University of Stavanger

Faculty of Science and Technology

MASTER'S THESIS

Study program/ Specialization: Master in Risk Management – Enterprise Risk Management	Spring semester, 2013 Open
Writer: Bjarne Skeisvoll Jakobsen	…… (Writer's signature)
Faculty supervisor: Roy Endre Dahl External supervisor(s):	
Title of thesis: Performance evaluation of Skagen Kon-Tiki and some emerging market funds, with an emphasis on the funds' performance relative to the underlying risk	
ECTS: 30	
Key words: • Risk • Uncertainty • Fund evaluation • Mutual funds	Pages: 113 + attachments/other: 9 Stavanger, 15.06.2013

Acknowledgements

This master thesis completes my education for a M.Sc. degree in Risk Management - Enterprise Risk Management at the University of Stavanger (UiS). The main objective for this thesis was to conduct a performance evaluation of some mutual funds, with an emphasis on the funds' performance and underlying risk.

The subject of finance and related risk has been of interest for me for a long time. This thesis offered me an opportunity to combine these subjects, and to utilize a variety of the subjects from my education. Furthermore, it provided me with a chance to learn more about the financial markets, risk management and to apply these in a mutual fund performance evaluation. The process of writing this thesis has been both challenging and time consuming, but also interesting. I am sure I will benefit from this knowledge and experience in my future career.

I am thankful to my instructor Roy Endre Dahl at the University of Stavanger, for his advice, guidance and discussions during the process of writing this paper. In addition, I would like to thank Igor Eliassen, for his feedback and discussions related to this paper.

Bjarne Skeisvoll Jakobsen

Stavanger, June 2013.

Abstract

The financial markets are as complex as ever due to an accelerating development in technology and complex financial instruments available to investors. This has contributed to the world becoming more financially integrated, which has affected the risk picture for finance. This along with other factors has resulted in that the financial industry is facing some different challenges related to risk. The financial institutions and banks form an essential part of the community, and lay the foundation for the economic interaction in the markets. It is therefore important that the financial industry incorporate sufficient tools to understand and manage the risk associated with their products.

The main purpose of this thesis was to perform a mutual fund evaluation for Skagen Kon-Tiki and some emerging markets funds, with an emphasis on the funds' performance relative to the underlying risk. To perform the evaluation, finance theory, fundamental statistics and modern portfolio theory was applied. Three sub-objectives were added to supplement the main purpose and to clarify the evaluation focus. The first sub-objective was related to the funds returns, ignoring the risk. The second sub-objective was to evaluate the funds returns relative to the risk, and the third sub-objective was to evaluate the funds relative to the risk.

To perform a quantitative fund evaluation, a series of methods was used to measure the funds' performance. The evaluation was performed over a period ranging from the start of 2002 till the end of 2012. A total of 4 mutual funds and benchmark was selected, and used in the performance evaluation. The results from four of the methods were presented, discussed and a ranking of how the funds performed provided. The results were divided into three periods, to better understand when the funds perform well, and poorly. At the end, a summary of the methods rankings was presented to give an overview of how the funds overall performed. To ensure that there was a significant difference between the funds results, a statistical test was performed for each ranking. After the test, a new ranking was provided ensuring evaluation presented the true performance of the funds.

To aid in managing the challenges the financial industry are facing, it is proposed to use Avens (A,C,U) perspective as a tool to incorporate the uncertainty. A qualitative evaluation was performed to incorporate this perspective. This provided a more complete evaluation and shed light on the uncertainty perspective that is often neglected in fund evaluations. Three sources of epistemic uncertainty were assessed for the evaluation. The completeness uncertainty, model uncertainty and parameter uncertainty were assessed for the three sub-objectives. This provided the basis for the qualitative evaluation.

Overall, the evaluation indicated that Skagen performed best of the selected funds over the complete period, it was therefore concluded that Skagen deserves its current gold rating by Morningstar. JPM and MSCI performed second best, and it was concluded that JPM deserves its rating of silver. Fidelity performed moderately, obtaining the fourth position in the rank. Based on the overall evaluation, it was concluded that the fund deserved its current bronze rating. DNB was the fund that performed worst overall.

Contents

Acknowledgements II

Abstract III

1. Introduction 1

1.1. Background 1

1.2. Purpose 2

1.1.1. Objective 1 3

1.1.2. Objective 3 3

1.1.3. Objective 2 3

1.3. Structure 4

2. Fundamental statistics 5

2.1. Expected return 5

2.2. Variance 7

2.3. Skewness 8

2.4. Kurtosis 9

2.5. Covariance 11

2.6. Student t-test 11

3. Risk 13

3.1. Introduction 13

3.2. Risk definition 13

3.3. Uncertainty 16

3.3.1. Completeness uncertainty 16

3.3.2. Model uncertainty 17

3.3.3. Parameter uncertainty 18

3.4. Risk related to securities 18

3.5. Risk management 20

3.5.1. Challenges in risk management 21

3.5.2. Proposed tool 21
4. Finance and portfolio theory 22
4.1. Mutual funds 22
4.1.1. Money market funds 23
4.1.2. Fixed income funds 23
4.1.3. Hybrid funds 24
4.1.4. Equity funds 24
4.2. Portfolio Management 24
4.2.1. Active management 25
4.2.2. Passive management 25
4.2.3. Fundamental analysis 26
4.2.4. Technical analysis 26
4.3. The Efficient Market Hypothesis 27
4.4. Capital Asset Pricing Model – CAPM 30
4.5. Morningstar rating 34
5. Methods 35
5.1. Sharpe Ratio 35
5.1.1. Criticisms of and limitations of the Sharpe ratio 37
5.2. Jensen`s alpha 38
5.3. Value-at-risk (VaR) 39
5.3.1. Parametric simulation 41
5.3.2. Non–parametric simulation 42
5.3.3. Monte Carlo simulation 43
6. Data 44
6.1. Selection of funds 44
6.2. Introduction to selected mutual funds 45
6.3. MSCI Emerging Markets Index 48

6.4. The Libor rate 51
6.5. Time period 52
6.6. Data collection 53
7. Empirical results 54
7.1. Descriptive statistics 54
7.1.1. Total period 54
7.1.2. Trend analysis 56
7.1.3. Sub-periods 58
7.1.4. Supplementary statistics 63
7.1.6. Improved ranking 66
7.1.7. Summary descriptive statistics 67
7.2. Sharpe Ratio 68
7.2.1. Total time period 68
7.2.2. Sub periods 70
7.2.4. Improved ranking 73
7.2.5. Summary Sharpe Ratio 74
7.3. Jensen`s Alpha 75
7.3.1. Total period 75
7.3.2. Sub periods 76
7.3.4. Summary Jensen's Alpha 79
7.4. Value at Risk 80
7.4.1. Worst daily changes 80
7.4.2. 500-days 99% VaR 81
7.4.3. 250-days 99% VaR 82
7.5. Standard deviation 83
7.5.1. Total time period 83
7.5.2. Standard deviation ranking 85

7.5.3. Improved standard deviation ranking 85
7.5.4. Summary standard deviation 86
7.6. Final ranking 87
7.6.1. Ranking summary 87
7.6.2. Ranking after test 89
8. Discussion 91
8.1. Introduction 91
8.2. Uncertainty approach 92
8.2.1. Assessing uncertainty 94
8.3. Model uncertainty 96
8.3.1. Effects on risk 96
8.3.2. Effects on vulnerability 97
8.3.3. Summary of model uncertainty 98
8.4. Parameter uncertainty 99
8.4.1. Effects on risk 99
8.4.2. Effect of vulnerability 100
8.4.3. Summary of parameter uncertainty 101
8.5. Completeness uncertainty 102
8.5.1. Known uncertainty level 102
8.5.2. Unknown uncertainty level 103
8.5.3. Summary of completeness uncertainty 104
8.6. Reflection 105
9. Conclusion 106
9.1. Further research 108
10. Reference List: 110

Figure List

Figure 1: Distribution Skewness (Bell 2012) 9
Figure 2: Distribution Kurtosis (Methods 2013) 10
Figure 3: The new risk perspective (Aven 2013) 15
Figure 4: Systematic and unsystematic risk (Bank 2013) 19
Figure 5: Versions of the Efficient Market Hypothesis (Turtle 2013) 28
Figure 6: Characteristics of the CAPM (Prenhall 2013) 32
Figure 7: The Efficient Frontier (Euronomist 2013) 33
Figure 8: The Capital Market Line 37
Figure 9: Jensen's alpha characteristics 39
Figure 10: Skagen Kon-Tiki`s risk scale (Skagenfondene 2013) 46
Figure 11: Regional distributions of Skagen Kon-Tiki and MSCI EMI (Fondene 2013) 49
Figure 12: Country distribution of Skagen Kon-Tiki and MSCI EMI (Fondene 2013) 50
Figure 13: Monthly and 1-year Libor rate 51
Figure 14: Cumulative returns for the funds and benchmark for complete period 55
Figure 15: The average yearly returns 57
Figure 16: The funds and benchmarks returns for period 1 59
Figure 17: The funds and benchmarks returns for period 2 60
Figure 18: The funds and benchmarks returns for period 3 61
Figure 19: Continuous and average Sharpe Ratio for the funds and benchmark 68
Figure 20: Sharpe Ratio for period 1 70
Figure 21: Sharpe Ratio for period 2 71
Figure 22: Sharpe Ratio for period 3 72
Figure 23: Jensen`s Alpha for complete period 75
Figure 24: Jensen's Alpha for period 1 76
Figure 25: Jensen's Alpha for period 2 77
Figure 26: Jensen's Alpha for period 3 78
Figure 27: 500-days 99% VaR 81
Figure 28: 250-days 99% VaR 82
Figure 29: The funds and benchmarks standard deviation for complete period. 84
Figure 30: Approach for applying (A,C,U) perspective 93
Figure 31: A model for decision-making under uncertainty (Aven 2003) 108

List of tables

Table 2: Overview of mutual funds 45
Table 3: The sub-periods 58
Table 4: Summary of supplementary statistics 63
Table 5: Ranking for the returns. 65
Table 6: Results from t-test for the returns 66
Table 7: New ranking for returns 66
Table 8: Ranking for the Sharpe Ratio 73
Table 9: Statistical test for the Sharpe Ratio 73
Table 10: Final ranking for the Sharpe Ratio 74
Table 11: Ranking for Jensen`s Alpha 79
Table 13: Worst 1%, 5% and daily changes 80
Table 14: Standard deviation ranking 85
Table 15: T-test results for standard deviation 85
Table 16: Ranking for standard deviation after t-test 86
Table 17: Final summary of ranking before t-test 87
Table 18: Final rating before the t-test 88
Table 19: Final ranking summary after t-test 89
Table 20: Final ranking after t-test 89
Table 21: Uncertainty classification (Flage and Aven 2009) 94
Table 22: Sensitivity classification (Flage and Aven 2009) 95
Table 22: Assessment of the model uncertainty 98
Table 23: Assessment of the parameter uncertainty 101
Table 24: Assessment of the completeness uncertainty 104

1. Introduction

This chapter introduces the background and purpose of the thesis. Further, it presents the motivation and provides an overview of the structure. It is assumed that the reader has a fundamental understanding for finance and economics.

1.1. Background

In finance, evaluations of mutual fund performance have been a subject of interest since the introduction of these financial services. Investors or fund customers want to obtain the highest returns, at the same time by taking on the lowest possible risk. It is therefore of interest to perform evaluations of mutual funds, as these evaluations can provide the investors with insight to which funds are best. Harry Markowitz laid much of the foundation of the Capital Asset Pricing Model, (CAPM), in his work on Modern Portfolio Theory (1952). Markowitz argued that investors should be compensated for taking on additional risk, and introduced a framework for measuring risk.

“Where there is money, there is risk!”. This statement by Paul Getty describes one of the challenges one faces in the financial markets. Risk has been an element associated with trading throughout history. During the Renaissance, Venetian merchants hedged their risk or speculated on cargos on their route, through the purchase and sale of option contracts. Since the Renaissance, trading has increased in scope and magnitude. The world has become more financially integrated. This is due to an accelerating development in the communication lines with the introduction of the Internet, computers, cell phones and other technological innovations. Information flow propagates through the markets within a manner of minutes. This development has affected the risk picture within finance.

In addition, the financial markets have experienced some major events the last twenty years. In 2001, the so-called “Internet Bubble” burst, and along with the September 11 attack it contributed to a downturn in the stock markets. Many Internet companies went bankrupt, and several accounting scandals shook the markets, of most note the Enron and WorldCom scandals. A few years down the road, the global financial crisis hit in 2007-08. This was perhaps the most serious incident the financial industry has been through since the 1930s, threatening to crash the whole financial system. Several major banks and financial institutions

went bankrupt, and the whole financial system was crumbling. Financial institutions and banks form an essential part of our community, and lay the foundation of the economic interaction in the financial markets. It is therefore essential that they balance their risk appetite in accordance with their pre-determined risk profile, to minimize the possibility of a similar event such as the 2007 crisis from occurring again. Today, the handling of risk is as essential as ever in the financial markets, since they are so correlated. With this in mind it is vital to have risk management, or risk studies for the financial institutions to manage risk in a better way. This can contribute to that major financial institutions and fund managers better understand the risk they are exposed to, and as such be in a better position to manage the risk. Furthermore fund managers can use risk management as a tool to be better prepared for unexpected events in the market, and to be in a better position to take advantage of potential profitable investment opportunities. A funds risk manager, utilizes various tools for determining and gaining insight to the risks the funds are exposed to. These tools can aid the risk manager in ensuring that the funds risks are according to the pre-determined risk profile. Risk management has a central role for mutual funds to create long-term growth for the funds customer or investors.

