrelated residuals the estimators are no longer efficient. To correct for these potential problems, the Newey-West (1987) procedure is implemented for our regressions. The method assists to account for the existence of serial correlation and heteroscedasticity that might occur from using time series data, like our historical fund return data. Newey-West standard errors are also used, which affects the estimated standard errors by accounting for serial correlation and heteroscedasticity.

Since monthly data is used in the study, the Newey-West procedure using a lag of 12 is chosen, as suggested by Woodridge (2012).

Before running our Newey-West regressions since time series are used, an additional check testing for autocorrelation is constructed. Performing the Breusch-Godfrey test with a lag of one, we are able to examine the presence of serial correlation. The test is useful as it does not require strictly exogenous regressors, Breusch (1978).

6.4 Robustness

To test for robustness, different regressions using various indices are run. We use MSCI WI, SIX RX and CRSP TMI as indices for the portfolios. As an additional index the AQR global index is used to test the findings for robustness. Additionally, regressions are run using the previously mentioned regressions models (CAPM, the Fama–French three-factor model and the Carhart four-factor model) for all the portfolios. The model specifications for the MSCI World Index and regressions using different benchmarks are shown in the appendix.

6.5 Time & Seasonality

The data is cross-sectional time series data as 10 years of data on a monthly basis is used to observe the performance of the portfolios. Thereby, tests are run where the Carhart four-factor model is adjusted for time and to test the significance level of time as an extra explanatory variable. Doing this it is possible to determine if time is significant and if the effect of time is present in the sample. If time is significant the effect of time is present in the sample forcing an adjustment of the regression to be made by adding time as an additional variable.

The tests have been made using all three portfolios, including the difference portfolio when using MSCI World Index as benchmark. If the effect of seasonality is significant, a variation in the time data occur at specific regular intervals, meaning that the returns differ substantially between months. Seasonality consists of periodic and generally regular and predictable patterns in the time series data. By adding dummy variables for 12 months in the regression model it is possible to pair each dummy to the portfolios. Testing the joint significance for the dummy variables, it is possible determine whether seasonality is present or not.

From the tests we see that only seasonality is present and significant for the Swedish and U.S. portfolio when benchmarked against the MSCI World Index. The corresponding p-values to the tests and the adjusted Carhart regressions are shown in tables in appendix.

7 Empirical Results

Doing a test for correlation in the form of a correlation matrix, we investigate whether our regression variables are correlated to each other. If no coefficients in the Carhart four-factor model are highly correlated, we will not have a multicollinearity problem, Farrar and Glauber (1967). Shown in Appendix, is the correlation matrix for the global Carhart factors gathered from AQR. The results indicate no highly correlated variables for either market. The highest correlation between two variables is between the MOM and the MKT, where a negative relationship of (–0.4375) is perceived. In figure II, the monthly returns are illustrated for the equally weighted portfolios plotted against the MSCI World Index, for the whole time period. There is no large variations or differences between the performance of our portfolios. However, the figure indicate that Swedish funds seem to have both a lower minimum return and a higher maximum return. In line with our descriptive statistics, the Swedish portfolio seem to be more volatile than the U.S. portfolio.

Figure II – Return Development 2006-2016

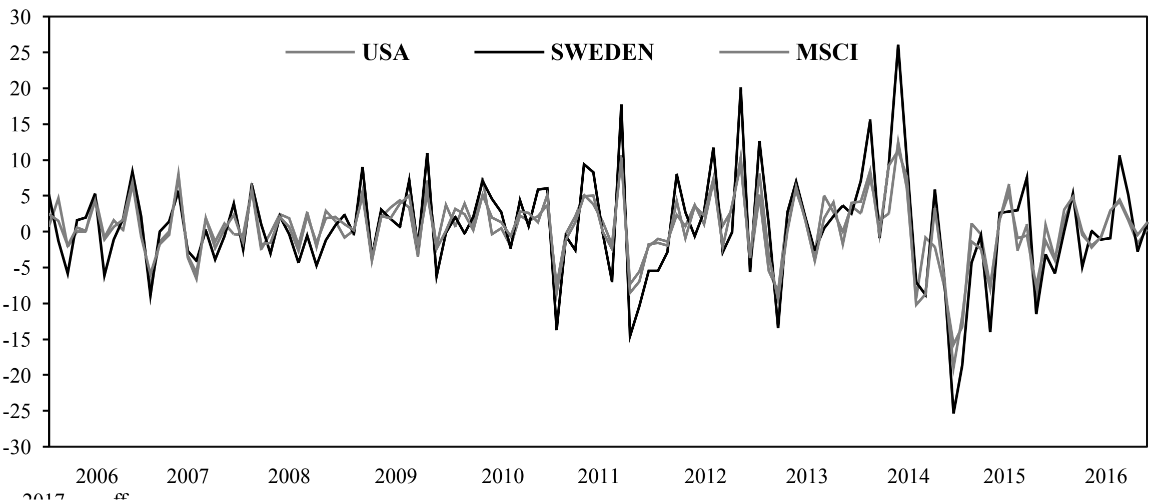


Figure II: Show the development of the average monthly total return for the U.S. and Swedish portfolio compared to the MSCI World Index. On the Y-axis show the total return expressed in percentages and on the X-axis is the date, from 2006-2016.

