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## **How to Invest the Swedish Occupational Pension**

*- Are there any simple and easily applicable pension investment strategies generating better alphas than the Default Options do?*

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### **ABSTRACT**

During the last couple of years the Swedish Occupational Pension plan has gone through some alterations. Today the risk of future wealth lies with each individual and how to invest the pension contribution is a major decision for every Swede. Using a sample containing the development of 1532 PPM funds between 2000-2013, this paper compares simple and easily applicable investment strategies to the Default Options. Through investigating the ability of fund managers to generate alphas, 16 strategies are compared to the Default Option. In addition an examination of the Occupational Pension Plan is presented. The aim of the study is to provide guidance in the choice of investment, either through a strategy to apply or through a reason to actively choose the Default Option. The study concludes that less than 42% of the PPM fund managers generate positive alphas and the evidence suggests that the Default Option significantly outperforms all examined strategies during the period of study.

Keywords: Occupational Pension, PPM, Default Option, Carhart, Fama-French, Alpha

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## TABLE OF CONTENTS

<b>1. INTRODUCTION .....</b>	<b>3</b>
1.1 QUESTION OF RESEARCH .....	3
1.3 CONTRIBUTION .....	4
1.4 RESULTS .....	4
1.5 IMPLICATIONS .....	4
<b>2. THE SWEDISH PENSION SYSTEM .....</b>	<b>5</b>
2.1 THE SWEDISH PENSION SYSTEM IN BRIEF .....	5
2.1.1 <i>The National Retirement Pension</i> .....	5
2.1.2 <i>The Occupational Pension</i> .....	6
2.1.3 <i>The Private Pension</i> .....	6
2.2 EXAMINATION OF THE OCCUPATIONAL PENSION PLAN .....	6
<b>3. PREVIOUS LITERATURE .....</b>	<b>9</b>
<b>4. EMPIRICAL FRAMEWORK .....</b>	<b>11</b>
4.1 THE CAPITAL ASSET PRICING MODEL .....	11
4.2 THE FAMA-FRENCH THREE-FACTOR MODEL .....	12
4.3 THE CARHART FOUR-FACTOR MODEL .....	13
<b>5. DATA .....</b>	<b>15</b>
5.1 MAIN DATASET .....	15
5.1.1 <i>The nature of a PPM fund</i> .....	15
5.2 FEES .....	16
5.3 MORNINGSTAR RATING .....	16
5.4 DEFAULT OPTION DATA .....	16
5.5 FAMA-FRENCH'S AND CARHART'S FACTOR DATA .....	16
<b>6. METHODOLOGY .....</b>	<b>18</b>
6.1 STRATEGIES .....	18
6.1.1 <i>Fund Fee Strategies</i> .....	18
6.1.2 <i>Past Return Based Strategies</i> .....	19
6.1.3 <i>Morningstar Rating Strategies</i> .....	20
6.2 FINDING THE BEST STRATEGIES .....	21
6.2.1 <i>Determination of Alphas</i> .....	21
6.3 COMPARISON OF BEST STRATEGIES AND DEFAULT OPTIONS .....	23
<b>7. RESULTS AND ANALYSIS .....</b>	<b>24</b>
7.1 FINDING THE BEST STRATEGIES .....	25
7.1.1 <i>Past Return Based Strategies</i> .....	25
7.1.2 <i>Fund Fee Based Strategies</i> .....	26
7.1.3 <i>Morningstar Rating Strategies</i> .....	27
7.2 COMPARISON OF BEST STRATEGIES AND DEFAULT OPTIONS .....	28
<b>8. IMPLICATIONS AND CONCLUSIONS .....</b>	<b>31</b>
8.1 LIMITATIONS .....	32
8.2 FURTHER RESEARCH .....	33
<b>9. REFERENCES .....</b>	<b>34</b>
<b>10. APPENDIX .....</b>	<b>36</b>
APPENDIX A – DATA REFERABLE TO GRAPHS .....	36
APPENDIX B – STRATEGY STATISTICS .....	39

## 1. Introduction

During the last couple of years, the Swedish pension system has gone through some extensive alterations in structure. The greatest transformation has been within the occupational pension plan. Sweden has changed from the traditional defined benefit plan (a certain percentage of your salary at retirement become your pension payment) to a defined contribution plan (a contribution is paid from your employer each month for you to invest) for almost everyone born in the 1980's or later. The outcome is a transfer of risk. Today, the responsibility of future pension payments lies with each individual. Most Swedes are responsible for the growth and future value of their individual occupational pension and if you do not actively make a decision, your contributions are automatically put in a Default Option chosen by the contracted trade union.

Despite the fact of carrying the great risk of your future wealth, only a fraction of the first-time investors choose to actively invest their money. Also, the activity among the Swedish PPM funds has dropped by approximately 40 percent during the last year. The main reasons are unknown but seem to be; lack of awareness of the transferred risk and lack of belief in the ability to beat the fund chosen by the trade union, the Default Option.

The purpose of this study is to explore the occupational pension system and examine whether there is a way for the average Swede to, with limited effort, achieve a greater portfolio alpha than the Default Options' by actively investing their pension contributions.

### 1.1 Question of Research

There are several well-known investment strategies constantly discussed among private investors. Almost all of them are referable to asset and stock investments and just a few relate to investments in funds. This study is an examination of different, easily understood and applied, fund investment strategies for the occupational pension investments. All strategies are based on information accessible for all individuals and applicable without any investment experience. Easily applicable strategies in this study are strategies based *solely* on either past returns, fund fees or Morningstar Rating. The study aim to answer one main question:

*“Are there any simple and easily applicable pension investment strategies generating better alphas than the Default Options do?”*

### 1.3 Contribution

We aim to contribute with guidance in the choice of pension investment alternative for the Swedish population, either with a beneficial strategy or a reason to actively choose the Default Option.

### 1.4 Results

The results show that some investment strategies are significantly better than others. Among the strategies based on past returns, a portfolio solely investing in funds with the top 50 % of the previous year's returns generated the highest cumulative alpha during the time period of study. Among the strategies based on fund fees, portfolios invested in funds with low fund fees generated the highest cumulative alpha. Among the strategies based on Morningstar Ratings, the highest cumulative alpha was, not surprisingly, generated by the portfolio invested solely in funds with a Morningstar Rating of 5. It was also the strategy that managed to generate the highest cumulative alpha, but the survivorship-biased sample limits the credibility of this result.

When comparing the strategies to the Default Option alphas, none of the chosen strategies stand a chance of generating better alphas.

### 1.5 Implications

Less than 42 % of the fund managers of PPM funds manage to generate positive alphas and the average fund alpha is slightly negative even before deducting fund fees. This suggests that fund managers generally do not add enough value to justify the level of fund fees charged, implicating reasons for considering more strict requirements for a fund to be classified as a PPM fund. This would favor and benefit the Swedish population.

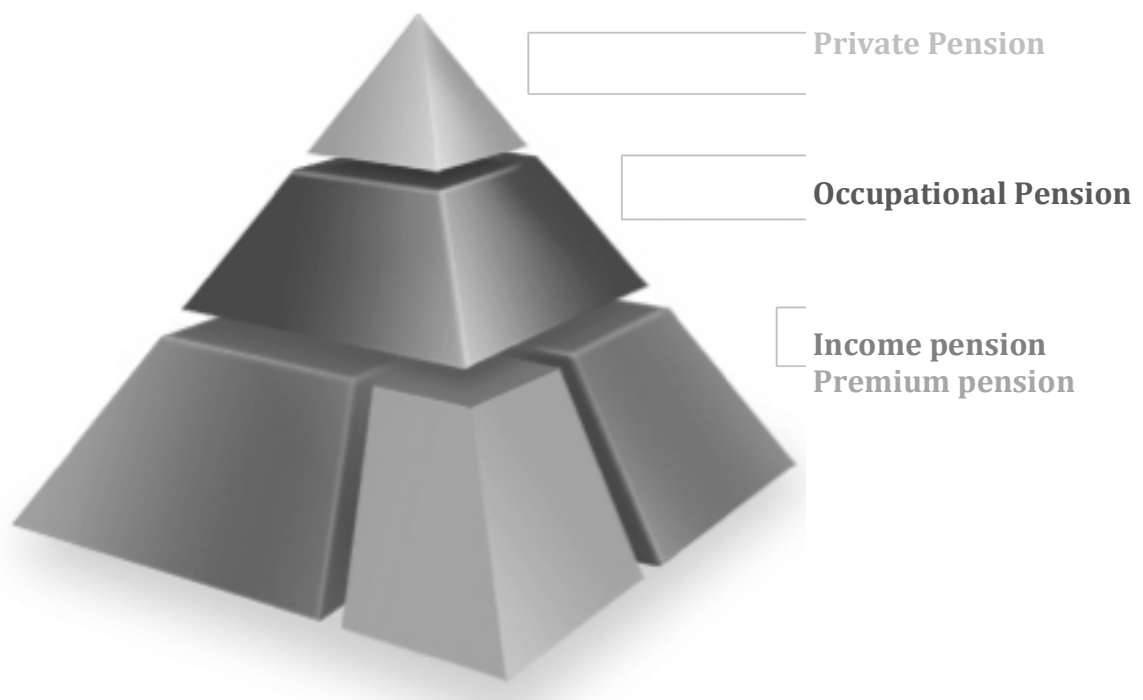
The results of the study imply that inexperienced pension investors are better off staying with the Default Option than trying to single-handedly conduct portfolios based on simple and easily applicable strategies.

## 2. The Swedish Pension System

This thesis is regarding one of the three major parts of the Swedish pension system, the occupational pension. This section gives a fundamental overview of all three parts of the system, but focuses on the essential parts of the occupational pension. Since the other parts have no greater value for this thesis, explanations are brief.

### 2.1 The Swedish Pension System in brief

The Swedish pension system is divided into three major components; *the national retirement pension* that is based on the accumulated income you've paid tax on, *the occupational pension* you've earned and *the private pension scheme*.