Despite the development in risk management, it does contain a potential weakness. The "traditional" approach for risk management does not incorporate the uncertainty perspective. This is a potential pitfall. The question that arises based on this, is if the current framework is sufficient for evaluating funds.

1.2. Purpose

Skagen Fondene is a Scandinavian mutual fund company that has performed at a high level since its establishment in 1992. It has enjoyed an impressive growth and has become Norway`s biggest investment fund company. The fund in Skagen Fondene that has performed best is Skagen Kon-Tiki, which has received a numerous awards and accolades. This triggered the initial interest for this thesis. There was a curiosity to conduct a performance evaluation of the fund relative to some of its competitors, with a more central focus on the funds risk.

The main purpose of the thesis is to conduct a:

"Performance evaluation of Skagen Kon-Tiki and some emerging market funds, with an emphasis on the funds' performance relative to the underlying risk."

When performing an evaluation of mutual funds there can be different focus points. In order to aid in the performance evaluation and to clarify the evaluation focus, three sub-objectives are added. These objectives are structured in a manner that supports the main purpose.

1.1.1. Objective 1

The first objective of this thesis is to evaluate the funds and benchmarks returns.

1.1.3. Objective 2

The second objective is to evaluate the funds returns relative to the risk. One will investigate how the funds have performed relative to the risk they exposed their portfolio`s too.

1.1.2. Objective 3

The third objective it to analyze the risk the funds have and are exposed to.

The empirical investigation of the Emerging Market funds and benchmark will be carried out for the period spanning from the beginning of 2002 till the end of 2012. The evaluation is divided into three periods to compare the funds performance`s before, during and after the global financial crisis. Different performance measures such as Sharpe Ratio, Jensen's Alpha, standard deviation, VaR and others will be used as tools to evaluate the fund's performance. In addition, a rating for four of these performance measures will be conducted. For the rating, a statistical test will be carried out to ensure that the results are significantly different. To

supplement the quantitative evaluation, a qualitative evaluation will be performed. This will incorporate the uncertainty perspective into the evaluation.

1.3. Structure

This thesis consists of ten chapters, in addition to the bibliography.

- Chapter 1 presents the introduction, purpose, background and structure.
- Chapter 2 presents some fundamental statistics that provide the backbone for the thesis, with central subjects such as expected return and variance.
- Chapter 3 presents the subject of risk, linking the risk concept to finance and portfolio practice.
- Chapter 4 presents some finance and portfolio theory, necessary to evaluate the funds. Subjects such as the Efficient Markets, mutual funds, CAPM and Morningstar's rating system are presented.
- Chapter 5 will present the methods used to evaluate the funds performances, such as the Sharpe Ratio, Jensen's Alpha, and Value at Risk.
- Chapter 6 presents the selected funds, benchmark, risk-free interest rate and the chosen time periods.
- Chapter 7 presents the results obtained for the five performance measurement methods. These form the quantitative evaluation. The methods include the geometric returns, standard deviation, Sharpe Ratio, Value at Risk and Jensen's Alpha.
- Chapter 8 presents the discussion, forming the qualitative evaluation.
- Chapter 9 presents the conclusion, and suggestions to future research.
- Chapter 10 presents the reference list.

2. Fundamental statistics

In this section, some fundamental statistics is presented, used to evaluate the performance of a financial asset like a mutual fund. These will be applied to provide a description of the data used in the empirical part. Last, a section on covariance and student t-test is presented.

In general, a distribution can be described by its moments. Probability distribution, expected mean and variance are central concepts in mathematics, as well as portfolio theory. These moments form the basis for analyzing data. In mathematics, there are four quantitative elements that help analyzing a distribution of different values. These four elements are:

- Expected return
- Variance
- Skewness
- Kurtosis

These methods are used to analyze the data from the fund distributions to get a better understanding of the mutual funds performances. Finally the chapter introduces some well-known facts on financial assets returns.

2.1. Expected return

In finance and portfolio theory the expected return is a central element for investors. The reason being that they makes the basis for many methods within finance, such as calculating companies' valuation, or as in this thesis evaluating some mutual funds' performance.

The expected return is part of a statistical and probabilistic thinking centering on an understanding of distributions. A distribution consists of two elements; a list of all possible outcomes, and a probability function describing how likely the outcomes are. To calculate the historical average returns for an asset or mutual fund, one usually chose between the arithmetic or geometric mean. These methods can be calculated by a continuous or a discrete probability function. To calculate the arithmetic mean, one simply takes the average realized returns of an asset or portfolio for each year. To calculate the geometric mean one has to adjust for the compounding interest, and reinvestment effect.

To calculate the future yearly returns one look at the outcomes of yearly returns as discrete

random variables. This means that the expected return of a portfolio is the weighted-average outcome of some outcomes, defined as (Paul Newbold 2003):

$$E(X) = \sum_{x} xP(x)$$

where,

x $= \ the\ returns\ of\ the\ various\ outcomes$

$P(x)$ $= the\ probability\ of\ the\ various\ outcomes$

For the calculations performed in this work, the historical return is more essential than calculating the future yearly returns. To calculate historical arithmetic mean from year one till n, one uses the following formula:

$$\bar{R} = (R_1 + R_2 \ + \ R_3 \ + R_n) = \frac{1}{n}\sum_{n=1}^{n} R_n$$

where,

$\bar{R}$ $= \ the\ average\ historical\ returns\ for\ a\ fund$

R_n $= \ the\ funds\ return\ for\ period\ n$

Each period in the formula is weighted equally when calculating the periodic returns. The arithmetic mean is the simpler of the two methods and well suited as an estimate for future returns. The disadvantage of averaging this way is that one does not adjust for the compounding interest effect and the reinvestment effect. This leads to the other method for calculating historical average returns, the geometric mean. The geometric mean is the most common way to display the mutual funds average historical returns as it adjusts for the compounding interest effect and the reinvestment effect. It is also the requirement of the Global Investment Performance Standards, (GIPS), and recommended by the Norwegian Society of Financial Analysts. Adjusting for the compounding interest -and reinvestment effect, the geometric mean will always lie below the arithmetic mean. The difference between

the arithmetic and geometric return will be greater if there is a large deviation in the period returns. The reason for this is that negative values are given more weight by the geometric mean than the arithmetic.

The geometric mean is defined by the following formula:

$$\bar{R} = [(1 + R_1)(1 + R_2)\ (1 + R_3) \ldots . (1 + R_n)]^{\frac{1}{n}} - 1$$

where,

$\bar{R}$ = *the average historical returns for a fund*

R_n = *the funds return for period n*

The geometric method was chosen in the analysis, as it is the most widely used method to calculate historical returns. Furthermore it gives a better description of the long-term performance of mutual funds than what the arithmetic, by accounting for the compounding interest effect and reinvestment effect. The study is conducted using daily data; therefore it is necessary to calculate the annual daily data on the basis of daily returns. This is calculated by:

$$R_{yearly} = \left(1 + R_{daily}\right)^{n} - 1$$

Where the n in the formula represents the days in the year for which the market is active.

2.2. Variance

Variance, also called measure of dispersion, describes how far the numbers in a dataset lie from the estimated mean. The variance is a parameter describing either the theoretical probability distribution of a data sample, or the actual probability distribution of an observed population of numbers. In the first case, the sample of data from a distribution can be used to make an estimate of its variance, a so-called sample variance. This is defined as (Paul Newbold 2003):

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{X})}{n - 1}$$

where,

s^2 is the sum of the squared difference between an observation and the sample mean divided by the sample size minus 1. In the latter case, population variance is used, which is defined as:

$$\sigma^2 = \frac{\sum_{i=1}^{N}(x_i - \mu)^2}{N}$$

where,

μ = Expected mean

N = Population size

2.3. Skewness

When analyzing data for a portfolio, one uses skewness for describing potential asymmetry in the portfolios distribution. A distribution is skewed if the observations are not symmetrically distributed around the estimated mean. The portfolios distribution might have tails in the left or right direction. This is an important aspect to analyze, as it describes the portfolios probabilities of extreme events. It allows an investor or customer to get a better understanding of a fund's performance relative to the risk.

Skewness is defined as:

$$Skewness = \frac{\sum_{i=1}^{n}(xi - \bar{x})^3 / n}{s^2}$$

A normal distribution has zero skewness. If a portfolios distribution is negatively skewed, that is, skewed to the left; the distribution has a greater left tail than the right tail. This results in a tail extending to the left direction. A negative skew means that the portfolios returns are more likely to be positive than negative, which is a good sign.

If however, a distribution is positively skewed, the tail extends to the right direction. A positive skew means the portfolios returns are more likely to be negative than positive, which is not ideal. (Paul Newbold 2003). Figure 1 illustrates the different versions of skewness for a distribution.

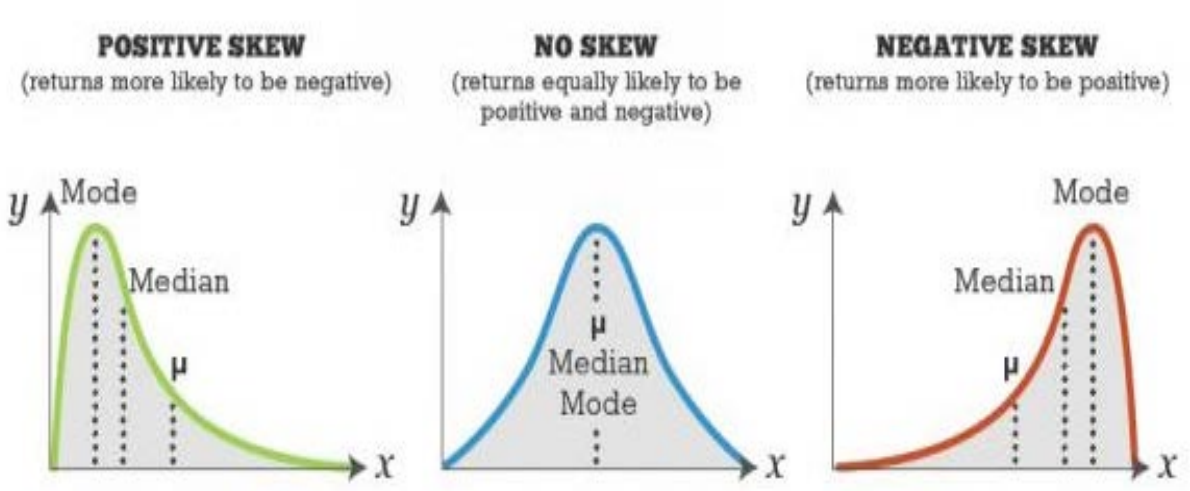


Figure 1: Distribution Skewness (Bell 2012)

2.4. Kurtosis

Kurtosis is a measure of the weight in the tails, or the fatness of a probability density function. More simply stated it is the measure of the peak of a distribution, indicating how high the distribution is around the mean. It indicates the probability of observing extreme values, which is an important aspect for analyzing portfolio performance.

The Kurtosis is defined as:

$$Kurtosis = \frac{\sum_{i=1}^{n}(xi - \bar{x})^4 / n}{s^2}$$

The kurtosis of a distribution has three categories of classification:

- Mesokurtic distribution, have excess kurtosis of zero.
- Leptokurtic distribution, have positive excess kurtosis.
- Platykurtic distribution, have negative excess kurtosis.

The kurtosis distributions are illustrated further in figure 2.

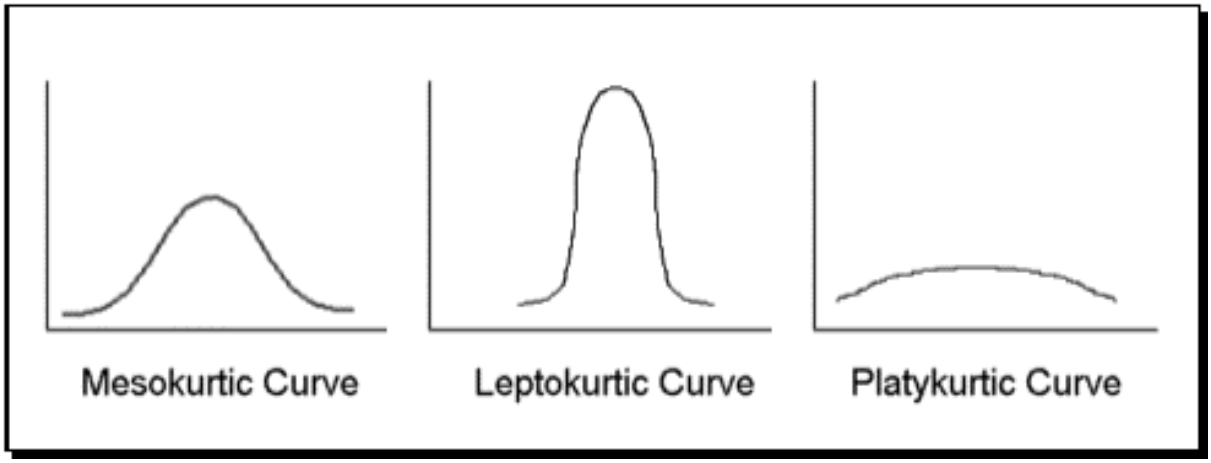


Figure 2: Distribution Kurtosis (Methods 2013)

A normal distribution has a kurtosis of 3, which is the basis for mesokurtic distributions. To calculate the excess kurtosis, one takes the calculated kurtosis and subtract with 3. If it is a normal distribution, this should give an excess kurtosis of 0. This is seldom the case in practice and it is important to understand what the numbers obtained in the kurtosis calculation means. A distribution with a kurtosis higher than three is said to be leptokurtic, while a distribution with kurtosis less than three is platykurtic. A positive excess kurtosis results in a distribution with a pointy tip around the mean and with fat tails on the sides. (Paul Newbold 2003)

- Mesokurtic

The Kurtosis is usually measured with respect to a normal distribution, and a distribution that is peaked the same way as a normal distribution is said to be mesokurtic. As shown in figure 2, the peak of the mesokurtic distribution is neither low nor high, and it considered the baseline for the two other distributions.