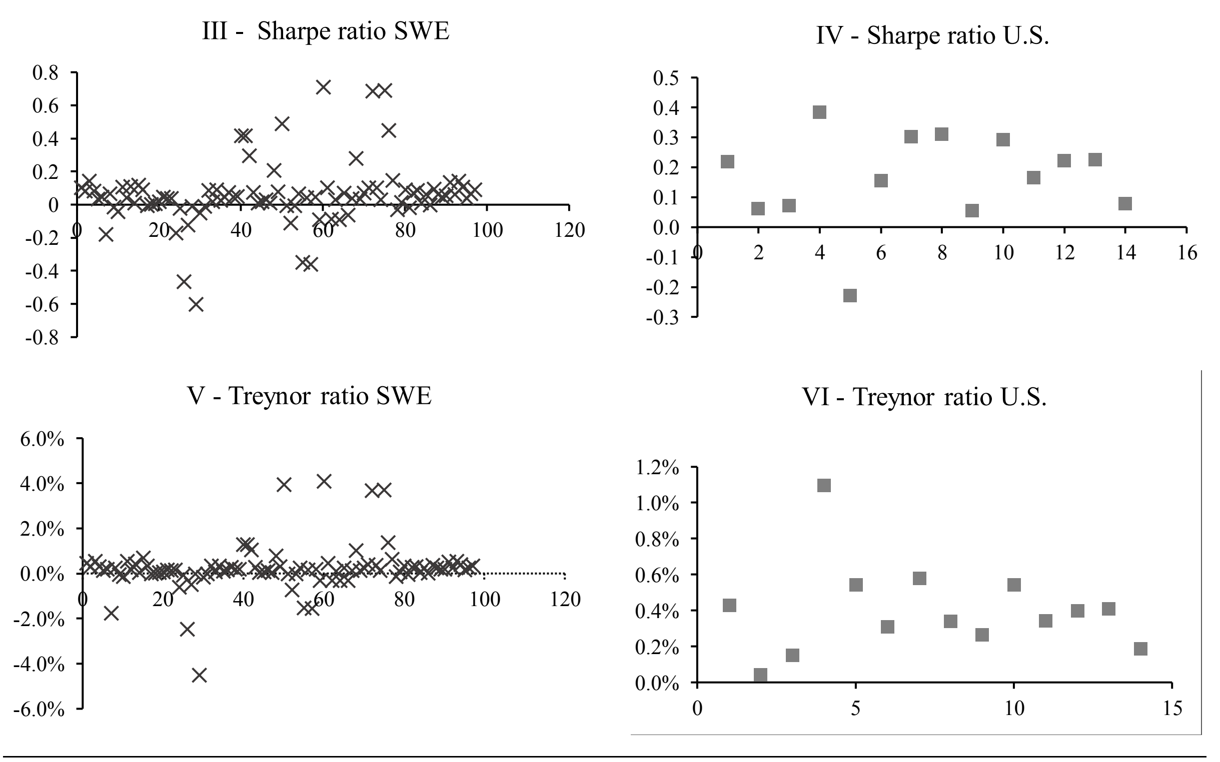
The following section will detail the benchmark and risk-adjusted returns for each segment using indices based on whether the funds are compared to their domestic market or whether a direct comparison is made using the world index.

7.1 Sharpe & Treynor ratios

The Sharpe ratio and the Treynor ratio both measure the risk-adjusted return, however, the Sharpe ratio do not utilize beta, or market risk, to examine the risk-adjusted return for the funds. Illustrating the ratios in scatter plots below, it is possible to determine if there are outliers in the sample. Observing the scatterplots, the Swedish portfolio is found to provide both positive and negative Sharpe and Treynor ratios. The American portfolio provides exclusively positive Treynor ratios, which is in line with the findings by Arugaslan, Edwards and Samant (2007), evaluating U.S. funds. The Sharpe ratios are all positive with an exception of one fund.

There are a few extreme observations in the sample for both markets, however, we decide not to remove any as we want to observe the whole sample.

Figures III-VI – Sharpe & Treynor ratios



Figures III-VI: Scatter plots for the Treynor and Sharpe ratios for both the U.S. and Swedish investing funds. Calculated using 12-month of data and compared to the MSCI World Index. Y-axis show the values for the Sharpe ratios and for the Treynor ratios they are expressed in percentage terms. Further, the X-axis shows the number of funds.

By simply looking at the scatter plot we can not determine if the there are any differences in performance by investing in different investment areas. In Table III, the values from a two sided t-test is specified for both measurements along with the mean values for each portfolio. The mean values indicate that neither of the portfolios ratios are negative, implying that the average fund return is higher than the actual risk-free rate of return. The Treynor beta is also positive. A positive beta of 1 illustrates that the funds have the same level of risk as the benchmarked index. However, the sample displays a beta about 1.12 which indicate a more volatile response to market movements.

Observing the Sharpe and Treynor ratio, the funds investing in the U.S. market demonstrate higher averages than the funds investing in the Swedish market. By observing the averages, in terms of risk-adjusted returns, the U.S. investing funds seem to perform better than Swedish investing funds. With lower volatility, the U.S. portfolio achieves both higher average Sharpe and Treynor ratios.