#### 2.1.1 The National Retirement Pension

The national retirement pension is divided into three parts. *The income pension* is a certain fraction of the salary at the date of retirement, based on different variables. *The guaranteed pension* is only distributed to those with low or no income pension at all. *The premium pension* is the accumulated premiums earned throughout a career. 18,5% income tax of all salaries conducts the national retirement pension. 16% of the

salary is paid to the government to cover the income pensions while 2,5% of each individual's salary constitutes the premium referable to the individual<sup>1</sup>.

### **2.1.2 The Occupational Pension**

The occupational pension is an additional income most Swedes are subject for. If the employer is tied to a trade union the employer is obligated to put aside money on the employee's behalf, in addition to the negotiated salary. If not tied to a union, the employee is recommended to negotiate terms of occupational pension individually. Today approximately 90% of all Swedes receive occupational pension from their employer<sup>2</sup>.

### **2.1.3 The Private Pension**

The private pension is optional and is not affected by the other two components. This is for those who feel the necessity to complement their earned pension with some additional savings. Up until today the government has subsidized the private pension investments through a tax relief<sup>3</sup>.

## **2.2 Examination of the Occupational Pension Plan**

There are two main types of occupational pension: defined benefit and defined contribution. In a defined benefit pension, you are guaranteed a certain percentage of your final salary when you retire. In a defined contribution pension, your employer has to pay a predetermined fraction of your salary to one of the connected trade unions' pension companies. Exactly how much your pension will be with this solution depends on the yield and the management fee that is charged. The employee affects his occupational pension through the choices he makes. This thesis will focus on the defined contribution part of the occupational pension. Therefore the defined benefit part will not be described in any further detail.

Within the defined contribution pension there is a distinction between traditional insurance (traditionell försäkring) and fund insurance (fondförsäkringar)<sup>4</sup>. Traditional insurance is a safer choice for those who do not prefer to actively monitor their investments. The manager takes care of everything, and the employee is guaranteed a minimum level of his future pension. Investing in fund insurances is a

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<sup>1</sup> <http://secure.pensionsmyndigheten.se/DenAllmannaPensionen.html>

<sup>2</sup> <http://secure.pensionsmyndigheten.se/Tjanstepensionen.html>

<sup>3</sup> <https://www.notisum.se/rnp/sls/lag/19991229.htm#K59>

<sup>4</sup> <http://www.fora.se/sv/SAF-LO/Pensionsvalshjalpen/>

flexible choice for those who want to have a say in how their money is invested. The employee chooses which PPM funds their money should be in. Therefore, on one hand there is no guaranteed growth. On the other hand, their money has the opportunity to increase more in value if, for example, the stock market goes well.

Depending on which trade union an employee belongs to the regulations slightly differ in terms of how much money he can choose to invest in PPM funds. In some cases the rules also differ within the trade unions depending on age. In those cases this thesis will focus on the regulations applying to the younger population. There are four trade union agreements that cover the vast majority of the employed people in Sweden: ITP, SAF-LO, KAP-KL, and PA-03<sup>5</sup>.

ITP applies to approximately 2 million privately employed employees (privatanställda tjänstemän). Employees born in 1979 or later (but at least 25 years old) are subject to a subsection called ITP 1. However, companies that sign a new agreement on ITP can apply for ITP 1 to all of their privately employed employees regardless of age. Also, employees born in 1978 or earlier, earning at least 10 income base amount<sup>6</sup> (inkomstbasbelopp), may agree with their employer to completely move to the defined contribution ITP 1<sup>7</sup>.

SAF-LO applies to approximately 2,8 million private sector workers (privatanställda arbetare). Generally it works the same for all, regardless of age. However, employees must be at least 25 years old before their employers can pay money to their defined contribution retirement<sup>8</sup>.

KAP-KL applies to approximately 1 million municipal- and county employees (kommun- och landstingsanställda). Generally it works the same for all, regardless of age. However, employees must be at least 21 years old before their employers can pay money to their defined contribution retirement<sup>9</sup>.

PA-03 applies to approximately 500 000 state workers (statligt anställda). The defined contribution part of this collective agreement applies to employees born 1973 or later. Also, employees must be at least 23 years old before their employers can pay money to their defined contribution retirement<sup>10</sup>.

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<sup>5</sup> <http://www.pensionsmyndigheten.se/Tjanstepensionen.html>

<sup>6</sup> <https://www.collectum.se/sv/ITP2/Sa-paverkas-din-pension/Hur-paverkas-du-/Tjanar-over-tio-inkomstbasbelopp/Jamfor-ITP-1-och-ITP-2/>

<sup>7</sup> <https://www.alecta.se/Foretag/Om-tjanstepension/Tjanstepension-i-Alecta/ITP-1/>

<sup>8</sup> <http://www.fora.se/sv/SAF-LO/Om-avtalspension-SAF-LO/>

<sup>9</sup> <http://www.pensionsvalet.se/For-anstallda/KAP-KL/>

<sup>10</sup> <http://www.spv.se/Privatperson/Statlig-tjanstepension/Nyfiken-pa-pension/>

For obvious reasons there is, in each of the four largest trade unions, a Default Option for the employees who do not actively make a choice. The Default Options are in all these cases traditional insurances. That, together with different regulations relevant for this thesis, is presented in the table below:

**Table 1 –** *This table consists of brief information regarding the four major collective agreements on the Swedish market as of today.*

Collective Agreement	Employers Contributions	Limitations	Default Option
<b>ITP 1</b>	4,5 % of salary up to 7,5 income base amounts. 30 % of salary above 7,5 income base amounts.	50 % must be put in traditional insurance. The other 50 % can either be put in traditional insurance or in PPM funds.	<i>Alecta</i>
<b>SAF-LO</b>	4,5 % of salary up to 7,5 income base amounts. 30 % of salary above 7,5 income base amounts.	100 % may by choice be put in either traditional insurance or in PPM funds.	<i>AMF</i>
<b>KAP-KL</b>	4,5 % of salary up to 30 income base amounts.	100 % may by choice be put in either traditional insurance or in PPM funds.	<i>KPA Pension</i>
<b>PA-03</b>	4,5 % of salary.	2 % will automatically be put in the default option. The remaining 2,5 % may by choice be put in either traditional insurance or in PPM funds.	<i>Kåpan Pensioner</i>



### 3. Previous Literature

The Swedish Pension System has been a hot subject lately, but only limited studies have been completed relating to this topic. However, there are a couple of noteworthy researches that should be considered throughout the study. Some of them relate to the correlation between certain attributes and fund performance, whilst others refer to investor behavior.

Jensen (1969) concluded that the average excess return (the alpha) of mutual funds was slightly above 0 before management fees but below after conducting the expenses. Wermers and Moskowitz (2000) found that funds hold stocks that outdo the market by 1,3 percent per year, but the funds returns underperform by 1 percent. 0,7 percent of the 2,3 percent difference is due to underperformance of non-stock holdings whilst the rest of the 1,6 percent is due to expenses and transaction costs. Consequently, their conclusion is that funds pick stocks well enough to cover their costs. Their evidence supports the value of active management. However, Malkiel (1995) comes to the conclusion that, by using a unique dataset preventing earlier studies survivorship bias, mutual funds tend to underperform the market even before deducting management expenses.

Grinblatt and Titman (1992) found that there is a positive relation between momentum trading and performance. They suggest that the positive performance of mutual funds may have at least partially been created by the simple trading rule rather than by superior information. In line with their results for stocks, Carlson (1970) found that funds with above-median returns the previous year, typically repeat their superior performance.

Caginalp, Porter and Smith (2000) attempted to construct a “momentum model”, which assumes that investors follow a mixture of two factors when setting prices: fundamental value and the latest price trend. The results from the model were similar to those of several previous laboratory experiments; suggesting that momentum trading leads to price bubbles. Investors drive up prices far above fundamental value, after which the price crash. Also, they found that higher level of liquidity leads to larger price bubbles.

While preceding literature identified the actuality of repeat winners, Brown and Goetzmann (1995) found, by desegregating persistence tests on annual basis, that

the persistence of mutual fund performance is vastly dependent on the time period of study. Also, they found that fund performance is correlated through managers.

Dahlquist, Engström and Söderlind (2000) studied the relationship between fund performance and fund attributes. Their results show that praiseworthy performance were found in low-fee funds, funds with great trading activity, and funds with good past performance.

Palme, Sundén and Söderlind (2004) inspected investment choices in the Swedish individual accounts scheme. Their results demonstrated a positive relation between income and the level of risk in each individuals overall portfolio. However, looking more closely, they found that the relationship is more U-shaped: low-income investors undertake more risk than middle-income investors.

## 4. Empirical Framework

For any investor, saving for retirement or something else, it is required to get a return that reflects the level of risk taken. Otherwise it would be an obvious choice to buy government bonds and achieve a low but safe interest rate. If the risk of the investment is equal to zero the investor will strive to get a return that is at least as good as a government bond.

Investors in general, especially those saving for retirement, tend to be risk averse. Risk averse means they require a greater return when adding risk to the savings. That is called a risk premium and increases with every extra stock that increases the total risk of the portfolio.

There are two types of risk: idiosyncratic risk and systematic risk. The idiosyncratic risk is the one related to single companies or assets and is considered diversifiable. Diversifiable means that it is possible to, by adding assets with different types of risk into one portfolio, make the different risks add up to zero. The systematic risk on the other hand is the risk carried by the market as a whole and is not diversifiable.

It's hard to explain how the required rate of return fluctuates since it isn't observable. It isn't observable because it is derived from the expectations of the returns of a portfolio. One way to explain it is to presume that investors will demand the same return in the future for investments with a certain risk level, as today. Another complication appears when you realize that the historical required returns cannot be observed either. The solution is to assume the actual historical return on average is equal to the expected return. By doing this, it's possible to determine the expected rate of return.

### 4.1 The Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) is one way to determine the expected return and was published back in 1964 Sharpe. The CAPM is probably the most renowned model that expresses the correlation between risk and expected return. In the CAPM formula it is assumed that all the idiosyncratic risk is diversified and only the systematic risk needs to be considered.