- Leptokurtic

A leptokurtic distribution has a positive excess kurtosis, that is, a kurtosis greater than the mesokurtic distribution. As the figure shows, leptokurtic distributions are typically recognized by thin and tall peaks.

- Platykurtic

The third distribution is the platykurtic distribution, which has a negative excess kurtosis. The platykurtic distribution has a relative flat peak, and slender tails.

2.5. Covariance

The covariance measures the strength of the linear relationship between two numerical variables, X and Y. The sample covariance is defined as (Berenson, Levine et al. 2009):

$$cov(X,Y) = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{n-1}$$

2.6. Student t-test

William S. Gosset, a statistician working for Guiness Breweries in Ireland, developed the Student t-distribution. The t-distribution is quite similar to the normal distribution, being symmetric and bell-shaped. The differences between the distributions are that the t-distribution has heavier tails, which means that it can contain more extreme values than the normal distribution. The student distribution is used to estimate a mean of a normally distributed population, where the sample size is small, and the samples standard deviation is unknown.

The t-test is a statistical test that follows a Student t-distribution, and can be used to assess if there is a significant difference between two values, or samples.

$$t_{STAT} = \frac{(\overline{X_1} - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{S^2{}_1}{n_1} + \frac{S^2{}_2}{n_2}}}$$

where

$X_1 = mean\ of\ the\ sample\ taken\ from\ population\ 1$

$n_1 = size\ of\ the\ sample\ from\ sample\ 1$

$S^2{}_1 = variance\ of\ the\ sample\ taken\ from\ population\ 1$

$\bar{X}_2 = mean\ of\ the\ sample\ taken\ from\ population\ 2$

$S^2{}_2 = variance\ of\ the\ sample\ taken\ from\ population\ 2$

$n_2 = size\ of\ the\ sample\ from\ sample\ 2$

If one wishes to test if there is a significant difference between two results, a null hypothesis must be established. If the results are similar according to the t-test, the hypothesis is retained. Otherwise, the hypothesis is rejected. Based on this it is then statistically unlikely that the differences between the data are due to chance. When deciding whether one should reject or keep a hypothesis, a significance level must be chosen. This is up to the assessor, but a common significant level is 1%, or 5%. Placing a significance level of a= 0.05 means that one accept there is a 5% chance of making a rejection error.

Performing a t-test will give a p-value, stating the probability that the data results are different. If p<a one rejects the null hypothesis, and chose the alternative hypothesis. The smaller the p-value, the more certain one can be that the differences are not due to chance.

3. Risk

3.1. Introduction

The term risk is familiar with most; however people perceive the terminology risk in different ways. There are various definitions of risk and how to view it, depending on which area or industry one operates in. The oil and gas industry use the Petroleum Safety Authority risk definition, "*Risk means a combination of probability and consequence*" (Norway). On the other hand if one were to ask investors an investor how he perceives risk associated with purchasing an asset or stock, they will most likely associate it with losing money. Skagenfondene defines risk, as "*risk is the risk of not achieving your saving target*". One can argue that this is an unclear definition, as it does not really answer what risk is. Another question that arises from this definition is how can one determine what the customers saving target is? A customers saving target will obviously vary; as some investors would expect higher returns than other.

There seems to be little consensus on how to define risk, at least an overall definition. For most, risk is associated with negative consequences. There are however, divided opinions whether the risk concept should be restricted to negative consequences. According to Aven 2010, restricting the concept of risk to negative consequences only is problematic as it is often difficult to determine what a negative outcome and what is a positive outcome (Aven 2010).

Risk can also be associated with an opportunity. The risk management standard COSO, regard risk indicators as events that can result in sources resulting in consequences. These events can affect the goals positively or negatively. A negative event is something unwanted, while a positive event is considered as a possibility.

3.2. Risk definition

Many people associate risk with statistics, and determine the risk based on historical data. The question is then, do historical data provide the assessor with enough information to say something about the risk in the future. Aven (2010) argues that historical data provide a good picture of what to expect in the future, but the prediction one makes about the future could turn out to be poor. When using historic data to predict the future, one is assuming the future will be like the history. According to Aven (2010) there is a huge step from using history of risk as an assumption for transforming the data to the future. To fully express risk one need to

look beyond historic-based data. The traditional probability-based perspective defines risk using probabilities and probability distributions. The assigned numbers or data are conditioned on a number of assumptions, simplifications and suppositions, which depend on background knowledge. Aven (2010) argues that uncertainties are often hidden in the background knowledge, and one take care not to restrict attention just to the assigned probabilities, as they could hide factors that could result in surprising outcomes. This lead to subject that risk is more than computed probabilities and expected values. Probability distributions such VaR can be an informative risk measure, it does not however capture the full information, and consequently has to be used with care (Aven 2010). Aven (2008) argues that the uncertainty should be the pillar of risk, instead of just using probability distributions. Based on this argument, Aven introduces a risk-definition based on the knowledge-based uncertainty perspective. This means that the risk does not exist independently of the assessor, as the uncertainties are based on the assessors' background knowledge.

Aven (2008) defines risk as:

By risk we understand the two-dimensional combination of

(i) events A and the consequences of these events C, and
(ii) the associated uncertainties U (whether A will occur and what value C will take).

This is referred to as the (A,C,U) perspective (Aven 2008).

Risk is related to future events A and their consequences (outcomes) C. Today, we do not know if these events will occur or not, and if they occur, what the consequences will be. In other words, there is uncertainty U associated with both A and C. How likely it is that an event A will occur and that specific consequences will result, can be expressed by means of probabilities p, based on our knowledge (Aven 2008).

This definition introduces a new risk perspective, adding the uncertainty dimension to the traditional risk perspective. The basic features of the new risk perspective are presented in figure 3.

Figure 3: The new risk perspective (Aven 2013)

From the risk definition above, Aven argues that risk is associated with uncertainty. Nevertheless, it does not mean that risk is uncertainty. A common misconception in finance is that risk equals uncertainty. Such a perspective is problematic if one search for a general definition of risk. Uncertainty seen in isolation from the consequences and the severity of the consequences cannot be used as a general definition of risk. It fails to capture an essential aspect of risk, the consequence dimension. Uncertainty cannot be isolated from the size, extension, and severity of the consequences (Aven 2010). Modern portfolio theory is built on the basis of viewing risk as volatility, and not as a likelihood of loss. More on this is presented in chapter 3.2, relating the concept of risk with securities.

Description of (A,C,U) perspective

Risk is described by (A,C,U,P,K), that is, by events and consequences, associated uncertainties (whether A will occur and what value C will take), knowledge-based probabilities with reference to a standard, and K the background knowledge that U and P are based on. The probabilities are the tool to express uncertainties, but there is a need to look beyond the probabilities and associated expected values when assessing uncertainties. Uncertainty may be 'hidden' in K (Aven 2010). In addition, sensitivities (S) may be included to show how the results depend of variation in input assumptions and conditions. To reflect this, the risk description is adjusted to (A,C,U,P,S,K) (Flage and Aven 2009).

3.3. Uncertainty

There are various definitions of uncertainty and how to view it. There seems to be little consensus on how to define uncertainty, at least an overall definition.

Businessdictionary (Dictionary 2013) defines uncertainty as:

"Decision making: Situation where the current state of knowledge is such that (1) the order or nature of things is unknown, (2) the consequences, extent, or magnitude of circumstances, conditions, or events is unpredictable, and (3) credible probabilities to possible outcomes cannot be assigned."

Uncertainty can arise from two main causes, natural variation and the lack of knowledge. These two categories of uncertainty are commonly referred to as aleatory and epistemic uncertainty in the literature. Aleatory uncertainty is the uncertainty arising from, or associated with the inherent, irreducible, and natural randomness of a system or process. Epistemic uncertainty is the uncertain arising from the lack of knowledge about the performance of a system or process. The epistemic uncertainty will be reduced when new knowledge comes available, while the aleatory uncertainty cannot, in principle be reduced. However, several types of uncertainty, which in the past was classified aleatory, are now considered epistemic, indicating that the uncertainty classification is not fixed (Jin, Lundteigen et al. 2012). The nuclear industry (M. Drouin 2009) distinguishes between three sources of epistemic uncertainty:

I. Completeness uncertainty
II. Model uncertainty
III. Parameter uncertainty

3.3.1. Completeness uncertainty

Completeness uncertainty is about factors that are not properly included in the analysis. Failing to include all relevant factors in the analysis will give incorrect estimates of the results, even if the data and model selection is perfect. For completeness uncertainty one distinguishes between two categories; the known uncertainty, and the unknown uncertainty.

- Known completeness uncertainty is uncertainty arising from factors that are known, but deliberately not included. Reasons for exclusion some factors may be the lack of

understanding the limitations of the system in its operating context, time or cost constraints, lack of models, lack of data to support the models, or lack of competence in using the models. The known completeness uncertainty reflects assumptions and simplifications that have been made in a trade-off of costs, available resources, competence of analysts, and the state of knowledge about the system and its operating environment.

- Unknown completeness uncertainty is uncertainty arising from factors that are not known or identified. The factors are truly unknown, and are therefore difficult to account for or make judgments about. The unknown completeness is problematic, as its contribution is invisible. However, indirect factors, i.e. factors that may impact to what extent "we don`t know", may give an indication of the contribution. The use of new technology or the use of existing technology in new application areas may suggest that the contribution from unknown completeness uncertainty is high compared with when proven technology is used (Jin, Lundteigen et al. 2012).

3.3.2. Model uncertainty

Model uncertainty arises from the fact that any model, conceptual or mathematical, will inevitably be a simplification of the reality it is designed to represent (Jin, Lundteigen et al. 2012). The subject of model uncertainty is important in financial theory since use of models is frequently used as a tool for investors. In the financial industry models are used for prediction and risk management. There are a variety of models available for estimating similar concept within finance, suggesting a lack of consensus to which model is most accurate. With the element of model uncertainty present, it makes it more challenging to draw conclusions regarding mutual fund performance persistence, or to evaluate a mutual fund manager's performance. Model uncertainty is one factor contributing to mixed findings on performance persistence for mutual funds. If an investor had full confidence in a fund manager's ability to outperform the funds benchmark, then any period with underperforming would be regarded as a result of bad luck, and not emphasized. Brown and Goetzmann (Stephen J. Brown 1995) found evidence supporting persistent performance using a conditional version of the CAPM. Carhart (Carhart 1997) on the other hand found little evidence supporting persistent performance.

3.3.3. Parameter uncertainty

Parameter uncertainty is related to uncertainty of the parameter values used in methods and models. Estimates of some parameters may be based on expert judgment. Mathematical models are either parametric or nonparametric. Parametric models are the dominating approach in the financial industry, as these are easier to analyze and fit to data. A limitation of the parametric models is their limited flexibility, resulting in low variance and some bias; whereas nonparametric models are flexible and less biased, but often poor (highly variable) predictors (Lindstrøm 2010).

3.4. Risk related to securities

There are various types of risks associated with investments in assets. Risk is usually divided into systematic and unsystematic risk. The total risk is defined as:

$$Total\ risk = Systematic\ risk + unsystematic\ risk$$

$$\sigma_p^2 = \beta_p^2 \sigma_m^2 + \sigma^2(e_p)$$

where,

σ_p^2 $= the\ portfolio\ total\ risk$

$\beta_p^2 \sigma_m^2$ $= the\ portfolio`s\ systematic\ risk$

$\sigma^2(e_p)$ $= the\ portfolio`s\ unsystematic\ risk$

Systematic risk is the risk of the overall market, and cannot be diversified away. It represents the correlation between the return on the market and the return on the portfolio. The systematic risk is to a large extent related to events on a macro level. Examples of systematic risk associated with the market are: inflation, taxes, interest rates, political factors, oil prices, business cycles and fiscal policies. The global financial crisis in 2007 is a recent example of an increased systematic risk, resulting in a steep decline in the markets.

