

Lappeenranta University of Technology
School of Business
Finance



DOWNSIDE RISK MEASURES IN EVALUATION OF PORTFOLIO PERFORMANCE

Bachelor's thesis
Antto Alenius
0297799

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1. Introduction

The popularity of downside risk among investors is growing and downside risk measures in portfolio selection seem to oppress the familiar mean variance approach. One reason for this success is that unlike in standard deviation based risk meters in which all uncertainty is considered to be risky, downside risk measures only consider returns that are below investor's goal to be risky. The global idea behind downside risk is that the left hand side of a return distribution involves risk while the right hand side contains the better investment opportunities (Grootveld & Hallerbach, 1999). The major advantage of downside risk over standard deviation is that it accommodates different views of risk (Riddles Neil, 2001:93).

As early as 1952 Roy noted that investors care differently about downside losses than they care about upside gains. If a stock is more sensitive to downward market movement than upward market movement an investor holding the stock requires a premium for holding the stock with high downside risk. Authors Andrew Ang, Joseph Chen and Yuhang Xing (2006) have showed that there is a premium for holding stocks with higher downside risk. In their study they found that portfolios with the most downside risk and the least downside risk had the difference in average returns of 6,5 percent per year.

Hitherto, the most common risk measure used to rank mutual funds is Sharpe ratio. It calculates the key ratio by dividing excess return of a portfolio by its standard deviation. However, standard deviation assumes the returns of the funds to be normally distributed, which can be misleading when interpreting the results. (Eling & Schuhmacher, 2007: 2632). Hence, Markowitz (1959) replaced standard deviation to semi-standard deviation. Later, Sortino & Price (1994) suggested that the numerator of the Sharpe ratio should also be replaced in a way that excess returns would be calculated over and above the target rate of return. Sortino named this measure as Sortino ratio. In Sharpe ratio excess return has been calculated over the risk-free return (Pätäri, 2000: 94).

The aim of this study is to introduce some most common downside risk measures and examine if downside risk measures rank portfolios differently than traditional risk

measures. Moreover, we examine if downside risk measures provide added value for an investor who is choosing a portfolio to invest.

The rest of the paper is organized as follows. Section 2 presents theoretical background of downside risk and portfolio performance evaluation. In section 3 the measures used in this study are introduced. Section 4 presents the empirical results. Finally, section 5 concludes and gives ideas for further research.

2. Theoretical background

Portfolio performance evaluation has been under scrutiny for more than 30 years. First, it was ruled by W.F Sharpe (1966) who compared the performance rank orders of 34 funds based on his Sharpe ratio from two successive decades and found a positive correlation between these two ranks (Pätäri, 2000: 143). Nowadays, Sharpe ratio is still one of the most widely used portfolio risk measure due to its simplicity.

Alongside with Sharpe became Treynor and Black in 1973 by introducing information ratio. The principle is the same than in Sharpe ratio. Both are measures of volatility-adjusted performance but the key difference is in the definition of excess returns. When Sharpe ratio uses excess returns over risk free interest rate as a numerator, Treynor and Black's numerator is excess returns over a relative benchmark index. Both measures use standard deviation of excess returns as a denominator (Israelsen, 2004).

Second commonly used single parameter risk measure is Treynor measure invented by Treynor (1965). It differs from Sharpe ratio by examining differential returns using Beta as a risk measure. (Elton et.al, 2007: 647)

In addition, Jensen (1969) examined abnormal performance of 65 funds with his Jensen Alpha measure. He used the same length of investment period and evaluation horizon as Sharpe. In his study there was a positive correlation in the performance between the evaluation horizon and the investment period meaning that some funds could perform better than others. (Pätäri, 2000: 144)

The pioneer in the field of risk is Harry Markowitz. Before him there was no attempt to quantify risk (Sortino, 2001: 3). For example, Markowitz (1959) used semi-variance as a measure of risk, because semi-variance measures downside losses rather than upside gains. In 1979, Kahneman and Tversky introduced loss aversion preferences, which allowed agents to place greater weights on losses relative to gains. Later, Gul (1991) invented disappointment aversion preferences, which could be used in the agents utility functions in the same way as Kahneman and Tversky's loss aversion preferences (Ang et al, 2006: 1).

One of the newest studies in the field of downside risk is Ang, Chen and Xing's study in 2006 where they examined downside risk premiums in the cross-section of stock returns. They found that cross-section of stock returns reflected a premium for downside risk. "Stocks that co-vary strongly with the market, conditional on market declines have high average returns" (Ang et al, 2006).

2.1 Variance and standard deviation

When analyzing risk of a portfolio the two most common terms investors confront are variance and standard deviation. The importance of variance of a random variable is in characterizing the scale of measurement and the spread of the probability distribution. Algebraically, variance can be written as

$$\text{Var}(X) = E[g(X)] = E[X - E(X)]^2 = E([X^2] - [E(X)]^2) \quad (1)$$

When observing the formula, it can be seen that variance of a random variable is the average squared difference between the random variable X and its mean value $E[X]$. Thus, the variance of a random variable is the weighted average of the squared differences between the values x of the random variable X and the mean of a random variable. "The larger the variance of a random variable, the greater the average squared distance between the values of the random variable and its mean" (Hill, Griffiths and Judge, 2001: 21).

Standard deviation is the square root of the variance of the random variable. Likewise variance, it measures the spread or dispersion of a distribution and it has the advantage of being in the same units of measure as the random variable (Hill et al, 2001: 21). Standard deviation is usually used to refer to risk.

2.2 Problems with single-parameter risk measures

The traditional portfolio risk measures like Sharpe ratio, Treynor ratio and Jensen alpha have some drawbacks, because they use single-parameter risk measures, which assume lending and borrowing at the same riskless rate. Second problem according to single-parameter risk measures is changing risk levels. One thing that fund managers do is that they try to forecast what happens next in the markets and get excess returns by adjusting the portfolio accordingly. This can be done, for example, by selling stocks and purchasing bonds when markets are bearish and vice versa. Moreover, another mode of action could be changing the beta of the portfolio. When markets are bullish fund manager increases the portfolio beta and when markets are bearish he decreases the beta. These actions change the risk level of the portfolio and bring problems to the portfolio's evaluation process. Very often the risk of a portfolio is calculated by using the past sequence of returns for the portfolio and, if the risk level of the portfolio has changed over time, an estimate of the risk can be misleading (Elton et al, 2007).

Standard deviation is the most widely used measure of investment risk. It assumes all investors agree on the degree of risk in every investment. However, investors tend to have different goals when making an investment plan. Some people are risk takers who want to get better return than in the markets on average and some people don't want to take any risk at all. Moreover, investor's age and wealth dictate different perceptions of the degree of risk in a given investment (Riddles, 2001: 93).

Second drawback of standard deviation is the underlying data. If the data is not normally distributed then the standard deviation is likely to give misleading results. "A number of studies have demonstrated that investment returns are not normally distributed". Hence, in the case of not normally distributed returns, investor using standard deviation as a risk measure is likely to reach wrong results (Riddles, 2001: 94).

Moreover, standard deviation which assumes normally distributed returns doesn't take into account skewness. If the skewness is negative it indicates that a return distribution has a tail extending towards more negative values. For positive skewness the impact is the opposite. (Rogers & Van Dyke, 2006). For example, in this study funds' logarithm returns were more or less negatively skewed every year.

2.3 Modern portfolio theory

Modern portfolio theory was invented by Harry Markowitz (1952, 1959). He formulated the problem of creating a portfolio as a choice of the mean and variance of a portfolio of assets. He proved the fundamental theorem of mean variance portfolio theory, which led to develop efficient frontier where investor could choose his preferred portfolio, depending on individual risk return preferences. One of the main points was that assets could not be selected only on characteristics that were unique to the security. More important was how each security co-moved with all other securities. Doing so, investor could construct a portfolio that has the same expected return and less risk than a portfolio that hasn't taken these interactions between securities into account. (Elton and Gruber, 1997: 1745)

However, lots of different theories which included more moments such as skewness were suggested to replace mean variance theory. In spite of that mean variance theory has remained its place as a cornerstone of modern portfolio theory. Elton and Gruber believed that there are two reasons for this. "First, mean variance theory itself places large data requirements on the investor, and there is no evidence that adding additional moments improves the desirability of the portfolio selected. Second, the implications of mean variance portfolio theory are well developed, widely known, and have great intuitive appeal". (Elton & Gruber, 1997: 1745)

One of the problems the mean variance portfolio theory has is that it was developed to find an optimum portfolio when an investor is concerned with a return distribution over a single period. If the problem is multi-period in nature the theory has to be modified. Fama (1970), Hakansson (1970, 1974) and Merton (1990) have all analyzed this problem and found that the problem can be solved as a sequence of single period

problems. “However, the optimum portfolio would be different from that selected if only one period was examined”. (Elton and Gruber, 1997: 1745)

2.4 Post-modern portfolio theory

Post-modern portfolio theory (PMPT) was invented originally to improve portfolio optimization and asset allocation. However, it has been increasingly applied to measure the investment performance of portfolios, investment managers and mutual funds. One reason for this must be that modern portfolio theory, which has been used as a basis for portfolio analysis for past four decades, uses standard deviation and assumes normal distribution in fund returns in its analysis (Rom & Ferguson, 2001: 59-60b). As mentioned in chapter 1.2, standard deviation has some major limitations and is not the best surrogate of risk.

PMPT recognizes that investment risk should be tied to each investor’s specific goals. Often, the target rate of return is referred to as the minimum acceptable return (MAR). “MAR represents the rate of return that must be earned to avoid failing to achieve some important financial objective.”(Rom & Ferguson, 1994: 351a)

One of the tools post modern portfolio theory uses is downside risk. It is measured by target semi-deviation and is termed downside deviation. Moreover, it is expressed in percentages and therefore allows rankings in the same way as standard deviation. (Rom & Ferguson, 2001: 59-60b.)

2.5 VaR

Value at risk (VaR) is one of the most widely used downside risk measure. It is an attractive measure because it is easy to understand. It compresses all the Greek letters that are used to measure risk (Gamma, Vega, Delta etc...) into a single number. Basically, it answers the question “how bad can things get?” (Hull, 2006) The main drawback is that VaR is only the amount which is at risk with a particular probability. For example, it doesn’t tell how much is at risk at twice that probability or at half that probability. Hence, it only tells part of the risk story. “A far more useful set of

information would be the complete cumulative probability distribution of how much is at risk at every level of probability.” (Balzer, 2001)

VaR uses two different parameters, which are time horizon measured in days (N) and confidence interval (X). Usually, time horizon used is one day, because there is not enough data to estimate directly the behaviour of markets variables over periods of time longer than one day. Formula is written as

$$\text{N-day VaR} = \text{1-day VaR} \times \sqrt{N} \quad (2)$$

When the changes in the value of the portfolio on successive days have independent identical normal distributions with mean zero this formula can be regarded true. In other cases the formula is an approximation (Hull, 2006: 437).

