

The Swedish Premium Pension

- *Should an investor actively select funds or keep the default option?*

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ABSTRACT

This paper examines the two alternatives currently available to Swedish employees for the investment of their PPM pension contributions. The aim of the study is to conclude which alternative is more beneficial: to actively select which mutual funds to contribute to or to passively invest pension contributions in the default option, *Premiesparfonden*. In order to achieve this aim, all registered PPM-funds as of October 2008 are analyzed, using the mean-variance framework developed by Markowitz (1952). This involves using a two factor asset pricing model and historical standard deviations for each fund. In addition, the concepts of utility certainty equivalent loss and return loss are used to determine potential losses of welfare, given the investor's preferences. The impact of differing management fees between the two alternatives is analysed by altering the asset pricing model to take into account the low fee applicable to the default option. The findings reveal that few mutual funds yield a higher utility than the default option. In addition, any attainable gains are only marginal and the cost of finding these top performing funds is comparatively high. Furthermore, the investor's utility and return are likely to be negatively affected by the choice to actively manage their pension contributions. Therefore, it appears that the default option is most beneficial for the majority of investors.

Key words: PPM, Premium Pension Authority, National Pension, Premiesparfonden, AP7

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Should an investor actively select funds or keep the default option?

“People who are either reluctant or unable to choose a fund manager for themselves should receive at least the same pension as others - that is what we aim to achieve”

Sjunde AP-Fonden

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1. Introduction and Purpose

In 1999 the Swedish pension system was reformed and as a result the Premium Pension System (PPM) was introduced. PPM is a system which enables individuals to invest a certain percentage of their pension contributions in mutual funds. This allows the individual to determine how that portion of their income pension is managed. For individuals who do not seek to actively manage their pension, their contributions are automatically invested in the government run Premium Savings Fund (*Premiesparfonden*), managed by Sjunde AP-Fonden.

The purpose of this study is to examine this relatively new system and analyse the two options which an investor can adopt: either invest in *Premiesparfonden* or invest in any of the available mutual funds. The aim is to investigate the question of whether it is more beneficial for Swedish individuals to keep their money in *Premiesparfonden* or to actively select mutual funds in which to invest. All 710 funds examined in the study are analysed in terms of diversification, using the mean-variance framework developed by Markowitz. Performance analysis, i.e. estimating each fund's alpha is not conducted.

1.1 Research Question

Every Swedish individual has to make a decision to either invest their future retirement money in mutual funds as part of the PPM system or to allow Sjunde AP-Fonden to invest their money for them. As this decision is relevant to all Swedish residents, we believe that a comparison of these two strategies can provide useful insight in how individuals should manage their future retirement money. Therefore this thesis aims to answer the following question:

Should an investor actively select funds or keep the default option?

1.2 Contribution

This thesis makes two key contributions to the existing academic studies within the field of household finance. Firstly, the thesis is the first to examine whether the default option is an optimal investment given a certain risk aversion. Secondly, the thesis also makes recommendations for how to improve the existing PPM system in order to benefit the individuals.

1.3 Outline

The outline of the thesis is structured as follows: In section two, we describe the Swedish pension system in general and the PPM system in particular. In section three, we outline a summary of previous empirical findings that are relevant to our field of research. In section four, we present our

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theoretical framework used to answer the research question. In section five, we present our quantitative dataset used to conduct the analysis and the assumptions that are made. In section six, we describe our methodology. In section seven, we present our results and analysis. In section eight, we conclude our study and present suggestions for future research topics.

2. The Swedish Pension System

In this section, the Swedish pension system is described. However, this thesis will only focus on one component of the system, the premium pension. Therefore, no detailed descriptions regarding other constituents will be considered.

2.1 The Swedish Pension System in Brief

The Swedish pension system is built on three parts; *national pension (allmän pension)*, *occupational pension (tjänstepension)* and *personal pension (frivilligt sparande)*. The national pension is the base of the system whereas the amount of occupational- and personal pension an individual receives depends on how much money the employer sets aside as well as the value of a personal pension insurance. In the national pension, money is set aside for each citizen each year they work and pay income tax. Every year an amount corresponding to 18,5 % of the pension based income is set aside for the pension entitlement of which 16% is set aside for the income pension and the remaining 2,5% is reserved for the premium pension. In the premium pension, each wage earner can choose how to invest the money among approximately 700 mutual funds. Although the amount of available funds is vast, an individual cannot hold more than five at a time. When investing in a fund, PPM buys shares in the funds for the capital that is set aside. When a person retires, PPM sells the shares in the funds and the money is paid out as pension. *Figure 1* depicts the Swedish pension system.

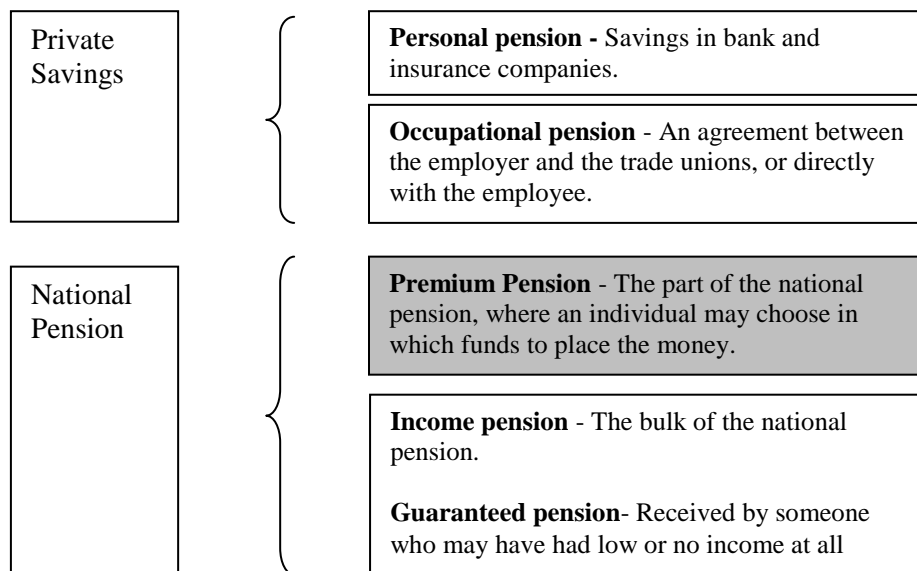


Figure 1: Schematic diagram of the Swedish pension system.

Managers for the mutual funds in the PPM system offer to manage individual's capital for a yearly fee, which varies between funds. PPM customers pay fund fees that are reduced by a price reduction

model. It is a progressive model which means that the more capital inflow from PPM investors to the fund, the higher percentage the charge will be reduced by. Fund companies pay back the discounts to PPM on a quarterly basis and the money allocated to each person is paid out to each individual's account yearly. Hereafter, this discounted fee applicable to PPM savers is referred as the PPM fee.

2.1.1 Premiesparfonden

Premiesparfonden is the mutual fund managed by Sjunde AP-Fonden. If an individual does not invest in any of the mutual funds available through PPM, all their money will automatically be invested in this fund.¹ Since an individual can only invest in *Premiesparfonden* if they do not select any of the PPM funds, it is not a listed fund among the available funds since it is not possible to hold a portfolio with a fraction of the capital in *Premiesparfonden*.

Once an investor has chosen to invest in any of the available PPM funds, it is not possible to switch to *Premiesparfonden*. It should be noted that there is one exception to this rule: if any of the funds chosen by an investor are no longer available and no substitute can be found from the same fund manager, the capital invested in that fund will be transferred to *Premiesparfonden*. However, the solution is only temporarily permitted and the next time the position is altered, it must be rebalanced to a portfolio consisting of selectable funds only.

The aim of *Premiesparfonden* is that those who do not wish to or are unable to choose their own mutual funds, can receive a pension that is at least as good as everyone else's. Furthermore, the Swedish Parliament's AP Funds Act stipulated that Sjunde AP-Fonden's capital should be invested in such a way that the total return earned by *Premiesparfonden*, during five-year periods, is at least as high as the average of all funds that can be chosen actively in the premium pension system. In addition, the risk should be lower. Not only does *Premiesparfonden* aim to earn a return that at least matches the average for all the funds in the PPM-system, it also offers a management fee that is one of the lowest in the system. The fee that is currently applicable to the PPM savers is 0,15 per cent.²

In order to depict *Premiesparfonden*'s historical performance, *Figure 2* compares the fund to the one of the most diversified equity indices, MSCI's World Index.

¹ Sjunde AP-Fonden, Annual Report 2007 p.10

² <http://www.ap7.se>

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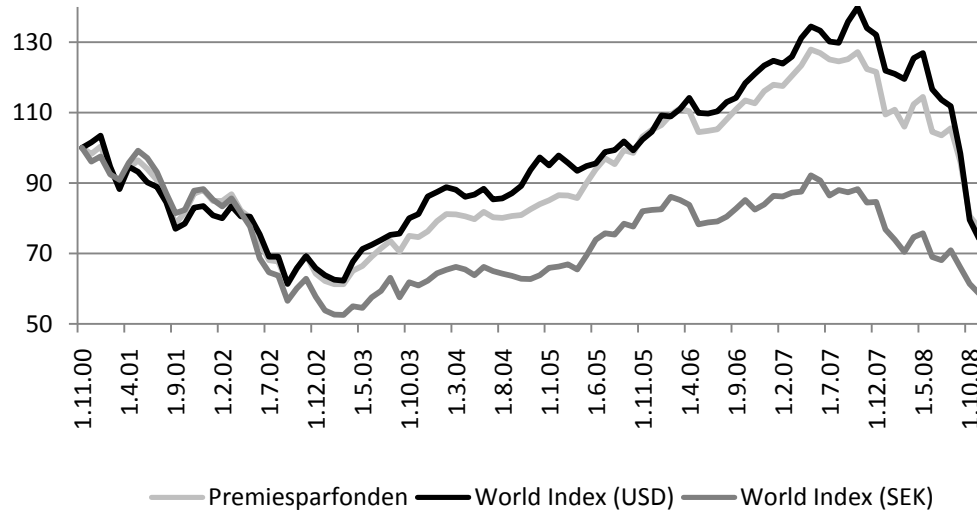


Figure 2: Historical development of *Premiesparfonden* and the World Index denominated both in US dollar and Swedish krona. The indices are rebased to 100 at the inception of *Premiesparfonden*. *Premiesparfonden* is gross of fees and denominated in Swedish krona.

In order to manage the SEK 90 billion that currently is invested in *Premiesparfonden*, Sjunde AP-Fonden employs both internal and external asset managers.³ Internal management means that the investment decisions are being made by portfolio managers employed by Sjunde AP-Fonden. External management means that the investment decisions are made by specially engaged external portfolio managers, often large specialist firms. Since the introduction of *Premiesparfonden*, the number of external managers has increased along with the fund's assets under management. Assets under management has grown from SEK 15 billion at the inception in fall 2000 to about SEK 90 billion at the end of 2007.

Premiesparfonden is classified as a global equity fund⁴, and invests in several different asset classes. The management of the fund is governed by a strategic portfolio, which shows the long-term breakdown of the fund's various assets, expressed as a proportion of the fund's total market value. *Figure 3* shows the strategic portfolios in 2008.

³ Sjunde AP-Fonden, Annual Report 2007 p.26-27

⁴ <http://www.morningstar.se>

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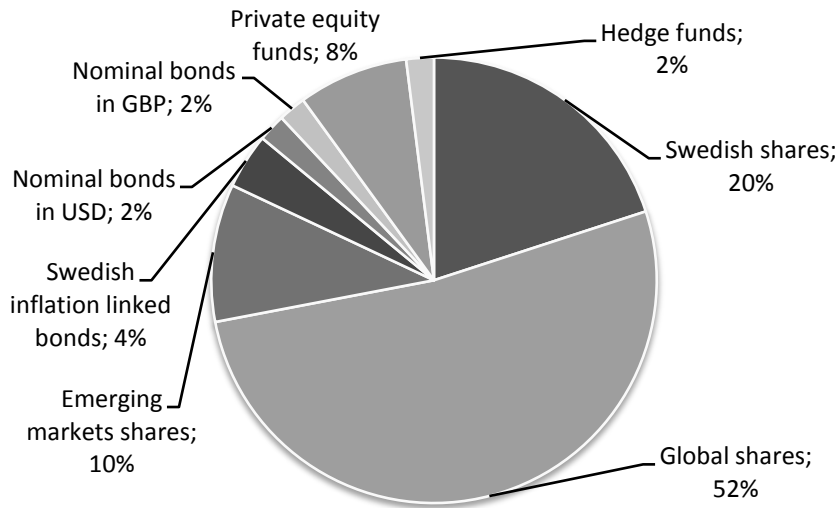


Figure 3: Investment proportions in *Premiesparfonden*

Most of the capital in *Premiesparfonden*, about 82%, is invested in shares listed on a stock exchange. The majority of these investments, approximately 65%, are global equities, which means American, European and Asian shares. The rest is invested in shares on the Swedish stock market (20%) and Emerging Markets (10%). More than half of the listed equities are managed in such a manner that they track the stock market index in that country, also known as passive management, whereas about 40% of these listed equities are actively managed. This means that the local managers in the various countries buy and sell shares at appropriate times to maximize returns. The managers are only permitted to buy shares in companies that they have good understanding of and where they think they can predict the trend.

All shares are purchased in local currency which exposes *Premiesparfonden* to currency risks. In order to prevent losses when, for example, the dollar exchange rate changes, *Premiesparfonden* has hedged half of the foreign holdings. Furthermore, the fund also includes fixed income investments. Half of these are inflation linked bonds. There are securities issued by the Swedish state that provides a guaranteed rate of interest and protection against inflation losses. Inflation linked bonds do not only pay the guaranteed interest rate, they also compensate for inflation. The other half of the interest rate investments are made in U.S. and U.K. nominal government bonds.