The CAPM Formula:

$$E(R_{pt}) = R_{ft} + \beta_{mp}[E(R_{mt}) - R_{ft}]$$

Where:

$E(R_{pt})$  = Expected Return of Portfolio  $p$ , at time  $t$

$R_{ft}$  = Risk-free rate, at time  $t$

$\beta_{mp}$  = Beta value for market  $m$  of portfolio  $p$

$E(R_{mt})$  = Expected return for the whole market, at time  $t$

The beta value is specific for every asset and demonstrates how the asset reacts to changes in the market.

## 4.2 The Fama-French Three-Factor Model

In a study from 1992 the two professors Eugene Fama and Kenneth French present a revising of the CAPM-formula. They weren't satisfied with the CAPM formula and figured out that the formula only explains approximately 70% of the variability in return. Through some modifications and by adding two new factors to the already existing CAPM they created the Fama-French three-factor model that, according to their study, explains approximately 90% of the variability in returns.

The two added, company specific, factors are size (size is the market value of equity) and book-to-market value. The authors distinguished an, on average, higher performance in stocks from small companies and stocks in companies with high book-to-market values than the market as a whole. The three-factor model calculates the expected return of a portfolio minus the risk-free rate:

$$E(R_{pt}) - R_{ft} = \alpha_p + \beta_{mp}[E(R_{mt}) - R_{ft}] + \beta_{sp} SMB_t + \beta_{hp} HML_t + \varepsilon_{it}$$

Where:

$E(R_{pt})$  = Expected Return of Portfolio  $p$ , at time  $t$

$R_{ft}$  = Risk-free rate, at time  $t$

$\beta_{mp}$  = Beta value for market  $m$  of portfolio  $p$

$E(R_{mt})$  = Expected return for the whole market, at time  $t$

$\beta_{sp}$  = Beta value for SMB of portfolio  $p$

$SMB_t$  = Famas-French Size factor, at time  $t$

$\beta_{hp}$  = Beta value for HML of portfolio  $p$

$HML_t$  = Famas-French book-to-market factor, at time  $t$

SMB (Small-Minus-Big) represents the size and HML (High-Minus-Low) represents the Book-to-Market value. None of the factors are absolute values. The factors represent, as presented in the article from 1995, how much larger the return of a stock

in a small company is compared to a large company and how much larger the return of a company with high Book-to-Market is than of a company with low Book-to-market respectively.

When first coming up with the two added factors the authors used a sample of all the companies listed on the New York Stock Exchange between 1963 and 1991. With this sample they assorted the sample two times, independently. First they were categorized based on size, where 50% of the companies (the ones with the largest market value) were categorized as *big* and the other 50 % categorized as *small*. The same stocks were then categorized based on the book-to-market level. 30% with the lowest BTM in one *low* category, 40% in the *middle* and another 30% were categorized *high*. By merging the different categories they created six different portfolios:

Three portfolios with small stocks; *SmallLow*, *SmallMiddle*, *SmallHigh*

Three portfolios with big stocks; *BigLow*, *BigMiddle*, *BigHigh*

The SMB is calculated through the following formula:

$$SMB = \frac{1}{3}(R_{SmallLow} + R_{SmallMiddle} + R_{SmallHigh}) - \frac{1}{3}(R_{BigLow} + R_{SmallMiddle} + R_{BigHigh})$$

The HML is calculated through the following formula:

$$HML = \frac{1}{2}(R_{SmallHigh} + R_{BigHigh}) - \frac{1}{2}(R_{SmallLow} + R_{BigLow})$$

In the HML formula the middle portfolios are excluded because empirical tests ran by Fama and French showed better results without them.

### 4.3 The Carhart Four-Factor Model

The benefits of the three-factor model are well acknowledged but still the model has been tested numerous times by different economists around the world. In his study from 1997, M.M. Carhart presented an improvement to the current Three-factor model. The improvement consisted of a fourth factor, the Momentum factor, also known as MOM (monthly momentum) or WML (winners minus losers). The new model showed to explain even more than the approximately 90% of the variability in returns the three-factor model managed to.

Momentum in an asset is the tendency to continue to keep increasing in value when rising and the tendency to keep decreasing in value when dropping. The WML factor is used to adjust for this issue, making the alpha represent solely the stock picking ability of a fund manager and adjust for returns of momentum strategies.

The Carhart Four-Factor formula:

$$E(R_{pt}) - R_{ft} = \alpha_p + \beta_{mp}[E(R_{mt}) - R_{ft}] + \beta_{sp} SMB_t + \beta_{hp} HML_t + \beta_{wp} WML_{pt} + \varepsilon_{it}$$

Where:

$E(R_{pt})$  = Expected Return of Portfolio  $p$ , at time  $t$

$R_{ft}$  = Risk-free rate, at time  $t$

$\beta_{mp}$  = Beta value for market  $m$  of portfolio  $p$

$E(R_{mt})$  = Expected return for the whole market, at time  $t$

$\beta_{sp}$  = Beta value for SMB of portfolio  $p$

$SMB_{pt}$  = Fama-French's Size factor, at time  $t$

$\beta_{hp}$  = Beta value for HML of portfolio  $p$

$HML_{pt}$  = Fama-French's book-to-market factor, at time  $t$

$\beta_{wp}$  = Beta value for WML of portfolio  $p$

$WML_{pt}$  = Carhart's momentum factor, at time  $t$

The WML factor is also calculated through six value-weighted portfolios. The portfolios are constructed through sorting assets into two groups, *Big* and *Small* (the same categories as in the original Fama-French three-factor model). Then both groups are divided into three smaller portfolios each, ranked on past performance (last twelve months). 30 percent best performers are the *Winners*, the 30 percent worst performers are the *Losers* and the rest are included in the *Middle* portfolios. Then WML is calculated as follows:

$$WML = \frac{1}{2} (Small\ High\ portfolio + Big\ High) - \frac{1}{2} (Small\ Low + Big\ Low)$$

In this case the middle portfolios are, once again, left out since this formula generates a more accurate result.

## 5. Data

This section is an exposition of the data underlying the results and analysis. The data used in this study is manually collected. Adjustments are made in order to increase the ability of answering the question of research in an optimal way.

### 5.1 Main Dataset

The initial dataset used in this study origin from “Pensionsmyndigheten” and consists of historical fund prices on a daily basis from the 1532 funds available for pension investments (PPM funds) in Sweden between 2000 and 2013. The prices are used to calculate the historical returns of each fund. After removal of funds with a lifetime of less than two months (no continuous monthly return, impossible to conduct a regression) the number of funds observed equals 1476. PPM was founded in 2000 and therefore this study includes all data referable to PPM funds ever presented. The currently active funds as well as the terminated funds are included. By including all funds, it is possible to avoid any survivorship biases. Before the data was adjusted to monthly basis, the total number of observations exceeded two millions. After adjusting to monthly basis the dataset consists of 102 184 observations and the average lifetime of a fund is 69 months.

#### 5.1.1 The nature of a PPM fund

PPM is an acronym for “PremiePensionsMyndigheten”, which is an authority controlled by the Swedish government. Hence, all options of pension investments are controlled and approved indirectly by the Swedish people. For a fund to be classified as a PPM fund some requirements need to be fulfilled:

1. A pension fund has to be reported as part of a company situated in Sweden, alternatively in the EEA (European Economic Area).
2. A pension fund cannot pay any other amounts than those paid when: a) the investor reaches a certain age (“ålderspension”), b) the investors’ ability to work decreases (“sjukpension”), c) the investor dies (“afterlevnadspension”).
3. An investment cannot be pledged, encumbered, transferred or sold.
4. The agreement should include certain information regarding the future retiree.
5. A foreign pension fund shall, for each agreement, send a written commitment to leave information to “Skatteverket”.

There are currently 848 active and approved PPM funds eligible for pension investments in Sweden.

## **5.2 Fees**

Each fund charges the investors a fee for investing the capital. A percentage of the amount invested that covers the administration costs and profits of the fund. The calculated historical returns are before charge of fees. Each fund has an individually chosen fee. Pension investors receive a discount and lower fees than private investors do. The used fees are referring to those paid by the pension investor. Sometimes rebates are received for investors who put a large amount of capital in the same fund. To avoid complications and uncertainties, those rebates have been excluded. The fund fees are retrieved from “Pensionsmyndigheten” and are stated on a monthly basis and reaches as far back as 2002. Due to the fact that the fund fees before 2002 could not be found, the study is limited to performances from 2002-2013.

## **5.3 Morningstar Rating**

Data of the historical Morningstar Rating of all active PPM funds have been retrieved from Morningstar. Some funds have not yet been graded (new funds) and cannot be part of the strategies. Since the Morningstar dataset covers only the active funds, all terminated funds are excluded from the main dataset.

## **5.4 Default Option Data**

The data of the Default Options used for comparison in this study are the annual total return (net of fees) for 2000-2013. The numbers are collected from each of Alecta, AMF, KPA pension, and Kåpan pensioner’s annual reports.

## **5.5 Fama-French’s and Carhart’s Factor Data**

Today, all the factors (including risk-free rate, market return, SMB, HML and WML) are calculated for different markets and regions of the world on a monthly basis. The numbers are trustworthy and accessible on Kenneth French’s website<sup>11</sup>. This study examines both the figures calculated for the European region and the global figures. The main part regards the global figures since most of the pension funds investigated do have the ability to invest in all the markets of the world. The global figures are derived out of market data from Australia, Austria, Belgium, Canada, Denmark,

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<sup>11</sup> <http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/>



Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Switzerland, Sweden, United Kingdom and United States.

## 6. Methodology

It is of every person's interest to monitor his or her savings for retirement, regardless of age. When the age of retirement approaches, the frequency of monitoring is likely to increase. For an average Swede with a significant amount of years left until retirement, the tendency is to not actively invest the occupational pension. The money tends to flow to the various Default Options. To find an investment strategy easily applicable for the average Swede, a non-time demanding strategy is needed. Thus, even though the study is based on monthly figures the strategies require reallocation of assets only once a year.