Taking a closer look at the Treynor ratios from the portfolios, a similar pattern is found as the one for the Sharpe ratios. The U.S. portfolio has a Treynor ratio of 0.40% compared to the Swedish portfolio of 0.29%, meaning that they are better performing.

Table III – Sharpe and Treynor Ratio Statistics

Variables	Swedish Portfolio	U.S. Portfolio
Mean Treynor Ratio	0.2945%	0.4016%
Mean Sharpe Ratio	0.0592	0.1659
Mean Standard Deviation (SR)	0.1883	0.1539
Mean Standard Deviation (TR)	0.0104	0.0025
No. Obs	97	14

Variables	Sharpe ratio	Treynor ratio
df	19	85
t-statistic	-2.3537**	-1.4387
p-value	0.0295	0.1540

Table III: Show the mean standard deviations and mean values for the ratios for both the Swedish and U.S. investing funds. The standard deviation, representing the volatility and are calculated using twelve-months of data using formula (2). Degrees of freedom (df) and the t-values from the two sided t-test, calculated using formula (3). The specified hypotheses are stated underneath, with the null hypothesis stating that there are no differences in mean value between the two fund groups. Formula (2) is used to calculate the two sided t-test.

$$H_{null} = (\overline{x_1} - \overline{x_2}) = 0$$
$$H_{Alt.} = (\overline{x_1} - \overline{x_2}) \neq 0$$

The p-values are gathered for a two-sided t-test with different degrees of freedom using the t-distribution calculator developed by Rice University, University of Houston Clear lake and Tufts University.

Testing the ratios for significance using a two sided t-test for differences in mean, the t-value for the Sharpe ratio between the portfolios is statically significant at 5 percent. Further, the sign of the t-statistic tells the direction of the difference in our sample. Additionally, the t-test values indicate how the two portfolios perform relative to each other.

A negative Sharpe value of (-2.3537) implies that the U.S. portfolio has a higher average than the Swedish portfolio, meaning that the portfolio has higher risk-adjusted returns. The results from the t-test do not support the initial assumption that the Swedish market should outperform the U.S. market due to potential market inefficiencies. Arugaslan, Edwards and Samant (2007), determine the risk-adjusted performance by using Sharpe, Treynor and Jensen's alpha using U.S. based international mutual funds and find similar evidence in their sample. Their results suggest that the majority of the U.S. funds obtain positive average Sharpe ratios and that funds with high standard deviation tend to have lower Sharpe ratios. This is in line with our findings. Observing the Sharpe ratio, the Swedish investing funds has on average both higher standard deviation and lower values.

Further, testing the Treynor ratios by using the same method we find a negative t-value as well. The results suggest that it is more probable that the U.S. portfolio over-performs on a risk-adjusted basis, although, not significant enough to reject the null hypothesis of zero difference since the t-value is not statistically significant at 10 percent. In conclusion, it is uncertain whether the U.S. portfolio over-perform or has higher Treynor ratio than the Swedish portfolio.

7.2 Regressions

Running regressions using robust standard errors before the Newey-West regressions, we acquire the R-squared, (R^2). The (R^2) increase as more factors are introduced in the regression setup, with the Carhart four-factor Model displaying the highest R-squared. The R-squared is the statistical variable that explains how close the data is to the fitted regression line, meaning that the Carhart four-factor model explains more than the alternatives and is therefore used when referring to the regressions.

Swedish & U.S. Portfolios - MSCI World Index

Table IV presents the regression output for all three portfolios when using the Carhart four-factor model and the global Carhart factors, benchmarked against the MSCI World Index. Positive alphas are found for the Swedish portfolio and the U.S. portfolio at 0.0987% and 0.1062%. These results can be interpreted as that the adjusted returns are higher than the benchmark returns, and that the U.S. portfolio is slightly outperforming the benchmark.

However, the alphas are rather small and also insignificant for the portfolios, meaning that we can not conclude anything about the performance. These non-significant findings are similar to the results Otten and Bams (2003) find when also using equally weighted portfolios, looking at fund performance. Further, observing the relative returns in the difference portfolio, the alpha received indicates that the Swedish portfolio seem to under-perform the U.S. portfolio, (-0.0581%). Again, the difference portfolio lacks statistical significance so we can not determine if there are any differences in the performance between the groups. The explanation of the absence of significant alphas will be covered in the discussion.

Table IV – Regressions using the MSCI World Index

Variables	Swedish Portfolio	U.S. Portfolio	Difference Portfolio
Alpha	0.0987	0.1062	-0.0581
	(0.2182)	(0.0803)	(0.2395)
MKT	1.3133***	0.9079***	0.4062***
	(0.0790)	(0.0402)	(0.0793)
SMB	0.4381***	0.3020***	0.1466
	(0.1794)	(0.0937)	(0.2146)
HML	-0.2778**	-0.0889	-0.1939
	(0.1259)	(0.0710)	(0.1523)
MOM	-0.1560*	0.0755**	-0.2330***
	(0.0806)	(0.0378)	(0.0576)
Observations	120	120	120

Table IV: Show the results from the Carhart four-factor model using a full sample for the Swedish, U.S. and difference portfolio having MSCI World Index as a benchmark. The regressions have been made on equally weighted portfolios for the full period, 2006 – 2016. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity.
Regressions are made using OLS and the following model:

$$R_i - R_f = \alpha_i + \beta_i^1(R_m - R_f)_i + \beta_i^2(SMB)_i + \beta_i^3(HML)_i + \beta_i^4(MOM)_i + u_i$$