Premiesparfonden invests in an asset class known as alternative investments, which includes hedge funds and private equity funds. Practically the fund invests in funds that in turn invest in a number of hedge funds and private equity funds. Investments are made only if they meet the liquidity requirements of the Swedish Financial Supervisory Authority (Finansinspektionen) for these types of investments. This asset class also includes units in listed companies, which in turn primarily invests in shares in unlisted companies or private equity funds.

2.1.2 Co-operation Agreement with PPM

To be permitted to offer funds via the Premium Pension system, a fund manager must be authorized to operate a fund management business in Sweden. In addition, an agreement between fund managers and PPM governs the cooperation. In order to ensure a fair treatment, PPM has decided to apply the same terms and conditions to all fund managers. The co-operation agreement consists of a brief contract form that includes the agreement to enter into a co-operation arrangement, and of the general terms and conditions that apply at any time between PPM and the fund managers.⁵

2.1.3 Restrictions to the PPM System

If one decides to invest in the available mutual funds, the PPM system is constrained by some rules which an investor ought to take into account:

1. *No short selling*: The PPM system does not allow short selling, hence there is not possible to hold a negative position in any of the PPM funds.
2. *No borrowing*. It is not possible to borrow money through the PPM system.
3. *Limited number of funds*. The investment universe includes all funds available, but an investor is not permitted, as already mentioned, to hold a portfolio containing more than five of these funds.

⁵ <http://www.ppm.nu>

3. Previous Research

Although the Swedish pension system has received some publicity in recent times⁶, no study closely related has been conducted. However, there are a few studies that should be borne in mind throughout our study. Some of them examine the correlation between fees and fund performance whilst others are within Behavioural Finance.

Dahlquist, Engström and Söderlind (2000) found that low-fee funds outperform high-fee funds. The study was done on Swedish mutual funds. In line with their results, Carhart (1997) finds a negative correlation between fees and performance for U.S. mutual funds.

Palme, Sundén and Söderlind (2004) found that the relationship between income and level of risk in a portfolio is somewhat U-shaped: low-income investors take on more risk than middle-income earners, and high-income earners take on more risk than middle-income earners. They also found that workers in the manufacturing sector - the sector that is probably most correlated with the Swedish stock market - are less likely to invest in foreign assets and thus are exhibiting some “home bias”.

Engström and Westerberg (2004) showed that individuals chase past returns and have strong preferences for low-fee funds. An even more important determinant of fund inflow is information cost. For instance, foreign-based funds with a track record similar to that of a domestic fund attract fewer investors and receive less capital. Furthermore, new funds without a track record also receive less capital. A few of these studies analyses the relationship between gender and investment decision. Engström and Westerberg (2003) showed that women and younger individuals are more likely than men and older individuals to make an active investment decision. Säve-Söderberg (2003) found that women have a tendency to be more home-biased than men. However, the home-biasedness seems to be a variable highly affected by e.g. place of employment.

Engström (2004) obtained evidence that active portfolio management creates value and finds a positive alpha for the average portfolio manager pursuing an active management strategy. The paper also shows a positive relationship between value created and trading activity. Wermers (2000) and Ipolito (1989) support the findings that active management can create value.

⁶ See e.g. <http://www.ft.com>

4. Theoretical Framework

This section provides a brief background to the financial theory underlying the methodology of this thesis. Specifically, the concepts of portfolio theory, return losses and investor preferences are presented.

4.1 Portfolio Theory

4.1.1 Mean-Variance Framework

Modern Portfolio Theory is primarily based on the findings of Harry M. Markowitz and William F. Sharpe. Markowitz studied the effects of asset risks, correlation and diversification of expected investment portfolio returns, and described how to combine assets into efficiently diversified portfolios. Specifically, an efficient portfolio is one where no added security can lower the portfolio's risk for a given level of return expectation or, alternately, no additional expected return can be gained without increasing the risk of the portfolio. Furthermore, all portfolios that provide the highest expected return for a given level of risk are said to lie on *the efficient frontier*.⁷

Based on the work of Markowitz, Sharpe introduced the famous Capital Asset Pricing Model (CAPM), which is used to determine the cost of capital of an asset.⁸ The formula takes into account the asset's sensitivity to non-diversifiable risk, as well as the expected return of the market as a whole and the expected return of a theoretical risk-free asset. The model is based on the rational assumption that investors should not be compensated for risk that they can avoid simply through diversification, idiosyncratic risk. The expected return of any financial asset is according to the Capital Asset Pricing Model given by *Equation 4.1*.

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) \quad (4.1)$$

Where:

$E(R_i)$ = Expected return of asset i .

R_f = Risk-free rate of return.

β_i = Beta of asset i .

$E(R_m)$ = Expected market return.

CAPM, being a single factor model, has been fiercely disputed since its inception, as a number of studies rejected that an intercept of a regression on excess returns over excess returns of the

⁷ Markowitz, H., 1952, Portfolio Selection, The Journal of Finance, Vol. 7, No. 1, pp. 77-91.

⁸ Sharpe, W., 1964, Capital Assets prices: A Theory of Market Equilibrium under Conditions of Risk, The Journal of Finance, Vol. 19, No. 3, pp. 425-442.

market is zero, which would imply that the CAPM does not hold. The most famous critique was put forward by Ross⁹, Roll¹⁰ and by Roll and Ross together¹¹. One reaction to the critique implied that CAPM was developed into several multifactor asset pricing models such as ICAPM¹² and APT¹³.

4.1.2 The Sharpe Ratio, Return Loss and Investor Preferences

William F. Sharpe has also named a measure of risk-adjusted performance.¹⁴ The measure, along with other measures, is often used to rank the performance of portfolio or mutual fund managers, but can also be used in the context of expected returns. The ratio is a reward-to-variability ratio and is specified in *Equation 4.2*.

$$S = \frac{E(R_i - R_f)}{\sigma_i} \quad (4.2)$$

Where:

$E(R_i - R_f)$ = Expected return over the risk free interest rate of asset i .

σ_i = Standard deviation of asset i .

While the Sharpe ratio is a rather straightforward measure, its numerical value is not easy to interpret. For example, comparing the ratios of two portfolios, A and B, might suggest one portfolio is outperforming the other. But the difference might not be meaningful from an economic view.

An alternative to the Sharpe ratio is the return loss measure. Like the Sharpe ratio, the return loss measure focuses on total volatility as the measure of risk, but the measure has the easy interpretation of the difference in return relative to the benchmark portfolio. To compute the return-loss measure, one of the portfolios is mixed with T-bills so it matches the volatility of the other portfolio (benchmark portfolio). This adjusted portfolio is called A*. Because the two portfolios now have the same standard deviation, one can compare them simply by comparing returns.

$$\text{Return Loss} = r_{A^*} - r_B \quad (4.3)$$

⁹ Roll, R., 1977, A Critique of the Asset Pricing Theory's Tests, *Journal of Financial Economics*.

¹⁰ Ross S.A., 1976, The Arbitrage Theory of Capital Asset Pricing, *Journal of Economic Theory*

¹¹ Roll, R and Ross, S.A., 1980, An Empirical of the Arbitrage Pricing Theory, *The Journal of Finance*.

¹² Merton, R.C., 1973, An Intertemporal Capital Asset Pricing Model, *Econometrica*, Econometric Society.

¹³ Ross, S.A., 1976, The Arbitrage Theory of Capital Asset Pricing, *Journal of Economic Theory*

¹⁴ Sharpe, W. F. 1966. "Mutual Fund Performance". *Journal of Business* 39 (S1): 119–138

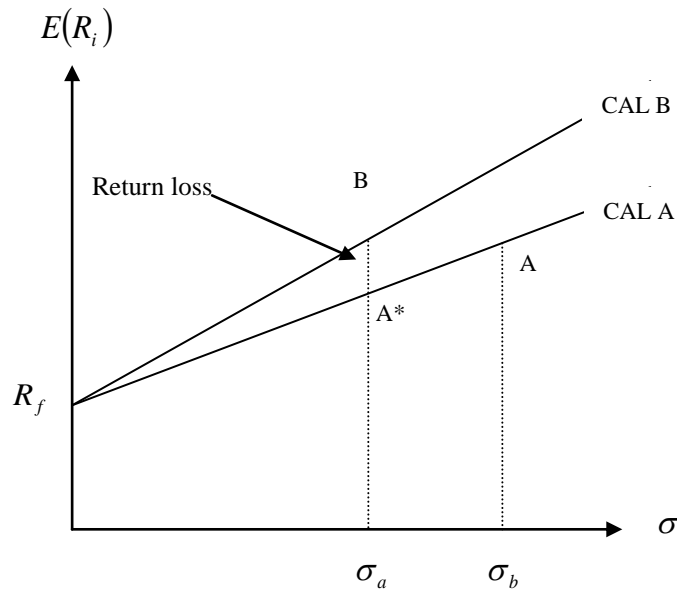


Figure 4: The return loss measure illustrated.

The graph shows the return loss measure for portfolio A. The Capital Allocation Line (CAL) depicts all possible combinations of the portfolio and the risk-free asset. We move down the capital allocation line, corresponding to portfolio A by mixing it with T-bills until we have reduced the standard deviation of the adjusted portfolio to the one for portfolio B. The return-loss measure is then the vertical distance between adjusted portfolio, A *, and portfolio B. As we can see from the graph, A has a negative value which means that its Sharpe ratio is less than that of portfolio B.¹⁵

Another measure we aim to employ is the concept of welfare consequences which is a widely used framework in microeconomics. The theory aims to explain an investor's preference between different consumption bundles. Suppose for instance there exist only two goods, X and Y, and a bundle of these is created which we call *a*. Then, a person is asked to identify all the bundles that gives the same amount of utility as consuming bundle *a*. Using the answers, a so called *indifference curve* can be drawn. In this study, we aim to implement a similar framework in our analysis with the exception that the goods are expected excess return and standard deviation. The bundles that are available are the funds in the PPM system. In the appendix to the paper *Down or Out: Assessing The Welfare Costs of Household Investment Mistakes* written by Calvet, Campbell and Sodini (2007), the authors use this methodology in a way which we aim to adopt. By introducing a measure called utility loss (UL), it is only necessary to consider the Sharpe ratios of two funds as well as the risk aversion (γ) of an investor in order to compute welfare effects. Formally the equation is written:

¹⁵ Bodie, Z. Kane, A. Marcus, A.J. (2005). Investments 5th edition , New York, McGraw-Hill, pp 868-870

$$UL_i = \frac{S_B^2 - S_i^2}{2\gamma_i} \quad (4.4)$$

Where:

S_B^2 = The squared Sharpe ratio of a benchmark.

S_i^2 = The squared Sharpe ratio of the fund held by investor i .

γ_i = Risk aversion of investor i .

We consider an investor i with risk aversion γ_i and observed Sharpe ratio S_i . If the investor instead adopts the Sharpe ratio, S_B , of a benchmark, the effect on utility is equivalent to an increase in the riskless interest rate given by *Equation 4.4*. The utility loss increases with the inefficiency of the selectable PPM fund, $S_B^2 - S_i^2$, and decreases with the investor risk aversion γ_i . While the Sharpe ratios are easily measured, the selection of γ_i must be addressed. *Figure 5* depicts this concept.

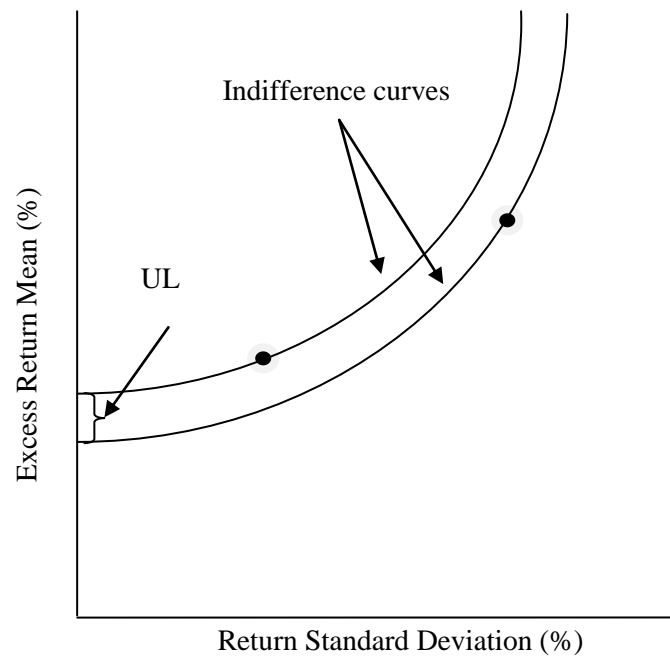


Figure 5: The concept of Utility Loss (UL) illustrated.

In this study, the benchmark, S_B^2 , is the default option as we aim to investigate the welfare effects for certain levels of risk aversion if an investor is being active within the PPM system. In the article by

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Calvet, Campbell and Sodini (2007), the authors also introduce an equation for estimating an investor's risk aversion, given the Sharpe ratio of the fund that is chosen. Formally, to compute the inferred γ_i , one should employ *Equation 4.5*.

$$\gamma_i = \frac{S_i}{\omega_i \sigma_i} \quad (4.5)$$

Where:

ω_i = Weight of risky asset.

σ_i = Standard deviation of portfolio i .

5. Data

In this section we present the data that will be analyzed in this study and argue for the assumptions being made. The data presented in this section comes from reliable data sources such as Morningstar Direct, the PPM authority, Thomson Datastream, Sweden's Central Bank's (Riksbankens) website and the Federal Reserve (FED).