The strategies do not demand any further research than what is easily accessible for the private investor. The vital information includes past performance, fund fees and Morningstar Rating and is to be found at PPM fund lists at; PPM.se, Morningstar.se or through the various insurance companies.

This section commences with a brief explanation of all the examined strategies. It continues with the examination. To examine the strategies, the Carhart (1997) extension of the *Fama-French three-factor model* is used to determine the *alphas* of each fund. The model is referred to as the *Carhart Four-Factor Model*.

### 6.1 Strategies

#### 6.1.1 Fund Fee Strategies

The first five strategies tested are based on the separate fees of the funds eligible for investing. The fund fees are usually the lowest for passive funds that keep the same investment over a long period of time. The reason is obviously that not as much effort is put in to the management of the fund. Funds with high activity demand more effort and management and tend to charge a higher fee. There are of course exceptions to this simple rule of thumb. Some large enough funds can utilize economy of scale and therefore offer a lower fee.

##### *Strategy #1 – Low fee funds*

This strategy consists of Equally Weighted asset allocation in the funds with the 50% lowest fees.

#### *Strategy #2 – High fee funds*

This strategy consists of Equally Weighted asset allocation in the funds with the 50% highest fees.

#### *Strategy #3 – Lowest fees (Percentile 25 of fund fees)*

This strategy consists of Equally Weighted asset allocation in the funds with the 25% lowest fees each year.

#### *Strategy #4 – Highest fees (Percentile 75 of fund fees)*

This strategy consists of Equally Weighted asset allocation in the funds with the 25% highest fees each year.

#### *Strategy #5 – Middle fees (Percentile 25-75 of fund fees)*

This strategy consists of Equally Weighted asset allocation in the funds not invested in with Strategy #3 or #4.

### **6.1.2 Past Return Based Strategies**

When discussing investment strategies regarding stocks, “Momentum investment” is a commonly used phrase and is constantly a hot topic among investors. Momentum investing implies buying latest winners and selling latest losers, i.e. investment in stocks with an up-going trend during the recent past. The strategy is used because of different reasons, e.g. utilize increases because of behavioural finance (herding).

The momentum strategies discussed in this study is not the same as the ones occurring in theoretical publications. They are named “Momentum” since they share the investing philosophy of the traditional investment strategies. But, the discrepancies in characteristics between funds and stocks, such as the fact that the underlying assets vary make them incomparable. In addition, an open-end, mutual fund (all PPM funds) do not share the same opportunistic features of a stock when it comes to behavioural finance since the value is not driven by supply and demand. When using a momentum strategy within open-end fund investment you are merely betting on the management ability of a fund manager to be consistent with recent performance.

A contrarian strategy means investing in the, to momentum, contrarian funds. Hence, the contrarian strategies are the opposite of the momentum strategies.

#### *Strategy #6 – Momentum*

This strategy consists of Equally Weighted asset allocation in last year's winners, i.e. all the funds yielding a positive return on the invested capital.

#### *Strategy #7 – Contrarian*

This strategy consists of Equally Weighted asset allocation in last year's losers, i.e. all the funds yielding a negative return on the invested capital.

#### *Strategy #8 – Momentum Top 50%*

This strategy consists of Equally Weighted asset allocation in the high 50 % of last year's winners, i.e. the top half of the funds yielding a positive return on the invested capital.

#### *Strategy #9 – Momentum Bottom 50%*

This strategy consists of Equally Weighted asset allocation in the low 50 % of last year's winners, i.e. the bottom half of the funds yielding a positive return on the invested capital.

#### *Strategy #10 – Contrarian Top 50%*

This strategy consists of Equally Weighted asset allocation in the high 50 % of last year's losers, i.e. the top half of the funds yielding a negative return on the invested capital.

#### *Strategy #11 – Contrarian Bottom 50%*

This strategy consists of Equally Weighted asset allocation in the low 50 % of last year's losers, i.e. the bottom half of the funds yielding a negative return on the invested capital.

### **6.1.3 Morningstar Rating Strategies**

Morningstar is an independent rating agency that aims to help private investors to compare funds. The rating is based upon past performance, risk and fees. The rating is solely objective and does not include any subjective values regarding the fund, company or management. The aim is not to foresee which funds will perform best, but rather help investors find competent fund managers. The rating is calculated

through the performance of the funds during the last 3, 5 and 10 years and is scaled from 1 to 5, where rating 5 is the best. Ratings are updated monthly and since the risk of the fund can change frequently the rating might vary from month to month.

*Strategy #12 – Funds with a Morningstar rating of 1*

*Strategy #13 – Funds with a Morningstar rating of 2*

*Strategy #14 – Funds with a Morningstar rating of 3*

*Strategy #15 – Funds with a Morningstar rating of 4*

*Strategy #16 – Funds with a Morningstar rating of 5*

## 6.2 Finding the Best Strategies

To be able to find the best of the examined investment strategies, a measurement of performance has to be conducted. This study includes data of the fund prices on a monthly basis and through comparing changes in fund price it is possible to determine the rate of return from month to month for each fund. The fund fees are then deducted and the adjusted numbers are the rate of return net of fees, which is used as the absolute measurement of a PPM fund's performance throughout this study:

$$R_{it} = (P_{it} - P_{it-1}) / P_{it-1}$$

Where:

$R_{it}$  = Return of fund  $i$ , at time  $t$

$P_{it}$  = Fund Price  $P$  of fund  $i$ , at time  $t$

$P_{it-1}$  = Fund Price  $P$  of fund  $i$ , at time  $t-1$

### 6.2.1 Determination of Alphas

An absolute measurement is perfect to use when looking at past performance but it is seldom the optimal solution when trying to determine the best strategy for future investments. Therefore, this study examines performances through comparison of the average excess returns – *the alphas* – of the funds. To find the alphas of each fund the empirical *Carhart Four-Factor Model* is used. In this formula the expected return of portfolio is replaced by actual return of a fund and the expected return of the market is replaced with the actual return of the market.

The Carhart Four-Factor Model used to find the alphas:

$$R_{it} - R_{ft} = \alpha_i + \beta_{mi}[R_{mt} - R_{ft}] + \beta_{si}SMB_t + \beta_{hi}HML_t + \beta_{wi}WML_t + \varepsilon_{it}$$

Where:

$R_{it}$  = Return of Portfolio  $p$ , at time  $t$

$R_{ft}$  = Risk-free rate, at time  $t$

$\beta_{mi}$  = Beta value for market  $m$  of portfolio  $p$

$R_{mt}$  = Return for the whole market, at time  $t$

$\beta_{si}$  = Beta value for SMB of portfolio  $p$

$SMB_{it}$  = Fama-French's Size factor, at time  $t$

$\beta_{hi}$  = Beta value for HML of portfolio  $p$

$HML_{it}$  = Fama-French's book-to-market factor, at time  $t$

$\beta_{wi}$  = Beta value for WML of portfolio  $p$

$WML_{it}$  = Carhart's momentum factor, at time  $t$

The factors ( $R_m$ ,  $SMB$ ,  $HML$  and  $WML$ ) at each *time* ( $t$ ) are given with the data of this study but to calculate the *betas* ( $\beta$ ) the following formulas have been used:

$$\beta_{mi} = Cov(R_{it} - R_{ft}, R_m - R_{ft}) / Var(R_m - R_{ft})$$

$$\beta_{si} = Cov(R_{it} - R_{ft}, SMB_t) / Var(SMB_t)$$

$$\beta_{hi} = Cov(R_{it} - R_{ft}, HML_t) / Var(HML_t)$$

$$\beta_{wi} = Cov(R_{it} - R_{ft}, WML_t) / Var(WML_t)$$

After conducting the *betas*, the only unknown variable of the equation is the *alpha* ( $\alpha$ ). The monthly *alpha* of each fund can then be determined. The alphas and betas are determined by standard OLS regressions, controlling for heteroscedasticity.

### 6.2.2 Interpreting the Alphas

To further examine which of the strategies that provide the best performance, an average *alpha* of all the funds invested in for each year is computed for each strategy and year. Each strategy will then receive a comparable *alpha* (the average of the fund's yearly *alphas*) for each year. The strategies are compared to an *Equally Weighted* portfolio, where strategies performing above that portfolio are compared to the Default Option. These strategies are considered better than randomly picking funds. The strategies with the highest cumulative *alphas* are to be considered the best strategies.

The reasons for not using a *value-weighted* portfolio are; private investors are not expected to be aware of market capitalizations, no data were found about market capitalization of funds and no consideration is given to size when talking about randomly picking funds.

### **6.3 Comparison of Best Strategies and Default Options**

To examine whether the chosen strategies have outperformed the Default Options since the origin of the PPM system, a test based on 10-year average alphas is made. The test will show a comparison of a value-weighted portfolio of Default Options' alphas and the chosen strategies' alphas. A value-weighted Default Option portfolio is used to better reflect as many investors' situation as possible, since the Default Option returns differ slightly between the four major trade unions.

## 7. Results and Analysis

This section provides graphs and figures of the results derived from the *Carhart Four-Factor Model* regression presented above. Firstly, a comparison between strategies and their cumulative *alphas* are shown to determine which strategies that generate the highest alphas over time. The best strategies will then be compared to the value-weighted Default Option portfolio. Analysis and potential explanations are presented along with the results throughout the section. Complementary tables of data are to be found in the appendix.

The analysis is made using Fama-French's reported factors. A decision was made to use the Global factors since all funds have the ability to invest in most of the markets of the world. Thus, the European factors, which replicate the European market, would not give a well-represented view of the performance of the funds. The optimal way to go would have been through usage of individual factors for each fund, dependent of where the fund is actively investing. But, to examine the market of activity for 1476 funds from year to year would have been too comprehensive to manage. It is therefore noticeable that the alphas might be deceptive in some cases but overall the global factors give the most suitable numbers.