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Continuing with the Carhart factors, the MKT variable, the beta of the regression, are positive for the Swedish and the U.S. portfolios at 1.31 (0.91). These betas are statistically significant at 1 percent. With statistical significance, our Swedish investing funds tend to move more than the market does, also more than the U.S. portfolio. The difference portfolio confirms this with a value of 0.40, significant at 1 percent. Since the comparison between the Swedish funds investing in different geographical areas is a novel approach, no previous study is found displaying these exact results. Reviewing the earlier results, the findings are comparable with what is found looking at the Sharpe and Treynor ratios and the descriptive statistic table. The Swedish portfolio appears to under-perform the U.S. portfolio and is considered more volatile with a standard deviation of 7.40% and 4.62% respectively.

Examining the other variables used in the Carhart four-factor model, leaving the alpha and beta, varying results are found. The positive SMB's can be interpreted as that the portfolios are more weighted towards investing in Small-Cap stocks, suggesting higher risks, Fama and French (2010). The factors are significant for both markets at 1 percent significance level, however, observing the difference portfolio, it cannot with statistical significance be concluded that a difference exists. The results from the U.S. portfolio is similar to Otten and Bams (2003), who find a positive U.S. market SMB of 0.09 at a 1 percent significance level.

The HML factors are indicative of the investment strategy, explaining if funds invest mainly in growth or value stocks. Both the Swedish and the U.S. portfolio displays negative HML variables at (-0.28) and (-0.089), the Swedish portfolio at 5 percent significance and the U.S. without significance. The reported values indicate that funds tend to invest more in growth stocks with lower book-to-market ratios than value stocks. As the difference portfolio do not show any significance difference between the group, we can not conclude that a difference exists. Otten and Bams (2003) find positive significant HML factors when observing U.S. equity fund returns. They also observe foreign mutual equity funds investing in the U.S. market, without being able to conclude that there exists a statistically significant difference.

The momentum effect, MOM, varies among the two groups with the Swedish portfolio at (-0.16), statistically significant at 10 percent and the U.S. portfolio at 0.076 statistically significant at 5 percent. Looking at the difference portfolio a difference is found at (-0.23) significant at 1 percent. Swedish market investing funds have a negative effect on momentum while the U.S. investing funds have a significant positive effect. Implying that the Swedish portfolio do not invest in stocks considered to be last years' winners on the market, while the U.S. portfolio do. Carhart (1997) concludes that a significant part of the generated fund return of his sample is caused by the momentum effect. Indicating that the positive momentum effect we observe for the U.S. portfolio seem to be consistent with Carhart.

Continuing with the investment styles positive alphas are found for Large-Cap and Mid/Small-Cap for both groups but lacking significance. For the U.S. portfolio the alphas are higher for Mid/Small-Cap funds than the Large-Cap funds, indicating a "small-firm effect". The difference portfolio shows no statistical significance for the reported difference, meaning that it cannot be determined if there are any differences in performance between investment styles using MSCI World Index as benchmark.

U.S. Portfolio - CRSP Total Market Index

Running regressions using the U.S. portfolio on the domestic, CRSP Total Market Index, an alpha of (-0.14%) is received, (See Table V below). Suggesting that the portfolio underperforms. However, the alpha is lacking statistical significance. Supporting the non-significant finding are the results from previous research written by Carhart (1997), Fama and French (2010) and Malkiel (1995) who find evidence for negative alphas on the U.S. market, with varying significance levels.

The Large-Cap sample display a negative alpha of (-0.09%). For the Mid/Small-Cap funds a negative alpha of (-0.083%) is observed. These values are non-significant as well. However, they suggest that the Large-Cap funds underperform the Mid/Small-Cap funds.

Table V – Regressions using Domestic Indices

	Swedish Portfolio - SIX RX			**U.S. Portfolio - CRSP TMI**		
Variables	**Total**	**Large**	**Mid/Small**	**Total**	**Large**	**Mid/Small**
Alpha	-0.0139	0.0437	-0.0444	-0.0846	-0.0898	-0.0831
	(0.0533)	(0.0739)	(0.0557)	(0.0579)	(0.0659)	(0.1539)
MKT	1.0128***	1.0197***	1.0049***	0.9672***	0.9635***	1.0020***
	(0.0175)	(0.0189)	(0.0170)	(0.03511)	(0.0325)	(0.0607)
SMB	0.1002***	0.2499***	0.0465**	0.1302*	-0.0363	0.8153***
	(0.0215)	(0.0279)	(0.0216)	(0.0754)	(0.07183)	(0.1310)
HML	-0.0332	-0.0227	-0.0357	-0.2254***	-0.1882**	***
	(0.3314)	(0.0412)	(0.0312)	(0.0833)	(0.0744)	(0.1426)
MOM	0.0109	0.0546***	-0.0032	0.0130	-0.0068	0.0985**
	(0.0149)	(0.2000)	(0.0165)	(0.0288)	(0.0259)	(0.0476)
Observations	120	120	120	120	120	120