5.1 Data Description

5.1.1 Fund Data

The core data in this study consists of monthly returns applicable to each fund that was categorized as a PPM fund in October 2008. Monthly, dividend adjusted, Swedish krona returns, net of fees¹⁶, from each fund's inception date are retrieved from *Morningstar Direct*. The returns are recalculated to reflect historical excess returns by subtracting the monthly Swedish krona risk free rate. The 3-month Swedish T-bill¹⁷ from the Swedish national bank (Riksbanken) is used as proxy.

The total amount of monthly return observations in our data set sums up to 72,420. The average and median life time of the funds are 102 and 97 months, respectively.

5.1.2 Fund Categories

All funds in the sample are open-end funds. The funds in the PPM-system are classified either as Equity, Fixed income, Mixed, Money Market (MM) or Generation. According to Morningstar's definitions, equity funds invest primarily in equities, fixed income primarily in bonds, mixed funds (also known as balanced or hybrid funds) have a rather equal split between equities and bonds whereas MM funds invest in short term debt instruments and can be viewed as a rather safe investment. Generation funds, however, contain mostly shares when retirement is far off and are gradually transferred to more interest-bearing securities as one approaches retirement age. According to the PPM authority, these are primarily made for those who do not want to be very active once they have changed from *Premiesparfonden*. Hereafter, we will treat these funds as mixed.¹⁸

The money market funds, 3% of the total sample, are assumed in line with Calvet, Campbell and Sodini (2007) to earn the risk free rate. This assumption is consistent with the data we have on these funds.

The total amount of funds in the dataset sums up to 710 (691 when MM funds are excluded), where equity funds constitute the majority. The geographical domiciles of the funds show that the majority come from either Sweden or Luxembourg.

¹⁶ These fees will henceforth be proxied by total expense ratios (TER).

¹⁷ <http://www.riksbank.se/>

¹⁸ Morningstar categorises Generation funds as Mixed funds.

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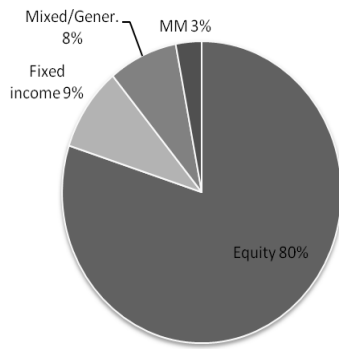


Figure 6: Funds' distribution by category

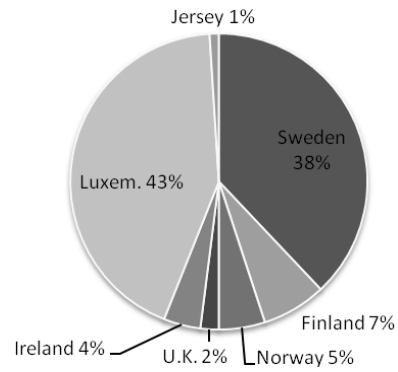


Figure 7: Funds' distribution by domicile

Table 1: Equity funds' distribution by Morningstar's Global Category

Other Europe Equity	24%	India Equity	2%
Global Equity Large Cap	12%	Latin America Equity	2%
Emerging Markets Equity	8%	Other Sector Equity	2%
Europe Equity Large Cap	8%	Real Estate Sector Equity	2%
US Equity Large Cap	6%	Global Equity	2%
Japan Equity	6%	US Equity Mid/Small Cap	2%
Asia ex Japan Equity	4%	Financials Sector Equity	2%
Technology Sector Equity	4%	Asia inc Japan Equity	1%
Europe Equity Mid/Small Cap	4%	Resources Sector Equity	1%
Global Equity Mid/Small Cap	3%	UK Equity Large Cap	1%
Healthcare Sector Equity	3%	Other Asia Equity	0,3%
China & HK Equity	3%	UK Equity Mid/Small Cap	0,1%

5.2 Fees

5.2.1 Fees Applicable to PPM Savers

Depending on how much money PPM savers in total invest in a certain fund, the yearly fee they need to pay is affected. As already mentioned, the more money being invested in a particular fund, the higher discount the PPM savers will get. The figure is determined using a progressive formula (which we do not present here). Money is paid back to the PPM authority quarterly from the fund managers whilst the PPM authority uses that inflow to reduce the yearly fee attributable to a fund for the investors annually. This implies that PPM-savers do not pay as much in management fees as investors who invest outside the PPM framework. As a major component in our dataset, we have each fund's historical PPM fees reported on a yearly basis. All these figures are received from the PPM authority.

5.2.2 Total Expense Ratio

In addition to the historical PPM fees, we have received each fund's historical total expense ratios (TER). TER is a measure of the total costs associated with managing and operating a fund. The cost

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consists primarily of management fees, and is hence a good proxy of historical management fees that investors outside the PPM framework have to pay. Specifically, the TER is estimated as:

$$TER = \frac{\text{Total Fund Cost}}{\text{Total Fund Assets}} \quad (5.1)$$

In *Table 2*, the PPM fees and TER by fund category are shown. In general, equity funds are the most expensive followed jointly by fixed income and mixed funds. Money market funds are disregarded as they are assumed to yield the risk free rate.

Table 2: Historical (pooled years), average, median, max and minimum annual fees by fund category

	Equity	Fixed income	Mixed/Generation
Average TER (%)	1,78	1,03	1,01
Average PPM fee (%)	0,99	0,64	0,64
Median TER (%)	1,77	0,85	0,85
Median PPM fee (%)	1,00	0,52	0,51
Max TER (%)	5,31	3,01	2,86
Min TER (%)	0,00 ¹⁹	0,15	0,15
Max PPM fee (%)	3,01	1,83	1,71
Min PPM fee (%)	0,00 ²⁰	0,13	0,13

¹⁹ The figure stems from the fund Avanza Zero which is a passively managed, zero fee, index funds, which aim to follow developments in the 30 largest companies on the Stockholm Stock Exchange.

²⁰ Ibid.

6. Methodology

In order to evaluate and compare each fund with Premiesparfonden, we will plot all funds in the mean-variance framework developed by Markowitz (1952). Each fund will be evaluated net of the PPM fee and net of Premiesparfonden's fee. Also, currency effects will be taken into account as the expected returns are to be estimated using both a "Local CAPM" and a "Global CAPM". By doing the analysis with slightly different inputs, the conclusions we can draw at the end will be more reliable. Premiesparfonden and the PPM funds are evaluated in terms of their diversification, how they co-vary with the market. Performance analysis, i.e. estimating the fund's alphas is not the purpose and will hence not be considered.

6.1 Expected Excess Return

6.1.1 The Model

Expected excess returns are notoriously difficult to estimate and some funds have only short samples of data. Given the uncertainty in this type of estimate, we infer the mean return from an asset pricing model. Even if the model is not exactly correct, it is likely to deliver better estimates than using means of historical returns.

Since the funds that are selectable within the PPM system are either equity funds, fixed income funds or mixed/generation funds, we need factors that can explain movements on both global equity markets and global bond markets. The model we aim to use is essentially an extension of the Global CAPM²¹ employed by Calvet, Campbell and Sodini (2007), with the difference that we add an explanatory variable, the global bond market return. The models we use estimate expected returns in either Swedish krona (Local CAPM) or US dollar (Global CAPM). Furthermore, as we aim to estimate expected excess returns net of fees applicable to the PPM system, we deduct the expected PPM fee (a motivation is shown in 6.1.3). The models are formally written in *Equations 6.1* and *6.2*.

$$E(r_{i,t}^e)_{Global} = \beta_{1i}^{\$} E(r_{m,t}^{\$e}) + \beta_{2i}^{\$} E(r_{b,t}^{\$e}) - E(f_{i,t}^{PPM\text{ fee}}) + \varepsilon_{i,t} \quad (6.1)$$

$$E(r_{i,t}^e)_{Local} = \beta_{1i}^{SEK} E(r_{m,t}^{SEKe}) + \beta_{2i}^{SEK} E(r_{b,t}^{SEKe}) - E(f_{i,t}^{PPM\text{ fee}}) + \varepsilon_{i,t} \quad (6.2)$$

Where:

$\beta_{1i}^{\$}$ = The correlation with the global equity market of fund i when the market is denominated in US dollar.

²¹ The global CAPM is a natural pricing framework for an analysis of diversification as it captures the expected return due to covariance with global equity markets. It is assumed that assets are priced on world markets in an international currency (the US dollar).

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β_{1i}^{SEK} = The correlation with the global equity market of fund i when the market is denominated in Swedish krona.

$E(r_{m,t}^{\$e})$ = The US dollar expected annual global equity market excess return.²²

$E(r_{m,t}^{SEKe})$ = The Swedish krona expected annual global equity market excess return.²³

$\beta_{2i}^{\$}$ = The correlation with the global bond market of fund i when the market is denominated in US dollar.

β_{2i}^{SEK} = The correlation with the global bond market of fund i when the market is denominated in Swedish krona.

$E(r_{b,t}^{\$e})$ = The US dollar expected annual global bond market excess return.²⁴

$E(r_{b,t}^{SEKe})$ = The Swedish krona expected annual global bond market excess return.²⁵

$E(f_{i,t}^{PPMfee})$ = The expected PPM fee of fund i .

$\varepsilon_{i,t}$ = An error term, a random variable with expected value equal to zero.

6.1.2 Beta Estimates

In order to employ the models in 6.1.1, each fund's betas need to be estimated. By calculating each fund's betas, the model can be implemented. In our study, we have used the below four beta calculations for each fund:

$$\beta_{1i}^{\$} = \frac{\text{cov}(r_{i,t}^{eD}, r_{m,t}^{\$} - r_{f,t}^{\$})}{\text{Var}(r_{m,t}^{\$} - r_{f,t}^{\$})} \quad (6.3)$$

$$\beta_{2i}^{\$} = \frac{\text{cov}(r_{i,t}^{eD}, r_{b,t}^{\$} - r_{f,t}^{\$})}{\text{Var}(r_{b,t}^{\$} - r_{f,t}^{\$})} \quad (6.4)$$

$$\beta_{1i}^{SEK} = \frac{\text{cov}(r_{i,t}^{eD}, r_{m,t}^{SEK} - r_{f,t}^{SEK})}{\text{Var}(r_{m,t}^{SEK} - r_{f,t}^{SEK})} \quad (6.5)$$

$$\beta_{2i}^{SEK} = \frac{\text{cov}(r_{i,t}^{eD}, r_{b,t}^{SEK} - r_{f,t}^{SEK})}{\text{Var}(r_{b,t}^{SEK} - r_{f,t}^{SEK})} \quad (6.6)$$

²² The excess return is computed by deducting the yearly risk free rate proxied by the 1 year US T-bill from the average annual return on the U.S. dollar World Index from 1983-2008.

²³ The excess return is computed by deducting the yearly risk free rate proxied by the 1 year Swedish T-bill from the average annual return on the Swedish krona World Index from 1983-2008.

²⁴ The excess return is computed by deducting the yearly risk free rate proxied by the 1 year US T-bill from the average annual return on the U.S. dollar IBOXX from 1998-2008.

²⁵ The excess return is computed by deducting the yearly risk free rate proxied by the 1 year Swedish T-bill from the average annual return on the Swedish krona IBOXX from 1998-2008.

Where:

$r_{i,t}^{eD}$ = Monthly excess domestic (Swedish krona) return of fund i , net of fees.

$r_{m,t}^{\$}$ = The equity market US dollar return.

$r_{b,t}^{\$}$ = The bond market US dollar return.

$r_{f,t}^{\$}$ = The risk free US dollar return.²⁶

$r_{m,t}^{SEK}$ = The equity market Swedish krona return.

$r_{b,t}^{SEK}$ = The bond market Swedish krona return.

$r_{f,t}^{SEK}$ = The risk free Swedish krona return.²⁷

The market equity return is measured as the US dollar return on the Morgan Stanley Capital International World Index²⁸ (World Index) in *Equation 6.3* and *6.4* whereas the Swedish krona returns on the World Index are used in *Equations 6.5* and *6.6*. The index is retrieved from MSCI's webpage.²⁹ As the index is not available in Swedish krona, we have used the historical SEK-USD exchange rates from Thomson Datastream. These are then used in order to compute the World Index denominated in Swedish krona.

The market bond return is proxied using the IBOXX Euro Overall Index³⁰ (IBOXX) which is one of the most diversified bond indices available. The data is retrieved from Thomson Datastream in both US dollar and Swedish krona.

6.1.3 Expected Excess Market Return

In order to implement our model, it is necessary to have an estimate of annual US dollar and Swedish krona expected excess returns on the global equity market as well as the global bond market. By taking the World Index per annum historical average returns during the period 1983-2008, we get a proxy for the market return. Using the same method but for the IBOXX index, we get a proxy for the bond market return. As the inception of this index occurred in 1998, we can only consider the period 1998-2008.

²⁶ The risk free US dollar return is proxied using the 3-month T-bill retrieved from FED.

²⁷ The risk free Swedish krona return is proxied using the 3-month T-bill retrieved from the Swedish National Bank.

²⁸ Morgan Stanley International World Index comprises stocks from 22 developed countries of which 14 are European markets.

²⁹ <http://www.msci.com>

³⁰ IBOXX Euro Overall Index comprises Sovereigns from eleven European countries, Non Sovereigns such as sub-sovereigns, collateralized and corporates. The index also comprises Non-sovereigns indices and Maturity indices.

6.1.4 Treatment of Fees

As our data consists of monthly returns that are net of fees, the implication of using our asset pricing model has to be carefully considered. Assuming that CAPM holds, the below equation must hold:

$$E(r_{i,t} - r_{f,t}) = \frac{\text{cov}(r_{i,t} - r_{f,t}, r_{m,t} - r_{f,t})}{\text{Var}(r_{m,t} - r_{f,t})} E(r_{m,t} - r_{f,t}) \quad (6.7)$$

Where:

$r_{i,t}$ = The gross return of fund i at time t .

$r_{f,t}$ = The risk free rate at time t .

$r_{m,t}$ = The market return at time t .