Unsystematic risk is the risk of individual companies, and can be diversified away by holding a portfolio of several stocks. Unsystematic risk is often referred to as diversifiable risk, or

firm-specific risk. An enterprise has several risks associated with the company such as industry, business cycles, prospects, management, shareholders and debt ratio to name a few. One can say that the unsystematic risk is to a large extent related to events on a micro level. By holding a portfolio with shares spread across various industries and countries, one can achieve a diversification in the portfolio. While some companies or industries might not do so well, others will experience a boom that will offset for the companies not performing well (Tor 1993).

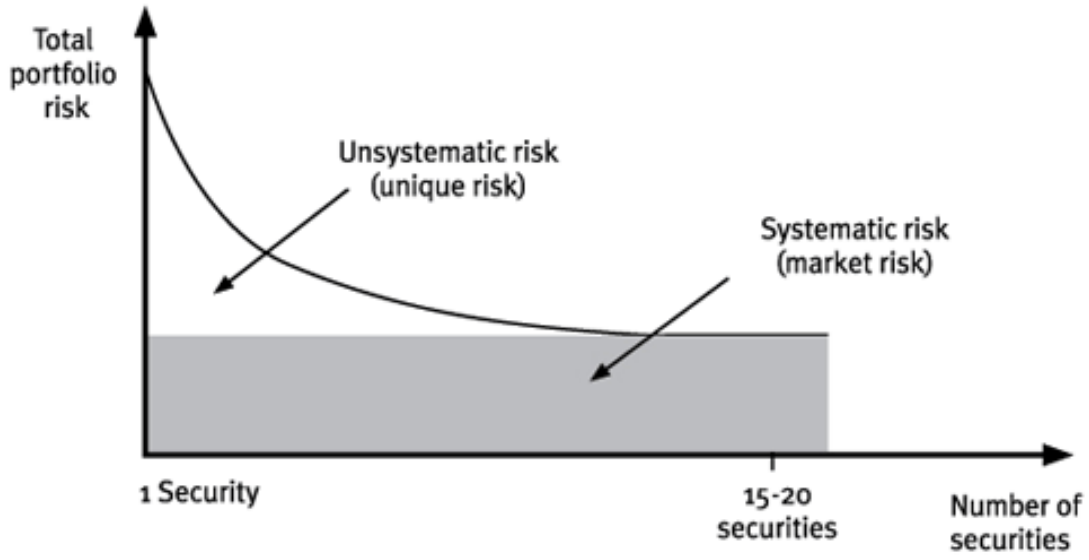


Figure 4: Systematic and unsystematic risk (Bank 2013)

One measure of risk in finance is the standard deviation of the fund's returns. Standard deviation measures the funds average deviation from the average return (Bodie 2009). Use of historical risk to provide estimates of the risk in the future, have shown to be more accurate than using historical returns to estimate future returns (Haslem 2003).

There are five principal risk measures: standard deviation, beta, alpha, r-squared, and the Sharpe ratio. Each risk measure is unique in how it measures risk. When comparing two or more potential investments, an investor should always compare the same risk measures to each different investment in order to get a relative performance perspective (Investopedia 2013).

3.5. Risk management

In finance, investment decisions are made ahead of time; meaning decisions are made under uncertainty. This introduces risk management, which is defined as the practice of identifying, assessing, controlling, and mitigating risks. Threats and vulnerabilities are key drivers of risk. Identifying these threats and vulnerabilities relative to an investments or organizations is an important step. The goal with risk management is not to eliminate risk, rather attempt to identify the risks that can be minimized, and implement measures to mitigate the risk. (Gibson 2010). Risk management can be divided into two types of activities, risk assessment and risk control activities.

The risk assessment activities include:

- Risk identification
- Risk analysis
- Risk prioritization

To identify risk one should use all available information, former lessons learnt from similar activities, checklists, brainstorming etc. When the risks have been identified, one can conduct a risk analysis to establish a probability for the incident to occur, and the consequences if it does occur. Based on these variables, one can get an insight to the risk exposed. This does not incorporate the uncertainty perspective.

Risk control activities use the outputs from the risk assessment, as input for the risk control activities. These include (Gardiner 2005):

- Risk response
- Risk resolution
- Risk monitoring and reporting

Effective risk management is related to understanding the threats and vulnerabilities one is facing. For mutual funds, risk management is used to complement and aid the fund managers in decision-making, characterized by high risk and large uncertainties.

3.5.1. Challenges in risk management

The financial markets are as complex as ever due to an accelerating development in technology and complex financial instruments available to investors. This has contributed to that the world has become more financially integrated, which has affected the risk picture for finance. One of the challenges the financial industry is facing is to understand and manage the risks. To meet these challenges the financial industry has development more complex and improved approaches to assess and manage enterprise-wide risks. Fund managers work in an industry where one must take risks in order to obtain returns. A fund should invest in assets complementing the portfolio and at the same time avoiding unnecessary risk. There are a variety of quantitative methods for determining the risk and to ensure the fund stay within the determined risk profile. Despite the development in risk management, it does contain a potential weakness. This is that the traditional approach for risk management does not incorporate the uncertainty perspective. Aven argues that this is a potential pitfall. Historical data can provide insight into risk (Aven 2010), but can occur that have not happened earlier with respect to background, complexity and magnitude.

3.5.2. Proposed tool

To aid in managing these challenges, it is proposed to use Avens (A,C,U) perspective as a tool to incorporate the uncertainty for the financial industry, or more specific related to this work, for a mutual fund evaluation. The aim is to use this risk perspective in a practical evaluation of the fund performance. Aven (2010) argues that it is not meaningful to quantify the model uncertainty. One should however, test and validate a model as one need to address the accuracy of the model. The uncertainty is often expressed through an uncertainty analysis. This may be performed using a: quantitative, qualitative or semi-qualitative analysis.

To incorporate the uncertainty into the evaluation, a qualitative evaluation is suggested. This will be supplemented with the quantitative evaluation. For the quantitative evaluation, the concept of risk is based on traditional tools for measuring risk such as standard deviation, beta, Jensens Alpha and the Sharpe Ratio. The qualitative evaluation will be built on this, to get a more complete evaluation of the funds' performance with respect to the underlying risk.

4. Finance and portfolio theory

This chapter introduces the theory necessary to develop an understanding of the models and methods used in this thesis. First, theory on mutual funds is presented, followed by a section of portfolio theory. A section of the efficiency of markets follows, where one discusses the financial markets efficiency.

Finally the chapter introduces the independent rating company Morningstar, including their rating system used to evaluated mutual funds. This rating system will be compared to this thesis findings, to evaluate if the funds and in particular Skagen Kon-Tiki deserves the current rating.

4.1. Mutual funds

Skagen defines mutual funds as:

«A fund that normally have 80 - 100 percent exposure to the stock market. The return consists primarily of gains (or losses). Dividends paid by the companies to shareholders will accrue to the shareholders of a mutual fund and the dividends will either be distributed to shareholders or reinvested in new shares. « (Fondene)

There are several types of mutual funds available to customers, divided into different investment strategies. Financial service companies manage several mutual funds, organizing an entire collection of funds to investors. This makes it easier for investors to allocate assets across various market sectors. The funds are classified by their principal investments, and described in prospects available for investors. Mutual funds are divided into three types of mutual funds; open-end, closed-end, and investment trust. The most common of these is the open-end fund. The open-end funds are exchange-traded funds and have an unlimited number of shares. An investor can purchase a piece of the fund, in which the fund creates a new share, and sells it to the investor. The closed-end funds an investor buys a piece of the fund, and one has to purchase an existing share. This type of fund is however, not as common as the open-end funds (Bodie 2009). Investment trust is an investment firm formed to hold other firms securities, and for obtaining its capital from public issues of shares traded on the stock

exchange. Investment trusts are closed-end funds, and represents the investors' interest in the trust's investment portfolio (Dictionary 2013).

In general there are four types of categories for funds; money market funds, bond or fixed income funds, hybrid funds and equity or stock funds. Within each of these categories the funds have various investment focuses with different risk and return characteristics. Investments focus can be industry distribution, geography, emerging markets, and small companies, to name a few. This makes it possible for investors to choose the most suitable categories, and risk profile for their portfolios.

4.1.1. Money market funds

Money market funds are mutual funds that invest in money market securities such as short-debt securities, repurchase agreements, commercial paper or certificates of deposit. The money market funds are regarded as being less risky, likened to bank deposits, but achieving higher returns. The money market funds aim to reduce the risk profile, seeking to limit exposure to losses due to liquidity and credit risks. The average maturity of the assets is relatively short, usually a bit longer than 1-month maturity. The money market is highly regulated. The funds must maintain a weighted average maturity, of 60 days or less; at the same time not investing more than 5% of the funds capital in one asset. Money market funds are important contributors to the financial markets, providing liquidity. There are usually no tax implications on money market funds, such as capital gains/losses associated. (Bodie 2009)

4.1.2. Fixed income funds

Fixed income or bond funds invest primarily in bonds and other debt instruments, specializing in the fixed-income sector. There are various types of bond funds, depending on the investment focus. Bond funds typically pay higher dividends to investors than money market funds. Examples of investment focus can be funds concentrating on corporate bonds, Treasury bonds, municipal bonds, or mortgage-backed securities. Some funds also specialize in other focus areas such as credit risk or maturity. The credit risk of the issuer is ranging from very safe to high-yield, also called "junk bonds" due to their risky nature. Most bond funds pays periodic dividends, including interest on the underlying securities, in addition to periodic capital appreciation (Bodie 2009).

4.1.3. Hybrid funds

Hybrid funds are mutual funds that invest in a mix of bonds and stocks. The mix may be fixed or vary over time. Hybrid funds can be appropriate for investors who seek higher returns than what is normal for bonds, and at the same time seek to reduce the volatility typical in stock funds. In actively managed funds, the fund manager varies the mix of bonds and stocks, relative to market changes, In passively managed funds however, the mix changes over the lifetime (Investopedia 2013).

4.1.4. Equity funds

Equity or stock funds are mutual funds that invest primarily in stock. The fund managers may combine stocks with fixed-income or other types of securities. Stock funds are traditionally classified by focusing on long-term growth through capital appreciation, combined with dividends from the stocks in the portfolio. Equity funds will usually hold a small percentage of total assets in cash or in money market securities. This is done to take advantage of new investment possibilities, and to ensure the fund is able to meet potential redemption of shares. There are several types of stock funds available for investors depending on investment focus, level of risk or investment style to mention a few (Bodie 2009).

4.2. Portfolio Management

Managementstudyguide (Managementstudyguide), defines portfolio management as:

«The art of selecting the right investment policy for the individuals in terms of minimum risk and maximum return is called as portfolio management. Portfolio management refers to managing an individual's investments in the form of bonds, shares, cash, mutual funds etc. so that he earns the maximum profits within the stipulated time frame".

Portfolio management is a general term, used as the description of a manager responsible for a mutual fund. The Investment Manager will select the composition between stocks, bonds, fixed income and cash, for a mutual fund. There are essentially two ways to manage mutual funds:

- Passive management
- Active management

4.2.1. Active management

Active management is a financial strategy, where the fund managers analyze companies and actively pick stocks for the mutual fund; with the goal of outperforming their benchmark index. The concept of active management is that a fund manager exploits market inefficiencies by stock picking, or market timing. A variety of strategies are used to construct a portfolio with the goal of outperforming their respective benchmark index, depending on the mutual fund. Active management funds have different fees related to the performance of the fund. The funds demand a certain management fee, usually a fixed fee and a percentage of an increase in the returns

The supporters of the efficient markets believe that active management is not appropriate. Their arguments are that since no shares are over, or underpriced, and since active management is more expensive than passive, then active management cannot beat passive management over the long run.

There are however, arguments in favor of active management. If there are no active managers in the market, then none of the information is reflected in stock prices. Furthermore, it may be bubbles in an index or sectors, and one can get large disparities in terms of industry distribution and/or geographic distribution. Empirical studies, such as "Mutual Fund Performance at the Oslo Stock Exchange" (Sørensen 2009) indicates that it is not profitable with active management after the management fees are deducted, compared with so-called passive management; and thus that at least some markets are efficient. The paradox is that, if all investors or mutual funds use a passive management style, then much less information will be reflected in prices, resulting in less efficient markets.

4.2.2. Passive management

Passive management is a financial strategy where a fund manager invests, following a pre-determined strategy, and does not try to invest actively by market timing or stock picking. The passive managed funds try to perform similar to a specific pre-determined index, such as Oslo Stock Exchange or New York Stock Exchange. There are many thousand different passive managed funds from which a customer can choose. Depending on which index or investment

area the investor wishes to be exposed to. The general idea behind passive management is according to the supporters of the efficient markets; that it is not possible to beat the market in the long term. They argue that it is better to follow a specified index and minimizing investing fees. A fund with passive management will have better possibilities of achieving higher returns than a fund with similar investments, but with higher fees.

4.2.3. Fundamental analysis

Fundamental analysis is a bottom-up approach, where the investor uses data and expectations of the future to determine/evaluate the value of a stock. Elements such as current and expected future earnings, owners, dividend, risk and expectations of future risk-free interest rate are only a few of the factors that are evaluated by the investor. The analysis is complemented with a thorough study of the companies' balance sheets, dividend history and past earnings. If the investor comes up with a value exceeding the current stock price, the investor will recommend purchasing the stock (Bodie, Kane et al. 2011).