Table V: Show the results from the Carhart four-factor model for the different investment styles using domestic indices for the Swedish and the U.S. portfolios. The Swedish SIX RX Index and the CRSP Total Market Return Index for the U.S. sample. The regressions have been made using Newey-West on equally weighted portfolios for the full period, 2006 – 2016. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity.
Regressions are made using following formula:

$$R_i - R_f = \alpha_i + \beta_i^1(R_m - R_f)_i + \beta_i^2(SMB)_i + \beta_i^3(HML)_i + \beta_i^4(MOM)_i + u_i$$

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

The market beta, MKT, for the portfolio, is reported as 0.9672 and is statistically significant at 1 percent. The SMB is positive at 0.1302 at a 10 percent significance level. Indicating that the funds invest more in Small-Cap companies, similar to what was found in the earlier section using the MSCI World Index as the benchmark. Further, the data suggest that the U.S. investing funds focus more on an investment style with growth stocks. The HML variable for the funds is (-0.2254) and is statistically significant at 1 percent. Continuing, we have the momentum effect. At 0.013 the momentum factor indicates that the funds are prone to using this effect, however, the variable lacks statistical significance.

Swedish Portfolio - SIX RX

For the Swedish portfolio benchmarked against the SIX RX, a non-significant alpha of (-0.0139%) is found, (See Table V above). Implying that the Swedish market investing funds underperform the SIX RX. Evidence backing up these claims are past studies on Swedish fund performance like Flam and Vestman (2014), and Ferreira, Keswani, Miguel, Ramos (2013), who find that Swedish funds are underperforming the market.

Continuing with the investment styles of the funds, the Swedish portfolio benchmarked against the SIX RX indicates that the Large-Cap funds over-perform the benchmark while the Mid/Small-Cap funds under-perform. However, these results are not statistically significant. Ergo, we can not determine that the performance differs from the benchmark.

Benchmarking the Swedish market investing funds against the SIX RX, the MKT is reported at 1.0128 and significant at 1 percent. The SMB factor is positive at 0.1002 and significant at 1 percent. Lacking statistical significance is the HML variable (-0.0332) and the momentum effect 0.0109. Without significance, we can not determine if the reported effects significantly differ from zero.

8 Discussion

This thesis examines the fund performance of Swedish equity mutual funds investing mainly in either the Swedish market or the U.S. market, looking at the years 2006 to 2016. Data has been collected from Bloomberg and Morningstar Direct on 97 funds investing in Sweden and 14 funds investing in the U.S. Equally weighted portfolios and a difference portfolio are created and used in our regressions based on Carhart’s four-factor model. Additionally, the Sharpe and the Treynor ratios are calculated based on 12 month of data, as this is the largest period all the funds have reported returns for. Important to consider is that these 12 months might not be completely representative of the true performance of the sample. Regression models adjusted for seasonality and different ratios are all used to further back up our claims.

In conclusion, using equally weighted portfolios on a rather small sample we have not managed to obtain positive alphas for our difference portfolios, meaning that based on the regressions we are unable to tell if it would be more valuable for Swedish investors to invest in Swedish funds focusing on the U.S. market compared to the Swedish market. This might be due to a small sample or due to the use of a too narrow period of time.

Revisiting our hypotheses, the first hypothesis states that the Swedish funds over-perform the U.S. investing funds. The output, however, indicate that the Swedish portfolio have lower alphas than the U.S. portfolio. Observing the difference portfolio, no statistical significance is found to back these claims. This is in line with Otten and Bams (2003) who also report that there is no statistically significant difference between U.S. and UK funds' performance.

Second, the hypothesis that U.S. and Swedish investing funds should over-perform the domestic indices can not be rejected. No statistically significant differences can be found to back up these claims. Even though not significant we find indications that both the Swedish market investing funds and the U.S. market investing funds under-perform their domestic benchmarks.

Lastly, we can not reject the hypothesis that there exists a statistically significant difference between the Sharpe and Treynor ratios. This can only be claimed for the Sharpe ratio. The Sharpe ratio for the U.S. portfolio is higher than for the Swedish portfolio, significant at 5 percent, which has been confirmed with the composition of a two-sided t-test. The Treynor ratio indicates the same pattern but for this ratio the t-value do not show statistical significance under 10 percent, therefore, the hypothesis that the Treynor ratio is different from zero cannot be rejected.

In conclusion, it is important to keep in mind that the findings are based on funds investing in two different markets, not all over the world. Additionally, the findings are limited and the sample selection resulted in a small number of funds, especially funds operating in the U.S. market.

10 Further Research

Going forward it would be of interest to further research if the initial hypotheses can be observed between the Swedish and the U.S. market. Continuing the research, a larger sample covering an increased period of time could increase the possibility of rejecting the hypotheses. Including variables such as Tracking error, Active share, fund size, fund age and more would in that case be of interest to explain the results. Cremers and Petajisto (2009) do this in their research with interesting results.