Equation 6.7 can be rewritten as:

$$E(r_{i,t}^N + f_{i,t} - r_{f,t}) = \frac{\text{cov}(r_{i,t}^N + f_{i,t} - r_{f,t}, r_{m,t} - r_{f,t})}{\text{Var}(r_{m,t} - r_{f,t})} E(r_{m,t} - r_{f,t}) \quad (6.8)$$

Where:

$r_{i,t}^N$ = Net of fees return of fund i at time t .

$f_{i,t}$ = The fee of fund i at time t .

If we then assume $\text{cov}(f_{i,t}, r_{m,t} - r_{f,t}) = 0$ which is a logical assumption, we can write:

$$E(r_{i,t}^N - r_{f,t}) = \frac{\text{cov}(r_{i,t}^N - r_{f,t}, r_{m,t} - r_{f,t})}{\text{Var}(r_{m,t} - r_{f,t})} E(r_{m,t} - r_{f,t}) - E(f_{i,t}) \quad (6.9)$$

As we have to consider the particular discounted fees for the PPM funds, we simply deduct the expected PPM fee (which we proxy by taking historical averages) to Equation 6.8. We then obtain the below equation which shows the intuition for using Equations 6.1 and 6.2.

$$E(r_{i,t}^{ND} - r_{f,t}) = \frac{\text{cov}(r_{i,t}^N - r_{f,t}, r_{m,t} - r_{f,t})}{\text{Var}(r_{m,t} - r_{f,t})} E(r_{m,t} - r_{f,t}) - E(f_{i,t}^{\text{PPMfee}}) \quad (6.10)$$

Where:

$r_{i,t}^{ND}$ = The return of fund i at time t , net of discounted fees.

$f_{i,t}^{PPMfee}$ = The discounted fee of fund i at time t .

6.2 Standard Deviation

Along with expected annual excess returns, it is necessary to have each fund's annual standard deviation in order to make it possible to use Markowitz framework. By computing each fund's historical annual figures, we get reasonably good proxies for future return volatility.

6.3 Evaluation

In order to answer our research question, we will consider the funds in terms of Sharpe ratios. For robustness, we conduct the same analysis for the Local and Global CAPM. As the amount of funds is large, we will focus only on certain funds. In order to do so, we define nine risk categories where each category represents the funds with standard deviation between 1-5%, 5-10%...40%- (see *Table 3*). Within each category, we consider five funds³¹: The 100th, 95th, 75th, 50th and 25th percentiles in terms of Sharpe ratios. Once these funds are identified, the utility- and return losses are computed where *Premiesparfonden* is the benchmark. Since risk aversion, γ_i , must be addressed for the utility loss calculations, we both compute the inferred figures using *Equation 4.5*³² as well as letting γ_i go from 0,5;1,0... 5,0.

Table 3: Selected risk categories

Standard deviation (%)	Risk category
0-5	1
5-10	2
10-15	3
15-20	4
20-25	5
25-30	6
30-35	7
35-40	8
40-	9

All utility- and return loss figures will be estimated when the funds are net of PPM fees and when all funds are net of the same fee applicable to *Premiesparfonden*. By doing so, we will get an idea of how much the low fee of *Premiesparfonden* contributes to its attractiveness.

³¹ The reason why we consider not only the best funds is simple. Imagine for instance an investor who is not informed, and randomly picks a fund. By investigating the percentiles, we get a clue of what the odds are the investor will attain a higher utility compared to the default option.

³² We will assume $\omega = 1$ which means the investor has 100% of its wealth in the particular fund.

7. Results and Analysis

In this section we present the figures and diagrams generated by the models in section 6. The results will be presented in three parts: Firstly, we show the mean-variance diagrams. Secondly, we consider *Premiesparfonden* in terms of Sharpe ratios. Thirdly, utility losses and return losses are estimated. Complementary tables and scatter plots to all figures are shown in Appendix A and B.

7.1 Mean-Variance Diagrams when funds are net of PPM Fees

In Figure 8 below, the funds within each percentile and risk category rendered by the Local CAPM are illustrated. Noticeably, *Premiesparfonden* seems to be one of the most efficient funds.

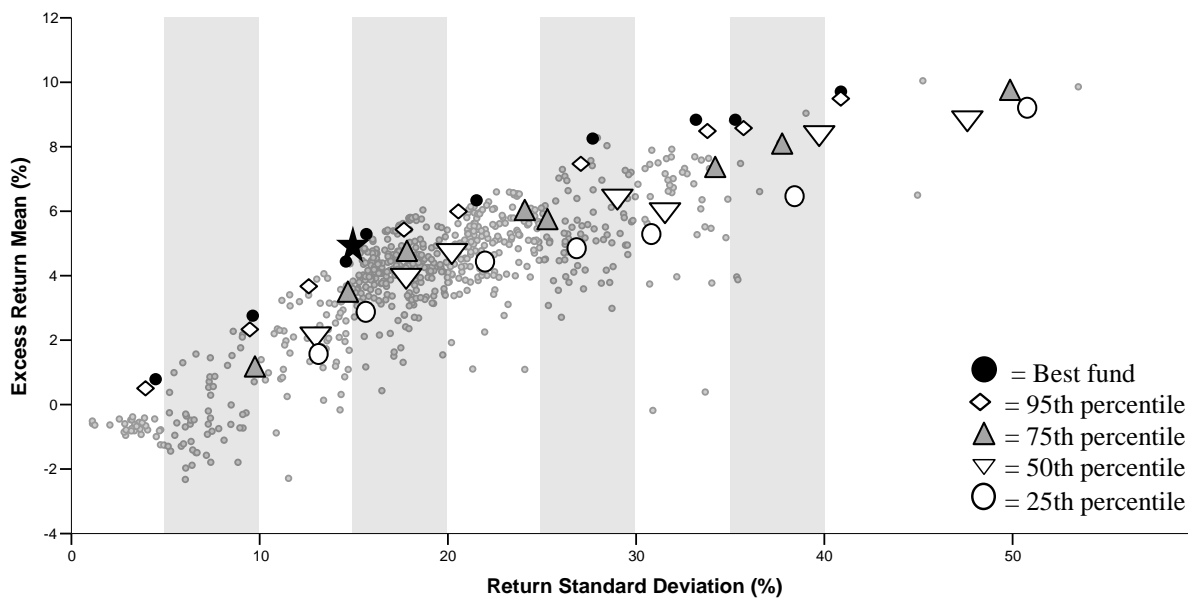


Figure 8: Diagram showing the funds within each percentile. The fund that is assigned a star is *Premiesparfonden*. The funds are assessed net of PPM fees and the Local CAPM is used.

The corresponding diagram using the Global CAPM illustrates a somewhat less dense pattern. However, *Premiesparfonden* still seems to be one of the most efficient funds.

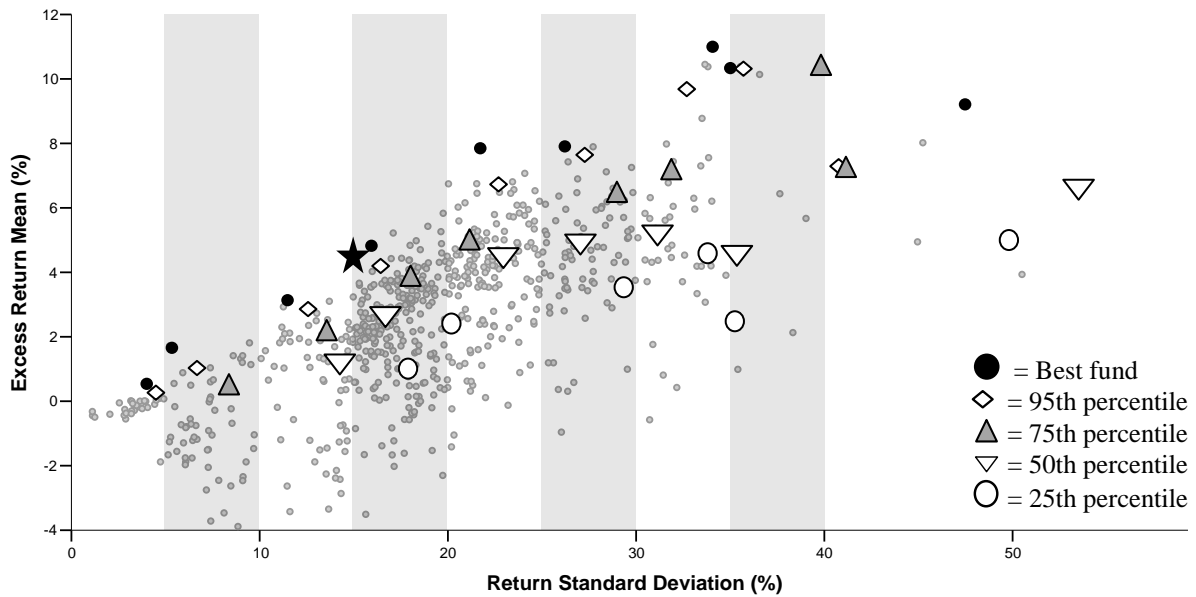


Figure 9: Diagram showing the funds within each percentile. The fund assigned a star is *Premiesparfonden*. The funds are assessed net of PPM fees and the Global CAPM is used.

The conclusion we can draw from the above diagrams is that *Premiesparfonden* is among the top performing funds from a diversification point of view. To get a more detailed overview, we have to consider the fund's Sharpe ratios.

7.2 Sharpe Ratio Analysis

As we mentioned in *section 4*, the Sharpe ratio can be used to rank funds. Although this does not give a comprehensive picture, it indicates how *Premiesparfonden* is doing compared to other PPM funds. From the Local CAPM, *Premiesparfonden* has an estimated Sharpe ratio of 0,32 while it equals 0,30 using the Global CAPM. *Tables 4* and *5* present the funds that outperform *Premiesparfonden*. When the Local CAPM is used, only 13 funds have higher figures whereas 10 funds outperform the fund using the Global CAPM. Considering the large amount of PPM funds (691 when MM funds are excluded), the Sharpe ratios indicate that *Premiesparfonden* is among the most attractive ones.

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Table 4:

Funds that outperform *Premiesparfonden* in terms of Sharpe ratios when the Local CAPM is used. All funds are estimated net of PPM fees.

Fund (risk category)	Class	Sharpe ratio	Beta_{Equity}	Beta_{Bond}
Folksam LO Världen Inc (4)	Global Equity Large Cap	0,335	0,99	-0,85
Folksam Tjänstemanna Världen (4)	Global Equity Large Cap	0,334	0,98	-0,89
Nordea Generationsfond 1980-84 (7)	Allocation	0,323	1,12	-1,12
Nordea Generationsfond 1960-64 (4)	Allocation	0,323	1,08	-1,06
Nordea Generationsfond 1970-74 (4)	Allocation	0,323	1,08	-1,06
Nordea Generationsfond 1950-54 (4)	Allocation	0,322	1,08	-0,87
SPP Aktieindexfond USA (4)	US Equity Large Cap	0,322	1,00	-1,05
Nordea Generationsfond 1955-59 (4)	Allocation	0,322	1,08	-1,02
SEB Generation 60 (4)	Allocation	0,322	1,01	-1,07
Nordea Generationsfond 1975-79 (4)	Allocation	0,322	1,08	-1,00
SEB Generation 70 (4)	Allocation	0,320	1,00	-0,97
SEB Generation 50 (4)	Allocation	0,320	0,96	-1,34
Swedbank Robur Aktiefond Pension (4)	Global Equity	0,320	1,03	-1,03
<i>Average</i>		<i>0,324</i>	<i>1,04</i>	<i>-1,02</i>
Premiesparfonden (3)	Global Equity	0,320	0,86	-0,98

Table 5:

Funds that outperform *Premiesparfonden* in terms of Sharpe ratios when the Global CAPM is used. All funds are estimated net of PPM fees.

Fund (risk category)	Class	Sharpe ratio	Beta_{Equity}	Beta_{Bond}
AMF Pensions Aktiefond (5)	Other Europe Equity	0,363	1,10	0,34
Spiltan Aktiefond Sverige (5)	Other Europe Equity	0,337	1,08	0,19
Öhman FöretagsOblgsfond (2)	Other Europe Fixed Income	0,329	0,25	0,77
Nordea Venäjä Acc (7)	Other Europe Equity	0,322	1,45	0,23
F&C European Small Cap A (5)	Europe Equity Mid	0,313	1,03	0,24
JPM Global Natural Resources (7)	Other Sector Equity	0,311	1,36	0,82
Swedbank Robur Balkanfond (7)	Emerging Markets Equity	0,307	1,51	0,50
Västernorrlandsfonden Inc (4)	Other Europe Equity	0,306	0,79	0,26
Premievalsfonden Inc (4)	Global Equity Large Cap	0,305	0,95	-0,22
First State Glb Resources (6)	Other Sector Equity	0,302	1,13	0,52
<i>Average</i>		<i>0,320</i>	<i>1,07</i>	<i>0,37</i>
Premiesparfonden (3)	Global Equity	0,300	0,82	-0,21

Interestingly, *Table 4* and *5* indicate that the source of *Premiesparfonden*'s good diversification is predominantly derived from its relatively low risk. The fund's betas are among the lowest and only one fund originating from a lower risk category outperforms *Premiesparfonden*. Furthermore, the comparatively low bond betas derived by the Local CAPM is partly explained by the strengthened Swedish krona during the period in which we have time series data of the IBOXX index. For instance, the USD/SEK exchange rate in mid 2001 was about 10,9 whilst it was 6,0 in mid 2008. Consequently, the IBOXX index denominated in Swedish krona has during 1998-2008 shown long periods with negative monthly returns.