2.6 Realised semi-variance

The newest study in the field of downside risk is Barndorf-Nielsen, Kinnebrock & Shepard’s study where they introduced a new measure of the variation of asset prices based on high frequency data. They call it realised semi-variance. It measures the variation of asset price falls. Their study extended the influential work of, for example, Andersen, Bollerslev, Diebold, and Labys (2001) on formalising so-called realised variances (RV), which links these commonly used statistics to the quadratic variation process (Barndorf-Nielsen et al, 2008: 3). Basically, they took a closer look of realised variance and detach it in two parts: downside realised semi-variance (RS-) and upside realised semi-variance (RS+). The equation can be written as

$$RV = RS^- + RS^+ \quad (3)$$

“Realised variance estimates the ex-post variance of asset prices over a fixed time period”. However, it only uses squares of the data, while lots of researches like Black’s (1976) and Nelson’s (1991) have indicated the importance of falls in prices as a driver

of conditional variance. Realised semi-variance provided a new source of information, on which focused on squared negative jumps. (Barndorf-Nielsen et al, 2008: 3)

3. Data and risk measures

21 Finnish mutual funds are examined in this study. All of them invest only in Finnish stocks. Usually, there are two different units of the same fund: yield unit and growth unit. Only yield units are taken into this study, because these funds pay dividends, earned from the stocks in the fund, to the investor (Rahastoesite, Suomeen rekisteröidyt rahastot). Growth units don't pay dividends for the investor but invest them automatically into the fund every time.

The time period is from the beginning of 2004 to the end of 2007. Values of the funds have been taken weekly every Wednesday. The risk free rate is one month euribor rate. Euribor rates have also been taken every Wednesday like the values of the funds.

OMXH Helsinki CAP price index is used as comparison portfolio in this study. Values are taken from OMXGroup's Internet site on the same days as euribor rates and fund values. Helsinki stock exchange calculates two different indexes based on OMXH Helsinki CAP index: price index and earnings index, which can be written as OMX Helsinki CAP_PI and OMX Helsinki CAP_GI. In this study OMX Helsinki CAP_PI is used because it doesn't take into account dividends. It is justified to use price index when comparing yield units, because yield units pay dividends out, so they don't add value to the fund. In the very end, the volatility of price movements is the main point of view in this study.

Evaluating fund's performance to the price index has been common among fund management companies because it shows better results for the fund's growth unit, which is most commonly the unit where households invest. When comparing fund performance with dividends to the price index where dividends haven't been taken into account the fund's success appears bigger than it should be. In 2004 only two from the

five biggest fund management companies in Finland used the dividend based index in their reports. (Karttunen Anu, 2004)

In this study euribor rate's weekly logarithm return is used as a target rate of return for all funds.

3.1 Risk measures

There are three traditional performance measures (Sharpe ratio, Treynor ratio and information ratio) and four downside risk measures (Adjusted Sharpe ratio 95 % and 99 %, Sortino ratio and RTASD) which are used in this study to compare funds to each other. These measures were chosen because of the easy comparability of the results. In section 4 outcomes of these measures are analyzed and compared to each other.

Celeres HR Suomi K fund couldn't be taken into analyzes in 2004 because it has been established in May 2004.

3.1.1 Sharpe ratio

Sharpe ratio is a measure of risk-adjusted performance. It measures portfolio's excess returns relative to standard deviation of the portfolio's returns. The main criticism of the Sharpe ratio has been directed to its risk surrogate: standard deviation. Especially, hedge fund performance shouldn't be measured with Sharpe ratio, because hedge fund returns do not display a normal distribution (Eling & Schuhmacher, 2006). Second drawback of the Sharpe ratio occurs when excess returns are negative (Israelsen, 2003). In that case comparing funds which have negative Sharpe ratios can give misleading results. For example, if we compare two funds with excess returns of -9 % for both and standard deviations of 10 % and 20 %. When calculating the Sharpe ratios of these funds it seems that the fund with 20 % volatility is better. Obviously this can't be true, because if both funds have generated -9 % excess returns, the one with least volatility should be the best of these two. Israelsen suggests that when excess returns are negative, exponent should be added to the denominator. The exponent is excess

return divided by absolute value of excess return. In the basic form Sharpe ratio can be written as follows

$$S = \frac{R_i - R_f}{\sigma_i} \quad (4)$$

where R_i is the return of a portfolio, R_f is the risk free rate and σ_i the standard deviation of portfolio's returns. $R_i - R_f$ forms the excess returns of the fund.

In this study funds' weekly excess returns over the risk free interest rates have been calculated by reducing the euribor rate's return time series value from the same date fund's logarithm return value. Excess return used in the formula is the one year average of weekly excess returns. Standard deviation in the formula is the standard deviation of the fund excess return values. Euribor rate's weekly return time-series value can be calculated as follows

$$R_f = (((1+30/360*r/100)^{12-1})^{7/360}) \quad (5)$$

where r is the weekly euribor rate.

The logarithm returns of the funds have been calculated dividing the fund value at time T by the value of the fund at time $T-1$. The formula can be written as

$$R_i = \ln\left(\frac{V_t}{V_{t-1}}\right) \quad (6)$$

3.1.2 Information ratio

Information ratio (IR) measures how well a portfolio has performed against market index. It is a variation of Sharpe ratio. It divides portfolio's excess returns over market index by the standard deviation of excess returns over market index. The purpose is to

try to reflect active bets by the manager more accurately. From this point of view the excess returns are often referred to as the manager's active return and standard deviation to as the manager's active risk. The formula can be written as

$$IR = \frac{R_i - R_b}{\sigma_i} \quad (7)$$

3.1.3 Treynor ratio

Treynor ratio uses beta as a measure of risk. Beta is not a measure of volatility but it shows a fund's correlation to market index. If the beta is small (<1) a fund follows market movements calmly but if the beta is high (>1) the fund's value even exaggerates market index movements. Treynor ratio underlines that market risk measured by beta can not be diversified away through investing in many different funds, and so on ought to be penalized. (Carnahan, 2002). Treynor ratio can be calculated as follows

$$T = \frac{R_i - R_f}{\beta} \quad (8)$$

where R_i is the logarithm return of a fund, R_f is the risk free rate and β is the beta of the fund. Beta can be calculated as follows

$$\beta = \frac{Cov_{ij}}{\sigma_j^2} \quad (9)$$

where, Cov_{ij} is the covariance between fund's and market index's return over risk free interest rate. σ_j^2 is the variance of the market index's logarithm return (Morningstar laskukaavat).

3.1.4 Adjusted Sharpe ratio

In adjusted Sharpe ratio the average of excess returns is divided by measure of dispersion corresponding to standard deviation of excess returns. The advantage over traditional Sharpe ratio is that adjusted Sharpe ratio takes funds excess returns' skewness and kurtosis into account when these returns don't display a normal distribution pattern.

Two types of adjusted Sharpe ratios are used in this study. 95 % adjusted Sharpe ratio takes 95 % of the values in normally distributed bell curve into account leaving 2,5 % of the values from the both end of the tails out of the analysis. Same rule applies to 99 % adjusted Sharpe when only 0,5 % of the tail values are left out of the analysis. Basically, the latter option takes more outlier values into the analysis.

3.1.5 Sortino ratio

One of the most well known statistics that applies downside deviation is Frank Sortino's Sortino ratio. It employs the numerator of the Sharpe ratio but uses the result of downside deviation as the denominator (Rogers & Van Dyke, 2006: 46-47). It measures how many units of return were received per unit of risk experienced (Riddles, 2001: 96). Or in other words measures the risk-adjusted return of an investment asset, portfolio or strategy. The main advantage Sortino ratio has is that it penalizes only those returns falling below a user-specified target, or required rate of return, while the Sharpe ratio penalizes both upside and downside volatility equally. Sortino ratio can be calculated as follows

$$\text{Sortino ratio} = \frac{R_i - R_f}{TSD} \quad (10)$$

Where TSD is the semi-standard deviation (downside risk), R_i is the funds logarithm return and R_f the risk free return, which is in this case the 1 month euribor rate. TSD can be calculated as follows

$$TSD = \sqrt{\frac{\sum_{i=1}^n (R_i - R_t)^2}{n}} \quad \text{for all } R_i < R_t \quad (11)$$

Where R_i is the portfolio return for each return interval, R_t the target rate of return below which outcomes are considered risky and n the number of observations in the whole distribution. In this case n represents weeks in one year. Only negative deviations are included in the sum of the subtractions. (Pätäri, 2000: 94)

3.1.6 RTASD

Reward-to-Target Absolute Semi-Deviation –ratio captures the security of not achieving the target level. In other words it represents the expected deviation of returns falling below the target level. T ASD is calculated as follows (Pätäri, 2000: 87):

$$TASD = \frac{\sum_{i=1}^n |R_i - R_t|}{n} \quad \text{for all } R_i < R_t \quad (12)$$

Where R_i is the portfolio return for each return interval, R_t the target rate of return below which outcomes are considered risky and n the number of outcomes in the whole distribution.

When using T ASD as risk surrogate RTSAD can be calculated as follows

$$RTSAD = \frac{R_i - R_f}{TASD} \quad (13)$$

3.2 Spearman's rank correlation

Spearman's rank correlation test is a technique used to test the direction and strength of the relationship between two variables. In this study Spearman's rank correlation test is used for measuring the persistence of the funds. The aim is to investigate if high performance rankings in one year forecast high rankings for the next year. This test is calculated for every performance measure.

Spearman's rank correlation coefficient takes values between -1 and 1. Positive correlation means that the ranks of both variables increase together and negative correlation is the opposite. P-value is used to measure random-error in the analysis. The lower the p-value the more reliable is the outcome of the analysis. Usually, the outcome can be seen as true if the p-value is lower than 0,05.

Spearman's rank correlation test can be calculated as follows

$$r = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n^3 - n} \quad (14)$$

where d_i is the difference between rankings, and n is the amount of observations in the test.

3.3 Jobson-Korkie test

Jobson-Korkie test measures the equality of the Sharpe ratios of any two portfolios. In other words it tests if Sharpe ratios are statistically different (Stevenson & Lee, 2005). The null hypothesis is that Sharpe ratios don't differ from each other. However, Jobson and Korkie have noted that the statistical power of the test is low, especially for small sample sizes. Cristoph Memmel (2003) modified the formula for better comparability between two Sharpe ratios. According to Memmel the formula can be written as follows

$$Z_{JK} = \frac{c_{JK}(\hat{\mu})}{\sqrt{\hat{\theta}}} = \frac{\hat{\sigma}_n \hat{\mu}_i - \hat{\sigma}_i \hat{\mu}_n}{\sqrt{\hat{\theta}}} \quad (15)$$

where θ is the asymptotic variance of the expressions in the numerator. Asymptotic variance can be written as follows

$$\theta = \frac{1}{T} \left[2\sigma_i^2 \sigma_n^2 - 2\sigma_i \sigma_n \sigma_{in} + \frac{1}{2} \mu_i^2 \sigma_n^2 + \frac{1}{2} \mu_n^2 \sigma_i^2 - \frac{\mu_i \mu_n}{\sigma_i \sigma_n} \sigma_{in}^2 \right] \quad (16)$$

σ_i = the standard deviation of the portfolio i

σ_n = the standard deviation of the portfolio n

T = number of observations

σ_{in} = covariance of returns

$\hat{\mu}_i$ = the average return of the portfolio i

$\hat{\mu}_n$ = the average return of the portfolio n

In this study we compare funds' and OMXH CAP index's Sharpe ratios and adjusted Sharpe ratios with each other. Positive Z-value indicates that the fund has outperformed market index and negative Z-value indicates that the market has been more lucrative than the fund. However, the significance level tells if the result can be assumed as true.