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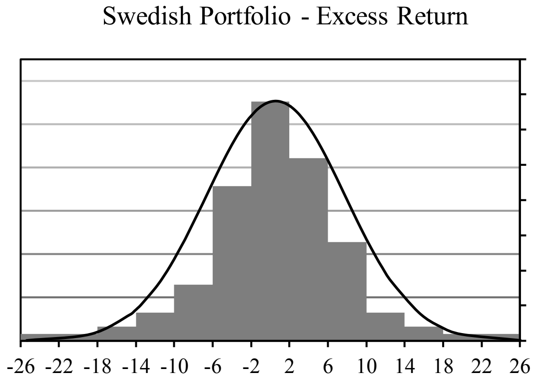
12 Appendix

Statistical Tests

Table VI - Graphical Illustration of Normality Distribution



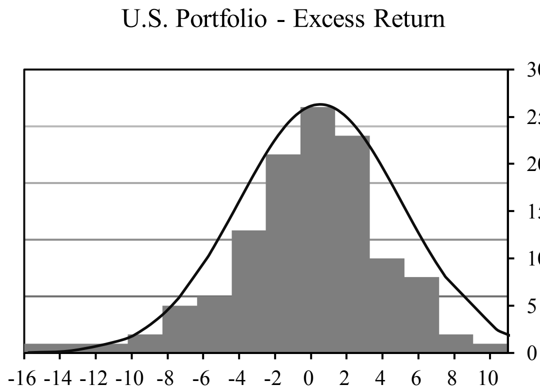


Table VI: Show the tests for normality distribution in the sample data. By plotting the excess return for our equally weighted portfolios and calculating the normal distribution in Excel we see that our data is approximately normally distributed, centered toward 0% in excess return. Y-Axis show the frequency while the X-axis represent the excess return in percentage.

The frequency tables above show how the total return data has been plotted after adjusting for the risk-free rate of return (excess return). From the tables we observe that the return distribution is approximately normal. Further, we have assumed this to be true, that our return data is normally distributed and follows the shape of a bell and centers towards zero.

Table VII - Correlation Matrix

Variables	Market	SMB	HML	MOM
MKT	1			
SMB	0.2345	1		
HML	0.2686	0.1197	1	
MOM	-0.4375	-0.3078	-0.3476	1

Table VII: Show the correlation matrix for the Carhart four-factor model where MKT is the factor obtained form the AQR database, the market returns for all available common stocks on the Compusstat/XpressFeed Global database for 23 developed market, minus the 1-Month Treasury Bill.

Table VIII - Heteroscedasticity & Serial Correlation

Variables	U.S. Portfolio	Swedish Portfolio	Difference
Breusch-Pagan	0.0690*	0.0351**	0.7978
White	0.0033***	0.0001***	0.5740
Breush-Godfrey	0.0840*	0.0157**	0.2757

Table VIII: Show the p-values for respective portfolio when using the MSCI World Index as benchmark. At different significance levels, we reject the null, that both heteroscedasticity and serial correlation is present for the U.S. and Swedish portfolio. Using Newey-West in our regressions we correct for these.

Significant at the 10% level ***
Significant at the 5% level **
Significant at the 1% level *

Table IX - Time & Seasonality

Variables	U.S. Portfolio	Swedish Portfolio	Difference
Seasonality	0.0325**	0.0883*	0.2489
Time	0.1201	0.601	0.205

Table IX: Show the p-values for respective portfolio when using the MSCI World Index as benchmark. At a 5 and 10 percent significance level, we reject the null, that seasonality is present in the U.S. and Swedish portfolio time series data.

Significant at the 10% level ***
Significant at the 5% level **
Significant at the 1% level *

For the Swedish and U.S. portfolio we see that seasonality is significant and present. In Table X below, we observe the Carhart regression adjusted for seasonality in all three portfolios when using MSCI World Index as benchmark.

However, the alphas change but remain statistically insignificant. Therefore, we cannot say that the Swedish portfolio outperforms the U.S. portfolio.

Table X - Carhart Regression Adjusted for Seasonality

Variables	Swedish Portfolio	U.S. Portfolio	Difference Portfolio
Alpha	0.2469	-0.2833	0.4504
	(0.5642)	(0.6708)	(0.9673)
MKT	1.2654***	0.8916***	0.3741***
	(0.0778)	(0.03980)	(0.0844)
SMB	0.5027***	0.3629***	0.1533
	(0.1538)	(0.1089)	(0.2300)
HML	-0.3847**	-0.0835	-0.3068
	(0.1586)	(0.0642)	(0.1954)
MOM	-0.1508*	0.0710**	-0.2237***
	(0.0750)	(0.0319)	(0.0701)
Observations	120	120	120

Table X: Show the values for the Carhart four-factor model corrected for seasonality, using the MSCI World Index as benchmark, for the whole time period, 2006 - 2016. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity Regressions are made using following formula:

$$R_i - R_f = \alpha_i + \beta_i^1(R_m - R_f)_i + \beta_i^2(SMB)_i + \beta_i^3(HML)_i + \beta_i^4(MOM)_i + \beta_i^5 Feb + \beta_i^6 Mar + \beta_i^7 Apr + \beta_i^8 May + \beta_i^9 Jun + \beta_i^{10} Jul + \beta_i^{11} Aug + \beta_i^{12} Sep + \beta_i^{13} Okt + \beta_i^{14} Nov + \beta_i^{15} Dec + u_i$$

Significant at the 10% level ***
Significant at the 5% level **
Significant at the 1% level *