Experimentally, we also estimated each fund within the mean-variance framework using the fee applicable to *Premiesparfonden* for all funds, i.e. 0,15%. Naturally, the attractiveness of

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the fund deteriorated somewhat. When the Local CAPM is used, 44 funds outperform the default option while only 30 funds outperform the default option when the Global CAPM is used. For a more detailed overview, see *Figures A1* and *A2* in the appendix.

Another interesting aspect we would like to highlight originates from the figures in *Table 4*. All funds are Swedish and are managed by well known fund managers. In addition, a majority of them are generation funds, tailor made for the pension system. Recalling the findings by Palme, Sundén, Söderlind (2004) and Säve-Söderbergh (2003), it is interesting to investigate whether the Sharpe ratios are high due to a large fee discount, i.e. if the money inflow to these funds is above average. By comparing the difference between this subsample's average TER and PPM fees to the corresponding figures for the whole sample, it is possible to get a hint of the relative size of the money inflow to the funds in the subsample.

The average TER and PPM fee of the mixed (allocation) funds in *Table 4* are 0,50% and 0,36% respectively. For the whole sample, the average TER and PPM fee among the mixed funds are 1,01% and 0,64% (*Table 2*), respectively. Hence, the discount does not seem to be extraordinary large. Instead, the attractiveness of the funds in the subgroup originates from the low fees (0,36% vs. 0,64%). For the equity funds in *Table 4*, a similar argument can be made since their average TER and PPM fee are 0,38% and 0,27% respectively. These figures should be compared to the sample mean of 1,78% (TER) and 0,99% (PPM fee).

7.3 Utility Losses

7.3.1 Utility Losses net of PPM fees

When we conduct the analysis using inferred risk aversion from the best fund within each risk category, the results for the Local CAPM indicate that an investor is better off picking the best fund within risk category 4, which yields a utility loss of -0,2%.³³ For the Global CAPM, an investor can attain slightly higher utilities for risk categories 2,4,5,6 and 7. In this case, an investor can attain an increased utility equal to 1,3%. The utility losses using the inferred risk aversions are presented in *Tables 6* and *7*.

Table 6: Utility losses per risk category and percentile using inferred risk aversions. The Local CAPM is used for estimating expected returns. Inferred gamma within brackets. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	0,9 (4,0)	0,3(3,0)	0,2(2,2)	-0,2(2,1)	0,6(1,4)	0,6(1,1)	2,0(0,8)	2,8(0,7)	3,9(0,6)
95	1,3(4,0)	0,9(2,6)	0,3(2,3)	0,0(1,8)	0,8(1,3)	1,3(1,0)	2,6(0,7)	2,8(0,7)	3,9(0,6)
75	na	4,4(1,1)	1,4(1,6)	0,9(1,6)	2,0(1,0)	2,9(0,9)	3,4(0,8)	4,9(0,6)	8,6(0,4)
50	na	na	2,6(1,4)	1,5(1,4)	2,2(1,1)	4,7(0,7)	4,4(0,6)	5,7(0,5)	8,6(0,4)
25	na	na	4,7(0,9)	2,1(1,3)	3,0(1,0)	5,5(0,7)	5,7(0,6)	8,5(0,4)	9,4(0,4)

³³ Utility losses are defined as the decrease in utility an investor will experience by investing in any of the PPM funds. Hence, a negative utility loss implies a utility gain by going active.

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Table 7: Utility losses per risk category and percentile using inferred risk aversions. The Global CAPM is used for estimating expected returns. Inferred gamma within brackets. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	1,1(3,3)	-0,2(6,3)	0,3(2,4)	-0,1(1,9)	-1,3(1,7)	-0,1(1,2)	-0,8(0,9)	0,3(0,8)	6,6(0,4)
95	4,4(1,0)	1,4(2,3)	1,1(1,8)	0,8(1,6)	0,3(1,3)	1,2(1,0)	-0,3(0,9)	0,8(0,8)	6,6(0,4)
75	na	7,5(0,6)	2,8(1,2)	2,4(1,1)	1,8(1,1)	2,9(0,8)	3,3(0,7)	1,8(0,6)	6,6(0,4)
50	na	na	6,2(0,7)	3,9(0,9)	3,4(0,8)	4,7(0,6)	5,4(0,6)	9,2(0,4)	15,7(0,2)
25	na	na	na	9,4(0,4)	5,9(0,6)	7,2(0,5)	8,6(0,4)	22,1(0,2)	19,7(0,2)

While computing the utility loss for each risk category by addressing the gamma, we obtain results that diverge somewhat among the asset pricing models: Using the Local CAPM, keeping *Premiesparfonden* yields a higher utility in all cases apart from the fourth risk category. Looking at *Table A1* in the appendix, an investor with low, medium or high risk aversions can attain utility losses of -1,0%, -0,2% and -0,1%, respectively, by picking the best fund in this particular risk category. Using the Global CAPM, on the other hand, another picture arises. By actively selecting the best fund in categories 2,4,5,6 or 7, a higher utility can be achieved. For categories 4 and 6, the potential increases are close to zero. For the other categories, however, the utility losses for a low, medium or high risk aversion lie in the ranges -0,1 to -4,2%, -0,1 to -1,1% and -0,1 to -0,5%, respectively. These figures are presented in *Table A2*.

If we consider the 95th percentile and compute utility losses within each risk category, it turns out that *Premiesparfonden* yields the highest utility in all cases apart from risk category 7 when the Global CAPM is used (*Tables A3* and *A4*). Nevertheless, the potential gain in that particular category is small. Given a low, medium or high risk aversion, an investor can according to *Table A4* attain utility losses equal to -0,5%, -0,1% or -0,1%, respectively.

For the 75th percentile, the utility loss an investor will encounter lies within the range 0,3-9,2% (Local CAPM) and 0,4-8,7% (Global CAPM). These figures are presented in *Tables A5-A6*.

For the 50th percentile an investor is substantially better off keeping *Premiesparfonden*. Our models render funds with negative expected excess return for the median fund in risk categories 1 and 2. We therefore omit these funds and consider only the remaining categories. The results generated from the Local CAPM (*Table A7*) indicate utility losses in the range of 0,4-7,0%. The corresponding range rendered by the Global CAPM (*Table A8*) is 0,5-8,1%.

The lowest percentile we consider, the 25th, suffers somewhat from omitted funds since some funds have negative expected excess return. These figures, however, show that the utility losses lie in the range 0,6-8,8% (Local CAPM) 0,7-8,4% or (Global CAPM). These figures are shown in *Tables A9 and A10*.

7.3.2 Utility Losses net of Premiesparfonden's Fee

When we conduct the utility analysis, but with the difference that all funds are net of *Premiesparfonden's* fee, an investor is better off picking the best fund within risk categories 3 and 4

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(Local CAPM), which will yield utility losses in the range -0,1 to -0,4%. For the Global CAPM, the investor can attain slightly higher utilities since the utility losses are in the range -0,2 to -1,9% for risk categories 2,4,5,6, 7 and 8. The utility losses using the inferred risk aversions are shown in the below tables.

Table 8: Utility losses per risk category and percentile using inferred risk aversions. The Local CAPM is used for estimating expected returns. All funds are net of *Premiesparfonden*'s fee. Gamma within brackets. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	0,3(5,7)	0,2(3,5)	-0,1(2,4)	-0,4(2,2)	0,2(1,4)	0,1(1,1)	1,0(0,9)	1,6(0,8)	2,9(0,6)
95	0,4(5,9)	0,3(3,2)	0,0(2,7)	-0,2(2,1)	0,5(1,4)	0,7(1,1)	1,5(0,9)	1,6(0,8)	2,9(0,6)
75	na	1,4(2,1)	0,3(2,7)	0,1(2,0)	0,9(1,2)	1,6(1,0)	2,3(0,8)	2,4(0,7)	4,6(0,5)
50	na	12,6(0,4)	0,9(2,0)	0,5(1,9)	1,3(1,2)	2,6(0,9)	3,1(0,7)	3,6(0,6)	7,3(0,4)
25	na	na	2,4(1,4)	1,0(1,7)	1,8(1,2)	3,8(0,8)	4,6(0,6)	6,9(0,5)	8,7(0,4)

Table 9: Utility losses per risk category and percentile using inferred risk aversions. The Global CAPM is used for estimating expected returns. All funds are net of *Premiesparfonden*'s fee. Gamma within brackets. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	0,3(5,8)	-0,6(8,1)	0,0(2,6)	-0,9(2,3)	-1,4(1,7)	-0,9(1,3)	-1,3(1,0)	-0,5(0,9)	5,1(0,5)
95	1,0(3,4)	-0,6(8,1)	0,3(2,0)	0,3(1,8)	-0,3(1,3)	0,0(1,1)	-1,1(1,0)	-0,5(0,9)	5,1(0,5)
75	3,2(1,4)	2,7(1,4)	1,4(1,8)	1,3(1,5)	1,4(1,0)	1,8(0,9)	2,4(0,7)	1,0(0,7)	6,2(0,4)
50	na	na	2,5(1,3)	2,5(1,1)	1,9(1,1)	3,1(0,8)	4,3(0,6)	6,7(0,4)	10,3(0,3)
25	na	na	na	5,0(0,7)	3,6(0,8)	5,1(0,6)	6,4(0,5)	13,6(0,3)	13,8(0,3)

While computing utility losses for each risk category by addressing the risk aversion, the results generated by the Local CAPM indicate that keeping *Premiesparfonden* yields a higher utility apart from risk category 3 and 4 (*Table A11*). An investor with low, medium or high risk aversion will attain utility losses within the range -0,1 to -1,6%, -0,1 to -0,4% and -0,1 to -0,2%, respectively, by picking the best funds in these risk categories. Using the Global CAPM the results show that actively selecting the best funds in categories 2,4,5,6,7 and 8, an increase in utility can be earned (*Table A12*). For category 8, the potential utility loss is not higher than -1,0% for any risk aversion. However, for the other categories the attainable utility losses lie in the ranges -0,9 to -9,0%, -0,4 to -4,0%, -0,5 to -4,9%, -0,2 to -2,2% and -0,3 to -2,6%, respectively.

When we consider the 95th percentile, using the Local CAPM, it turns out that keeping *Premiesparfonden* yields a higher utility apart from the fourth risk category. An investor with low, medium or high risk aversions can attain utility losses of -0,7%, -0,2% and -0,1% by actively picking the best fund in that risk category (*Table A13*). The results from the Global CAPM show that it is possible to earn an increase in utility by actively selecting the funds in categories 2, 5, 7 and 8 (*Table A14*). For category 5 and 8 the potential utility losses are higher than -1,0% for all levels of risk aversion. However, by actively selecting the best funds in risk category 2 and 7, utility losses in the range of -0,9 to -9,0% and -0,2 to -2,2%, respectively, can be achieved.

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The 75th percentile, suffers somewhat from omitted funds that have negative expected excess returns. Nevertheless, the utility losses an investor will encounter lies in the range 0,1-6,0% (Local CAPM, Table A15) and 0,1-9,0% (Global CAPM, Table A16).

For the 50th percentile the figures show that an investor is substantially better off staying with *Premiesparfonden*. The Local CAPM (Table A17) suggests that the utility losses lie in the range of 0,2-10,1% whereas the Global CAPM (Table A18) gives the range 0,4-9,0%.

For the lowest percentile we consider, the 25th (Tables A19 and A20) the results generated by the Local CAPM indicate utility losses in the range 0,3-6,9% and the corresponding figures are 0,6-9,0% for the Global CAPM.

7.4 Return Losses

7.4.1 Funds net of PPM fees

When we use the Local CAPM to compute the return losses for each risk category and percentile, net of PPM fees, the results show that an individual would encounter a return loss of -0,2%³⁴ by actively picking the best fund in risk category 4. Using the Global CAPM, the results show that an individual is better off actively picking the best fund in risk categories 2, 4, 5, 6 and 7, implying a return loss in the range -0,1 to -1,0%. Shaded areas in Tables 10 and 11 illustrate potential return losses. All figures are annualized.

Table 10: Return losses per risk category and percentile. The Local CAPM is used for estimating expected returns. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	2,2	0,4	0,2	-0,2	0,4	0,3	0,8	1,0	1,2
95	2,5	1,2	0,3	-0,0	0,6	0,7	1,0	1,0	1,2
75	na	3,3	1,2	0,7	1,0	1,4	1,4	1,6	1,9
50	na	na	2,1	1,1	1,4	1,8	1,6	1,6	2,0
25	na	na	3,0	1,6	2,2	3,7	5,5	6,3	6,1

Table 11: Return losses per risk category and percentile. The Global CAPM is used for estimating expected returns. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	2,5	-0,4	0,4	-0,1	-1,0	-0,0	-0,3	0,1	1,8
95	3,8	2,2	1,1	0,7	0,2	0,6	-0,1	0,3	1,8
75	na	3,8	2,2	1,6	1,1	1,3	1,3	0,6	1,8
50	na	na	3,1	2,3	1,7	1,9	1,9	2,3	2,6
25	na	na	na	3,3	2,6	2,5	2,4	3,5	3,0

7.4.2 Funds net of Premiesparfonden's Fee

When using the Local CAPM to compute return losses for each risk category, if all funds would charge the same fee as *Premiesparfonden*, the results show that an individual is better off by picking

³⁴ A negative return loss means an investor is better off investing in the alternative mutual fund.

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the best funds in risk categories 3 and 4, which would imply a return loss in the range -0,1 to -0,4%. The results from the Global CAPM show that an individual is better off actively picking the best fund in risk categories 2, 4, 5, 6, 7 and 8, implying a return loss in the range -0,2 to -0,9%. Comparing these figures to *Tables 8 and 9* it turns out that the utility losses and return losses are most similar when gamma is between 1,5-2,5.

A comparison of *Tables 10, 11, 12 and 13* provides insight of the impact of *Premiesparfonden's* relatively low management fee and what effect it has on the attractiveness of the fund. Interestingly, the differences are not large compared to when the funds are estimated net of PPM fees although the return losses by going active naturally have decreased.