4. Results

In this section the results of the funds performance measures are presented and analyzed. We compare the fund results to each other and analyze if there is a difference in the funds' performance rankings. Moreover, we analyze if some measures forecast future performance better than others.

4.1 Traditional performance measures

Differences in Sharpe ratios were small (see appendix 4). However, there are some funds that stand out from the group. For example, Celeres HR was the best fund in year 2005, second best in 2006 and it didn't perform badly in 2007, although it didn't reach the top three. Odin Finland was three times in top three and Handelsbanken Kasvu was also two times in top three-list. Noteworthy is that despite the success of Odin Finland during years 2004-2006 it was one of the worst performed funds in 2007. Moreover, Sharpe ratios of the funds tend to reduce towards the end of the inspection period. In 2007 there are 8 funds from 21, which have negative Sharpe ratio. This may derive from financial crisis that slowly started to grow in the late 2007.

As stated in section 3.1.1. negative Sharpe ratios create a problem for comparing funds. In this study Israelsen's suggestions are used in order to get better comparability of Sharpe ratios. However, Israelsen's method didn't turn the Sharpe ratios positive, but enables more trustworthy comparability. The worst fund was SEB Gyllenberg Small Firm.

Beta value, which shows how intensively the fund value follows the market index, was a bit less than one in most cases. This means that every fund follow market index quite accurately, but not fully. For example, if the fund beta is 0,87 and the market index goes up for 1 % the fund value appreciates 0,87 %.

Treynor ratio did revise Sharpe ratio rankings pretty closely, but in most cases it ranked funds same way as downside risk measures (see table 1). Same kinds of results were also achieved with information ratio during years 2005-2007. However, in 2004 the

information ratio ranked funds much more exceptionally than other measures. For example, Odin Finland was ranked just seventh although Sharpe ratio ranked it first and all other measures second. The main difference between information ratio and other measures is that information ratio mainly compares funds' performance to market index's performance. According to information ratio the best fund in 2004 was Seligson Suomi Indeksii. This derives from Seligson's high average excess returns over market index and low standard deviation of those returns.

| Fund ranking in 2004 | Sharpe | IR | Treynor | Adj.Sharpe 95% | Adj.Sharpe 99% | Sortino | RTASD |
|-----------------------------|--------|----|---------|-------------------|-------------------|---------|-------|
| Odin Finland | 1 | 7 | 2 | 2 | 2 | 2 | 2 |
| OP-Suomi Arvo A | 2 | 4 | 1 | 1 | 1 | 1 | 1 |
| FIM Fenno | 3 | 5 | 3 | 3 | 3 | 3 | 3 |
| Carnegie Suomi Osake A | 4 | 3 | 4 | 6 | 9 | 5 | 5 |
| Seligson Suomi Indeksii A | 5 | 1 | 5 | 4 | 6 | 4 | 4 |
| OP-Focus A | 6 | 2 | 6 | 5 | 7 | 6 | 6 |

Table 1. Top six fund ranking according to Sharpe ratio

4.2 Downside risk measures

Downside risk measures revised partly Sharpe ratio rankings (see appendix 2). However, interesting observations were found. Noteworthy is that in 2004 traditional Sharpe ratio ranked Odin Finland as the best fund but all other measures ranked it for second place. The best fund in 2004 was OP-Suomi Arvo, which was ranked second according to Sharpe ratio but all other risk measures ranked it first. One reason for this is that OP-Suomi Arvo had most positive skewness (0.0927). In addition, it had the best average weekly excess return.

However, downside risk measures tend to rank funds similarly. Usually, the differences in rankings are not big. Adjusted Sharpe ratio (99%) provides the biggest differences in rankings. For example, in 2006 it ranked Danske Finland fourth although all other measures ranked it for places nine to twelve. Moreover, in 2007 it ranked Nordea Fennia T third when all other measures ranked it for seventh or eighth. Mainly, this derives from the fact that more outliers are taken into account and normal distribution of excess returns is not taken for granted.

When analysing the overall performance and taking all risk measures into account the best fund was Celeres HR Suomi. It was established in May 2004 and couldn't be taken into analysis for that year. However, in 2005 it was the best fund, in 2006 it was the second best and in 2007 it was ranked fourth. One reason for this is that Celeres HR has had every year one of the lowest weekly downside deviation and its weekly excess returns have also been in a good level every year. Moreover, which adds value to the fund's performance is that it performed very well in rising market but also in downward market.

The best year for all funds was 2005 when weekly average excess returns were at highest and standard deviation and downside deviation at lowest. For this year all performance measures gave higher values than other years.

The worst year was 2007 which can be easily seen from small or, in some cases, negative returns. This year the volatility of the funds was also high and this reflected to performance measures. The best fund in the bearish markets was Alfred Berg Small Cap, which had the best average weekly excess return and lowest downside deviation. Moreover, its beta was also one of the lowest so it didn't follow the bearish market as accurately as other funds. This indicates that fund manager has been very well aware of market conditions at that time. Although, it performed well in bearish markets it was one of the worst funds in bullish markets in 2005.

4.3 Performance persistence

Test results showed that performance measures couldn't indicate next year's fund performance based on last year's performance. There was only one period when almost all performance measures indicated persistence. When analyzed year's 2006 performance based on last year's rankings only traditional Sharpe ratio, information ratio, adjusted Sharpe ratio (95 %) and Sortino ratio gave statistically significant results at 95 % confidence level (see Table 2). Especially, adjusted Sharpe (95 %) and Sortino ratio indicated quite high positive correlation.

One exception was found in 2007 when RTSAD gave statistically significant results at 95 % confidence level for positive correlation between its values in 2006 and 2007 (see appendix 3). However, it's clear that downside risk measures couldn't forecast future performance better than traditional performance measures. Only one year's persistence results don't give enough proves that this pattern would follow itself every year.

| Inspection period 2005-2006 | Sharpe | IR | Treynor | Adj.Sharpe (95 %) | Adj.Sharpe (99%) | Sortino ratio | RTSAD |
|--------------------------------|---------|---------|---------|----------------------|---------------------|------------------|---------|
| Correlation | 0,55844 | 0.57013 | 0.38052 | 0.63506 | 0.38701 | 0.64156 | 0.14935 |
| P-value | 0,0085 | 0.0070 | 0.0888 | 0.0020 | 0.0831 | 0.0017 | 0.5182 |

Table 2. Spearman's rank correlation test results from the period 2005-2006

4.4. Jobson-Korkie test

When analyzing the results of the funds traditional Sharpe ratios against market index's Sharpe ratio, the best fund according to Jobson-Korkie test was Odin Finland in 2004. It performed best against market index reaching the Z-value of 1,72. This result was statistically significant with 90 % confidence level. Hence, an assumption can be made that Odin Finland performed better than market index. Ten other funds got also a positive Z-value, but these results were not statistically significant. Odin Finland was also ranked first according to both adjusted Sharpe ratios. However, these results were not statistically significant and therefore the null hypothesis remains and Odin Finland cannot be regarded of outperforming the market index. Same conclusion can be made for all other results in 2004 (see appendix 5).

In 2005, Celeres HR Suomi reached statistically significant results at 95 % confidence level on traditional Sharpe ratio and adjusted Sharpe ratio (95 %). Moreover, adjusted Sharpe ratio (99%) got statistically significant result at 90 % confidence level. This means that Celeres HR Suomi clearly outperformed the market index according to all three measures. Four other funds reached also positive Z-values, but these results

were not statistically significant. Interesting is that only five funds outperformed the market index in 2005. This year was the best for all funds during the four year inspection period.

In 2007 Carnegie Suomi Osake A reached a statistically significant Z value according to traditional Sharpe ratio. All other Z-values were not statistically significant. In 2006 none of the funds got statistically significant values.

All in all, there were only a couple of funds in the whole inspection period, which can be statistical significantly regarded as outperforming the market index.

5. Summary and conclusions

The aim of this study was to compare rankings given by traditional performance measures and downside risk measures. Three types of traditional performance measures (Sharpe ratio, Treynor ratio and information ratio) and four types of downside risk measures (Adjusted Sharpe ratio 95% and 99%, Sortino ratio and RTSAD) were used to rank 21 Finnish stock funds. Examined time period was four years starting from year 2004 and ending to 2007.

It seems that despite standard deviation based ratios' weaknesses they still give quite truthful image of the portfolio's performance. Downside risk measures did rank the funds a bit differently than Sharpe ratio, but mainly funds' rankings were close to each other. The main result of the study was that downside risk measures didn't rank funds as differently as could have been expected after studying the performance measurement literature. Moreover, results showed that funds' last year rankings didn't forecast next year's rankings. There was only one period when Spearman's rank correlation reached the statistical significance at 95 % confidence level according to four risk measures.

Funds' traditional Sharpe ratios and adjusted Sharpe ratios statistical differences with market index's Sharpe ratios were also measured with Jobson-Korkie test. Only a few times a couple of funds were able to outperform the market index statistical significantly. For example, Celeres HR was the only fund, which statistical significantly outperformed the market index according to all three Sharpe measures.

However, downside risk measures bring valuable information about risks for investors and are a very effective tool for investor wanting to control risk. Especially, the customization feature that downside risk measures have when adjusting the target rate of return to investor specifically, ranks the funds from investor's point of view better than Sharpe ratio. This way funds are being penalized only from returns that fall below investor's target rate of return. Moreover, better understanding of risk is achieved when only returns that are below investors targets are taken into analysis.

The time horizon of this study was a bit short for achieving reliable results. Moreover, the shortage of funds cast a shadow on generalisation of the results. In order to compensate this shortage of observations, weekly information about fund values was used in this study. International studies of fund performance have usually a time frame of at least ten years and over 1000 funds can be taken into analysis.

Interesting further research idea could be to form portfolios based on traditional performance measures and downside risk measures. Then one could compare these different portfolios and analyze, which portfolio strategy gives the best return. Moreover, it would be interesting to see the stock selection of these portfolios.