Table XII - Regressions Using Different World Benchmarks

	MSCI World Index			AQR Global Index		
Variables	**Swedish Portfolio**	**U.S. Portfolio**	**Difference Portfolio**	**Swedish Portfolio**	**U.S. Portfolio**	**Difference Portfolio**
Alpha	0.0987	0.1062	-0.0581	0.1928	0.18071**	-0.0385
	(0.2182)	(0.0803)	(0.2395)	(0.2010)	(0.0847)	(0.2352)
MKT	1.3133***	0.9079***	0.4062***	1.2884***	0.8727***	0.4166***
	(0.0790)	(0.0402)	(0.0793)	(0.0792)	(0.0434)	(0.0758)
SMB	0.4381***	0.3020***	0.1466	0.2016	0.1451	0.0668
	(0.1794)	(0.0937)	(0.2146)	(0.1667)	(0.1045)	(0.2137)
HML	-0.2778**	-0.0889	-0.1939	-0.2216*	-0.0431	0.1837***
	(0.1259)	(0.0710)	(0.1523)	(0.1187)	(0.1058)	(0.1463)
MOM	-0.1560*	0.0755**	-0.2330***	-0.1456*	0.0752*	-0.2221
	(0.0806)	(0.0378)	(0.0576)	(0.0784)	(0.0414)	(0.0547)
Observations	120	120	120	120	120	120

Table XII: Show the results from the Carhart regressions, made for all three portfolios, the Swedish, the U.S. and the difference portfolio when using two global indices. The "Global Index" is gathered from the AQR database, while MSCI World Index is used as our main world index gathered from MSCI website. The regressions have been made using Newey-West on equally weighted data for the whole period, 2006 – 2016. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regressions are made using following formula:

$$R_i - R_f = \alpha_i + \beta_i^1(R_m - R_f)_i + \beta_i^2(SMB)_i + \beta_i^3(HML)_i + \beta_i^4(MOM)_i + u_i$$

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Table XIII - Model Specifications Using MSCI World Index

	U.S. Portfolio			Swedish Portfolio			Difference Portfolio		
Variables	**CAPM**	**Fama-French**	**Carhart**	**CAPM**	**Fama-French**	**Carhart**	**CAPM**	**Fama-French**	**Carhart**
Alpha	0.1384*	0.1503**	0.1062	-0.0160	0.0076	0.0987	-0.2063	-0.1941	-0.0581
	(0.0758)	(0.0683)	(0.0803)	(0.2592)	(0.2311)	(0.2182)	(0.2788)	(0.2654)	(0.2395)
MKT	0.6886***	0.6665***	0.9079***	1.3713***	1.3576***	1.3133***	0.4842***	0.4724***	0.4062***
	(0.0373)	(0.4170)	(0.0402)	(0.05860)	(0.0601)	(0.0790)	(0.0699)	(0.0784)	(0.0793)
SMB		0.2550***	0.3020***		0.5351***	0.4381***		0.2914*	0.1466
		(0.0696)	(0.0937)		(0.1254)	(0.1794)		(0.1569)	(0.2146)
HML		-0.1345*	-0.0889		-0.1835	-0.2778**		-0.0532	-0.1939
		(0.0773)	(0.0710)		(0.1439)	(0.1259)		(0.1841)	(0.1523)
MOM			0.0755**			-0.1560*			-0.2330***
			(0.0378)			(0.0806)			(0.0576)
Observations	120	120	120	120	120	120	120	120	120

Table XIII: Show the results for all regressions models (CAPM, Fama-French three-factor model and the Carhart four-factor model). Regressions has been made on all three portfolios when using the MSCI World Index as benchmark. The regressions have been made using Newey-West on equally weighted data for the whole period, 2006 – 2016. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regressions are made using following formulas:

CAPM

$$R_i - R_f = \alpha_i + \beta_i^1 (R_m - R_f)_i + u_i$$

Fama-French three-factor model

$$R_i - R_f = \alpha_i + \beta_i^1 (R_m - R_f)_i + \beta_i^2 (SMB)_i + \beta_i^3 (HML)_i + u_i$$

Carhart four-factor model

$$R_i - R_f = \alpha_i + \beta_i^1 (R_m - R_f)_i + \beta_i^2 (SMB)_i + \beta_i^3 (HML)_i + \beta_i^4 (MOM)_i + u_i$$

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Table XIV – Regressions for All Portfolios & Investment Styles Using MSCI World Index

	MSCI World Index								
	Swedish Portfolio			U.S. Portfolio			Difference Portfolio		
Variables	**Total**	**Large**	**Mid/Small**	**Total**	**Large**	**Mid/Small**	**Total**	**Large**	**Mid/Small**
Alpha	0.0987	0.1852	0.0591	0.1062	0.1032	0.1458	-0.0581	0.0820	-0.0868
	(0.2182)	(0.2128)	(0.2230)	(0.0803)	(0.0850)	(0.1856)	(0.2395)	(0.2557)	(0.2223)
MKT	1.3133***	1.3072***	1.3063***	0.9079***	0.8937***	0.9830***	0.4062***	0.4135***	0.3233***
	(0.0790)	(0.0632)	(0.0787)	(0.0402)	(0.0319)	(0.0749)	(0.0793)	(0.0831)	(0.0847)
SMB	0.4381***	0.5720***	0.3880**	0.3020***	0.1301	(0.9845)***	0.1466	0.4524**	-0.6070**
	(0.1794)	(0.1891)	(0.1795)	(0.0937)	(0.0862)	(0.1691)	(0.2146)	(0.2051)	(0.2976)
HML	-0.2778**	-0.3241**	-0.2467	-0.0889	-0.0615	-0.1896	-0.1939	-0.2676	-0.0570
	(0.1259)	(0.1789)	(0.1800)	(0.0710)	(0.0904)	(0.1465)	(0.1523)	(0.1623)	(0.1851)
MOM	-0.1560*	-0.1440*	-0.1592**	0.0755**	0.0553*	0.1691**	-0.2330***	-0.2007***	-0.3283
	(0.0806)	(0.0754)	(0.0830)	(0.0378)	(0.0322)	(0.0719)	(0.0576)	(0.0641)	(0.0406)
Observations	120	120	120	120	120	120	120	120	120