Table 12: Return losses per risk category and percentile. The Local CAPM is used for estimating expected returns. All funds are net of *Premiesparfonden's* fee. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	1,0	0,3	-0,1	-0,4	0,1	0,1	0,4	0,6	0,9
95	1,3	0,5	0,1	-0,2	0,3	0,4	0,7	0,6	0,9
75	na	1,7	0,3	0,1	0,6	0,8	0,9	0,9	1,2
50	na	na	1,0	0,4	0,8	1,3	1,2	1,2	1,7
25	na	na	2,0	0,9	1,1	1,6	1,6	2,0	1,8

Table 13: Return losses per risk category and percentile. The Global CAPM is used for estimating expected returns. All funds are net of *Premiesparfonden's* fee. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	1,0	-1,9	0,0	-0,9	-1,1	-0,5	-0,6	-0,2	1,5
95	2,3	-1,9	0,3	0,3	-0,2	0,0	-0,5	-0,2	1,5
75	na	2,5	1,4	1,1	0,8	0,9	1,0	0,4	1,6
50	na	na	2,1	1,7	1,1	1,4	1,5	1,9	2,3
25	na	na	na	2,7	1,8	2,1	2,1	2,9	2,4

7.4.3 Utility vs. Return Losses

Comparing *Tables 6, 7, 8 and 9* with *10, 11, 12 and 13* it is noticeable that the utility losses are in general larger than the return losses. The reason to this is described in the appendix to the paper by Calvet, Campbell and Sodini (2007). The authors explain that an investor incurs two types of losses for the utility figures: (1) they do not choose the highest-yielding fund given their risk aversion; and (2) they choose a suboptimal level of risk because they are unduly pessimistic about the optimal Sharpe ratio. The return losses, on the other hand, only takes into account the increase in expected return at a constant standard deviation.

7.4.4 How much does the PPM System Lower the Return Losses?

Due to the significant differences between TER and PPM fees, it is interesting to evaluate how much these differences reduce the return loss. Specifically, we want to get estimates on how much the return losses decrease when the funds come inside the PPM framework. In *Tables 14 and 15* the differences between the TER and the PPM fee for each fund and percentile are shown. For the best funds, a

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reduction in the return loss is, for the lowest risk categories, between 0,2-0,6% whilst the corresponding figures for higher risk categories are about 0,3-1,4%. These figures clearly show the impact of the discounted fees within the PPM system.

Table 14: The return loss (%) (TER-PPM fees) by going outside the PPM framework by percentile and risk category. Expected returns are estimated using the Local CAPM. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	0,6	0,1	0,2	0,2	0,1	0,3	0,8	0,6	0,6
95	0,0	0,7	0,2	0,2	0,7	0,8	1,4	0,6	0,6
75	na	0,7	0,6	0,4	0,9	0,9	0,9	1,0	1,5
50	na	na	0,6	0,7	0,6	0,9	1,4	1,7	1,3
25	na	na	0,8	0,6	0,6	0,8	0,9	0,9	1,5

Table 15: The return loss (%) (TER-PPM fees) by going outside the PPM framework by percentile and risk category. Expected returns are estimated using the Global CAPM. All numbers are annualized.

Percentile	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
100	0,3	1,6	0,5	0,7	0,2	0,5	1,1	1,5	0,6
95	0,4	0,2	0,2	0,9	0,8	1,1	1,4	0,9	0,6
75	na	0,6	0,6	0,1	0,8	0,9	1,2	1,7	0,6
50	na	na	0,8	0,5	0,7	0,5	1,1	0,7	1,8
25	na	na	na	0,7	1,2	0,8	1,4	1,0	1,5

7.5 Currency Hedging

As mentioned in section 2.1.1, *Premiesparfonden* is exposed to currency risks as all assets are purchased in local currency. By estimating the Sharpe ratio differentials between *Premiesparfonden* and the top fund within each risk category, it is possible to examine whether the fund hedges currency risk better than the alternative funds. If the Global CAPM differentials are larger than the corresponding Local CAPM figures, *Premiesparfonden* hedges currency risk better than other top funds. The differentials are presented in *Table 16*.

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Table 16: The Sharpe ratio differentials between *Premiesparfonden* and the top funds generated by the Global CAPM. The differentials are estimated both for the Global CAPM and the Local CAPM.

Fund (risk class)	Differential Global	Differential Local
Skandia Allt i Ett Försiktig (1)	0,17	0,19
Öhman FöretagsOblgsfond (2)	-0,03	0,25
Templeton Glb Abso Return (3)	0,03	0,15
Västernorrlandsfonden Inc (4)	-0,01	0,10
AMF Pensions Aktiefond (5)	-0,06	0,05
First State Glb Resources A (6)	0,00	0,14
Nordea Venäjä (7)	-0,02	0,10
UBS (Lux) ES-Russia B (8)	0,01	0,11
East Capital Turkish Fund (9)	0,11	0,13

The numbers are greater for the Local CAPM compared to the Global CAPM, which means *Premiesparfonden* does not hedge currency risk as well as other funds. A possible explanation to these results may be the costs incurred for currency hedging. As Sjunde AP-Fonden's objective is to manage *Premiesparfonden* for a low fee, it is therefore likely that currency hedging is not possible to the same extent as for other funds since it is too expensive to conduct. The data we have supports this theory as the average TER and PPM fee of the mutual funds in *Table 16* are 1,57% and 0,78% respectively. This can be compared to *Premiesparfonden's* 0,15%. Hence, the differences are rather large which strengthens the possibility that better currency hedging incurs higher management costs.

8. Conclusions, Limitations and Further Research

In this section, we will conclude our study and discuss potential problems with our methodology. We will also present some ideas that could be useful for future research.

8.1 Conclusion

The purpose of this study was to find out whether an investor should actively select funds or stay passive within the Swedish Premium Pension System. We have presented the fundamental properties of PPM and emphasized the restrictions the system imposes on fund analysis, especially if one considers Markowitz's mean-variance framework. Moreover, we have discussed the elements of *Premiesparfonden* in detail and introduced our theory, which states that staying with the default option could in fact be an optimal choice. We have tested this theory analytically based on Markowitz mean-variance framework, with support from the concepts of Sharpe ratios, return losses and welfare analysis. Focus has been on diversification benefits offered by the funds in the PPM system. This is done by looking at how the funds covary with the global equity and bond market.

The data set consists of all available PPM funds, 710 in total, as of October 2008. By constructing a two factor model we estimated each fund's expected excess returns by using both a well diversified equity benchmark as well as a broad bond index. We estimated the betas for each fund twice in order to get results both when the market is denominated in Swedish krona and when it is denominated in US dollar. This enhanced the robustness of the results. The figure used for the PPM fee was calculated as an average of all historical fees. We made the assumption that this figure will not deviate in the future. This assumption was also made for the average we calculated based on the historical TER fees for all funds. These fees have historically been relatively stable.

Our results prove that *Premiesparfonden* is a very attractive fund. Although the fund is outperformed by a few, the attainable return and utility gains are rather small in comparison to the effort required to identify these. Hence, we have strong reasons to believe that an investor is better off keeping the default option. The only exception to this takes place when an investor finds the cost of identifying the very best funds within certain risk categories less than the extra return and utility earned given a certain risk aversion. However, it is important to consider the fact that once one has left *Premiesparfonden*, it is not possible to select it in the future. Hence, if the selectable funds change in terms of composition or fees in the future, the investor must once again find the best funds, which incurs new costs.

Another interesting aspect our results shed light on is the potential return and utility loss an investor will encounter by randomly picking an investment. By randomly picking, the median fund ought to be the expected outcome. Looking at these figures, the return/utility losses can be as much as 2%/8% and at least 1%/0.5%, depending on how risk averse the investor is. Imagine the investor is rather lucky, and manage to randomly pick a fund in the 75th percentile; the return/utility outcome is

still negative. In fact, the investor must basically be so lucky so some of the absolutely best funds within risk categories 2, 4, 5, 6 and 7 are chosen. Something that is very unlikely.

To deepen the analysis, we calculated the expected excess returns again after imposing *Premiesparfonden*'s fee on all funds. The results showed that an investor still has to pick funds in the top percentiles, even though it is possible to attain welfare gains among more risk categories. These results prove that the attractiveness of *Premiesparfonden* is due to the low fee in addition to the strong composition of the fund.

Our analysis identifies that there are currently a large number of underperforming funds. Removing these funds would create a higher quality selection, thereby increasing the likelihood that an individual is able to select funds that have the ability to outperform *Premiesparfonden*. However, implementing this strategy could be problematic. Further studies, with different approaches and performance analysis, would be necessary in order to identify the worst performing funds.

8.2 Limitations

As mentioned in *section 6*, expected returns are notoriously difficult to estimate. In this thesis we have estimated figures from a very mixed sample of funds. Most of them are equity funds with investments in equities originating from all over the globe, but some are more exposed to global bond markets or a mix of the two. Although we have implemented a two factor model with well diversified equity and bond indices to try to capture the correlation with the markets, the predictions naturally still lacks accuracy.³⁵

A further issue we have dealt with originates from currency fluctuations. Since all fund returns are measured in the Swedish krona, the figures are affected by global exchange rate movements. We have attempted to account for this by presenting all estimated figures using two different models. The fact that the results do not diverge substantially among the two, enhances the reliability of our conclusions. Assessing the funds using the euro may have further improved the reliability, however, as the euro currency has only existed for ten years, calculating the beta estimates based on such a limited set of data may have weakened the credibility of the estimate.

Since an investor can combine up to five funds within the PPM system, it means there is a vast amount of possible investments. Taking this into account would have meant an enormous amount of work. However, by combining funds, the only thing that an individual can achieve is enhanced diversification. As many of the funds in the PPM system are global equity or global mixed funds, there are already investment opportunities with a very high degree of diversification. Therefore it is unlikely that a high number of combinations of the funds would yield diversification benefits that outperform *Premiesparonden*.

³⁵ Some funds are estimated having negative expected excess returns, which tells us the asset pricing model lacks accuracy. Specifically, for the Local CAPM, 93% of the funds with negative expected excess returns are fixed income funds and the remaining mixed funds. For the Global CAPM, approximately 50% are equity funds and the remaining are fixed income funds. These results suggest that especially the IBOXX index does not accurately mirror the global bond market.

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A final limitation to this study stems from the nature of the PPM system. Over time funds enter and leave the PPM window which naturally will affect our results in the future. Fees, especially discounted fees, also differ over time.

8.3 Further Research

As the research field covering the PPM system has not at all been examined, we think there are several interesting topics for future research:

- It would be interesting to examine whether the brand name of the fund manager has impact on returns. That is, discounted fees are impacted by money inflow which in turn might be affected by fund manager visibility. Thus, a potential research question could be: *Is it a better strategy to invest in funds managed by big and well known institutions rather than investing in funds managed by less known fund managers?*
- In recent times, the PPM system has been criticized as a majority of the savers have lost money due to the financial turmoil. A potential research question could therefore be: *What policy changes to the Swedish premium pension system would make individuals in the pension system better off?*
- Performance analysis of the PPM mutual funds would probably be of great interest to many individuals. A potential research question could be: *How good are the fund managers in the Swedish premium pension system at generating alphas?*
- *Considering the fact that over 40% of the individuals in the PPM system have their contributions invested in the passive alternative it would be interesting to know why individuals staying with the default option?*
- *Since our results indicate that Premiesparfonden outperforms the vast majority of funds in the PPM System a potential research question might be: Is it necessary to have 700 funds in the Swedish Premium Pension system?*
- *It might even be a potential research question to try to answer if the current system is necessary?*

9. References

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Appendix A: Tables

Table A 1: Local CAPM utility losses (%) per risk category and risk aversion. The best fund within each risk category is used.

Gamma	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	7,2	1,8	0,8	-1,0	1,6	1,3	3,2	3,9	4,5
1,0	3,6	0,9	0,4	-0,5	0,8	0,6	1,6	2,0	2,3
1,5	2,4	0,6	0,3	-0,3	0,5	0,4	1,1	1,3	1,5
2,0	1,8	0,4	0,2	-0,3	0,4	0,3	0,8	1,0	1,1
2,5	1,4	0,4	0,2	-0,2	0,3	0,3	0,6	0,8	0,9
3,0	1,2	0,3	0,1	-0,2	0,3	0,2	0,5	0,7	0,8
3,5	1,0	0,3	0,1	-0,1	0,2	0,2	0,5	0,6	0,6
4,0	0,9	0,2	0,1	-0,1	0,2	0,2	0,4	0,5	0,6
4,5	0,8	0,2	0,1	-0,1	0,2	0,1	0,4	0,4	0,5
5,0	0,7	0,2	0,1	-0,1	0,2	0,1	0,3	0,4	0,5

Table A 2: Global CAPM losses (%) per risk category and risk aversion. The best fund within each risk category is used.

Gamma	Risk category									
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%	
0,5	7,2	-1,9	1,6	-0,4	-4,2	-0,1	-1,4	0,4	5,8	
1,0	3,6	-0,9	0,8	-0,2	-2,1	-0,1	-0,7	0,2	2,9	
1,5	2,4	-0,6	0,5	-0,1	-1,4	0,0	-0,5	0,1	1,9	
2,0	1,8	-0,5	0,4	-0,1	-1,1	0,0	-0,4	0,1	1,4	
2,5	1,4	-0,4	0,3	-0,1	-0,8	0,0	-0,3	0,1	1,2	
3,0	1,2	-0,3	0,3	-0,1	-0,7	0,0	-0,2	0,1	1,0	
3,5	1,0	-0,3	0,2	-0,1	-0,6	0,0	-0,2	0,1	0,8	
4,0	0,9	-0,2	0,2	0,0	-0,5	0,0	-0,2	0,1	0,7	
4,5	0,8	-0,2	0,2	0,0	-0,5	0,0	-0,2	0,0	0,6	
5,0	0,7	-0,2	0,2	0,0	-0,4	0,0	-0,1	0,0	0,6	

Table A 3: Local CAPM utility losses (%) per risk category and risk aversion. The 95th percentile within each risk category is used.