**Table 2 -** *The table shows the average alphas of the funds tested, both before and after adjustment of fund fees. Both the results based on European and Global factors are presented. All numbers are on monthly basis.*

Number of funds	Pre fund fee		Net of fund fee	
	Number of funds with positive alpha	Average fund alpha (monthly)	Number of funds with positive alpha	Average fund alpha (monthly)
<i>Alpha calculations based on Fama-French's Global factors</i>				
1476	612	-0,0033	519	-0,0039
<i>Alpha calculations based on Fama-French's European factors</i>				
1476	680	-0,0041	606	-0,0048

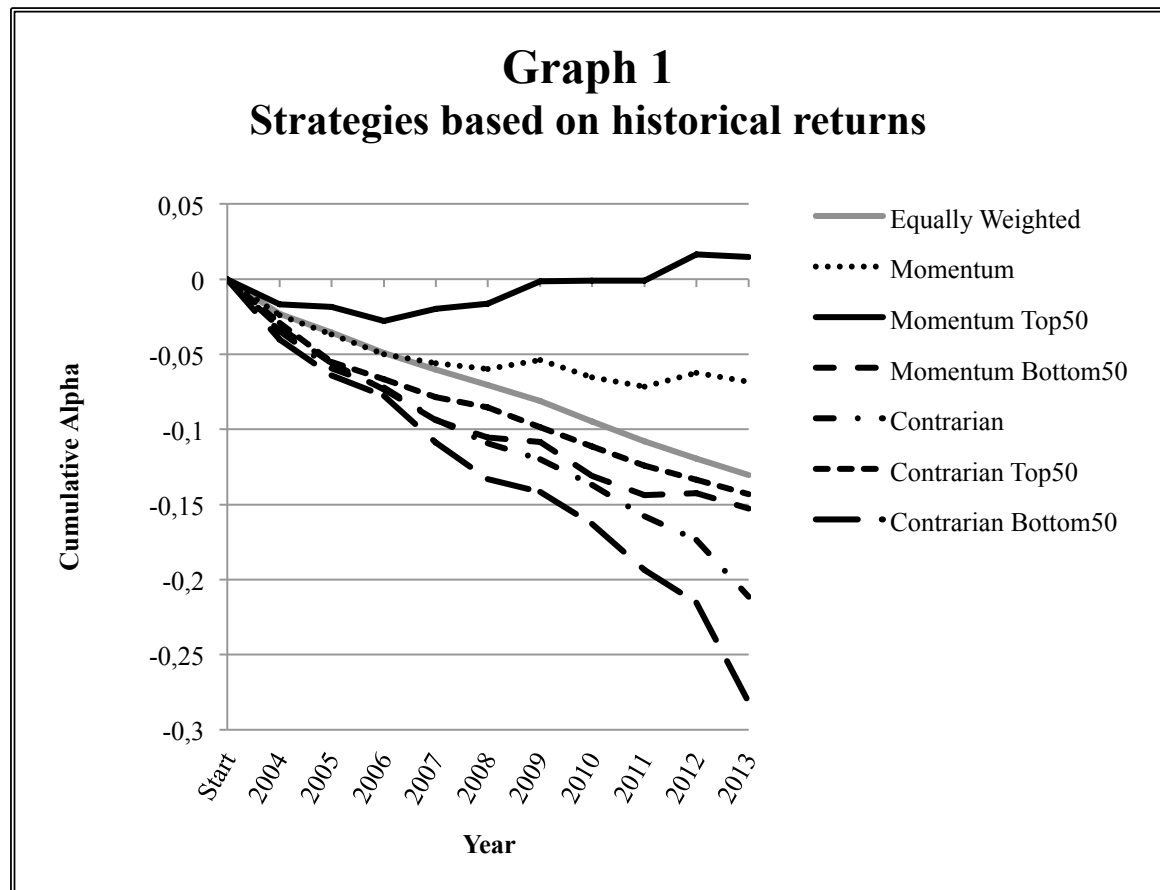
Table 2 shows that funds, on average, generate negative alphas. If correct, fund managers overall perform worse than the return expected through the *Carhart Four-Factor Model* at a given level of risk. Such results imply that cautiousness should pervade investments in PPM funds. The inexperienced investors are likely to pick funds performing worse than the risk they generate. Therefore it would be wise to follow a strategy that increases the probability to receive, at least, higher alphas than average.



## 7.1 Finding the Best Strategies

To interpret the following graphs it is important to realize that the *Equally Weighted* portfolio consists of equal investments in all funds. It is to be considered the average return of funds when picking randomly and strategies generating higher cumulative *alphas* are considered a better investment strategy than putting faith with luck.

### 7.1.1 Past Return Based Strategies

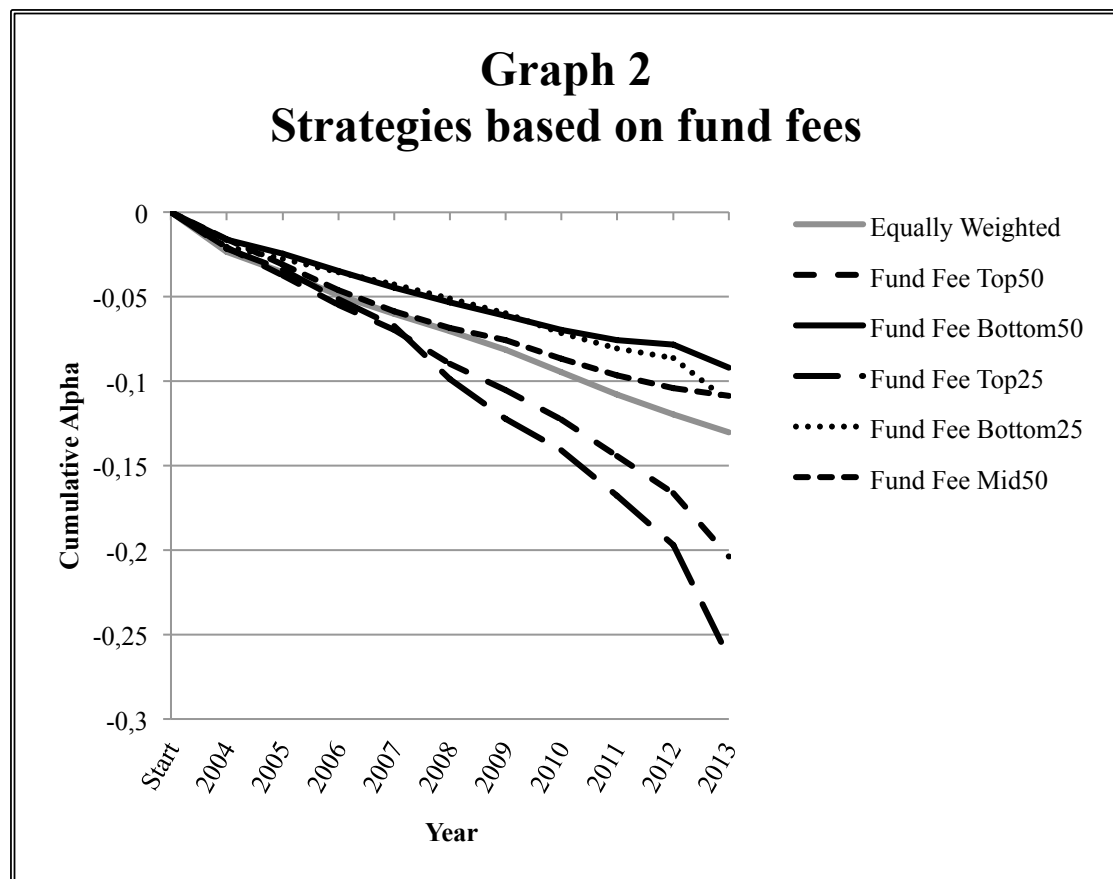


*Graph 1 presents the cumulative alphas on a yearly basis for an Equally Weighted portfolio, and for each of the strategy portfolios based on past returns. An alpha value of 0,01 represents beating the expected return by 1%. The period of study is between 2004-2013.*

As viewable in Graph 1, two out of six strategies perform better than being equally invested in all available funds. The two strategies; Momentum and Momentum Top50 are invested in the funds with a positive last-year return and it seems like the ability of generating positive return last year is a good implication of the ability to generate better-than-average *alphas* the coming year. However, since the two strategies aren't mutually exclusive it is important to see that it is the Momentum Top50 strategy that generates alphas above average, the other 50% of the Momentum strategy are actually generating lower than average numbers.

The theories of momentum investing regarding stocks are not compatible with fund investments. But, a possible explanation for the momentum strategies' distinct outperformance of the other *past return based strategies* in this study is the fact of the variability in the underlying assets. It is not assets or stocks that fluctuates, but the investing ability of a fund manager that determine the performance of a fund. This result implies that there are fund managers who manage to outperform their competitors one year and follow up with positive *alphas* the next. If true, it is important to invest with the best managers to have a better chance of finding funds generating good alphas. The only strategy generating positive alphas is the Momentum Top50, which consists of the best of last year's performers.

### 7.1.2 Fund Fee Based Strategies



Graph 2 presents the cumulative alphas on a yearly basis for an Equally Weighted portfolio, and for each of the strategy portfolios based on fund fees. An alpha value of 0,01 represents beating the expected return by 1%. The period of study is between 2004-2013.

Graph 2 reveals information regarding the fund fees in general. A common mistake might be to think that the best fund managers charge the highest fees. If calculating alphas based on return after fees, this study proves the opposite; the funds charging

higher fees do not manage to receive better alphas than those charging low fees. All three strategies charging relatively low fees, Fund Fee Bottom25, Fund Fee Bottom50 and Fund Fee Mid50, did manage to generate alphas above average. However, none of them generated positive alphas and all strategies are questionable whether or not they are good to invest in. The best cumulative alpha was generated by the funds with the 50 % lowest fees, which further implies that avoidance of funds charging high fees is wise.

### 7.1.3 Morningstar Rating Strategies

In the analysis of the Morningstar Rating strategies, another dataset is used than in the previous analyses. This dataset consists solely of the funds active by the end of 2013 and the performances of terminated funds are therefore not included. Hence, the performances of these strategies are survivorship-biased and not necessarily comparable to the other funds' performances.