4.2.4. Technical analysis

Technical analysis is an attempt to exploit recurring and predictable patterns in stock prices to generate superior investment performance. Fund managers using technical analysis do not deny the value of fundamental information. However, they believe that studying historical market data can be used to predict the direction the stock price is going. The managers study historical data of the stocks prices, based primarily on the prices and volume, to identify trends and patterns.

The efficiency of the technical analysis is disputed by the efficient market hypothesis, which states that the prices fully reflect all available information. Thus, that the stock prices are unpredictable in the long run (Bodie, Kane et al. 2011).

4.3. The Efficient Market Hypothesis

Investors have studied stock prices in the financial markets for some time to find possible patterns. This has been a challenging task, with the stock market going up one day and down the next. Several ideas have been presented over the years. The Efficient Market Hypothesis, (EMH), has received most attention. Today the EMH is the most used and respected theory for estimating future stock prices. The EMH, also known as Random Walk Theory; is the proposition that assets prices fully reflect all available information. The theory is important for investors, as it is one of the most fundamental theories in finance, explaining why prices in assets change. The proposition was first expressed in a thesis, ”The Theory of Speculation”, by the French mathematician Louis Bachelier around 1900. Bachelier worked to identify if stock and assets prices fluctuated randomly or not. The proposition was further developed by Eugene Fama with his Ph.D. thesis,”Efficient Capital Markets; A Review of Theory and Empirical Work”. In this proposition Fama presented strong evidence that stock prices fluctuate randomly and that the random-walk hypothesis therefore holds. This contributes to the argument that active fund management does not attribute with anything else than higher cost. Mutual fund customers or investors may wonder whether one should choose passive management over active management if this proposition holds. How the investor perceives the degree of efficiency in the market will play a large role in the choice of passive or active management (Fama 1970). There are according to the definition of the efficient market hypothesis some necessary conditions for the market efficiency hypothesis to be true (Shleifer 2000):

1. Investors are rational. There is a large number of rational profit maximizing investors in the market, who actively participate and keep updated on the market.
2. If some investors are irrational other irrational investors cancel out their trades, or rational arbitrageurs eliminate their influence in the market without affecting prices.
3. Information is costless and available to all market participants at the same time. Investors react quickly to new information, causing stock prices to adjust accordingly.

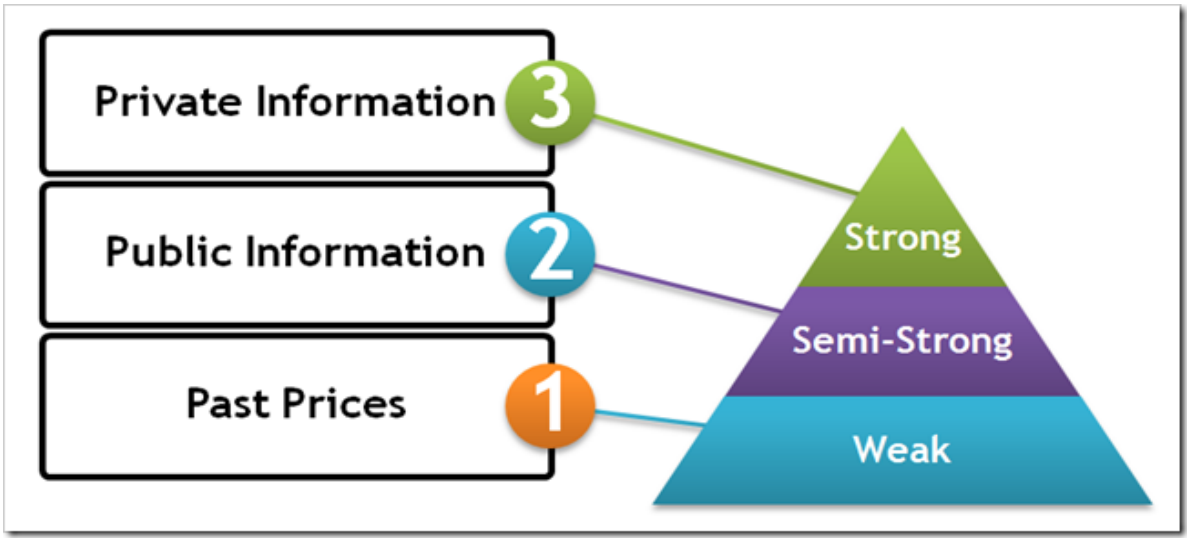


Figure 5: Versions of the Efficient Market Hypothesis (Turtle 2013)

One distinguishes between three versions of the EMH; the weak, semi-strong and strong form of the hypothesis. The weak-form hypothesis asserts that stock prices fully reflect all historical information. There are no possibilities for investors to detect mispriced stocks, and beating the market by looking at history of past prices, trading volume, or short term interest. Consequently, investors should not be able to profit from using information that is available for everyone.

The semi strong-form hypothesis assumes that stock prices reflect all public information, including data reported in companies' financial statements. That is in addition to the historical information the following information is reflected in the stock prices; a companies' balance sheets, expected future earnings, patents, risk and expected future dividends are reflected in the stock price. The strong-form hypothesis however, assumes that stock prices reflect all available information relevant to the company, including inside information. (Bodie, Kane et al. 2011)

If the financial markets had a strong-form there would be no use for financial valuation models and actively managed funds, as all stocks and assets would be valued and traded at a price reflecting all available information. One says that well-established and developed markets have semi-strong form efficiency. With the ongoing debate surrounding a fund manager's ability to outperform the index in a semi-strong market, one moves into the efficiency paradox. The paradox is based on the fact that many fund managers believe that the financial markets are not efficient, and try to exploit this. They look for mispriced stocks,

in an attempt to outperform the index. The fact that there is currently a huge market for actively managed funds available for customers shows it is possible to achieve higher returns with actively managed funds. This is however a challenging task and many funds are not able to outperform the respective index (Tor 1993).

A question of interest is whether fund performance persists. Performance persistence is the idea that historic performance will continue in the future. If for instance a mutual fund that have outperformed other funds earlier, will it continue to do so in the future, or if a fund that have consistently underperformed, will continue to do so in the future. Investors obviously want the highest possible return for their invested capital. They want consistently good performance, and will most likely remove the invested capital from consistently poor performing funds. Another question that arise is if investors have found consistent performing funds, should they stick with these and sell any underperforming funds? Fama (Fama 1991) argued that if the markets are efficient, then mutual fund returns should not be predictable using historic information. The counter argument is according to Gruber (Gruber 1996) that since a mutual fund sells its shares at net asset value, superior fund management skill, the source of performance, may not be priced. That is fund returns may be predictable. In the debate on fund performance persistence three factors are pointed out (Bodie 2009).

The first factor is that one need to manage relatively large portfolios to get benefits from analysis. The second factor is that if a fund finds an investment strategy that can actually outperform the market year after year, it is unlikely that the fund will share this with anyone. Thus, neither strategy becomes available to the public. The third factor is down to luck. There are numerous actively managed mutual funds in the markets; there will of course be some who succeed. The question is then is this down to superior ability, or luck. The critics of active management claim that if not all, and then most will be down to luck. Despite divided opinions, most regard the markets generally as efficient (Bodie 2009).

4.4. Capital Asset Pricing Model – CAPM

The capital asset pricing model, (CAPM), was introduced by Treynor (1961), and further developed individually by William Sharpe (1964), John Lintner (1965) and Jan Mossin (1966). The foundation of the CAPM was laid by Harry Markowitz (1952) in his work on modern portfolio theory. CAPM is a model used to determine an appropriate required rate of return for an asset, in relation to the assets risk. That is, the expected returns of alternative investments with the corresponding risk. The model can be used for pricing both an individual asset and a portfolio consisting of multiple assets. The CAPM suggests that an optimal portfolio is a combination of a risk-free asset and the markets portfolio. The model can be used to provide a benchmark for evaluating investments and portfolio performances (Bodie, Kane et al. 2011).

Modern portfolio theory and CAPM is built on a set of simplified fundamental assumptions, where the complexity of the market is ignored:

Assets:

- Assets returns are normally distributed.
- Everyone agrees on their distribution.
- There is a risk-free asset.

Investors:

- Are rational and behave in a manner as to maximize their utility.
- Base decisions on expected returns and standard deviations of the returns.
- Are risk averse and try to minimize the risk and maximize return.
- Perceive risk as the standard deviation of returns.
- Maximize the single-horizon utility.
- Are price takers, i.e. cannot influence prices.

Markets:

- Guarantee free access to fair and correct information on the returns and risk.
- Are efficient and absorb the information quickly and perfectly.
- Have no transaction costs or taxes.
- Allow unrestricted short selling.
- Every asset is tradable at any point in time.

The Capital Asset Pricing Model is defined as:

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

where,

$E(R_i)$ = The expected return on the capital asset

R_f = Risk − free rate of interest

$E(R_m)$ = The expected return of the market

$E(R_m) - R_f$ = The market premium

β_i = The assets beta

Beta measures the sensitivity of the returns on an asset relative to the return of the market, and is defined as:

$$\beta_i = \frac{Cov(R_i, R_m)}{Var(R_m)}$$

where,

$Cov(R_i, R_m)$ = Covariance between return on the asset and the return on the market

σ^2 = Variance of the market.

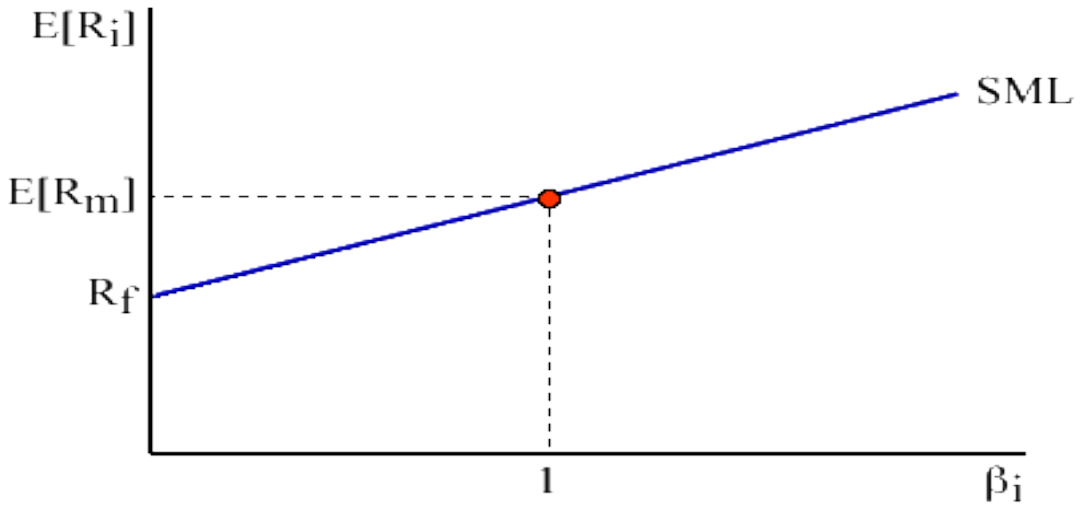


Figure 6: Characteristics of the CAPM (Prenhall 2013)

The beta is introduced to capture movements in the portfolio relative to the market. The market has a β equal to 1. So if a portfolio has a beta-value equal to 1, the portfolio and the market have the same sensitivity. If the portfolio has a β higher than 1; it indicates that the portfolio will be more volatile than the market portfolio and as such, have a higher risk than the market. An upward movement in the market will result in a higher rise for the portfolio. Similarly, if the portfolio has a beta-value less than 1, it indicates that the asset has a lower sensitivity than the market portfolio; and as such the asset is less risky than the market (Bodie, Kane et al. 2011).

The CAPM only provides compensation for the systematic risk, which means the model assumes that portfolios are well diversified. That is, the model states that the unsystematic risk has no effect on the expected returns. This is one of the reasons that the CAPM has been subject to criticism, as in reality many portfolios are not sufficiently diversified (Fama and French 2004). Despite the CAPM`s weaknesses, it is the standard other risk and reward models are compared to. The background for this is CAPM´s simplicity and effectiveness.

One of the most essential concepts within modern portfolio theory is the efficient frontier introduced by Harry Markowitz. As mentioned earlier the CAPM suggests that an optimal portfolio is a combination of a risk-free asset and the markets portfolio. The idea behind the

efficient frontier is that an investor or fund manager should combine assets in a portfolio as efficient as possible to ensure that one is able to achieve the highest possible returns for its level of risk. This can be illustrated in figure 8.