References

- Alfred Berg Rahastoyhtiö Oy, [Internet document] "*Rahastoesite, Suomeen rekisteröidyt rahastot*" source:
http://www.alfredberg.fi/~media/Files/AM/AMFI/FI/Prospects/koonti_fi%20pdf.ashx
used 13.11.2008
- Ang A, Chen J & Xing Y "*Downside Risk*" *Review of Financial Studies* 19 (2006), 1191-1239.
- Balzer L.A. "*Investment risk: a unified approach to upside and downside returns*" in the book of Sortino Frank A & Satchell Stephen E "*Managing downside risk in financial markets*"; 2001; Butterworth-Heinemann, UK: 113
- Barndorf-Nielsen, Kinnebrock & Shepard; "*Measuring downside risk – realised semivariance*" Economics working paper, Nuffield College, University of Oxford, 2008
- Carnahan Ira; [Internet document] "*Assess Your Risk*", Forbes.com, Money and Investing, 2002. Source: www.forbes.com/forbes/2002/1028/338.html
- Eling Martin & Schuhmacher Frank, "*Does the choice of performance measure influence the evaluation of hedge funds*", *Journal of Banking and Finance* 31 (2007), 2632-2647.
- Elton E.J & Gruber M.J, "*Modern portfolio theory, 1950 to date*", *Journal of Banking & Finance* 21 (1997), 1743-1759
- Elton, Gruber, Brown & Goetzman; "*Modern portfolio theory and investment analysis*"; 7th edition 2007; John Wiley & Sons, Inc.
- Grootveld Henk and Hallerbach Winfried, "*Variance vs downside risk: Is there really that much difference?*", *European Journal of Operational Research* 114, 1999, 304-319

Hill, Griffiths & Judge; “*Undergraduate econometrics*”; 2nd edition, 2001; John Wiley & Sons, Inc

Hull John C.; “*Options, futures and other derivatives*”, 6th edition 2006; Pearson Prentice Hall

Israelsen Craig L.; “*A refinement to the Sharpe ratio and information ratio*”, Journal of asset management, Henry Stewart Publications 2005, 423-427.)

Israelsen Craig L, “*Sharpening the Sharpe ratio*” Financial Planning 2003, Vol. 33 Issue 1, p49

Karttunen Anu; [Internet document] “*Indeksikikkailu kukoistaa*”, Talouselämä.fi, 2004, source: http://www.talouselama.fi/docview.do?f_id=566313, used 13.11.2008

Memmel Christoph, “*Performance Hypothesis Testing with the Sharpe Ratio*” Finance Letters 1 (2003), 21-23

Morningstar laskukaavat, [Internet document] used 13.11.2008, source <http://www.morningstar.fi/aboutus/calculations.asp>

Pätäri Eero; “*Essays on portfolio performance measurement*”; 2000; 143

Riddles Neil; “*A portfolio manager’s view of downside risk*” in the book of Sortino Frank A & Satchell Stephen E; “*Managing downside risk in financial markets*”; 2001; Butterworth-Heinemann, UK

Rogers Douglas S. & Van Dyke Christopher J; “*Measuring the Volatility of Hedge Fund Returns*”; The Journal of Wealth Management, 2006; 45-53

Rom Brian M. & Ferguson Kathleen W. “*Post-Modern Portfolio Theory Comes of Age*”, Journal of Investing 1 (1994), 349-364 a.

Rom Brian M & Ferguson Kathleen W; “*A software developer’s view: using Post-Modern Portfolio Theory to improve investment performance measurement*” in the book of Sortino Frank A & Satchell Stephen E; “*Managing downside risk in financial markets*”; 2001; Butterworth-Heinemann, UK b.

Sortino Frank A; “*From alpha to omega*” in the book of Sortino Frank A & Satchell Stephen E; “*Managing downside risk in financial markets*”; 2001; Butterworth-Heinemann, UK

Stevenson Simon & Lee Stephen, “*Testing the Statistical Significance of Sector & Regional Diversification*” *Journal of Property Investment and Finance* 23 (2005), 394-411

Appendix 1: Funds

Funds being used in this study

| | |
|-------------------------------------|--|
| Aktia Capital A | Aktia fund management company |
| Alfred Berg Finland A | Alfred Berg fund management company |
| Alfred Berg Small Cap Finland A | Alfred Berg fund management company |
| Carnegie Suomi Osake A | Carnegie fund management company |
| Celeres HR Suomi K | Aventum fund management company |
| Danske Finland K | Danske Capital |
| Danske Finland Yhteisöosake Kasvu A | Danske Capital |
| Evli Select A | Evli fund management company |
| FIM Fenno | FIM fund management company |
| Fondita Equity Spice A | Fondita fund management company |
| Handelsbanken Osake | Handelsbanken fund management company |
| Nordea Fennia K | Nordea fund management company |
| Nordea Pro Suomi K | Nordea fund management company |
| Odin Finland | Odin fund management company |
| OP-Delta A | OP fund management company |
| OP-Focus A | OP fund management company |
| OP-Suomi Arvo A | OP fund management company |
| SEB Gyllenberg Finlandia A | SEB Gyllenberg fund management company |
| SEB Gyllenberg Small Firm A | SEB Gyllenberg fund management company |
| Seligson Suomi Indeksi A | Seligson & Co |
| Säästöpankki Kotimaa A | SP fund management company |

Appendix 2: Fund rankings

| Fund rankings 2004 | Sharpe | IR | Treynor | Adj.Sharpe 95% | Adj.Sharpe 99% | Sortino | RTASD |
|-------------------------------|--------|----|---------|-------------------|-------------------|---------|-------|
| Aktia Capital A | 14 | 16 | 12 | 15 | 18 | 15 | 14 |
| Alfred Berg Finland | 11 | 10 | 15 | 11 | 13 | 11 | 15 |
| Alfred Berg Small Cap | 12 | 12 | 7 | 12 | 15 | 12 | 12 |
| Carnegie Suomi Osake A | 4 | 3 | 4 | 6 | 9 | 5 | 4 |
| Danske Finland T | 20 | 20 | 20 | 19 | 12 | 20 | 19 |
| Danske Finland Yhteisöosake T | 17 | 19 | 18 | 18 | 10 | 18 | 17 |
| Evli Select A | 18 | 17 | 19 | 20 | 20 | 19 | 18 |
| FIM Fenno | 3 | 5 | 3 | 3 | 3 | 3 | 3 |
| Fondita Equity Spice A | 13 | 13 | 14 | 14 | 16 | 13 | 13 |
| Handelsbanken Osake | 9 | 9 | 10 | 9 | 11 | 9 | 9 |
| Nordea Fennia T | 7 | 8 | 9 | 8 | 5 | 7 | 8 |
| Nordea Pro Suomi T | 10 | 11 | 11 | 10 | 4 | 10 | 11 |
| Odin Finland | 1 | 7 | 2 | 2 | 2 | 2 | 2 |
| OP-Delta A | 8 | 6 | 8 | 7 | 8 | 8 | 7 |
| OP-Focus A | 6 | 2 | 6 | 5 | 7 | 6 | 6 |
| OP-Suomi Arvo A | 2 | 4 | 1 | 1 | 1 | 1 | 1 |
| SEB Gyllenberg Finlandia A | 16 | 15 | 16 | 13 | 14 | 14 | 16 |
| SEB Gyllenberg Small Firm A | 19 | 18 | 17 | 16 | 17 | 17 | 20 |
| Seligson Suomi Indeksi A | 5 | 1 | 5 | 4 | 6 | 4 | 5 |
| Säästöpankki Kotimaa A | 15 | 14 | 13 | 17 | 19 | 16 | 10 |

| Fund rankings 2005 | Sharpe | IR | Treynor | Adj.Sharpe 95% | Adj. Sharpe 99% | Sortino | RTSAD |
|-------------------------------|--------|----|---------|-------------------|--------------------|---------|-------|
| Aktia Capital A | 11 | 11 | 7 | 14 | 15 | 11 | 8 |
| Alfred Berg Finland | 15 | 14 | 16 | 11 | 11 | 13 | 16 |
| Alfred Berg Small Cap | 20 | 15 | 18 | 18 | 18 | 19 | 20 |
| Carnegie Suomi Osake A | 4 | 4 | 6 | 4 | 7 | 4 | 4 |
| Celeres HR Suomi K | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Danske Finland T | 17 | 20 | 19 | 17 | 8 | 17 | 15 |
| Danske Finland Yhteisöosake T | 16 | 19 | 15 | 16 | 9 | 16 | 14 |
| Evli Select A | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| FIM Fenno | 13 | 9 | 14 | 12 | 13 | 12 | 13 |
| Fondita Equity Spice A | 6 | 6 | 4 | 7 | 10 | 7 | 7 |
| Handelsbanken Osake | 3 | 3 | 3 | 3 | 4 | 3 | 3 |
| Nordea Fennia T | 9 | 17 | 11 | 6 | 6 | 8 | 12 |
| Nordea Pro Suomi T | 18 | 16 | 17 | 19 | 3 | 18 | 18 |
| Odin Finland | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| OP-Delta A | 7 | 8 | 9 | 9 | 17 | 6 | 6 |
| OP-Focus A | 10 | 10 | 13 | 10 | 16 | 10 | 9 |
| OP-Suomi Arvo A | 14 | 13 | 10 | 13 | 14 | 14 | 17 |
| SEB Gyllenberg Finlandia A | 19 | 18 | 20 | 20 | 20 | 20 | 19 |
| SEB Gyllenberg Small Firm A | 12 | 7 | 8 | 15 | 19 | 15 | 11 |
| Seligson Suomi Indeksi A | 8 | 12 | 12 | 8 | 12 | 9 | 10 |
| Säästöpankki Kotimaa A | 21 | 21 | 21 | 21 | 21 | 21 | 21 |

| Fund rankings 2006 | Sharpe | IR | Treynor | Adj.Sharpe 95% | Adj. Sharpe 99% | Sortino | RTSAD |
|-------------------------------|---------------|-----------|----------------|---------------------------|----------------------------|----------------|--------------|
| Aktia Capital A | 18 | 18 | 18 | 18 | 19 | 18 | 18 |
| Alfred Berg Finland | 8 | 12 | 10 | 8 | 11 | 7 | 9 |
| Alfred Berg Small Cap | 19 | 14 | 19 | 19 | 18 | 19 | 20 |
| Carnegie Suomi Osake A | 4 | 4 | 4 | 4 | 8 | 4 | 3 |
| Celeres HR Suomi K | 2 | 3 | 2 | 2 | 1 | 2 | 2 |
| Danske Finland T | 11 | 11 | 9 | 10 | 4 | 10 | 11 |
| Danske Finland Yhteisöosake T | 10 | 10 | 8 | 7 | 2 | 9 | 10 |
| Evli Select A | 16 | 15 | 16 | 17 | 17 | 17 | 16 |
| FIM Fenno | 7 | 5 | 6 | 9 | 12 | 8 | 7 |
| Fondita Equity Spice A | 14 | 8 | 12 | 13 | 14 | 13 | 13 |
| Handelsbanken Osake | 3 | 2 | 3 | 3 | 6 | 3 | 4 |
| Nordea Fennia T | 13 | 19 | 13 | 11 | 7 | 11 | 14 |
| Nordea Pro Suomi T | 17 | 20 | 17 | 15 | 5 | 16 | 17 |
| Odin Finland | 1 | 1 | 1 | 1 | 3 | 1 | 1 |
| OP-Delta A | 5 | 7 | 5 | 5 | 9 | 5 | 5 |
| OP-Focus A | 12 | 9 | 11 | 12 | 13 | 12 | 8 |
| OP-Suomi Arvo A | 20 | 17 | 20 | 20 | 21 | 20 | 19 |
| SEB Gyllenberg Finlandia A | 9 | 13 | 15 | 14 | 15 | 14 | 15 |
| SEB Gyllenberg Small Firm A | 21 | 21 | 21 | 21 | 20 | 21 | 21 |
| Seligson Suomi Indeksi A | 6 | 6 | 7 | 6 | 10 | 6 | 6 |
| Säästöpankki Kotimaa A | 15 | 16 | 14 | 16 | 16 | 15 | 12 |