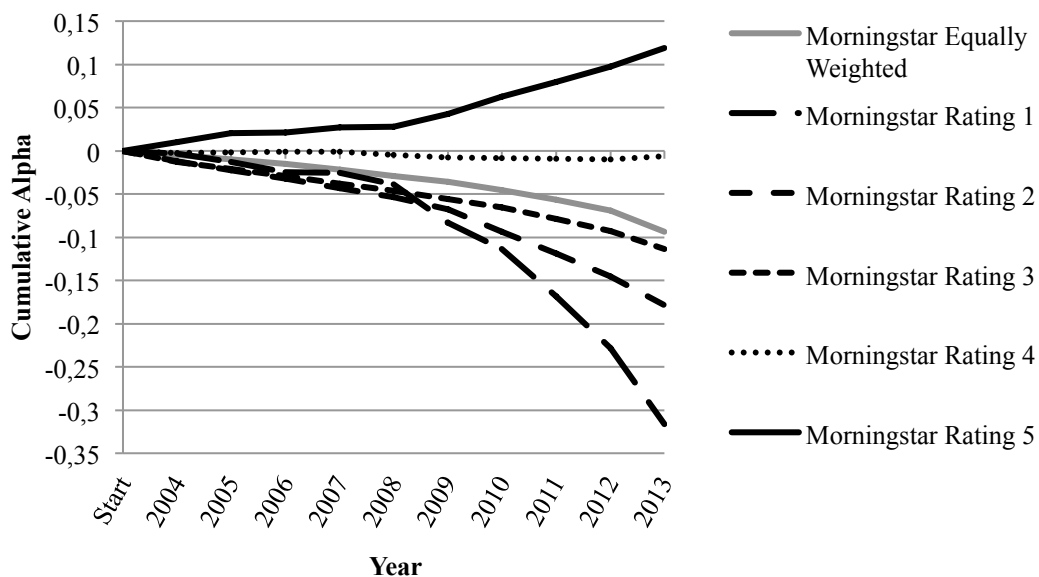
**Table 3 -** *The table shows average alphas of all available funds from year to year. The first Equally Weighted portfolio refers to the original dataset, including terminated funds. The second Equally Weighted portfolio refers to a dataset excluding all terminated funds (by the end of 2013). The alphas are presented on a yearly basis.*

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2013 (cumulative)
Alphas of Equally Weighted Portfolio (%)	-2,33	-1,20	-1,36	-1,13	-1,02	-1,08	-1,34	-1,32	-1,16	-1,08	-13,04
Alphas of Equally Weighted Portfolio Survivorship Biased (%)	-0,44	-0,50	-0,58	-0,67	-0,69	-0,69	-0,99	-1,10	-1,22	-2,49	-9,37

Table 3 clearly shows that this survivorship-biased dataset generates higher average alphas, with the only exception in 2012 and 2013. This suggests that terminated funds aren't usually the best performing funds, which is not unexpected. The usage of this survivorship-biased dataset when conducting the Morningstar Rating strategies creates discrepancies in reliability from the original dataset. The performance of the Morningstar Rating strategies might generally appear better, compared to the previously generated strategies. Since no information is provided regarding the Morningstar Rating of the terminated funds, it cannot be determined if the relative order of the investment strategies would have been the same if a non-survivorship-biased dataset was used. Bearing that in mind, the next part will discuss the results from the performance analysis of the Morningstar Rating strategies.

### Graph 3

#### Strategies based on morningstar rating



Graph 3 presents the cumulative alphas on a yearly basis for an Equally Weighted portfolio, and for each of the strategy portfolios based on Morningstar rating. An alpha value of 0,01 represents beating the expected return by 1%. The period of study is between 2004-2013.

The results from Graph 3 are not very unexpected, at least not the relative order of the strategies' performances. A portfolio consisting of funds with a relatively higher Morningstar Rating perform better than a portfolio consisting of funds with a relatively lower Morningstar Rating over the 10-year time period. However, the portfolio consisting of Morningstar Rating 5 funds generated a positive cumulative alpha of approximately 11,9 %. It is the only strategy based on Morningstar Rating that actually generates a cumulative alpha above zero. This strategy could be a good option to follow. It is important to remember that funds with a Morningstar Rating of 5 have continuously shown good results, good risk-return relation and acceptable fees, i.e. Return, *Alphas* and Fees have remained on a good level in the past. In line with what our analyses have proved be important factors. Graph 3 also suggests that it is better to invest in funds with only Morningstar Rating 4 than to invest equally in all available funds.

## 7.2 Comparison of Best Strategies and Default Options

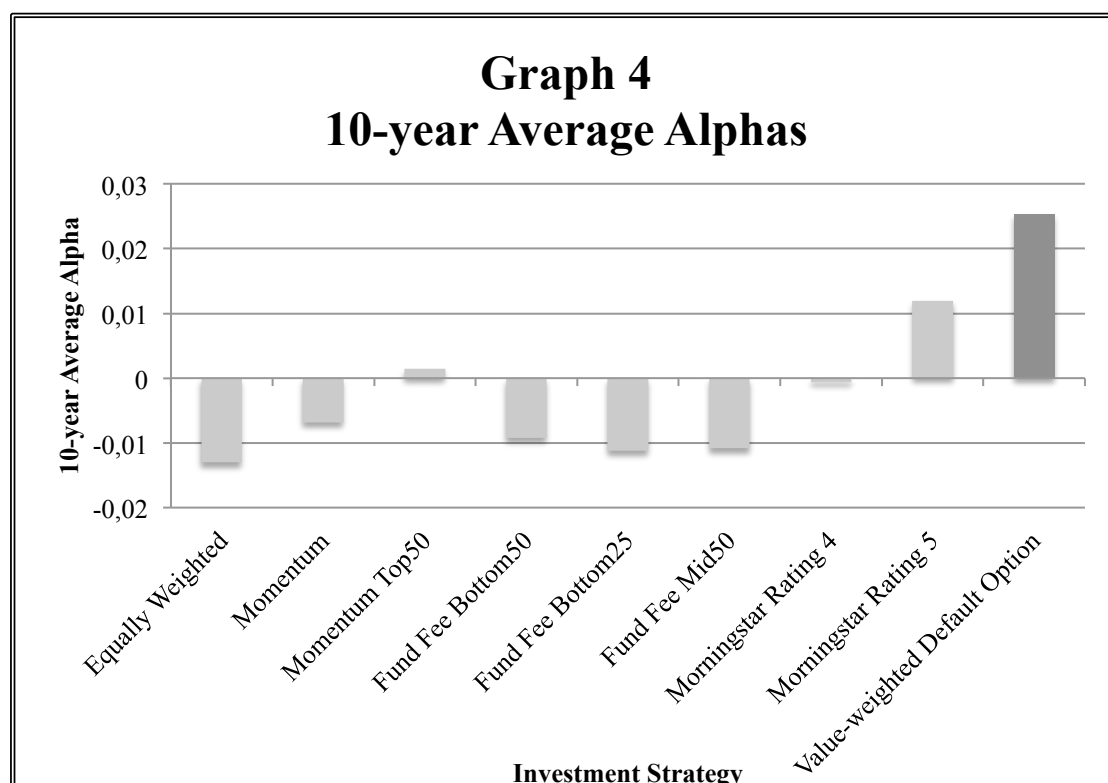
To compare the different strategies to the Default Options a Value Weighted portfolio of the Default Options is conducted. The returns of the Default Options, net of fees,

are weighted together through valuation based on amount of assets under management. The combined Default Option portfolio is shown in Table 4 below.

**Table 4 -** *The table shows the value weighted return of the combined Default Options on a yearly basis. No data was found regarding KPA pension year 2004, 2005 and 2013. Hence, the option was excluded from the combined portfolio those years.*

Trade Union	Year	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004
Alecta	Return net of fees (%)	10,2	11,4	-2,1	9,6	12,8	-7,4	4,8	8,4	14,2	10,2
	Assets under Management (MSEK)	602266	545719	487666	496434	453686	403093	439288	429609	397226	347602
AMF	Return net of fees (%)	9,3	8,0	2,4	9,8	12,6	-6,6	4,9	9,6	16,0	9,8
	Assets under Management (MSEK)	335222	303953	277611	270474	282842	252199	275977	265016	251100	217750
KPA Pension	Return net of fees (%)	n/a	7,2	5,6	8,2	12,4	6,3	-3,0	1,7	n/a	n/a
	Assets under Management (MSEK)	n/a	89415	78900	70871	62591	46549	46671	36564	n/a	n/a
Kåpan Pensioner	Return net of fees (%)	8,4	10,5	3,9	8,2	13,8	-15,6	1,5	8,8	14,5	9,0
	Assets under Management (MSEK)	60256	53693	46627	42703	37247	30748	33280	29463	25376	20575
<b>Default Options Combined</b>	<b>Value-weighted Return (%)</b>	<b>9,8</b>	<b>9,9</b>	<b>0,3</b>	<b>9,5</b>	<b>12,7</b>	<b>-6,6</b>	<b>4,2</b>	<b>8,5</b>	<b>14,9</b>	<b>10,0</b>

The comparison of the combined option is made to all the strategies generating better *alphas* than the Equally Weighted portfolio. The results are presented in Graph 4 below.



*Graph 4 presents the 10-year average alphas of the strategies generating the best alphas and the value weighted Default Option on a yearly basis.*

As clearly pictured in Graph 4, none of the strategies manage to generate anywhere near as good alphas as the Default Options. As previously stated, low fee funds tend

to generate higher alphas than high fee funds, at least after adjustment for fees. It has also been stated that Morningstar Rating 4 and 5 funds generate higher *alphas* than other rated funds. The Default Options are funds with capital invested in solely Morningstar rating 4 and 5 funds and are among the funds charging the lowest fees. Hence, it is natural that they manage to generate higher alphas than any simple amateur fund-picking strategy.

## 8. Implications and Conclusions

The purpose of this study was to explore whether there is a way for the average Swede, with limited effort, to actively invest their occupational pension contributions and select a portfolio of PPM funds generating better alphas than other strategies. The attributes assumed easily accessible (i.e. without limited effort) for the average Swede in this study are past returns, fund fees, and Morningstar Ratings. The study emphasizes the essential parts of the occupational pension system and conducted a performance analysis, which suggests that staying with the Default Option might in fact be the best choice for the average Swede saving for retirement.