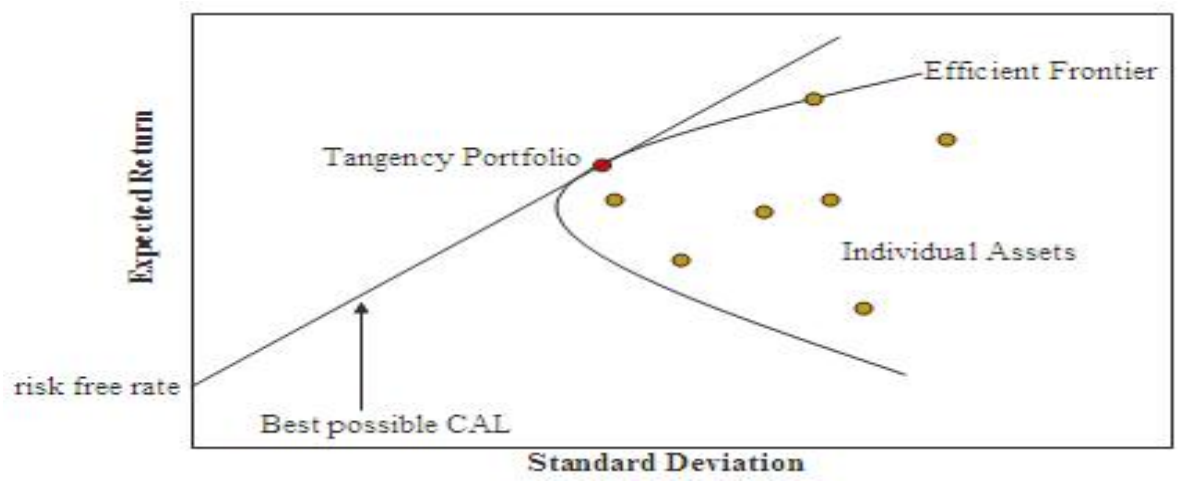


Figure 7: The Efficient Frontier (Euronomist 2013)

The point of tangency with the capital market line is the point where a portfolio provides the highest possible return at minimal level of risk. An investor or fund manager's position in the efficient set will depend on the investors pre-determined risk profile. The fund manager will strive to diversify the portfolio in order to reduce the unsystematic risk as low as possible in order to come as close to the point of tangency.

According to the Norwegian Treasury Department (Finansdepartementet 1997), a good fund management strategy can be characterized by the ability to maximize return given the maximum pre-determined risk, or to minimize the uncertainty associated with the overall risk of the investments. In this context, risk is defined as the uncertainty related to the variation in total return from period to period. In such a portfolio, the risk will be spread across multiple types of assets in various markets and securities. By diversifying, one can achieve a reduction of risk without necessarily reducing the expected return. In an efficient portfolio a fund manager should only take on risk if one can achieve higher returns for the risk. A portfolio of multiple assets will have lower risk than if an investment was placed in one individual asset.

The stronger negative correlation between price changes for the various securities, the more risk one can eliminate without costs.

4.5. Morningstar rating

Morningstar supplies investors with information on mutual funds, offering tools and analysis to help simplify investment decisions. Morningstar does not give any direct advice on which fund investors should choose, leaving the investment decisions to the individual.

Morningstar’s rating is based on the funds' historical returns and risk figures, minus costs. The rating ranging from one to five stars, relative within the category the fund belongs. The top 10 percent funds receive five stars, 22.5 percent receive four stars, the next 35 percent receive three stars, and the following 22.5 percent gets two stars, while the last 10 percent only receive one star. All the funds available for sale in Europe are categorized and evaluated against each other. Equity funds that are younger than three years are not granted stars. Morningstar’s rating gives an indication of how a funds risk-adjusted historical return is compared with other funds in the same category. The rating system is updated once a month and publicized on Morningstar’s homepage. For mutual funds, the categories rating are based on the last 36 months, Morningstar Risk Adjusted Return. Each fund in Morningstar's database is assigned to a category based on the fund's asset allocation over the past few years. The number of stars a fund has achieved only shows how well the fund has performed relative to other funds within a category until today. One should not rely blindly on the rating, as historical returns are not always a good indication for the future. Risk and returns are interrelated; that is, the higher return a fund has obtained, the greater risk can be found in the fund (Morningstar 2013).

5. Methods

The introduction of the CAPM provided a framework for assessing the portfolio`s return adjusted for the risk. From this framework, one has that returns and risk are positively correlated, that is, higher returns usually carry higher risk. In general investors cannot expect higher returns from investments, without taking on higher risks. If a portfolio achieves higher returns than other comparable funds by taking on the same risk, they have outperformed the market. This may be down to chance or a result of a fund manager's superior ability. The longer time period a fund can demonstrate higher returns, the more likely it is a result of superior ability.

This chapter builds on the CAPM framework, introducing methods used for evaluating mutual fund performances. The following methods presented: Sharpe ratio, Jensen's alpha and Value at Risk. The Sharpe ratio is introduced to evaluate the funds returns relative to the risk. Jensen's Alpha is presented to analyze if the funds have obtained their results from superior investments, or by taking on more risk. Last, the Value at Risk is presented to get a more thorough analysis of the underlying risk of the funds. First, a general definition of VaR is presented, followed by different methods to estimate the VaR.

5.1. Sharpe Ratio

The Sharpe ratio is a measure of performance for mutual funds, introduced by William Sharpe in 1966. Sharpe received the Nobel Prize in 1990, for "pioneering work in the theory of financial economics". The Sharpe ratio or reward-to variability ratio is one of the most widely used performance targets for portfolio assessment. It is a ratio that measures the excess return over the risk-free rate per unit of total risk.

The Sharpe ratio for a portfolio is defined as:

$$S_p = \frac{R_p - R_f}{\sigma_p}$$

where,

- S_p = Sharpe Ratio for the portfolio

- R_p = Portfolio return
- R_f = Risk − free interest rate
- σ_p = Standard deviation of the portfolio

The Sharpe ratio for the market is defined as:

$$S_m = \frac{R_m - R_f}{\sigma_m}$$

where,

- S_m = Sharpe Ratio for the market
- R_m = Markets return
- R_f = Risk − free rate
- σ_m = Standard deviation of the market

The Sharpe ratio is often plotted against Capital Market Line, (CML) as a benchmark. CML shows the relationship between risky and risk-free investments. The market's Sharpe ratio is the slope of the capital market line, which is if a fund performs just as well as the market; the portfolio will be on the CML. If the fund performs better (or worse) it will be above (or below) the CML. A positive Sharpe ratio indicates that a fund has achieved a positive return relative to the risk free rate/ 3-year government bond index. Similarly, if a Sharpe ratio is negative the fund has achieved a lower return than the risk-free rate.

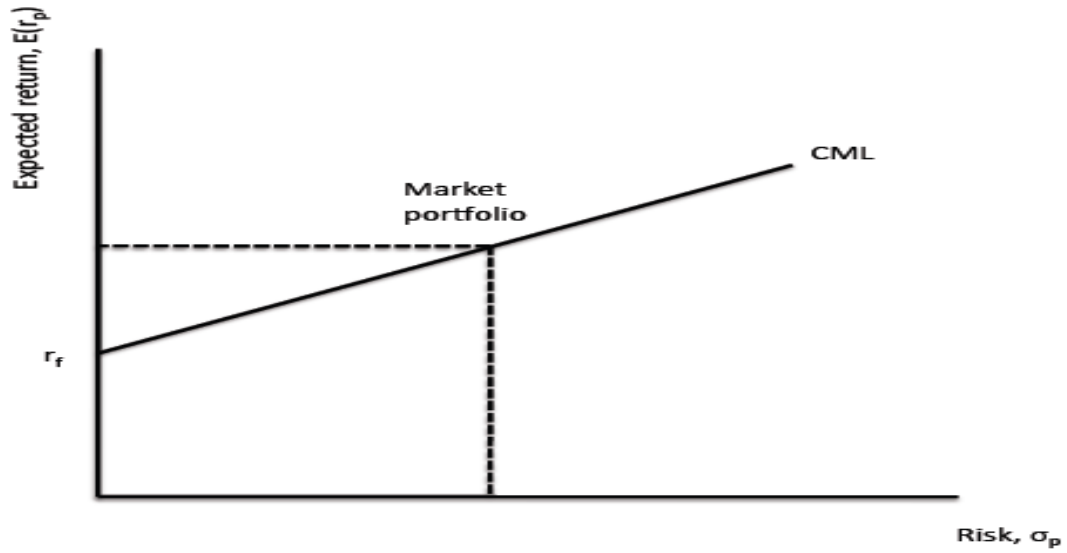


Figure 8: The Capital Market Line

5.1.1. Criticisms of and limitations of the Sharpe ratio

The advantages of the Sharpe Ratio are that the model is intuitive, and the calculations are simple. Despite the models simplicity, the Sharpe Ratio has some limitations, for which it has received some criticism. Sharpe presented some of these limitations when he introduced the method in 1966. Among the limitations associated with the method is that it does not take into account the correlation effects a fund may have with other assets or investments. William Sharpe stated that the Sharpe Ratio is a method that should be supplemented by other performance measures. The main problem with the Sharpe Ratio is that it assumes that returns are normally distributed, which is not always the case. Bernardo and Ledoit (Bernardo A. E 2000) illustrated that the Sharpe Ratio can give misleading results if the returns are not normally distributed. If the return distribution is skewed, and has a positive change, it will lead to a higher Sharpe Ratio. That is, if there are abnormalities in the probability distribution, like skew and kurtosis, it can results in that the method will give little constructive feedback. Dybvig and Ingersoll (Dybvig P. H 1982) illustrated that non-linear payoffs limit the application of the Sharpe Ratio for performance evaluation. Despite the models criticism and limitations, the Sharpe Ratio stands as an appropriate model for representing funds returns relative to the risk. One should however as William Sharpe stated upon the release of the method, supplemented the Sharpe Ratio by other performance measures.

5.2. Jensen`s alpha

Jensen's alpha is a risk-adjusted measure of the active return on an investment or a portfolio; used to test the fund managers' ability to achieve higher returns than expected by the CAPM. The alpha is one of the most used and known terms in finance for evaluating mutual funds' performance. Jensen's Alpha makes use of the CAPM, where the alpha sign is used to test whether a fund manager has outperformed or underperformed relative to a market index.

Jensen's alpha was developed by Michael Jensen (1967), in an article where Jensen wanted to investigate if some chosen fund managers was able to consistently beat the market over a longer period. Jensen calculated the returns of 115 different mutual funds against expected return through the CAPM, and developed an absolute measure, where each fund was measured against an absolute standard (CAPM). The measure he developed is known as Jensen alpha or index, and is defined as:

$$\alpha_p = R_p - [r_f + \beta_p(R_m - r_f)]$$

where,

- α_p = The portfolios alpha
- R_p = The portfolios return
- R_m = The market return
- $r_f + \beta_p(R_m - r_f)$ = CAPM

As with most models, it is a simplification of more complex situations. The model is only as good as the numbers one put in. The assumptions behind the model are a constant beta and risk-free rate. This is however problematic, since a portfolios beta changes continuously with the introduction of new stocks, or other changes in the portfolio. One will also have to take note to use the right benchmark index when calculating Jensen`s alpha, as the selection of index will influence the result.

In an efficient market, the alpha coefficient is expected to be zero. A positive alpha indicates that a portfolio has outperformed the market on a risk-adjusted basis. A negative alpha indicate that a portfolio have performed worse than the market on a risk-adjusted basis (Bodie 2009).

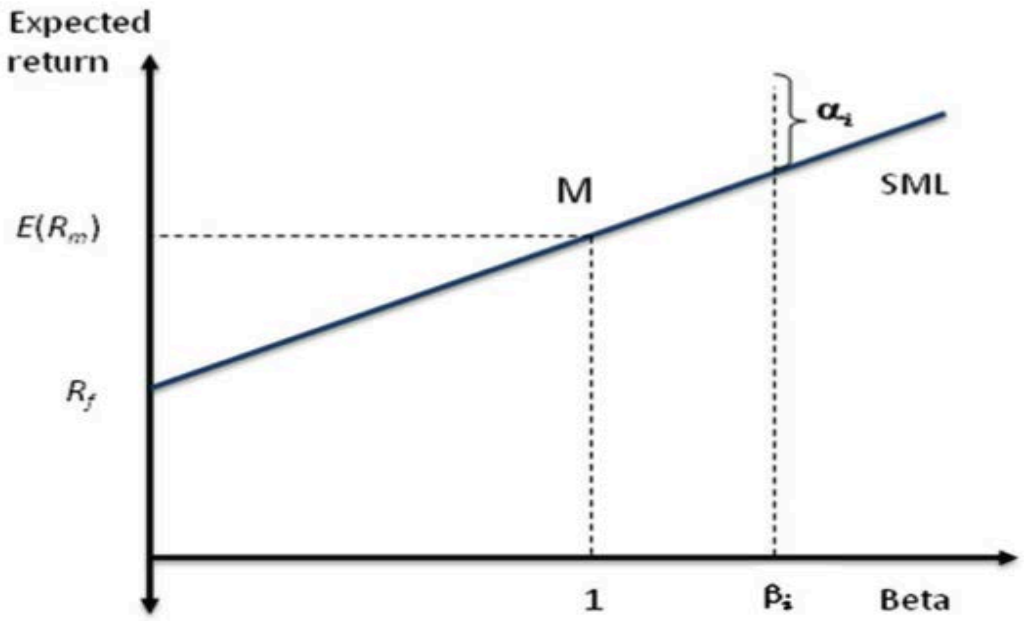


Figure 9: Jensen's alpha characteristics

5.3. Value-at-risk (VaR)

Value-at-Risk, VaR, is one of the most widely used models in risk management in the financial industry. VaR is a risk measure that defines the worst-case loss that can occur under normal market conditions over a specified time horizon and at a certain confidence level (Ong 2006). The VaR is an important tool in the financial industry as it is one of the major risk indicators available for fund managers and investors. The VaR was introduced in the 1980`s as a result of new financial instruments available such as futures, Treasure Bill futures, currency and interest rate swaps, derivatives and options to mention some. Along with these new financial instruments came the opportunities for leverage, especially instruments such as securities lending and short sales allowed higher leverage opportunities. The introduction of these new instruments' changes the risk picture in the financial markets. Firms were more leveraged then earlier, and the markets became increasingly volatile. These factors resulted in that the traditional risk methods were all of a sudden ineffective, especially when applied to derivatives. The need for new risk measures was needed and resources to implement VaR were allocated, which led to the introduction of the VaR (Holton 2002).