| Fund rankings 2007 | Sharpe | IR | Treynor | Adj.Sharpe 95% | Adj. Sharpe 99% | Sortino | RTSAD |
|-------------------------------|---------------|-----------|----------------|---------------------------|----------------------------|----------------|--------------|
| Aktia Capital A | 16 | 18 | 17 | 17 | 18 | 17 | 18 |
| Alfred Berg Finland | 8 | 7 | 8 | 8 | 9 | 8 | 7 |
| Alfred Berg Small Cap | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Carnegie Suomi Osake A | 2 | 1 | 2 | 2 | 2 | 2 | 2 |
| Celeres HR Suomi K | 4 | 5 | 4 | 4 | 6 | 4 | 4 |
| Danske Finland T | 18 | 17 | 18 | 18 | 12 | 18 | 17 |
| Danske Finland Yhteisöosake T | 15 | 15 | 16 | 16 | 10 | 16 | 16 |
| Evli Select A | 5 | 6 | 5 | 5 | 7 | 5 | 5 |
| FIM Fenno | 14 | 16 | 15 | 15 | 17 | 15 | 15 |
| Fondita Equity Spice A | 17 | 14 | 13 | 13 | 16 | 13 | 13 |
| Handelsbanken Osake | 3 | 3 | 3 | 3 | 4 | 3 | 3 |
| Nordea Fennia T | 7 | 9 | 7 | 7 | 3 | 7 | 8 |
| Nordea Pro Suomi T | 13 | 13 | 14 | 14 | 5 | 14 | 14 |
| Odin Finland | 20 | 20 | 19 | 19 | 19 | 19 | 19 |
| OP-Delta A | 9 | 8 | 9 | 9 | 11 | 9 | 9 |
| OP-Focus A | 6 | 4 | 6 | 6 | 8 | 6 | 6 |
| OP-Suomi Arvo A | 12 | 12 | 12 | 12 | 15 | 12 | 12 |
| SEB Gyllenberg Finlandia A | 10 | 10 | 10 | 10 | 13 | 10 | 10 |
| SEB Gyllenberg Small Firm A | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| Seligson Suomi Indeksi A | 11 | 11 | 11 | 11 | 14 | 11 | 11 |
| Säästöpankki Kotimaa A | 19 | 19 | 20 | 20 | 20 | 20 | 20 |

Appendix 3: Spearman's rank correlation test results

| Inspection period 2004-2005 | Sharpe | IR | Treynor | Adjusted Sharpe 95% | Adjusted Sharpe 99% | Sortino ratio | RTSAD |
|--------------------------------|---------|---------|---------|------------------------|------------------------|------------------|---------|
| correlation | 0.38195 | 0.35639 | 0.25714 | 0.41805 | 0.13383 | 0.43158 | 0.30827 |
| p-value | 0.0965 | 0.1230 | 0.2738 | 0.0666 | 0.5738 | 0.0574 | 0.1861 |

| Inspection period 2005-2006 | Sharpe | IR | Treynor | Adj.Sharpe (95 %) | Adj.Sharpe (99%) | Sortino ratio | RTSAD |
|--------------------------------|---------|---------|---------|----------------------|---------------------|------------------|---------|
| correlation | 0,55844 | 0.57013 | 0.38052 | 0.63506 | 0.38701 | 0.64156 | 0.14935 |
| p-value | 0,0085 | 0.0070 | 0.0888 | 0.0020 | 0.0831 | 0.0017 | 0.5182 |

| Inspection period 2006-2007 | Sharpe | IR | Treynor | Adjusted Sharpe 95% | Adjusted Sharpe 99% | Sortino ratio | RTSAD |
|--------------------------------|---------|---------|---------|------------------------|------------------------|------------------|---------|
| correlation | 0.25974 | 0.29481 | 0.19740 | 0.23896 | 0.09481 | 0.24286 | 0.57532 |
| p-value | 0.2555 | 0.1945 | 0.3911 | 0.2968 | 0.6827 | 0.2888 | 0.0064 |

Appendix 4: Fund values

| Funds' key ratios 2004 | Excess return p.a | Sharpe | IR | Beta | Treynor | Adj.Sharpe 95% | Adj.Sharpe 99% | Sortino | RTASD | Skewness | Excess return* | Standard deviation** | Downside deviation* |
|-------------------------------|-------------------|--------|--------|------|---------|----------------|----------------|---------|--------|----------|----------------|----------------------|---------------------|
| Aktia Capital A | 10.61 % | 0.1438 | -0.011 | 0.68 | 0.0030 | 0.1083 | 0.0908 | 0.1104 | 0.4586 | -1.3540 | 0.2040 % | 1.42 % | 1.057 % |
| Alfred Berg Finland | 13.21 % | 0.1554 | 0.040 | 0.93 | 0.0027 | 0.1441 | 0.1475 | 0.1399 | 0.4481 | -0.4168 | 0.2541 % | 1.64 % | 1.098 % |
| Alfred Berg Small Cap | 13.36 % | 0.1501 | 0.028 | 0.7 | 0.0037 | 0.1313 | 0.1175 | 0.1376 | 0.4743 | -0.4431 | 0.2570 % | 1.71 % | 1.158 % |
| Carnegie Suomi Osake A | 18.65 % | 0.2470 | 0.214 | 0.9 | 0.0040 | 0.2175 | 0.2106 | 0.2244 | 0.8223 | -0.6142 | 0.3587 % | 1.45 % | 0.941 % |
| Danske Finland T | 8.86 % | 0.0971 | -0.049 | 1.03 | 0.0017 | 0.0715 | 0.1772 | 0.0742 | 0.3055 | -1.4634 | 0.1704 % | 1.76 % | 1.351 % |
| Danske Finland Yhteisöosake T | 9.89 % | 0.1088 | -0.029 | 1.04 | 0.0018 | 0.0806 | 0.1897 | 0.0812 | 0.3424 | -1.4736 | 0.1902 % | 1.75 % | 1.340 % |
| Evli Select A | 9.63 % | 0.1003 | -0.028 | 1.02 | 0.0018 | 0.0665 | 0.0512 | 0.0751 | 0.3331 | -2.3870 | 0.1851 % | 1.85 % | 1.490 % |
| FIM Fenno | 22.22 % | 0.2508 | 0.184 | 0.88 | 0.0049 | 0.2551 | 0.2677 | 0.2551 | 0.8629 | 0.0461 | 0.4274 % | 1.70 % | 0.986 % |
| Fondita Equity Spice A | 12.80 % | 0.1476 | 0.028 | 0.89 | 0.0028 | 0.1164 | 0.1028 | 0.1233 | 0.4660 | -1.1577 | 0.2462 % | 1.67 % | 1.207 % |
| Handelsbanken Osake | 15.85 % | 0.1996 | 0.140 | 0.96 | 0.0032 | 0.1800 | 0.1794 | 0.2025 | 0.6325 | -0.5317 | 0.3048 % | 1.53 % | 1.001 % |
| Nordea Fennia T | 15.30 % | 0.2224 | 0.146 | 0.85 | 0.0035 | 0.2067 | 0.2332 | 0.2166 | 0.6991 | -0.4324 | 0.2942 % | 1.32 % | 0.842 % |
| Nordea Pro Suomi T | 12.68 % | 0.1661 | 0.028 | 0.79 | 0.0031 | 0.1442 | 0.2543 | 0.1531 | 0.5000 | -0.7081 | 0.2438 % | 1.47 % | 1.012 % |
| Odin Finland | 18.33 % | 0.3047 | 0.165 | 0.65 | 0.0054 | 0.2836 | 0.2895 | 0.3024 | 1.1087 | -0.3887 | 0.3525 % | 1.16 % | 0.686 % |
| OMXH CAP_PI | 11.26 % | 0.1531 | - | 1 | - | 0.1428 | 0.1494 | - | - | -0.4328 | 0.2165 % | 1.41 % | |
| OP-Delta A | 17.12 % | 0.2216 | 0.177 | 0.93 | 0.0035 | 0.2071 | 0.2129 | 0.2058 | 0.7005 | -0.3802 | 0.3293 % | 1.49 % | 0.942 % |
| OP-Focus A | 18.63 % | 0.2352 | 0.221 | 0.96 | 0.0037 | 0.2205 | 0.2258 | 0.2205 | 0.7695 | -0.3551 | 0.3582 % | 1.52 % | 0.956 % |
| OP-Suomi Arvo A | 23.02 % | 0.2939 | 0.188 | 0.69 | 0.0064 | 0.3006 | 0.3120 | 0.3664 | 1.1257 | 0.0927 | 0.4428 % | 1.51 % | 0.821 % |
| SEB Gyllenberg Finlandia A | 11.78 % | 0.1354 | 0.011 | 0.98 | 0.0023 | 0.1235 | 0.1246 | 0.1148 | 0.3958 | -0.4922 | 0.2265 % | 1.67 % | 1.160 % |
| SEB Gyllenberg Small Firm A | 9.24 % | 0.0984 | -0.028 | 0.83 | 0.0021 | 0.0967 | 0.0948 | 0.0966 | 0.2895 | -0.0018 | 0.1777 % | 1.81 % | 1.197 % |
| Seligson Suomi Indeksi A | 19.52 % | 0.2412 | 0.236 | 0.97 | 0.0039 | 0.2227 | 0.2265 | 0.2386 | 0.7881 | -0.4349 | 0.3753 % | 1.56 % | 0.976 % |
| Säästöpankki Kotimaa A | 12.28 % | 0.1389 | 0.016 | 0.84 | 0.0028 | 0.0870 | 0.0633 | 0.0991 | 0.5170 | -2.8627 | 0.2361 % | 1.70 % | 1.362 % |