The main dataset consists of all existing PPM funds 2002-2013, 1532 in total. By using Carhart's Four-Factor Model, with global factors as benchmark, we have estimated each fund's alpha on a monthly basis, using the historical PPM funds' returns. The monthly alphas have been recalculated to yearly basis. Less than 42 % of the fund managers generate a positive alpha and the average fund alpha is slightly negative even before deducting fund fees, suggesting that fund managers generally do not add enough value to justify the level of fund fees (even taking the government rebate into account). An implication of this observation is to consider more strict requirements to be classified as a PPM fund, to further benefit the Swedish population. The investment strategies based on past returns and fund fees have further been analyzed based on the yearly alphas, and tested on an annual basis.

The second dataset consists of all PPM funds between 2002 and 2013 that are active by the end of 2013. An exclusion of terminated funds creates a survivorship-biased dataset, which resulted in a higher alpha on average. This is shown through comparing one equally weighted portfolio from each dataset. Thus, the investment strategies based on Morningstar Ratings are expected to be relatively higher than they should, and not entirely comparable to the other strategies.

Our results prove that some investment strategies are significantly better than others. Among the strategies based on past returns, a portfolio solely investing in funds with the top 50 % of the previous year's returns generated the highest cumulative alpha during the 10-year period of study. It was one out of two strategies that managed to generate a positive cumulative alpha. Among the strategies based on fund fees, portfolios invested in funds with low fund fees generated the highest cumulative alpha during the 10-year period. Finally, among the strategies based on

Morningstar Ratings, the highest cumulative alpha was, not surprisingly, generated by the portfolio invested solely in funds with a Morningstar Rating of 5. It was also the strategy that managed to generate the highest cumulative alpha, but the survivorship-biased sample limits the credibility of this result.

When comparing to the Default Options, none of the best strategies stand a chance of generating better alphas. Hence:

*Are there any simple and easily applicable pension investment strategies generating better alphas than the Default Options do?*

- No.

## 8.1 Limitations

When estimating performances of funds it is hard to come up with accurate numbers. By combining the Carhart Momentum factor with the Fama-French model, the study has a good initial chance of finding accurate numbers. But, the factor numbers used are very generalized and in reality numbers differs between markets and thus for each fund. Sometimes it differs from asset to asset even within funds, since they are invested in different markets. Without a more comprehensive analysis on fund basis it is hard to determine the performance of individual funds. This study is possibly accurate on an overall basis but no conclusion should be drawn regarding separate funds' performances.

By using the changes in price of funds as starting point when calculating returns, no consideration of fluctuations in neither currency nor inflation is included. The fact that all numbers are nominal is functional, since the study isn't measuring absolute returns. But, the fact that currency fluctuations aren't accounted for, some numbers might be deceptive.

A weakness of the study is the fact that the alphas of the Default Options were calculated based on yearly numbers. Since the fund alphas are based on monthly numbers, some discrepancies might occur. A robustness test with yearly strategy numbers was made but due to short life lengths, 382 funds couldn't be included. Those funds represent more than one fourth of the total amount and thus, the test was considered invalid to use for comparison.

The fact that only the simplest, most easily applicable investing strategies are used makes it useful for inexperienced individuals, i.e. most of the Swedish



population. For people with greater knowledge, who are doing extensive research, other strategies might be used that perform better than the strategies covered in this study.

## **8.2 Further Research**

Due to the fact that the Swedish Pension System has been under a lot of debate lately, it would be interesting to further analyze some unexplored areas within the subject. Firstly, since this study ended up with the conclusion that PPM funds, on average, generated negative alphas; it would be exciting to examine whether there are fund managers that consistently generate negative alphas. As an extension to that study it would be thought-provoking to see if these bad-performing fund managers share similar characteristics. Ultimately it may support an argument of assembling stricter restrictions for funds to be classified as a PPM fund, and hence increase the utility for Swedes who are saving for retirement.

Another intriguing question to explore would be why the activity among PPM funds decreased by 40 % during the last year. Does it have something to do with a more positive attitude towards the Default Options among Swedes?

Finally, this study aimed to be of guidance for the greater part of the Swedish population. It would be interesting to examine strategies applicable for more experienced investors. Perhaps there are more advanced investment strategies that manage to beat the Default Options.

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## 10. Appendix

### Appendix A – Data Referable to Graphs

**Table A.1 –** *This table contains all data referable to Graph 1. The numbers represent the average yearly alphas of each strategy.*

	Equally Weighted	Momentum	Momentum Top50	Momentum Bottom50
Start	0	0	0	0
2004	-0,0233244	-0,0241116	-0,0166368	-0,03207
2005	-0,035346	-0,0369216	-0,0185388	-0,056166
2006	-0,0489696	-0,0501024	-0,027864	-0,0734004
2007	-0,0602988	-0,056094	-0,0198216	-0,0938844
2008	-0,0704976	-0,0599208	-0,016278	-0,1052736
2009	-0,0813372	-0,0540468	-0,0014796	-0,1083252
2010	-0,0947868	-0,0651468	-0,0008784	-0,130932
2011	-0,1079376	-0,0715728	-0,000884328	-0,143586
2012	-0,1195716	-0,0624468	0,016675272	-0,1424172
2013	-0,1304148	-0,0684996	0,014787672	-0,1527228
	Contrarian	Contrarian Top50	Contrarian Bottom50	
Start	0	0	0	
2004	-0,0345852	-0,029034	-0,0401364	
2005	-0,059568	-0,0550692	-0,0640224	
2006	-0,0721512	-0,0667056	-0,0775524	
2007	-0,0935616	-0,0785904	-0,1086672	
2008	-0,1091064	-0,085266	-0,1330068	
2009	-0,120024	-0,0984612	-0,1416384	
2010	-0,137022	-0,1114212	-0,162774	
2011	-0,1580496	-0,1240056	-0,1935072	
2012	-0,1737972	-0,1336824	-0,2152368	
2013	-0,21144	-0,143172	-0,281754	

**Table A.2 -** *This table contains all data referable to Graph 2. The numbers represent the average yearly alphas of each strategy.*

	Equally Weighted	Fund Fee Top50	Fund Fee Bottom50
Start	0	0	0
2004	-0,0233244	-0,020766	-0,0161556
2005	-0,035346	-0,0375636	-0,0245712
2006	-0,0489696	-0,054984	-0,0349152
2007	-0,0602988	-0,0694836	-0,0444888
2008	-0,0704976	-0,0897348	-0,0534576
2009	-0,0813372	-0,105156	-0,0611964
2010	-0,0947868	-0,1227156	-0,0694344
2011	-0,1079376	-0,1443408	-0,0756912
2012	-0,1195716	-0,166206	-0,0782964
2013	-0,1304148	-0,2039796	-0,0920568
	Fund Fee Top25	Fund Fee Bottom25	Fund Fee Mid50
Start	0	0	0
2004	-0,0213612	-0,0204096	-0,0158676
2005	-0,0341004	-0,0276192	-0,0310308
2006	-0,0513828	-0,0354504	-0,046224
2007	-0,0672708	-0,0427584	-0,0587352
2008	-0,0987372	-0,0509256	-0,0683736
2009	-0,1221708	-0,0597984	-0,0758604
2010	-0,1407264	-0,0715416	-0,0865596
2011	-0,1678632	-0,0806088	-0,096468
2012	-0,1968432	-0,0863424	-0,1041504
2013	-0,2637672	-0,11199	-0,1086624

**Table A.3 -** *This table contains all data referable to Graph 3. The numbers represent the average yearly alphas of each strategy.*

	Morningstar Equally Weighted	Morningstar Rating 1	Morningstar Rating 2
Start	0	0	0
2004	-0,0044124	-0,0033108	-0,0117564
2005	-0,0094392	-0,012966	-0,0220272
2006	-0,0152232	-0,0242688	-0,0320244
2007	-0,021918	-0,025446	-0,0431028
2008	-0,0288276	-0,038862	-0,0537036
2009	-0,0357012	-0,0832992	-0,0677304
2010	-0,0456024	-0,1136928	-0,0936444
2011	-0,0565692	-0,1685172	-0,1185612
2012	-0,0688152	-0,22821	-0,145728
2013	-0,0936804	-0,3162036	-0,1785168
	Morningstar Rating 3	Morningstar Rating 4	Morningstar Rating 5
Start	0	0	0
2004	-0,0125832	-0,00234	0,0103416
2005	-0,0210984	-0,0013524	0,0203628
2006	-0,0293172	-0,001218	0,0213252
2007	-0,0376092	-0,0008196	0,0268848
2008	-0,046278	-0,0044556	0,0280404
2009	-0,0559008	-0,0072588	0,0427764
2010	-0,0652356	-0,0084684	0,0628332
2011	-0,078558	-0,0088428	0,0800928
2012	-0,0929616	-0,009984	0,0977064
2013	-0,1138956	-0,0059604	0,1194444

**Table A.4 -** *This table contains all data referable to Graph 4. The numbers represent the 10-year average alphas for each strategy.*

Equally Weighted	Fund Fee Top50	Fund Fee Bottom50	Fund Fee Top25
-0,01304148	-0,02039796	-0,00920568	-0,02637672
Fund Fee Bottom25	Fund Fee Mid50	Momentum	Momentum Top50
-0,011199	-0,01086624	-0,00684996	0,001478767
Momentum Bottom50	Contrarian	Contrarian Top50	Contrarian Bottom50
-0,01527228	-0,021144	-0,0143172	-0,0281754
Morningstar Rating 1	Morningstar Rating 2	Morningstar Rating 3	Morningstar Rating 4
-0,03162036	-0,01785168	-0,01138956	-0,00059604
Morningstar Rating 5	Morningstar Equally Weighted	Value-weighted Default Option	
0,01194444	-0,00936804	0,025348	