The VaR gives a measure of the maximal potential loss for a specified time horizon under a given probability, for a portfolio or a financial product. The time horizon is often referred to as the holding period and it is the time the assets in the portfolio are constant. A typical time horizon for funds is one day. One can utilize different confidence intervals according to what one is interested to identify. If for instance a 1-day VaR at 90 % confidence interval, provide the value that gives the portfolio or financial products maximum daily loss with 90 % probability. In other words, there is a 10 % probability that the portfolio or financial product will yield a return less than the VaR value.
The greater share of high-risk assets in a portfolio or financial product, the higher VaR value one will get. In practice VaR is best for measuring risk for a shorter time period, from a day till two weeks (Simons 2000).

Pearson and Linsmeier (1996) defines VaR as:

Value at risk is a single, summary statistical measure of possible portfolio losses. Specifically, value at risk is a measure of losses due to `normal` market movements. Losses greater than the value at risk are suffered only with a specified small probability. Subject to simplifying assumptions used in its calculation, value at risk aggregates all of the risks in a portfolio into a single number suitable for use in the boardroom, reporting to regulators, or disclosure in an annual report. Once one crosses the hurdle of using a statistical measure, the concept of value at risk is straightforward to understand. It is simply a way to describe the magnitude of the likely losses on the portfolio (Pearson 1996).

VaR is a useful tool utilized in several industries and areas. VaR has four main areas for which it is used; financial control, financial reporting, risk management and to determine regulatory capital. In this thesis the VaR is used for risk management where it has some important characteristics for the funds risk managers, for risk measurement in the portfolio`s. The risk managers can use VaR to estimate the risk they are exposed to, and to manage the portfolio in such a manner that it is in accordance with the funds overall risk target. Furthermore, the VaR can be used to determine the maximum amount the fund it likely to lose in a period, to maintain adequate capital in the fund to cover possible losses. So the VaR provides a common consistent risk measure for fund managers, for the risk factors the fund is exposed to, and the correlations between different risks. That is, the VaR takes into account if risks offset each other and update the funds risk picture. This is essential if the fund manager is to be able to manage the portfolios risk.

Terje Aven has a more technical definition for VaR, defined as:

The value-at-risk, x_p, equals the 100p% quantile of the probability distribution of the potential loss X. Mathematically x_p is given by the formula $P\left(X \leq x_p\right) = p$. VaR is the size of the loss for which there is a small (e.g. 0.1%) probability of exceedance. Thus, if the VaR at probability level 99% is $100 million there is only 1% probability of a loss larger than $100 million (Aven 2010).

There are three basic approaches to VaR estimation:

- Parametric simulation
- Non-parametric simulation
- Monte Carlo simulation

5.3.1. Parametric simulation

Parametric or analytical estimation is viewed as the least complex of the three VaR approaches. The parametric approach does not require a lot of data, instead relying on a statistical distribution to describe or characterize the potential losses. Most parametric approaches assume normal distribution. To estimate the parametric VaR one has to set the VaR parameters for the simulation, that is; confidence level, probability of loss, time horizon and base currency. The advantages with parametric simulations, relative to the other simulation methods, are that it does not require extensive historical data, and is by far, the fastest simulation method. The general steps for calculating VaR are as follows:

1. Insert the VaR parameters; the confidence level, probability of loss, time horizon, and currency.
2. Determine the market value for each individual position in terms of currency.
3. Calculate the VaR of the individual positions with the given market volatilities.
4. Calculate the portfolio`s VaR with the correlations between the variables.

The VaR can be estimated by:

VaR = Market value * Price volatility

The standard deviation is used to express the volatility in the formula. The volatility will depend of the confidence interval for the VaR, i.e. confidence level multiple *standard deviation. For instance choosing a VaR with a confidence level of 99%, the volatility will be 2.58 * standard deviation.

5.3.2. Non–parametric simulation

Non-parametric, also called historical simulation generates scenarios based on actual historical returns for an asset or portfolio. The general idea behind the historical simulation approach is to use historical returns from an asset or portfolio, to simulate the funds portfolio`s VaR. By using historical simulation, one assumes history will give a good model for the future, i.e. that the historic risk factors will be representative for the future. To apply the historical simulation one has to collect a sample of historical returns for a portfolio over some period. The sample is used to form a hypothetical distribution for the portfolio`s future returns. From the distribution one can observe the funds profit and losses, and analyze the funds underlying risk.

"The historical approach uses the historical data directly by using historical changes as the possible outcomes of the coming change. If the historical data comprise of 501 days, the 500 possible changes together constitute the distribution of tomorrows change. By sorting the outcomes VaR can be easily found as the 5^{th} worst scenario for a 99% confidence level. The estimate can be easily updated day by day as the newest 501 days are used as the historical data set. " (Dahl 2009).

There are a number of advantages of using historical approach. First, the method is intuitive and straightforward, and as such a useful method to present to the fund customers, or management. Second, the data is available and easy to implement in a spreadsheet. Furthermore, the method does not depend on any assumptions about the return distribution. This results in that a risk manager avoids estimating incorrect parameters, which is one of the challenges faced when using approaches based on specific distributions, such as the normal distribution. The model also to a large extent avoids model risks. There has been some debate

whether the historical simulation or the normal distribution is the most suitable method for calculating the VaR. Some evidence is found that the historical simulation approach actually works better than normal approaches (Mahoney 1996) .Mahoney found evidence supporting that historic simulation provide unbiased estimates of VaR for all confidence levels up to at least 99 %, while normal approaches typically underestimate VaR for confidence levels above 95 %. Similarly Jackson, Maude and Perraudin found evidence that historical simulation is superior due to the fact that fat tails are allowed in historical simulation, while this is not supporter by the normal approach. Other studies, for instance (Kupiec 1995) point in the direction that the normal approach is superior. So the studies conducted within this field are controversial. There are however some proven shortcoming with the historical simulation. First the method has a restriction on the estimation part by assuming the asset or portfolio`s returns are independent and identically distributed. There are strong empirical evidence pointing to the contrary, that portfolio`s returns follow certain patterns and are as such not independent. Second, the historical simulation has restrictions related to the time, assuming equal weight to all the returns of the whole period that is obviously not the case. The advantages of using the historical simulation however outweigh the models shortcomings.

5.3.3. Monte Carlo simulation

The Monte Carlo method named after famous Monte Carlo in Monaco is the third VaR tool (Rollett and Manohar 2004). Monte Carlo simulation is a statistical method that can be used to determine solutions to analytically challenging mathematical problems. In the simulation process, some underlying random objects statistics known are sampled, to provide a distribution of possible future outcomes. The quality of the sample increases with more simulations of random events, resulting in increased accuracy for the data. The method was first introduced into the financial theory by David Bendel Hertz in an article in Harvard Business Review, when he discussed the methods applications in finance (Hertz 1964). Monte Carlo is used in various industries and has a wide range of application of valuing and analyzing investments and portfolios.

6. Data

This section presents the collected data sample and identified funds that lay the foundation for the analysis.

- Section 6.1 presents the selection of mutual funds.
- Section 6.2 presents the funds investment objective, risk profile and background.
- Section 6.3 presents the benchmark, the MSCI Emerging Market Index.
- Section 6.4 presents the risk-free rate, the Libor rate.
- Section 6.5 presents the time period.
- Section 6.6 presents the data selection.

6.1. Selection of funds

To investigate how Skagen Kon-Tiki has performed against funds with similar investment categories, 4 funds where identified from the independent investment company Morningstar. The funds were chosen from the category emerging markets. In the fund selection there was an emphasis of choosing a mix of ranking from Morningstar. The dataset was provided by Netfonds homepage (Netfonds), and contains daily net returns; calculated using arithmetic average after deducting the funds management costs.

The following funds were selected in for the analysis:

- *Skagen Kon-Tiki*
- *Fidelity Funds Emerging Markets Fund*
- *DNB Global Emerging Markets*
- *JP Morgan Funds – Emerging Markets Equity A*

Skagen Kon-Tiki currently holds a gold rating by Morningstar, which is the highest rating. The selected funds currently have the following rating in Morningstar: one gold candidate, one silver candidate and two bronze candidates. In addition, Kon-Tiki's rival fund in Scandinavia, DNB Global Emerging Markets was selected. DNB currently does not hold any rating in Morningstar, as it a relatively new fund established in 2004.

An overview of the funds, listing the fund manager, benchmark and year of establishment is provided in table 2.

6.2. Introduction to selected mutual funds

This section introduces a presentation of the funds, and provides the funds' investment objective, risk profile and background. This is presented to contribute to the readers understanding of the fund's investment objectives, as to the pre-determined risk profiles.

Table 1: Overview of mutual funds

Fund	Manager	Benchmark
Skagen Kon-Tiki	Skagen Forvaltning As	MSCI Emerging markets
Fidelity Funds Emerging Markets Fund	Fidelity Investments As	MSCI Emerging markets
DNB Global Emerging Markets	DNB ASA	MSCI Emerging markets
JP Morgan Funds – Emerging Markets Equity A	JPMorgan Chase & Co	MSCI Emerging markets

Skagen Kon-Tiki

Skagen Kon-Tiki is part of the Scandinavian mutual fund company Skagen Fondene, situated in Stavanger, Norway. Skagen Fondene was founded in 1992, and has become one of the largest fund managers in the Scandinavian market. The company has received several awards for investment excellence, and currently holds a gold rating by the independent investment research company Morningstar. The Skagen Kon-Tiki fund was established in April 2002.

Skagen Fondene is an actively managed fund, inspired by Benjamin Graham's investment philosophy; using a value-based and active investments strategy to achieve excess returns. Skagens philosophy is to invest in companies that are Undervalued, Under-researched and

Unpopular. They have a broad mandate; where they can freely invest in industries and countries around the world. Furthermore, they have a patient investment philosophy, on average holding investments for 3-5 years. (Fondene) Using a value-based and active investment strategy, Skagen Fondene does not consider the markets efficient. They try to beat their respective benchmarks, by market timing and stock-picking. The stock picking is taking advantage of mispriced companies; identifying undervalued, under-researched and unpopular stocks they consider having a value exceeding the current stock price (Skagenfondene 2013).

Investment objective:

According to Kon-Tiki¨s prospects, Skagen Kon-Tiki invests at least 50 percent of the fund's assets in emerging markets, i.e. countries or markets not covered by the MSCI Developed Market Series. The fund's objective is to find high quality at a low price, which is characterized by being undervalued, under-researched and unpopular. To reduce risk, the fund seeks to maintain a reasonable geographical and sector balance.

Risk profile:

Skagen has placed a risk profile of *high risk* for Kon-Tiki. The funds risk rating is determined to hold the value of 6; where the risk index spanning from 1, being the lowest, to 7, the highest rating.

Figure 10: Skagen Kon-Tiki`s risk scale (Skagenfondene 2013)

Fidelity Funds - Emerging Markets Fund

Fidelity Funds Emerging Markets Fund is a fund from the American multinational financial service corporation, Fidelity Investments. Fidelity Investments was founded in 1946, and is today one of the largest mutual fund and financial service groups in the world, with investment areas spanning worldwide.

Investment objective:

Invests principally in areas experiencing rapid economic growth including countries in Latin America, South East Asia, Africa, Eastern Europe (including Russia) and the Middle East.

Risk profile:

According to Fidelity Investments prospects, Fidelity Funds have been placed a risk profile of *very high risk* for the fund.

DNB Global Emerging Markets

DNB Global Emerging Markets is a fund from DNB ASA, which is currently Norway's largest financial service group.

Investment objective:

According to DNBs prospects, the purpose is to invest in the international stock market to achieve the highest possible risk adjusted returns, relative to their benchmark index. The fund's index is the Morgan Stanley Emerging Markets Free Index, MSNREF.

Risk profile:

DNB has placed a risk profile of *very high risk* for the fund. The funds risk rating is determined to hold the value of 6; where the risk index spanning from 1, being the lowest, to 7, the highest.

JP Morgan Funds - Emerging Markets Equity A (acc) - EUR

JP Morgan Funds – Emerging Markets Equity A is part of the global financial service company, JPMorgan Chase & Co, offering financial services worldwide.

Investment objective:

According to the funds prospect, the investment strategy of the fund is to invest achieve a long-term capital growth based on a portfolio of equity and equity related instruments in the so-called emerging markets in Eastern Europe, Latin America and Asia. The funds own benchmark is the MSCI, Emerging Markets Net Index.

Risk profile:

JP Morgan has placed a risk profile of *very high risk* for the fund.