Table XII: Show the results from the Carhart regressions made for all three portfolios, the Swedish, the U.S. and the difference portfolio when using the MSCI World Index as benchmark for all investment styles. The regressions have been made using Newey-West on equally weighted data for the whole period, 2006 – 2016. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regressions are made using following formula:

$$R_i - R_f = \alpha_i + \beta_i^1(R_m - R_f)_i + \beta_i^2(SMB)_i + \beta_i^3(HML)_i + \beta_i^4(MOM)_i + u_i$$

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Table XV - List of Funds

Swedish Portfolio			U.S. Portfolio
Affärsvärldenfonden A	Nordea PB Sverige Plus	Viktig Fonder Sverige A	AMF Aktiefond Nordamerika
Agenta Svenska Aktier	Nordea Selekta Sverige	Carnegie Småbolagsfond	Folksams Aktiefond USA
Aktie-Ansvar Sverige A	Nordea Sverigefond	Swedbank Robur Sverigefond	Handelsbanken Amerika Tema
Alfred Berg Sverige Plus A	Nordea Swedish Stars	Swedbank Robur Småbolagsfond Sverige	Inside USA
AMF Aktiefond Sverige	Nordic Equities Sweden	Swedbank Humanfond	Inside USA Small Cap
Avanza zero	Öhman Sverige Hållbar A	Swedbank Robur Ethica Sverige MEGA	Länsförsäkringar USA Aktiv A
Carnegie Sverige	Öhman Sverige Koncis A	Spiltan Aktiefond Sverige	SEB Nordamerika Små och Medelstora
Carnegie Sverige Select	Öhman Sverigefond 2 A	Spiltan Aktiefond Småland	SEB Nordamerikafond
Catella Reavinstfond	PriorNillson Sverige Akitv A	Spiltan Aktiefond Stabil	SEB Nordamerikafond Småbolag
Cicero Focus A	Quesada Sverige	Nordea Småbolagsfond Sverige	Skandia Nordamerika Exponering
Cicero Focus SRI A	SEB Choice Sverigefond 1	Lannebo Sverige	Skandia USA
Cliens Sverige A	SEB PB svensk Aktieportfölj	Lannebo Småbolag	SPP Aktiefond USA
Cliens Sverige Fokus A	SEB SKF Allemansfond	Handelsbanken Svenska Småbolag	Swedbank Robur Access USA
Coeli Select Sverige	SEB Special Clients Sverigefond	Gustavia Sverige SEK	Swedbank Robur Amerikafond
Danske Invest SRI Sverige	SEB Stiftelsefond Sverige	Granit Småbolag	
Danske Invest Sverige	SEB Sverigefond Chans/Risk	Didner & Gerge Aktiefond	
Enter Select	SEB Swedish Ethical Beta Fund	Didner & Gerge Småbolag	
Enter Selecet Pro	SEB Swedish Focus	Danske Invest Sverige Fokus	
Ethos Aktiefond	SEB Swedish Value Fund	Catella Småbolag	
Folksam LO Sverige	Skandia Cancerfonden	Team Catella Tennisfond	
Folksam LO Västfonden	Skandia Junior Golf Fond	Utdelningsfonden Särimner	
Folksams Aktiefond Sverige	Skandia Svea Aktie		
Folksams Tjänstemanna Sverige	Skandia Sverige		
Granit Sverige 130/30	Skandia Sverige Exponering		
Handelsbanken Astra Zeneca Allemans	Skandia Världsnaturfonden		
Handlesbnaken Bostadsrätterna	Solidar Fonder Sverige		
Handelsbanken Radiohjälpsfonden Inc	Sparbanken Aktiefond Sverige		
Handelsbanken Sverige Selektiv	SPP Aktiefond Sverige		
Handelsbanken Sverigefond	SPP Aktiefond Sverige Aktiv		
Indecap Guide Sverige	Swedbank Robur Access Sverige		
Lannebo Sverige Flexibel	Swedbank Robur Ehica Sverige		
Lannebo Sverige Plus	Swedbank Robur Exportfond		
Lannebo Utd. Länsförsökringar Sverige Aktiv A	Swedbank Robur Hockeyfond		
Nordea Alfa	Swedbank Robur Sverigefond MEGA		
Nordea Inst. Aktie Sverige	Swedbank Robur Sweden High Dividend		
Nordea Olympia	Swedbank Robur Vasaloppsfonden		