Gamma	Risk category									
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%	
0,5	10,2	4,5	1,3	0,0	2,3	2,6	3,9	3,9	4,5	
1,0	5,1	2,3	0,6	0,0	1,1	1,3	1,9	2,0	2,3	
1,5	3,4	1,5	0,4	0,0	0,8	0,9	1,3	1,3	1,5	
2,0	2,6	1,1	0,3	0,0	0,6	0,7	1,0	1,0	1,1	
2,5	2,0	0,9	0,3	0,0	0,5	0,5	0,8	0,8	0,9	
3,0	1,7	0,8	0,2	0,0	0,4	0,4	0,6	0,7	0,8	
3,5	1,5	0,6	0,2	0,0	0,3	0,4	0,6	0,6	0,6	
4,0	1,3	0,6	0,2	0,0	0,3	0,3	0,5	0,5	0,6	
4,5	1,1	0,5	0,1	0,0	0,3	0,3	0,4	0,4	0,5	
5,0	1,0	0,5	0,1	0,0	0,2	0,3	0,4	0,4	0,5	

Should an investor actively select funds or keep the default option?

Table A 4: Global CAPM losses (%) per risk category and risk aversion. The 95th percentile within each risk category is used.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	8,7	6,6	4,0	2,6	0,8	2,4	-0,5	1,3	5,8
1,0	4,4	3,3	2,0	1,3	0,4	1,2	-0,2	0,6	2,9
1,5	2,9	2,2	1,3	0,9	0,3	0,8	-0,2	0,4	1,9
2,0	2,2	1,6	1,0	0,7	0,2	0,6	-0,1	0,3	1,4
2,5	1,7	1,3	0,8	0,5	0,2	0,5	-0,1	0,3	1,2
3,0	1,5	1,1	0,7	0,4	0,1	0,4	-0,1	0,2	1,0
3,5	1,2	0,9	0,6	0,4	0,1	0,3	-0,1	0,2	0,8
4,0	1,1	0,8	0,5	0,3	0,1	0,3	-0,1	0,2	0,7
4,5	1,0	0,7	0,4	0,3	0,1	0,3	-0,1	0,1	0,6
5,0	0,9	0,7	0,4	0,3	0,1	0,2	0,0	0,1	0,6

Table A 5: Local CAPM utility losses (%) per risk category and risk aversion. The 75th percentile within each risk category is used.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	9,2	4,4	2,8	4,0	5,2	5,1	5,6	6,6
1,0	na	4,6	2,2	1,4	2,0	2,6	2,5	2,8	3,3
1,5	na	3,1	1,5	0,9	1,3	1,7	1,7	1,9	2,2
2,0	na	2,3	1,1	0,7	1,0	1,3	1,3	1,4	1,6
2,5	na	1,8	0,9	0,6	0,8	1,0	1,0	1,1	1,3
3,0	na	1,5	0,7	0,5	0,7	0,9	0,8	0,9	1,1
3,5	na	1,3	0,6	0,4	0,6	0,7	0,7	0,8	0,9
4,0	na	1,1	0,6	0,3	0,5	0,6	0,6	0,7	0,8
4,5	na	1,0	0,5	0,3	0,4	0,6	0,6	0,6	0,7
5,0	na	0,9	0,4	0,3	0,4	0,5	0,5	0,6	0,7

Table A 6: Global CAPM losses (%) per risk category and risk aversion. The 75th percentile within each risk category is used.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	8,7	6,5	5,2	3,8	4,4	4,4	2,3	5,8
1,0	na	4,4	3,3	2,6	1,9	2,2	2,2	1,1	2,9
1,5	na	2,9	2,2	1,7	1,3	1,5	1,5	0,8	1,9
2,0	na	2,2	1,6	1,3	1,0	1,1	1,1	0,6	1,4
2,5	na	1,7	1,3	1,0	0,8	0,9	0,9	0,5	1,2
3,0	na	1,5	1,1	0,9	0,6	0,7	0,7	0,4	1,0
3,5	na	1,2	0,9	0,7	0,5	0,6	0,6	0,3	0,8
4,0	na	1,1	0,8	0,6	0,5	0,6	0,5	0,3	0,7
4,5	na	1,0	0,7	0,6	0,4	0,5	0,5	0,3	0,6
5,0	na	0,9	0,7	0,5	0,4	0,4	0,4	0,2	0,6

Should an investor actively select funds or keep the default option?

Table A 7: Local CAPM utility losses (%) per risk category and risk aversion. The median fund within each risk category is used.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	na	7,0	4,2	5,0	6,3	5,6	5,7	6,8
1,0	na	na	3,5	2,1	2,5	3,2	2,8	2,9	3,4
1,5	na	na	2,3	1,4	1,7	2,1	1,9	1,9	2,3
2,0	na	na	1,8	1,1	1,2	1,6	1,4	1,4	1,7
2,5	na	na	1,4	0,8	1,0	1,3	1,1	1,1	1,4
3,0	na	na	1,2	0,7	0,8	1,1	0,9	1,0	1,1
3,5	na	na	1,0	0,6	0,7	0,9	0,8	0,8	1,0
4,0	na	na	0,9	0,5	0,6	0,8	0,7	0,7	0,8
4,5	na	na	0,8	0,5	0,6	0,7	0,6	0,6	0,8
5,0	na	na	0,7	0,4	0,5	0,6	0,6	0,6	0,7

Table A 8: Global CAPM losses (%) per risk category and risk aversion. The median fund within each risk category is used.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	na	8,1	6,9	5,4	6,1	6,0	6,9	7,4
1,0	na	na	4,0	3,4	2,7	3,0	3,0	3,4	3,7
1,5	na	na	2,7	2,3	1,8	2,0	2,0	2,3	2,5
2,0	na	na	2,0	1,7	1,3	1,5	1,5	1,7	1,8
2,5	na	na	1,6	1,4	1,1	1,2	1,2	1,4	1,5
3,0	na	na	1,3	1,1	0,9	1,0	1,0	1,1	1,2
3,5	na	na	1,2	1,0	0,8	0,9	0,9	1,0	1,1
4,0	na	na	1,0	0,9	0,7	0,8	0,7	0,9	0,9
4,5	na	na	0,9	0,8	0,6	0,7	0,7	0,8	0,8
5,0	na	na	0,8	0,7	0,5	0,6	0,6	0,7	0,7

Table A 9: Local CAPM utility losses (%) per risk category and risk aversion. The 25th percentile within each risk category is used.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	na	8,8	5,7	6,0	7,3	6,8	7,4	6,8
1,0	na	na	4,4	2,8	3,0	3,6	3,4	3,7	3,4
1,5	na	na	2,9	1,9	2,0	2,4	2,3	2,5	2,3
2,0	na	na	2,2	1,4	1,5	1,8	1,7	1,9	1,7
2,5	na	na	1,8	1,1	1,2	1,5	1,4	1,5	1,4
3,0	na	na	1,5	0,9	1,0	1,2	1,1	1,2	1,1
3,5	na	na	1,3	0,8	0,9	1,0	1,0	1,1	1,0
4,0	na	na	1,1	0,7	0,7	0,9	0,9	0,9	0,9
4,5	na	na	1,0	0,6	0,7	0,8	0,8	0,8	0,8
5,0	na	na	0,9	0,6	0,6	0,7	0,7	0,7	0,7

Should an investor actively select funds or keep the default option?

Table A 10: Global CAPM utility losses (%) per risk category and risk aversion. The 25th percentile within each risk category is used.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	na	na	8,4	7,3	7,2	7,1	8,5	8,0
1,0	na	na	na	4,2	3,7	3,6	3,5	4,3	4,0
1,5	na	na	na	2,8	2,4	2,4	2,4	2,8	2,7
2,0	na	na	na	2,1	1,8	1,8	1,8	2,1	2,0
2,5	na	na	na	1,7	1,5	1,4	1,4	1,7	1,6
3,0	na	na	na	1,4	1,2	1,2	1,2	1,4	1,3
3,5	na	na	na	1,2	1,0	1,0	1,0	1,2	1,1
4,0	na	na	na	1,0	0,9	0,9	0,9	1,1	1,0
4,5	na	na	na	0,9	0,8	0,8	0,8	0,9	0,9
5,0	na	na	na	0,8	0,7	0,7	0,7	0,9	0,8

Table A 11: Local CAPM utility losses (%) per risk category and risk aversion. The best fund within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	4,0	1,2	-0,4	-1,6	0,5	0,3	1,8	2,5	3,6
1,0	2,0	0,6	-0,2	-0,8	0,3	0,2	0,9	1,2	1,8
1,5	1,3	0,4	-0,1	-0,5	0,2	0,1	0,6	0,8	1,2
2,0	1,0	0,3	-0,1	-0,4	0,1	0,1	0,4	0,6	0,9
2,5	0,8	0,2	-0,1	-0,3	0,1	0,1	0,4	0,5	0,7
3,0	0,7	0,2	-0,1	-0,3	0,1	0,1	0,3	0,4	0,6
3,5	0,6	0,2	-0,1	-0,2	0,1	0,0	0,3	0,4	0,5
4,0	0,5	0,1	-0,1	-0,2	0,1	0,0	0,2	0,3	0,5
4,5	0,4	0,1	0,0	-0,2	0,1	0,0	0,2	0,3	0,4
5,0	0,4	0,1	0,0	-0,2	0,1	0,0	0,2	0,2	0,4

Table A 12: Global CAPM utility losses (%) per risk category and risk aversion. The best fund within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	3,5	-9,0	0,1	-4,0	-4,9	-2,2	-2,6	-0,9	5,1
1,0	1,8	-4,5	0,0	-2,0	-2,4	-1,1	-1,3	-0,4	2,5
1,5	1,2	-3,0	0,0	-1,3	-1,6	-0,7	-0,9	-0,3	1,7
2,0	0,9	-2,3	0,0	-1,0	-1,2	-0,6	-0,6	-0,2	1,3
2,5	0,7	-1,8	0,0	-0,8	-1,0	-0,4	-0,5	-0,2	1,0
3,0	0,6	-1,5	0,0	-0,7	-0,8	-0,4	-0,4	-0,1	0,8
3,5	0,5	-1,3	0,0	-0,6	-0,7	-0,3	-0,4	-0,1	0,7
4,0	0,4	-1,1	0,0	-0,5	-0,6	-0,3	-0,3	-0,1	0,6
4,5	0,4	-1,0	0,0	-0,4	-0,5	-0,2	-0,3	-0,1	0,6
5,0	0,4	-0,9	0,0	-0,4	-0,5	-0,2	-0,3	-0,1	0,5

Should an investor actively select funds or keep the default option?

Table A 13: Local CAPM utility losses (%) per risk category and risk aversion. The 95th percentile within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	4,7	1,9	0,3	-0,7	1,3	1,5	2,6	2,5	3,6
1,0	2,3	1,0	0,1	-0,4	0,7	0,7	1,3	1,2	1,8
1,5	1,6	0,6	0,1	-0,2	0,4	0,5	0,9	0,8	1,2
2,0	1,2	0,5	0,1	-0,2	0,3	0,4	0,7	0,6	0,9
2,5	0,9	0,4	0,1	-0,1	0,3	0,3	0,5	0,5	0,7
3,0	0,8	0,3	0,0	-0,1	0,2	0,2	0,4	0,4	0,6
3,5	0,7	0,3	0,0	-0,1	0,2	0,2	0,4	0,4	0,5
4,0	0,6	0,2	0,0	-0,1	0,2	0,2	0,3	0,3	0,5
4,5	0,5	0,2	0,0	-0,1	0,1	0,2	0,3	0,3	0,4
5,0	0,5	0,2	0,0	-0,1	0,1	0,1	0,3	0,2	0,4

Table A 14: Global CAPM utility losses (%) per risk category and risk aversion. The 95th percentile within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	6,8	-9,0	1,2	1,0	-0,7	0,0	-2,2	-0,9	5,1
1,0	3,4	-4,5	0,6	0,5	-0,4	0,0	-1,1	-0,4	2,5
1,5	2,3	-3,0	0,4	0,3	-0,2	0,0	-0,7	-0,3	1,7
2,0	1,7	-2,3	0,3	0,3	-0,2	0,0	-0,5	-0,2	1,3
2,5	1,4	-1,8	0,2	0,2	-0,1	0,0	-0,4	-0,2	1,0
3,0	1,1	-1,5	0,2	0,2	-0,1	0,0	-0,4	-0,1	0,8
3,5	1,0	-1,3	0,2	0,1	-0,1	0,0	-0,3	-0,1	0,7
4,0	0,8	-1,1	0,2	0,1	-0,1	0,0	-0,3	-0,1	0,6
4,5	0,8	-1,0	0,1	0,1	-0,1	0,0	-0,2	-0,1	0,6
5,0	0,7	-0,9	0,1	0,1	-0,1	0,0	-0,2	-0,1	0,5

Table A 15: Local CAPM utility losses (%) per risk category and risk aversion. The 75th percentile within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	6,0	1,4	0,5	2,3	3,3	3,6	3,6	4,6
1,0	na	3,0	0,7	0,2	1,1	1,6	1,8	1,8	2,3
1,5	na	2,0	0,5	0,2	0,8	1,1	1,2	1,2	1,5
2,0	na	1,5	0,4	0,1	0,6	0,8	0,9	0,9	1,2
2,5	na	1,2	0,3	0,1	0,5	0,7	0,7	0,7	0,9
3,0	na	1,0	0,2	0,1	0,4	0,5	0,6	0,6	0,8
3,5	na	0,9	0,2	0,1	0,3	0,5	0,5	0,5	0,7
4,0	na	0,8	0,2	0,1	0,3	0,4	0,4	0,4	0,6
4,5	na	0,7	0,2	0,1	0,3	0,4	0,4	0,4	0,5
5,0	na	-0,9	0,9	0,1	-0,1	0,0	-0,2	-0,1	0,5

Should an investor actively select funds or keep the default option?