## Appendix B – Strategy Statistics

**Table B.1** - Yearly statistics for Equally Weighted portfolio of main dataset.

Year	Number of funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	498	0,1346087	-0,0324864
2004	589	0,0531855	-0,0233244
2005	656	0,301163	-0,0120216
2006	701	0,0672022	-0,0136236
2007	722	0,0482287	-0,0113292
2008	679	-0,3084224	-0,0101988
2009	727	0,3148853	-0,0108396
2010	732	0,0573888	-0,0134496
2011	689	-0,1257669	-0,0131508
2012	717	0,0771541	-0,011634
2013	749	0,1362509	-0,0108432

**Table B.2** - Yearly statistics for Fund Fee Top50 portfolio of main dataset.

Year	Number of funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	308	0,1655083	-0,0433128
2004	343	0,0587365	-0,020766
2005	366	0,3593114	-0,0167976
2006	386	0,0715272	-0,0174204
2007	377	0,0817803	-0,0144996
2008	378	-0,3785479	-0,0202512
2009	383	0,3779397	-0,0154212
2010	395	0,0614558	-0,0175596
2011	389	-0,1625794	-0,0216252
2012	406	0,0870428	-0,0218652
2013	412	0,1363177	-0,0377736

**Table B.3** - Yearly statistics for Fund Fee Bottom50 portfolio of main dataset.

Year	Number of funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	315	0,1060952	-0,0176844
2004	349	0,048614	-0,0161556
2005	363	0,2506351	-0,0084156
2006	390	0,0632209	-0,010344
2007	402	0,0186963	-0,0095736
2008	378	-0,2447974	-0,0089688
2009	400	0,2556981	-0,0077388
2010	396	0,05358	-0,008238
2011	382	-0,0921244	-0,0062568
2012	396	0,0674025	-0,0026052
2013	409	0,1361836	-0,0137604

**Table B.4** - Yearly statistics for Fund Fee Top25 portfolio of main dataset.

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	159	0,1638046	-0,0428268
2004	177	0,050005	-0,0213612
2005	160	0,3788791	-0,0127392
2006	190	0,0797606	-0,0172824
2007	182	0,0798216	-0,015888
2008	185	-0,3890925	-0,0314664
2009	180	0,4110651	-0,0234336
2010	198	0,0635081	-0,0185556
2011	192	-0,1956794	-0,0271368
2012	192	0,0881207	-0,02898
2013	205	0,0889492	-0,066924

**Table B.5** - Yearly statistics for Fund Fee Bottom25 portfolio of main dataset.

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	157	0,0795526	-0,0125796
2004	178	0,0360624	-0,0204096
2005	184	0,2176132	-0,0072096
2006	194	0,0461135	-0,0078312
2007	201	0,0038724	-0,007308
2008	190	-0,1992376	-0,0081672
2009	194	0,1780656	-0,0088728
2010	172	0,0251063	-0,0117432
2011	172	-0,0574323	-0,0090672
2012	175	0,0479101	-0,0057336
2013	222	0,128163	-0,0256476

**Table B.6** - Yearly statistics for Fund Fee Mid50 portfolio of main dataset.

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	307	0,1501501	-0,0329844
2004	337	0,0642965	-0,0158676
2005	385	0,3159512	-0,0151632
2006	392	0,0726116	-0,0151932
2007	396	0,0579356	-0,0125112
2008	381	-0,3327413	-0,0096384
2009	409	0,3404918	-0,0074868
2010	421	0,0680774	-0,0106992
2011	407	-0,1280637	-0,0099084
2012	435	0,0842137	-0,0076824
2013	394	0,1647209	-0,004512



**Table B.7** - *Yearly statistics for Momentum portfolio of main dataset.*

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	415	0,0649511	-0,0241116
2005	410	0,3101302	-0,01281
2006	594	0,0725766	-0,0131808
2007	435	0,0723918	-0,0059916
2008	386	-0,325378	-0,0038268
2009	82	-0,0111769	0,005874
2010	598	0,068285	-0,0111
2011	452	-0,1449496	-0,006426
2012	103	0,0220835	0,009126
2013	585	0,1546898	-0,0060528

**Table B.8** - *Yearly statistics for Momentum Top50 portfolio of main dataset.*

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	214	0,1028348	-0,0166368
2005	208	0,3765553	-0,001902
2006	305	0,1204952	-0,0093252
2007	221	0,0938088	0,0080424
2008	196	-0,4312736	0,0035436
2009	41	-0,0245505	0,0147984
2010	296	0,1271265	0,0006012
2011	223	-0,1974914	-5,93E-06
2012	50	0,0132711	0,0175596
2013	295	0,1677514	-0,0018876

**Table B.9** - *Yearly statistics for Momentum Bottom50 portfolio of main dataset.*

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	201	0,0246171	-0,03207
2005	202	0,2417321	-0,024096
2006	289	0,0220051	-0,0172344
2007	214	0,0502742	-0,020484
2008	190	-0,2161384	-0,0113892
2009	41	0,0021968	-0,0030516
2010	302	0,0106126	-0,0226068
2011	229	-0,0937844	-0,012654
2012	53	0,030397	0,0011688
2013	290	0,141403	-0,0103056

**Table B.10** - *Yearly statistics for Contrarian portfolio of main dataset.*

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	56	-0,0275594	-0,0345852
2005	143	0,2235557	-0,0249828
2006	34	-0,0234941	-0,0125832
2007	213	-0,0196721	-0,0214104
2008	239	-0,267995	-0,0155448
2009	571	0,3552607	-0,0109176
2010	80	-0,0161727	-0,016998
2011	185	-0,0726041	-0,0210276
2012	536	0,0892316	-0,0157476
2013	79	0,0243538	-0,0376428

**Table B.11** - *Yearly statistics for Contrarian Top50 portfolio of main dataset.*

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	28	-0,0103562	-0,029034
2005	73	0,2039082	-0,0260352
2006	17	-0,0195746	-0,0116364
2007	108	0,0137236	-0,0118848
2008	119	-0,2085388	-0,0066756
2009	286	0,2089698	-0,0131952
2010	40	-0,0257559	-0,01296
2011	100	-0,0618981	-0,0125844
2012	266	0,0733969	-0,0096768
2013	40	0,0947762	-0,0094896

**Table B.12** - *Yearly statistics for Contrarian Bottom50 portfolio of main dataset.*

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	28	-0,0447625	-0,0401364
2005	70	0,2440452	-0,023886
2006	17	-0,0274136	-0,01353
2007	105	-0,054022	-0,0311148
2008	120	-0,3269557	-0,0243396
2009	285	0,5020649	-0,0086316
2010	40	-0,0065895	-0,0211356
2011	85	-0,0851993	-0,0307332
2012	270	0,1048317	-0,0217296
2013	39	-0,0478742	-0,0665172

**Table B.13** - Yearly statistics for Morningstar Equally Weighted portfolio of survivorship-biased dataset.

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	206	0,1490858	-0,0060588
2004	282	0,0629414	-0,0044124
2005	325	0,3102822	-0,0050268
2006	361	0,0839587	-0,005784
2007	382	0,0519909	-0,0066948
2008	409	-0,3011795	-0,0069096
2009	455	0,3288011	-0,0068736
2010	485	0,0667397	-0,0099012
2011	520	-0,1270004	-0,0109668
2012	559	0,0822715	-0,012246
2013	583	0,1388876	-0,0248652

**Table B.14** - Yearly statistics for Morningstar Rating 1 portfolio of survivorship-biased dataset.

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	8	0,0347057	-0,0033108
2005	14	0,3323402	-0,0096552
2006	14	0,0398002	-0,0113028
2007	7	0,0180977	-0,0011772
2008	7	-0,3015428	-0,013416
2009	18	0,5309087	-0,0444372
2010	20	0,0514195	-0,0303936
2011	24	-0,164797	-0,0548244
2012	18	0,0949647	-0,0596928
2013	18	0,0230735	-0,0879936

**Table B.15** - Yearly statistics for Morningstar Rating 2 portfolio of survivorship-biased dataset.

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	52	0,0407417	-0,0117564
2005	68	0,3253771	-0,0102708
2006	49	0,08007	-0,0099972
2007	68	0,0724458	-0,0110784
2008	66	-0,2636103	-0,0106008
2009	77	0,381798	-0,0140268
2010	80	0,078412	-0,025914
2011	80	-0,1566009	-0,0249168
2012	102	0,1019008	-0,0271668
2013	99	0,1061563	-0,0327888

**Table B.16** - *Yearly statistics for Morningstar Rating 3 portfolio of survivorship-biased dataset.*

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	114	0,0440233	-0,0125832
2005	131	0,296003	-0,0085152
2006	149	0,0662135	-0,0082188
2007	144	0,0478164	-0,008292
2008	153	-0,2989139	-0,0086688
2009	172	0,3410163	-0,0096228
2010	183	0,0584063	-0,0093348
2011	199	-0,1319479	-0,0133224
2012	206	0,0814583	-0,0144036
2013	222	0,1428972	-0,020934

**Table B.17** - *Yearly statistics for Morningstar Rating 4 portfolio of survivorship-biased dataset.*

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	63	0,087301	-0,00234
2005	69	0,2986132	0,0009876
2006	81	0,0999946	0,0001344
2007	102	0,0449086	0,0003984
2008	128	-0,3080321	-0,003636
2009	128	0,2779783	-0,0028032
2010	147	0,0729295	-0,0012096
2011	159	-0,1153433	-0,0003744
2012	178	0,0724329	-0,0011412
2013	156	0,1790873	0,0040236

**Table B.18** - *Yearly statistics for Morningstar Rating 5 portfolio of survivorship-biased dataset.*

Year	# funds invested in	Average Annual Return	Average Annual Alpha (Monthly * 12)
2003	n/a	n/a	n/a
2004	41	0,1060719	0,0103416
2005	42	0,3429058	0,0100212
2006	55	0,107947	0,0009624
2007	56	0,0612511	0,0055596
2008	54	-0,3302043	0,0011556
2009	51	0,2634662	0,014736
2010	52	0,058787	0,0200568
2011	55	-0,0776851	0,0172596
2012	50	0,072301	0,0176136
2013	57	0,1578024	0,021738