*weekly average

**average of weekly excess returns

| Funds' key ratios 2005 | Excess return p.a | Sharpe | IR | Beta | Treynor | Adj.Sharpe 95% | Adj. Sharpe 99% | Sortino | RTASD | Skewness | Excess return* | Standard deviation** | Downside deviation* |
|-------------------------------|-------------------|--------|---------|------|---------|----------------|-----------------|---------|--------|----------|----------------|----------------------|---------------------|
| Aktia Capital A | 22.05 % | 0.2766 | -0.0468 | 0.77 | 0.0055 | 0.2071 | 0.1784 | 0.3884 | 1.1130 | -1.5428 | 0.4241 % | 1.53 % | 1.092 % |
| Alfred Berg Finland | 20.25 % | 0.2469 | -0.1127 | 0.90 | 0.0043 | 0.2119 | 0.1934 | 0.3767 | 0.8747 | -0.6245 | 0.3894 % | 1.57 % | 1.034 % |
| Alfred Berg Small Cap | 17.50 % | 0.1982 | -0.1130 | 0.80 | 0.0042 | 0.1699 | 0.1683 | 0.2840 | 0.6615 | -0.8742 | 0.3366 % | 1.70 % | 1.185 % |
| Carnegie Suomi Osake A | 25.85 % | 0.3383 | 0.0468 | 0.88 | 0.0056 | 0.2545 | 0.2113 | 0.5035 | 1.4322 | -1.3237 | 0.4971 % | 1.47 % | 0.987 % |
| Celeres HR Suomi K | 33.20 % | 0.4609 | 0.2704 | 0.81 | 0.0078 | 0.3848 | 0.3266 | 0.8413 | 2.3457 | -0.5882 | 0.6385 % | 1.39 % | 0.759 % |
| Danske Finland T | 18.95 % | 0.2376 | -0.1435 | 0.87 | 0.0042 | 0.1892 | 0.2048 | 0.3431 | 0.8881 | -1.0505 | 0.3645 % | 1.53 % | 1.062 % |
| Danske Finland Yhteisöosake T | 19.44 % | 0.2450 | -0.1318 | 0.87 | 0.0043 | 0.1916 | 0.2031 | 0.3510 | 0.9244 | -1.1617 | 0.3739 % | 1.53 % | 1.065 % |
| Evli Select A | 25.95 % | 0.3176 | 0.0338 | 0.87 | 0.0057 | 0.2479 | 0.2203 | 0.4688 | 1.2444 | -1.2786 | 0.4990 % | 1.57 % | 1.064 % |
| FIM Fenno | 23.02 % | 0.2562 | -0.0345 | 0.97 | 0.0045 | 0.2114 | 0.1897 | 0.3844 | 0.9317 | -0.8510 | 0.4427 % | 1.73 % | 1.151 % |
| Fondita Equity Spice A | 25.94 % | 0.3026 | 0.0261 | 0.83 | 0.0060 | 0.2289 | 0.1967 | 0.4398 | 1.1604 | -1.4293 | 0.4989 % | 1.65 % | 1.134 % |
| Handelsbanken Osake | 29.46 % | 0.3662 | 0.1905 | 0.94 | 0.0060 | 0.2726 | 0.2232 | 0.5458 | 1.6163 | -1.3570 | 0.5666 % | 1.55 % | 1.038 % |
| Nordea Fennia T | 21.10 % | 0.2843 | -0.1211 | 0.86 | 0.0047 | 0.2326 | 0.2180 | 0.4340 | 1.0477 | -0.8428 | 0.4057 % | 1.43 % | 0.935 % |
| Nordea Pro Suomi T | 18.63 % | 0.2215 | -0.1154 | 0.84 | 0.0043 | 0.1660 | 0.2283 | 0.3021 | 0.8008 | -1.4886 | 0.3582 % | 1.62 % | 1.186 % |
| Odin Finland | 33.60 % | 0.4128 | 0.2332 | 0.89 | 0.0073 | 0.3114 | 0.2620 | 0.6378 | 1.8735 | -1.3605 | 0.6462 % | 1.57 % | 1.013 % |
| OMXH CAP_PI | 24.51 % | 0.3090 | - | 1.00 | - | 0.2518 | 0.2198 | - | - | -0.8526 | 0.4714 % | 1.53 % | |
| OP-Delta A | 24.28 % | 0.3025 | -0.0091 | 0.94 | 0.0050 | 0.2193 | 0.1726 | 0.4474 | 1.2295 | -1.4136 | 0.4669 % | 1.54 % | 1.044 % |
| OP-Focus A | 23.15 % | 0.2779 | -0.0466 | 0.96 | 0.0046 | 0.2166 | 0.1762 | 0.4224 | 1.1051 | -0.9305 | 0.4452 % | 1.60 % | 1.054 % |
| OP-Suomi Arvo A | 21.33 % | 0.2487 | -0.0579 | 0.83 | 0.0050 | 0.2082 | 0.1883 | 0.3740 | 0.8629 | -0.7688 | 0.4102 % | 1.65 % | 1.097 % |
| SEB Gyllenberg Finlandia A | 18.90 % | 0.2034 | -0.1300 | 1.02 | 0.0036 | 0.1416 | 0.1162 | 0.2623 | 0.7769 | -2.1444 | 0.3634 % | 1.79 % | 1.386 % |
| SEB Gyllenberg Small Firm A | 25.38 % | 0.2706 | 0.0153 | 0.92 | 0.0053 | 0.1941 | 0.1648 | 0.3656 | 1.0895 | -1.9659 | 0.4881 % | 1.80 % | 1.335 % |
| Seligson Suomi Indeksi A | 23.12 % | 0.2853 | -0.0557 | 0.95 | 0.0047 | 0.2248 | 0.1914 | 0.4252 | 1.1002 | -1.0237 | 0.4445 % | 1.56 % | 1.045 % |
| Säästöpankki Kotimaa A | 14.27 % | 0.1675 | -0.1776 | 0.80 | 0.0034 | 0.1073 | 0.0784 | 0.2136 | 0.6588 | -2.4505 | 0.2744 % | 1.64 % | 1.285 % |

| Funds' key ratios 2006 | Excess return p.a | Sharpe | IR | Beta | Treynor | Adj. Sharpe 95% | Adj. Sharpe 99% | Sortino | RTASD | Skewness | Excess return* | Standard deviation** | Downside deviation* |
|-------------------------------|-------------------|--------|---------|------|---------|-----------------|-----------------|---------|--------|----------|----------------|----------------------|---------------------|
| Aktia Capital A | 14.03 % | 0.1189 | -0.0895 | 0.87 | 0.0031 | 0.0915 | 0.0827 | 0.1525 | 0.3886 | -1.4898 | 0.2698 % | 2.27 % | 1.769 % |
| Alfred Berg Finland | 18.74 % | 0.1639 | -0.0192 | 0.92 | 0.0039 | 0.1296 | 0.1157 | 0.2237 | 0.5425 | -1.1841 | 0.3603 % | 2.20 % | 1.610 % |
| Alfred Berg Small Cap | 14.59 % | 0.1131 | -0.0668 | 0.91 | 0.0031 | 0.0893 | 0.0846 | 0.1439 | 0.3553 | -1.4363 | 0.2805 % | 2.48 % | 1.949 % |
| Carnegie Suomi Osake A | 22.89 % | 0.1893 | 0.0820 | 0.97 | 0.0045 | 0.1433 | 0.1280 | 0.2503 | 0.7146 | -1.6047 | 0.4401 % | 2.32 % | 1.758 % |
| Celeres HR Suomi K | 23.52 % | 0.2114 | 0.0879 | 0.87 | 0.0052 | 0.1623 | 0.1465 | 0.2844 | 0.7478 | -1.5065 | 0.4522 % | 2.14 % | 1.590 % |
| Danske Finland T | 19.46 % | 0.1549 | -0.0001 | 0.93 | 0.0040 | 0.1228 | 0.1376 | 0.2075 | 0.5047 | -1.2514 | 0.3743 % | 2.42 % | 1.804 % |
| Danske Finland Yhteisöosake T | 20.04 % | 0.1632 | 0.0093 | 0.91 | 0.0042 | 0.1300 | 0.1455 | 0.2200 | 0.5373 | -1.2329 | 0.3853 % | 2.36 % | 1.751 % |
| Evli Select A | 15.36 % | 0.1330 | -0.0722 | 0.87 | 0.0034 | 0.0993 | 0.0853 | 0.1725 | 0.4602 | -1.5660 | 0.2954 % | 2.22 % | 1.713 % |
| FIM Fenno | 24.44 % | 0.1670 | 0.0674 | 1.09 | 0.0043 | 0.1275 | 0.1128 | 0.2220 | 0.5937 | -1.4738 | 0.4700 % | 2.81 % | 2.117 % |
| Fondita Equity Spice A | 20.51 % | 0.1443 | 0.0154 | 1.07 | 0.0037 | 0.1120 | 0.1020 | 0.1891 | 0.4848 | -1.4364 | 0.3944 % | 2.73 % | 2.086 % |
| Handelsbanken Osake | 23.46 % | 0.1909 | 0.0987 | 1.00 | 0.0045 | 0.1487 | 0.1356 | 0.2571 | 0.6651 | -1.4055 | 0.4512 % | 2.36 % | 1.755 % |
| Nordea Fennia T | 16.03 % | 0.1483 | -0.0944 | 0.88 | 0.0035 | 0.1190 | 0.1296 | 0.2025 | 0.4848 | -1.1263 | 0.3083 % | 2.08 % | 1.522 % |
| Nordea Pro Suomi T | 14.48 % | 0.1303 | -0.1001 | 0.86 | 0.0032 | 0.1061 | 0.1362 | 0.1754 | 0.4127 | -1.0847 | 0.2784 % | 2.14 % | 1.587 % |
| Odin Finland | 29.38 % | 0.2193 | 0.1631 | 1.02 | 0.0055 | 0.1630 | 0.1427 | 0.2891 | 0.8519 | -1.7097 | 0.5650 % | 2.58 % | 1.954 % |
| OMXH CAP_PI | 19.46 % | 0.1700 | - | 1.00 | - | 0.1299 | 0.1118 | - | - | -1.3363 | 0.3743 % | 2.20 % | |
| OP-Delta A | 22.19 % | 0.1819 | 0.0628 | 0.96 | 0.0044 | 0.1401 | 0.1262 | 0.2424 | 0.6456 | -1.4690 | 0.4268 % | 2.35 % | 1.761 % |
| OP-Focus A | 19.95 % | 0.1548 | 0.0097 | 1.02 | 0.0038 | 0.1161 | 0.1029 | 0.2000 | 0.5522 | -1.6610 | 0.3837 % | 2.48 % | 1.919 % |
| OP-Suomi Arvo A | 13.25 % | 0.1092 | -0.0894 | 0.86 | 0.0030 | 0.0802 | 0.0689 | 0.1386 | 0.3604 | -1.7401 | 0.2549 % | 2.33 % | 1.839 % |
| SEB Gyllenberg Finlandia A | 17.79 % | 0.1639 | -0.0351 | 0.99 | 0.0034 | 0.1105 | 0.0997 | 0.1872 | 0.4778 | -1.3429 | 0.3420 % | 2.42 % | 1.827 % |
| SEB Gyllenberg Small Firm A | 12.69 % | 0.1033 | -0.1053 | 0.90 | 0.0027 | 0.0794 | 0.0709 | 0.1326 | 0.3295 | -1.4473 | 0.2440 % | 2.36 % | 1.840 % |
| Seligson Suomi Indeksi A | 22.31 % | 0.1799 | 0.0655 | 0.99 | 0.0043 | 0.1395 | 0.1251 | 0.2419 | 0.6349 | -1.3751 | 0.4291 % | 2.39 % | 1.774 % |
| Säästöpankki Kotimaa A | 15.23 % | 0.1394 | -0.0877 | 0.85 | 0.0035 | 0.1026 | 0.0870 | 0.1790 | 0.4866 | -1.6515 | 0.2930 % | 2.10 % | 1.636 % |