Table A 16: Global CAPM utility losses (%) per risk category and risk aversion. The 75th percentile within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	8,6	7,3	4,8	3,9	2,8	3,2	3,5	1,4	5,3
1,0	4,3	3,6	2,4	1,9	1,4	1,6	1,8	0,7	2,6
1,5	2,9	2,4	1,6	1,3	0,9	1,1	1,2	0,5	1,8
2,0	2,1	1,8	1,2	1,0	0,7	0,8	0,9	0,3	1,3
2,5	1,7	1,5	1,0	0,8	0,6	0,6	0,7	0,3	1,1
3,0	1,4	1,2	0,8	0,6	0,5	0,5	0,6	0,2	0,9
3,5	1,2	1,0	0,7	0,6	0,4	0,5	0,5	0,2	0,8
4,0	1,1	0,9	0,6	0,5	0,3	0,4	0,4	0,2	0,7
4,5	1,0	0,8	0,5	0,4	0,3	0,4	0,4	0,2	0,6
5,0	0,9	0,7	0,5	0,4	0,3	0,3	0,4	0,1	0,5

Table A 17: Local CAPM utility losses (%) per risk category and risk aversion. The 50th percentile within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	10,1	3,8	1,8	3,2	4,8	4,5	4,5	6,0
1,0	na	5,1	1,9	0,9	1,6	2,4	2,2	2,3	3,0
1,5	na	3,4	1,3	0,6	1,1	1,6	1,5	1,5	2,0
2,0	na	2,5	0,9	0,5	0,8	1,2	1,1	1,1	1,5
2,5	na	2,0	0,8	0,4	0,6	1,0	0,9	0,9	1,2
3,0	na	1,7	0,6	0,3	0,5	0,8	0,7	0,8	1,0
3,5	na	1,4	0,5	0,3	0,5	0,7	0,6	0,6	0,9
4,0	na	1,3	0,5	0,2	0,4	0,6	0,6	0,6	0,7
4,5	na	1,1	0,4	0,2	0,4	0,5	0,5	0,5	0,7
5,0	na	1,0	0,4	0,2	0,3	0,5	0,4	0,5	0,6

Table A 18: Global CAPM utility losses (%) per risk category and risk aversion. The 50th percentile within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	na	6,4	5,4	4,0	4,8	5,0	5,9	6,8
1,0	na	na	3,2	2,7	2,0	2,4	2,5	3,0	3,4
1,5	na	na	2,1	1,8	1,3	1,6	1,7	2,0	2,3
2,0	na	na	1,6	1,4	1,0	1,2	1,3	1,5	1,7
2,5	na	na	1,3	1,1	0,8	1,0	1,0	1,2	1,4
3,0	na	na	1,1	0,9	0,7	0,8	0,8	1,0	1,1
3,5	na	na	0,9	0,8	0,6	0,7	0,7	0,8	1,0
4,0	na	na	0,8	0,7	0,5	0,6	0,6	0,7	0,8
4,5	na	na	0,7	0,6	0,4	0,5	0,6	0,7	0,8
5,0	na	na	0,6	0,5	0,4	0,5	0,5	0,6	0,7

Should an investor actively select funds or keep the default option?

Table A 19: Local CAPM utility losses (%) per risk category and risk aversion. The 25th percentile within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	na	6,8	3,3	4,2	5,8	5,6	6,9	6,4
1,0	na	na	3,4	1,7	2,1	2,9	2,8	3,4	3,2
1,5	na	na	2,3	1,1	1,4	1,9	1,9	2,3	2,1
2,0	na	na	1,7	0,8	1,1	1,4	1,4	1,7	1,6
2,5	na	na	1,4	0,7	0,8	1,2	1,1	1,4	1,3
3,0	na	na	1,1	0,6	0,7	1,0	0,9	1,1	1,1
3,5	na	na	1,0	0,5	0,6	0,8	0,8	1,0	0,9
4,0	na	na	0,8	0,4	0,5	0,7	0,7	0,9	0,8
4,5	na	na	0,8	0,4	0,5	0,6	0,6	0,8	0,7
5,0	na	na	0,7	0,3	0,4	0,6	0,6	0,7	0,6

Table A 20: Global CAPM utility losses (%) per risk category and risk aversion. The 25th percentile within each risk category is used. *Premiesparfonden's* fee is deducted from all funds.

Gamma	Risk category								
	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-%
0,5	na	na	na	7,5	5,8	6,4	6,4	7,9	7,1
1,0	na	na	na	3,7	2,9	3,2	3,2	4,0	3,5
1,5	na	na	na	2,5	1,9	2,1	2,1	2,6	2,4
2,0	na	na	na	1,9	1,4	1,6	1,6	2,0	1,8
2,5	na	na	na	1,5	1,2	1,3	1,3	1,6	1,4
3,0	na	na	na	1,2	1,0	1,1	1,1	1,3	1,2
3,5	na	na	na	1,1	0,8	0,9	0,9	1,1	1,0
4,0	na	na	na	0,9	0,7	0,8	0,8	1,0	0,9
4,5	na	na	na	0,8	0,6	0,7	0,7	0,9	0,8
5,0	na	na	na	0,7	0,6	0,6	0,6	0,8	0,7

Appendix B: Mean-Variance Diagrams

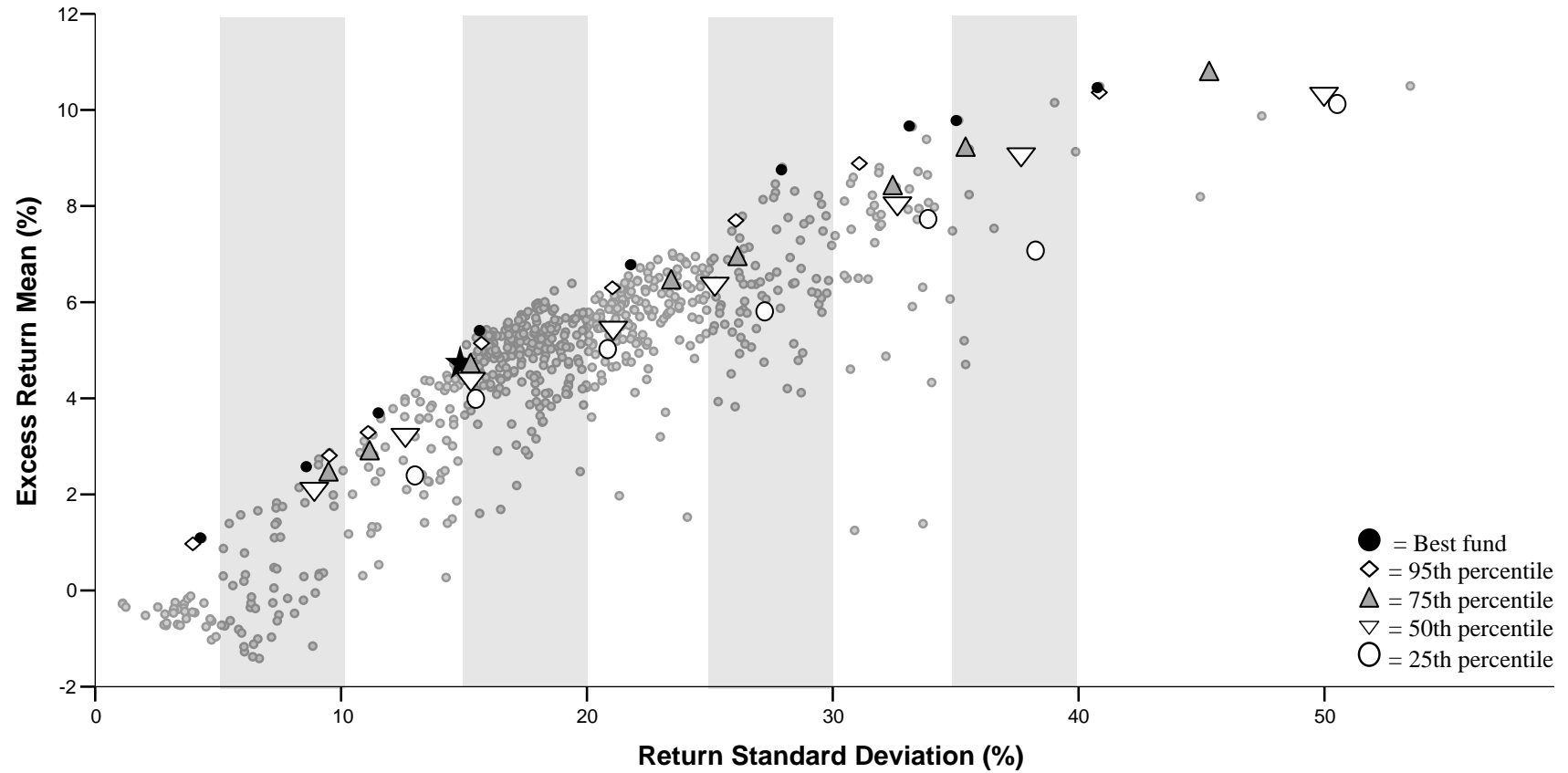


Figure A10: Diagram showing the funds within each percentile. The fund that is assigned a star is *Premiesparfonden*. The funds are assessed net of a fee equal to *Premiesparfonden*'s and the Local CAPM is used.

Should an investor actively select funds or keep the default option?

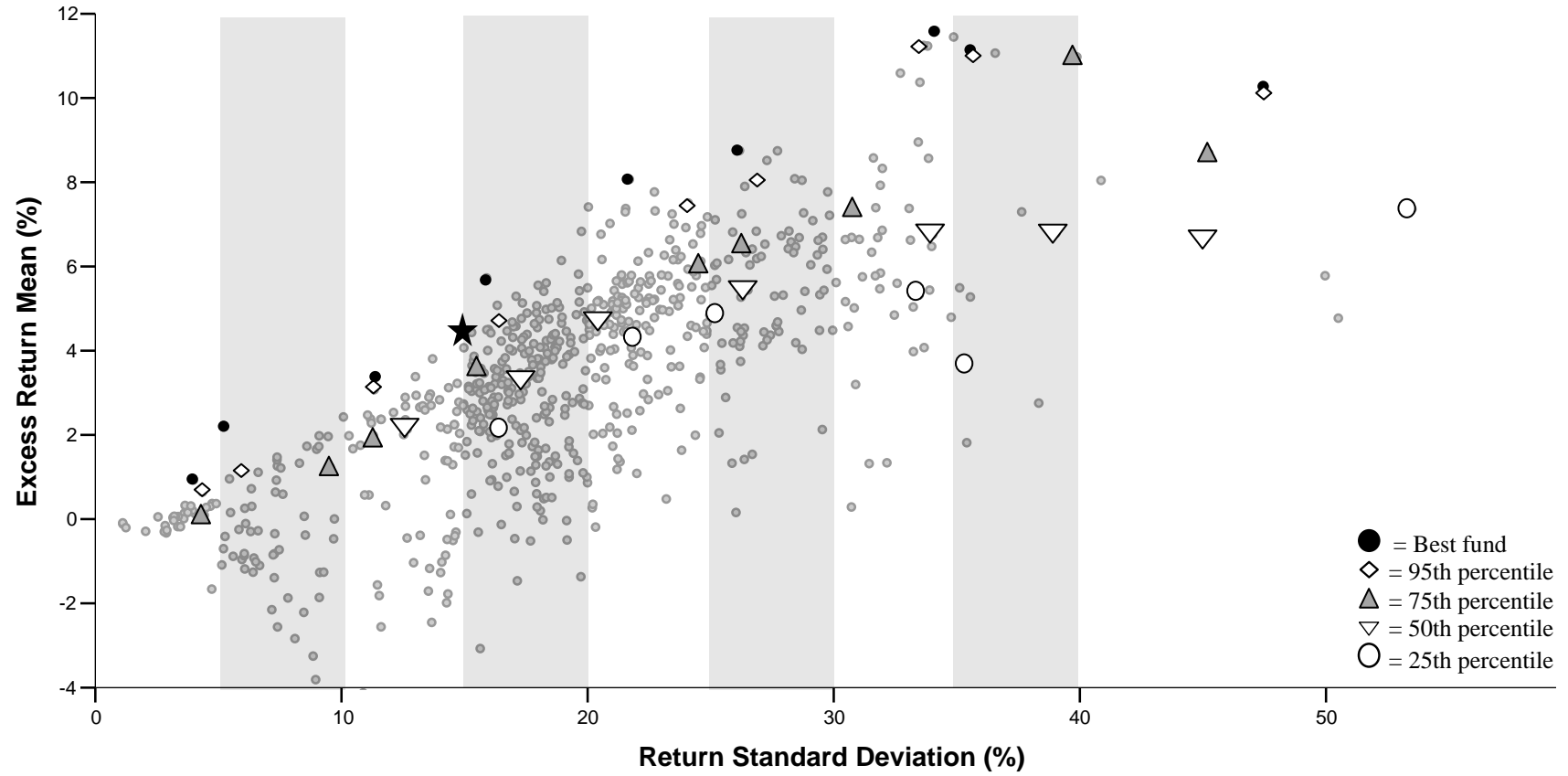


Figure A 2: Diagram showing the funds within each percentile. The fund that is assigned a star is *Premiesparfonden*. The funds are assessed net of a fee equal to *Premiesparfonden*'s and the Global CAPM is used.