| Funds' key ratios 2007 | Excess return p.a | Sharpe | IR | Beta | Treynor | Adj.Sharpe 95% | Adj. Sharpe 99% | Sortino | RTASD | Skewness | Excess return* | Standard deviation** | Downside deviation* |
|-------------------------------|-------------------|-----------|---------|------|---------|----------------|-----------------|---------|---------|----------|----------------|----------------------|---------------------|
| Aktia Capital A | -3.44 % | -1,64E-05 | -0.0434 | 0.96 | -0.0007 | -0.0232 | -0.0231 | -0.0330 | -0.0675 | -0.7914 | -0.0661 % | 2.48 % | 2.001 % |
| Alfred Berg Finland | 1.93 % | 1,64E-02 | 0.0816 | 0.91 | 0.0004 | 0.0138 | 0.0133 | 0.0209 | 0.0442 | -0.9253 | 0.0371 % | 2.26 % | 1.779 % |
| Alfred Berg Small Cap | 9.00 % | 7,82E-02 | 0.1396 | 0.76 | 0.0023 | 0.0686 | 0.0674 | 0.1067 | 0.2257 | -0.6840 | 0.1731 % | 2.22 % | 1.623 % |
| Carnegie Suomi Osake A | 8.62 % | 6,86E-02 | 0.2397 | 0.97 | 0.0017 | 0.0608 | 0.0624 | 0.0911 | 0.1848 | -0.7148 | 0.1657 % | 2.42 % | 1.819 % |
| Celeres HR Suomi K | 3.52 % | 3,12E-02 | 0.1017 | 0.85 | 0.0008 | 0.0283 | 0.0291 | 0.0410 | 0.0810 | -0.5663 | 0.0677 % | 2.17 % | 1.653 % |
| Danske Finland T | -3.50 % | -1,66E-05 | -0.0395 | 0.93 | -0.0007 | -0.0248 | 0.0110 | -0.0348 | -0.0660 | -0.5316 | -0.0673 % | 2.47 % | 1.937 % |
| Danske Finland Yhteisöosake T | -3.23 % | -1,52E-05 | -0.0355 | 0.91 | -0.0007 | -0.0230 | 0.0131 | -0.0323 | -0.0621 | -0.6038 | -0.0622 % | 2.44 % | 1.922 % |
| Evli Select A | 3.39 % | 2,78E-02 | 0.0901 | 0.91 | 0.0007 | 0.0231 | 0.0222 | 0.0350 | 0.0765 | -1.0460 | 0.0652 % | 2.34 % | 1.863 % |
| FIM Fenno | -3.13 % | -1,50E-05 | -0.0375 | 0.96 | -0.0006 | -0.0207 | -0.0201 | -0.0302 | -0.0604 | -0.8456 | -0.0603 % | 2.49 % | 1.995 % |
| Fondita Equity Spice A | -2.96 % | -1,66E-05 | -0.0250 | 1.08 | -0.0005 | -0.0173 | -0.0174 | -0.0248 | -0.0489 | -0.6757 | -0.0569 % | 2.92 % | 2.298 % |
| Handelsbanken Osake | 4.62 % | 3,56E-02 | 0.1350 | 1.00 | 0.0009 | 0.0318 | 0.0325 | 0.0464 | 0.0928 | -0.6500 | 0.0889 % | 2.50 % | 1.915 % |
| Nordea Fennia T | 1.84 % | 1,66E-02 | 0.0752 | 0.86 | 0.0004 | 0.0151 | 0.0395 | 0.0217 | 0.0417 | -0.5558 | 0.0354 % | 2.14 % | 1.631 % |
| Nordea Pro Suomi T | -2.44 % | -1,06E-05 | -0.0235 | 0.85 | -0.0006 | -0.0185 | 0.0298 | -0.0264 | -0.0507 | -0.6382 | -0.0469 % | 2.26 % | 1.778 % |
| Odin Finland | -5.49 % | -2,63E-05 | -0.0896 | 0.98 | -0.0011 | -0.0353 | -0.0336 | -0.0520 | -0.1051 | -0.9792 | -0.1055 % | 2.49 % | 2.027 % |
| OMXH CAP_PI | -1.10 % | -9,11E-03 | - | 1.00 | - | -0.0078 | -0.0076 | - | - | -0.8216 | -0.0211 % | 2.31 % | |
| OP-Delta A | 1.75 % | 1,41E-02 | 0.0774 | 0.97 | 0.0003 | 0.0125 | 0.0125 | 0.0183 | 0.0361 | -0.6559 | 0.0337 % | 2.39 % | 1.846 % |
| OP-Focus A | 2.82 % | 2,37E-02 | 0.1082 | 0.93 | 0.0006 | 0.0212 | 0.0211 | 0.0310 | 0.0617 | -0.5796 | 0.0543 % | 2.29 % | 1.753 % |
| OP-Suomi Arvo A | -1.66 % | -7,63E-06 | -0.0088 | 0.88 | -0.0004 | -0.0106 | -0.0097 | -0.0163 | -0.0368 | -1.2040 | -0.0319 % | 2.39 % | 1.951 % |
| SEB Gyllenberg Finlandia A | 1.30 % | 1,04E-02 | 0.0521 | 0.95 | 0.0003 | 0.0094 | 0.0097 | 0.0135 | 0.0260 | -0.5732 | 0.0250 % | 2.41 % | 1.854 % |
| SEB Gyllenberg Small Firm A | -8.83 % | -4,36E-05 | -0.1093 | 0.93 | -0.0018 | -0.0542 | -0.0505 | -0.0794 | -0.1633 | -1.0391 | -0.1699 % | 2.57 % | 2.138 % |
| Seligson Suomi Indeksi A | -0.10 % | -4,93E-07 | 0.0247 | 0.99 | 0.0000 | -0.0007 | -0.0007 | -0.0011 | -0.0021 | -0.6055 | -0.0020 % | 2.45 % | 1.909 % |
| Säästöpankki Kotimaa A | -5.34 % | -2,05E-05 | -0.0785 | 0.76 | -0.0014 | -0.0426 | -0.0408 | -0.0620 | -0.1269 | -1.0507 | -0.1027 % | 1.99 % | 1.657 % |

Appendix 5: Jobson-Korkie test results

| YEAR 2004 | | | | | | | | |
|----------------------------------|--------------------|-----------------------|----------------------------------|----------------|-----------------------|----------------------------------|----------------|-----------------------|
| SHARPE | OMXH CAP- PI | Significance level | Adj.Sharpe 95 % | OMXH CAP_PI | Significance level | Adj.Sharpe 99 % | OMXH CAP_PI | Significance level |
| Odin Finland | 1.72 | 0.086 | Odin Finland | 1.60 | 0.109 | Odin Finland | 1.59 | 0.111 |
| Carnegie Suomi Osake A | 1.42 | 0.155 | OP-Suomi Arvo A | 1.35 | 0.177 | OP-Suomi Arvo A | 1.39 | 0.165 |
| Seligson Suomi Indeks A | 1.39 | 0.163 | OP-Focus A | 1.27 | 0.204 | OP-Focus A | 1.25 | 0.212 |
| OP-Focus A | 1.34 | 0.181 | Seligson Suomi Indeks A | 1.27 | 0.205 | Seligson Suomi Indeks A | 1.22 | 0.221 |
| Nordea Fennia T | 1.27 | 0.204 | Nordea Fennia T | 1.17 | 0.240 | Nordea Fennia T | 1.19 | 0.235 |
| OP-Suomi Arvo A | 1.21 | 0.228 | Carnegie Suomi Osake A | 1.14 | 0.254 | Danske Finland T | 1.18 | 0.239 |
| OP-Delta A | 1.11 | 0.268 | FIM Fenno | 1.11 | 0.268 | FIM Fenno | 1.16 | 0.244 |
| FIM Fenno | 0.96 | 0.335 | OP-Delta A | 1.04 | 0.297 | Danske Finland Yhteisöosake T | 1.09 | 0.275 |
| Handelsbanken Osake | 0.78 | 0.436 | Handelsbanken Osake | 0.63 | 0.531 | OP-Delta A | 1.03 | 0.303 |
| Nordea Pro Suomi T | 0.14 | 0.890 | Alfred Berg Finland | 0.02 | 0.988 | Carnegie Suomi Osake A | 0.94 | 0.349 |
| Alfred Berg Finland | 0.03 | 0.979 | Nordea Pro Suomi T | 0.01 | 0.988 | Handelsbanken Osake | 0.50 | 0.614 |
| Alfred Berg Small Cap | -0.02 | 0.981 | Alfred Berg Small Cap | -0.09 | 0.928 | Nordea Pro Suomi T | 0.11 | 0.914 |
| Fondita Equity Spice A | -0.06 | 0.954 | SEB Gyllenberg Finlandia A | -0.24 | 0.814 | Alfred Berg Finland | -0.02 | 0.982 |
| Aktia Capital A | -0.08 | 0.933 | Fondita Equity Spice A | -0.28 | 0.781 | Alfred Berg Small Cap | -0.25 | 0.801 |
| Säästöpankki Kotimaa A | -0.13 | 0.894 | Aktia Capital A | -0.31 | 0.754 | SEB Gyllenberg Finlandia A | -0.32 | 0.749 |
| SEB Gyllenberg Finlandia A | -0.23 | 0.820 | SEB Gyllenberg Small Firm A | -0.40 | 0.687 | SEB Gyllenberg Small Firm A | -0.48 | 0.633 |
| SEB Gyllenberg Small Firm A | -0.48 | 0.632 | Säästöpankki Kotimaa A | -0.52 | 0.600 | Fondita Equity Spice A | -0.49 | 0.623 |
| Danske Finland Yhteisöosake T | -0.59 | 0.557 | Danske Finland Yhteisöosake T | -0.83 | 0.409 | Aktia Capital A | -0.53 | 0.594 |
| Evli Select A | -0.59 | 0.554 | Evli Select A | -0.86 | 0.392 | Säästöpankki Kotimaa A | -0.81 | 0.418 |
| Danske Finland T | -0.73 | 0.467 | Danske Finland T | -0.93 | 0.354 | Evli Select A | -1.10 | 0.272 |

Results are presented as best value on top

| YEAR 2005 | | | | | | | | |
|----------------------------------|----------------|-----------------------|----------------------------------|----------------|-----------------------|----------------------------------|----------------|-----------------------|
| SHARPE | OMXH CAP-PI | Significance level | Adj.Sharpe 95 % | OMXH CAP_PI | Significance level | Adj.Sharpe 99 % | OMXH CAP_PI | Significance level |
| Celeres HR Suomi | 2.41 | 0.016 | Celeres HR Suomi | 2.16 | 0.030 | Celeres HR Suomi | 1.77 | 0.076 |
| Odin Finland | 1.45 | 0.148 | Odin Finland | 0.85 | 0.394 | Nordea Pro Suomi T | 0.89 | 0.373 |
| Handelsbanken Osake | 1.20 | 0.232 | Handelsbanken Osake | 0.45 | 0.656 | Odin Finland | 0.61 | 0.541 |
| Carnegie Suomi Osake A | 0.55 | 0.581 | Carnegie Suomi Osake A | 0.05 | 0.959 | Handelsbanken Osake | 0.07 | 0.942 |
| Evli Select A | 0.11 | 0.910 | Evli Select A | -0.05 | 0.958 | Evli Select A | 0.01 | 0.995 |
| Fondita Equity Spice A | -0.07 | 0.946 | Fondita Equity Spice A | -0.25 | 0.806 | Carnegie Suomi Osake A | -0.16 | 0.869 |
| OP-Delta A | -0.14 | 0.889 | Nordea Fennia T | -0.37 | 0.710 | Fondita Equity Spice A | -0.25 | 0.804 |
| Aktia Capital A | -0.34 | 0.733 | OP-Suomi Kasvu A | -0.46 | 0.643 | Nordea Fennia T | -0.30 | 0.761 |
| SEB Gyllenberg Small Firm A | -0.42 | 0.675 | Aktia Capital A | -0.48 | 0.634 | OP-Suomi Kasvu A | -0.34 | 0.736 |
| Nordea Fennia T | -0.47 | 0.636 | FIM Fenno | -0.57 | 0.568 | Alfred Berg Finland | -0.40 | 0.690 |
| Seligson Suomi Indeks A | -0.53 | 0.600 | Alfred Berg Finland | -0.60 | 0.549 | FIM Fenno | -0.43 | 0.669 |
| OP-Focus A | -0.60 | 0.546 | Seligson Suomi Indeks A | -0.61 | 0.545 | Aktia Capital A | -0.44 | 0.657 |
| OP-Suomi Kasvu A | -0.64 | 0.525 | SEB Gyllenberg Small Firm A | -0.64 | 0.523 | Alfred Berg Small Cap | -0.50 | 0.619 |
| FIM Fenno | -0.74 | 0.462 | OP-Focus A | -0.69 | 0.489 | SEB Gyllenberg Small Firm A | -0.61 | 0.541 |
| Danske Finland Yhteisöosake T | -0.92 | 0.360 | OP-Delta A | -0.71 | 0.480 | Seligson Suomi Indeks A | -0.64 | 0.521 |
| Alfred Berg Finland | -0.92 | 0.358 | Alfred Berg Small Cap | -0.79 | 0.431 | Danske Finland Yhteisöosake T | -0.78 | 0.435 |
| Nordea Pro Suomi T | -0.98 | 0.327 | Danske Finland Yhteisöosake T | -0.87 | 0.383 | Danske Finland T | -0.78 | 0.434 |
| Danske Finland T | -1.02 | 0.309 | Danske Finland T | -0.90 | 0.367 | OP-Focus A | -0.86 | 0.388 |
| Alfred Berg Small Cap | -1.06 | 0.291 | Nordea Pro Suomi T | -0.97 | 0.331 | OP-Delta A | -1.03 | 0.304 |
| Säästöpankki Kotimaa A | -1.42 | 0.156 | Säästöpankki Kotimaa A | -1.46 | 0.144 | Säästöpankki Kotimaa A | -1.44 | 0.151 |
| SEB Gyllenberg Finlandia A | -1.53 | 0.125 | SEB Gyllenberg Finlandia A | -1.62 | 0.106 | SEB Gyllenberg Finlandia A | -1.53 | 0.126 |

| YEAR 2006 | | | | | | | | |
|----------------------------------|--------------------|-----------------------|----------------------------------|----------------|-----------------------|----------------------------------|----------------|-----------------------|
| SHARPE | OMXH CAP- PI | Significance level | Adj.Sharpe 95 % | OMXH CAP_PI | Significance level | Adj.Sharpe 99 % | OMXH CAP_PI | Significance level |
| Odin Finland | 0.75 | 0.453 | Celeres HR Suomi | 0.57 | 0.571 | Celeres HR Suomi | 0.61 | 0.544 |
| Celeres HR Suomi | 0.72 | 0.472 | Odin Finland | 0.51 | 0.612 | Handelsbanken Osake | 0.51 | 0.611 |
| Handelsbanken Osake | 0.44 | 0.657 | Handelsbanken Osake | 0.40 | 0.689 | Odin Finland | 0.47 | 0.635 |
| Carnegie Suomi Osake A | 0.39 | 0.695 | Carnegie Suomi Osake A | 0.27 | 0.785 | Carnegie Suomi Osake A | 0.33 | 0.741 |
| OP-Delta A | 0.23 | 0.814 | OP-Delta A | 0.20 | 0.841 | OP-Delta A | 0.29 | 0.776 |
| Seligson Suomi Indeksi A | 0.20 | 0.843 | Seligson Suomi Indeksi A | 0.19 | 0.847 | Seligson Suomi Indeksi A | 0.27 | 0.789 |
| FIM Fenno | -0.04 | 0.967 | Danske Finland Yhteisöosake T | 0.00 | 1.000 | Nordea Pro Suomi T | 0.21 | 0.834 |
| Danske Finland Yhteisöosake T | -0.09 | 0.925 | Alfred Berg Finland | -0.01 | 0.994 | Danske Finland Yhteisöosake T | 0.11 | 0.914 |
| Alfred Berg Finland | -0.13 | 0.896 | FIM Fenno | -0.03 | 0.973 | Alfred Berg Finland | 0.08 | 0.934 |
| Danske Finland T | -0.21 | 0.835 | Danske Finland T | -0.10 | 0.921 | Nordea Fennia T | 0.08 | 0.938 |
| OP-Focus A | -0.27 | 0.786 | Nordea Fennia T | -0.24 | 0.808 | FIM Fenno | 0.01 | 0.989 |
| Fondita Equity Spice A | -0.38 | 0.707 | OP-Focus A | -0.25 | 0.804 | Danske Finland T | 0.01 | 0.994 |
| Nordea Fennia T | -0.48 | 0.631 | Fondita Equity Spice A | -0.26 | 0.791 | Fondita Equity Spice A | -0.15 | 0.884 |
| Säästöpankki Kotimaa A | -0.51 | 0.612 | SEB Gyllenberg Finlandia A | -0.36 | 0.720 | OP-Focus A | -0.16 | 0.872 |
| SEB Gyllenberg Finlandia A | -0.52 | 0.603 | Nordea Pro Suomi T | -0.39 | 0.699 | SEB Gyllenberg Finlandia A | -0.22 | 0.823 |
| Evli Select A | -0.53 | 0.593 | Evli Select A | -0.44 | 0.657 | Alfred Berg Small Cap | -0.33 | 0.740 |
| Nordea Pro Suomi T | -0.64 | 0.521 | Säästöpankki Kotimaa A | -0.46 | 0.649 | Evli Select A | -0.38 | 0.700 |
| Alfred Berg Small Cap | -0.69 | 0.491 | Alfred Berg Small Cap | -0.50 | 0.621 | Aktia Capital A | -0.40 | 0.688 |
| Aktia Capital A | -0.70 | 0.485 | Aktia Capital A | -0.53 | 0.597 | Säästöpankki Kotimaa A | -0.41 | 0.679 |
| OP-Suomi Arvo A | -0.74 | 0.460 | OP-Suomi Arvo A | -0.61 | 0.543 | OP-Suomi Arvo A | -0.53 | 0.599 |
| SEB Gyllenberg Small Firm A | -0.88 | 0.377 | SEB Gyllenberg Small Firm A | -0.67 | 0.501 | SEB Gyllenberg Small Firm A | -0.55 | 0.585 |

| YEAR 2007 | | | | | | | | |
|-------------------------------|----------------|-----------------------|-------------------------------|----------------|-----------------------|-------------------------------|----------------|-----------------------|
| SHARPE | OMXH CAP-PI | Significance level | Adj.Sharpe 95 % | OMXH CAP_PI | Significance level | Adj.Sharpe 99 % | OMXH CAP_PI | Significance level |
| Carnegie Suomi Osake A | 1.69 | 0.091 | Carnegie Suomi Osake A | 1.50 | 0.134 | Carnegie Suomi Osake A | 1.53 | 0.127 |
| Alfred Berg Small Cap | 1.02 | 0.307 | Alfred Berg Small Cap | 0.90 | 0.371 | Alfred Berg Small Cap | 0.88 | 0.379 |
| Handelsbanken Osake | 0.97 | 0.331 | Handelsbanken Osake | 0.86 | 0.388 | Handelsbanken Osake | 0.87 | 0.382 |
| OP-Focus A | 0.78 | 0.435 | OP-Focus A | 0.69 | 0.490 | Celeres HR Suomi | 0.69 | 0.492 |
| Celeres HR Suomi | 0.75 | 0.451 | Celeres HR Suomi | 0.68 | 0.499 | OP-Focus A | 0.68 | 0.495 |
| Evli Select A | 0.65 | 0.518 | Evli Select A | 0.54 | 0.589 | Evli Select A | 0.52 | 0.602 |
| Alfred Berg Finland | 0.59 | 0.554 | Nordea Fennia T | 0.50 | 0.616 | Nordea Fennia T | 0.50 | 0.614 |
| Nordea Fennia T | 0.56 | 0.574 | Alfred Berg Finland | 0.50 | 0.617 | Alfred Berg Finland | 0.48 | 0.629 |
| OP-Delta A | 0.56 | 0.577 | OP-Delta A | 0.49 | 0.625 | OP-Delta A | 0.48 | 0.629 |
| SEB Gyllenberg Finlandia A | 0.38 | 0.706 | SEB Gyllenberg Finlandia A | 0.33 | 0.739 | SEB Gyllenberg Finlandia A | 0.33 | 0.738 |
| Seligson Suomi Indeksi A | 0.19 | 0.852 | Seligson Suomi Indeksi A | 0.16 | 0.873 | Danske Finland T | 0.27 | 0.791 |
| OP-Suomi Kasvu A | -0.06 | 0.953 | OP-Suomi Kasvu A | -0.04 | 0.969 | Danske Finland Yhteisöosake T | 0.24 | 0.813 |
| Fondita Equity Spice A | -0.15 | 0.881 | Fondita Equity Spice A | -0.14 | 0.891 | Nordea Pro Suomi T | 0.17 | 0.867 |
| Nordea Pro Suomi T | -0.17 | 0.861 | Nordea Pro Suomi T | -0.16 | 0.872 | Seligson Suomi Indeksi A | 0.15 | 0.877 |
| Danske Finland Yhteisöosake T | -0.24 | 0.808 | FIM Fenno | -0.22 | 0.829 | OP-Suomi Kasvu A | -0.03 | 0.976 |
| FIM Fenno | -0.25 | 0.799 | Danske Finland Yhteisöosake T | -0.23 | 0.822 | Fondita Equity Spice A | -0.14 | 0.887 |
| Danske Finland T | -0.27 | 0.788 | Danske Finland T | -0.25 | 0.800 | FIM Fenno | -0.21 | 0.834 |
| Aktia Capital A | -0.30 | 0.768 | Aktia Capital A | -0.26 | 0.796 | Aktia Capital A | -0.26 | 0.794 |
| Odin Finland | -0.62 | 0.535 | Odin Finland | -0.51 | 0.608 | Odin Finland | -0.49 | 0.628 |
| Säästöpankki Kotimaa A | -0.66 | 0.508 | Säästöpankki Kotimaa A | -0.54 | 0.587 | Säästöpankki Kotimaa A | -0.52 | 0.604 |
| SEB Gyllenberg Small Firm A | -0.75 | 0.455 | SEB Gyllenberg Small Firm A | -0.61 | 0.543 | SEB Gyllenberg Small Firm A | -0.56 | 0.574 |