6.3. MSCI Emerging Markets Index

In order to analyze the funds performances, a fund index or benchmark is required. The chosen index should reflect the funds' investments, both in terms of risk and composition. Using a benchmark makes it simpler for an investor to compare a fund's performance, and as such simplify the evaluation of a fund's performance. Fund managers try to show investors that they can create abnormal returns, in order to attract more investment capital. In doing so a fund manager can potentially choose an index that would give a biased representation of the funds' performance. That is, choosing an index that will make the funds performances look better than what has actually been the case. Further, the benchmark is used in methods such as Jensen's Alpha and the Sharpe Ratio. Care must be taken for choosing the right index, as choosing a false index will affect the beta-values, the market returns, and as such the results. It is therefore essential to identify the most representable index as benchmark for an evaluation. A thorough assessment has been performed, to ensure that the most representative index for the mutual funds was chosen. After a careful evaluation of indices, the index chosen was the MSCI Emerging Markets Index. This is the same index as most of the funds are following, according to their prospects. Figure 13 illustrates the regional distribution of Skagen Kon-Tiki vs. the MSCI EMI.

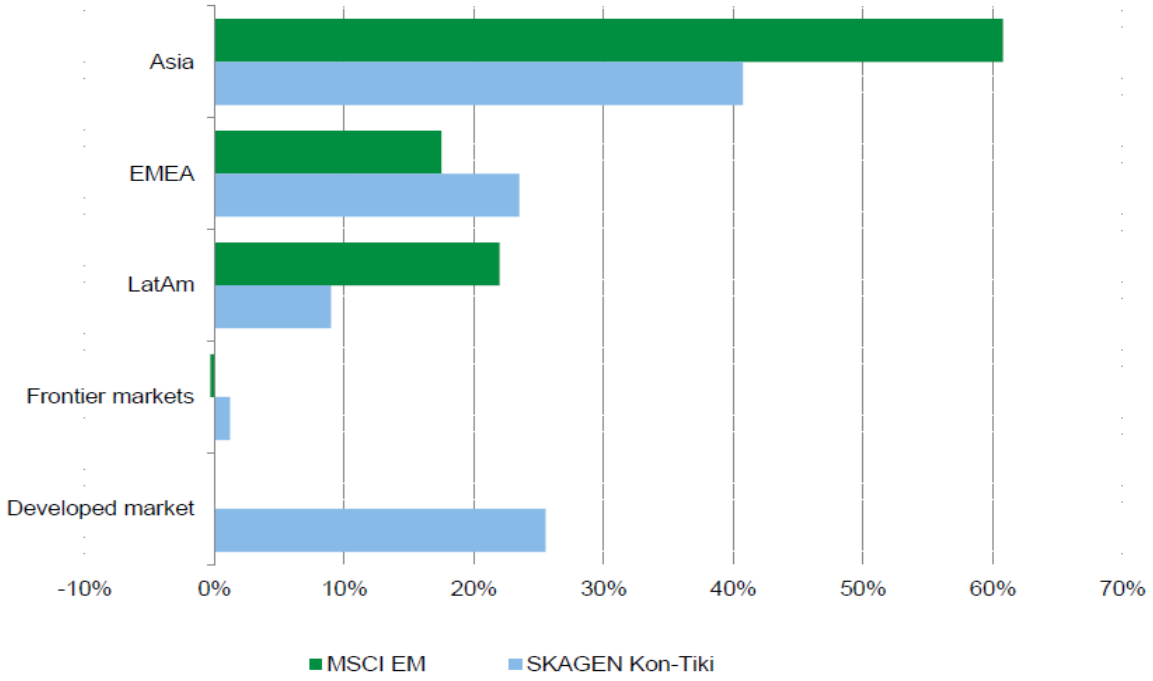


Figure 11: Regional distributions of Skagen Kon-Tiki and MSCI EMI (Fondene 2013)

The regional distribution for Skagen and MSCI EMI is quite similar. There are as expected some disparities, mainly in areas such as Asia and the developed markets. The MSCI EMI has more regional distribution in Asia than Skagen, and none in the emerging markets. Skagen has a smaller distribution in Asia, and around 25 % of their investments in the emerging markets. The regional distribution will change continuously for Skagen, as there are changes in the fund's portfolio. The funds regional distribution will therefore not be constant, and it is natural that changes will occur in the future. According to Skagens prospects, they have at least 50 % of their capital invested in companies in the global emerging markets.

The MSCI Emerging Markets Index is created by Morgan Stanley Capital International and is designed to measure the equity market performance in the global Emerging Markets. The Emerging Markets Index is a float-adjusted market capitalization index that consists of indices in 21 emerging economies: Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey. Figure 14 illustrates the country distribution of Skagen and the MSCI EMI.

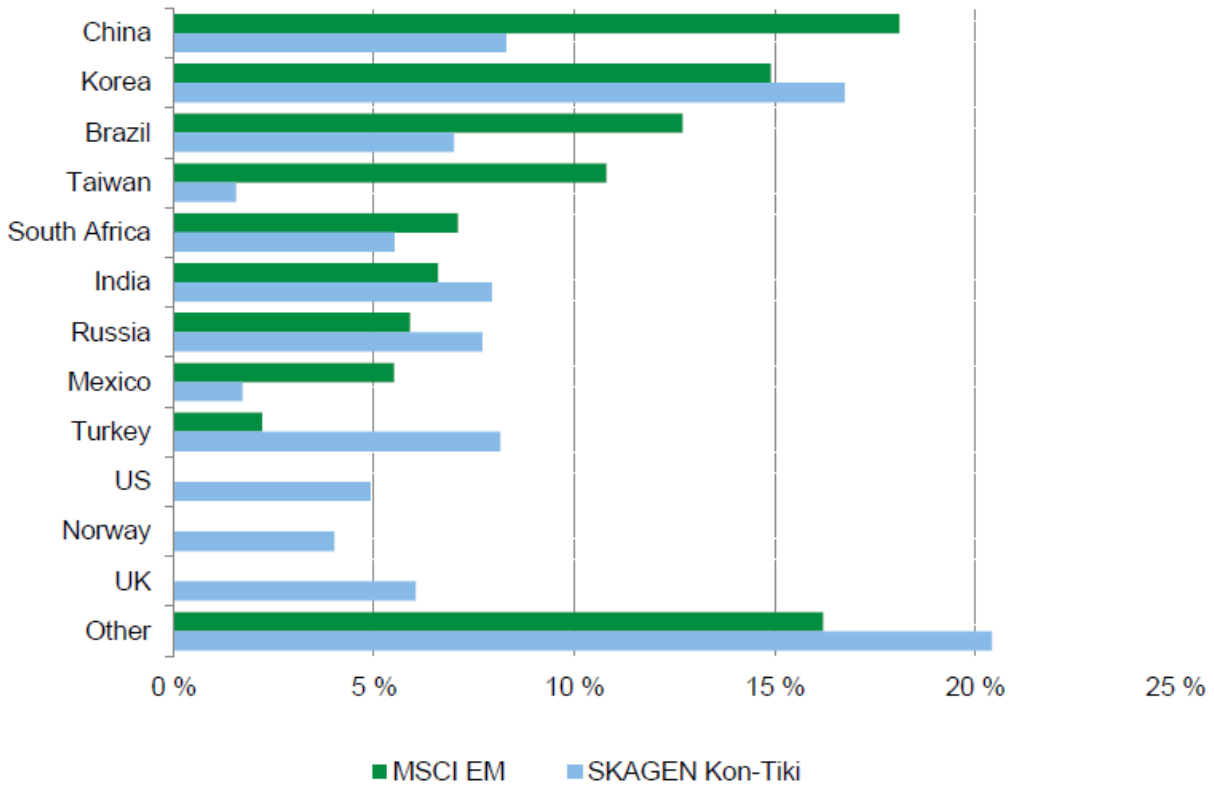


Figure 12: Country distribution of Skagen Kon-Tiki and MSCI EMI (Fondene 2013)

The figure illustrate that Skagen and MSCI EMI have very similar country distribution. There are as expected some disparities between the two, which was expected. One cannot expect the two to have identical distributions, since Skagen is an actively managed fund and will continuously evaluate new investment possibilities, resulting in changes. Overall, the presented figures indicate sufficient similarities for the regional and country distributions. Based on this the MSCI is a good benchmark for Skagen, and the other emerging market funds.

Emerging markets are considered relatively risky, because they carry additional political, economic and currency risks. Investing in these markets are not for risk averse investors. An investor in emerging markets should be willing to accept volatile returns. With the risk of large losses, there is however a possibility for larger profits. An upside to emerging markets is that their performance is generally less correlated with developed markets. As such, they can play a role in diversifying a portfolio, and thus reducing overall risk. (Investopedia 2013)

6.4. The Libor rate

To calculate the excess return, a representative risk-free rate is required. The risk-free rate chosen in this thesis is the 1 –year London Interbank Offered Rate, (LIBOR rate) (Rate 2013). The LIBOR rate is the average interest rate estimated by the major banks in London for what they would charge if borrowing from other banks. The LIBOR rate is along with Euribor widely regarded as the benchmark for short-term interest rates around the world. The changes in the LIBOR rates can have major consequences for the interest rates of many bank products such as loans, mortgages and savings accounts. The monthly LIBOR rate was used to calculate the average yearly LIBOR. The reason for this choice was to capture the interest rate development during the period, as the interest rates experienced some rather volatile fluctuations during the period. One can see the historical development of the monthly and calculated average yearly Libor rate below.

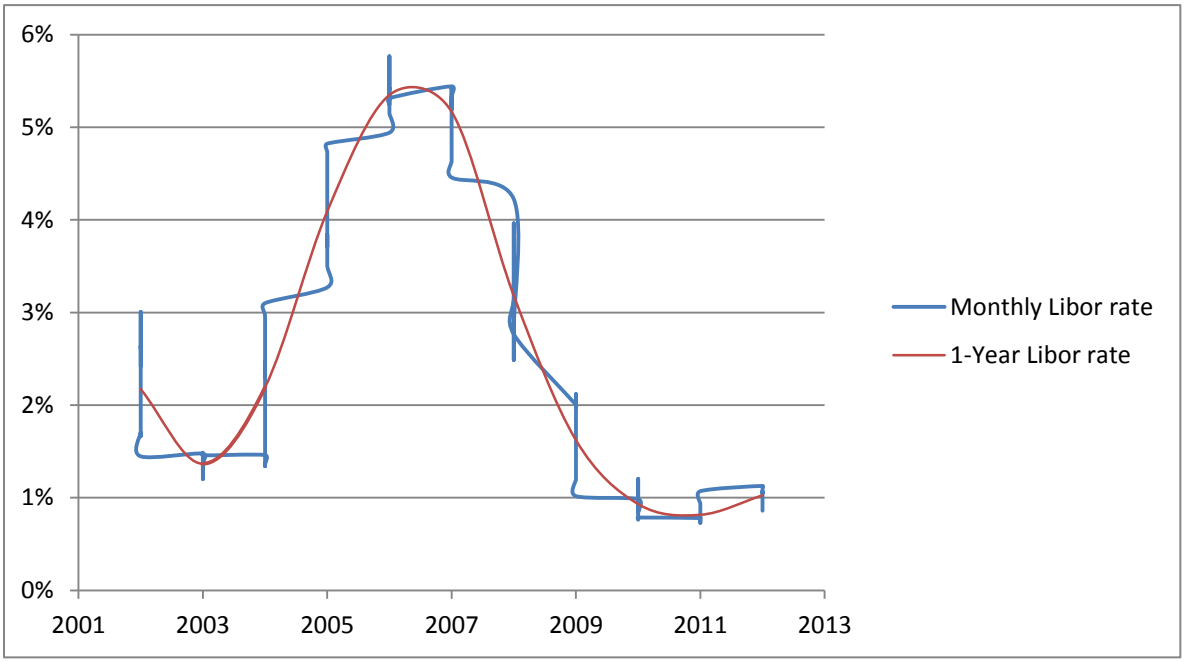


Figure 13: Monthly and 1-year Libor rate

The figure shows that the 1-Year Libor rate follows the monthly development of the Libor rate closely. The 1-Year Libor rate therefore provides a sufficient representation of the development of the risk free rate. Based on this the Libor rate is used in the calculations.

6.5. Time period

For the empirical study, it was important to collect as many observations as possible. Therefore daily data have been used to monitor the funds returns, to get as many observations as possible. The data sample is selected for the following time period, 01.01.2002-30.12.2012. The data set contains the funds, and the MSCI Emerging Markets returns. The returns are calculated using net-assets values, after subtracting dividends and yearly management's costs. The data have been divided into three periods, each period covering a four-year interval. This is done to get a better overview of how the performances have developed. The financial markets are constantly evolving, and in the selected data sample two financial crises have struck the markets. In 2001, the so-called "Internet bubble burst", and more recently in 2007-08 the global financial crisis paralyzed the markets. With this in mind, the choice of time period will have an impact on how the funds have performed.

In the first period, the Internet bubble burst, which obviously hurt the markets, and resulted in lower returns. Likewise, in the third period, the global financial crisis sent shockwaves through the markets. The background for the crisis was the collapse in the U.S. housing bubble, which peaked in 2006. Resulting in plummeting housing prices in U.S., this quickly spread across the world's major financial institutions. The stock markets collapsed, and there was a threat of a total collapse in the markets. The result was a major financial threat, one which the markets had not seen the likes of since the Great Depression of the 1930s. There were several bailouts of banks and financial institutions by the national governments, which after some time stabilized the markets. The markets started a steady rise in 2009 towards the top levels the markets was in 2007. This ensures that the data sample has some challenging and interesting subjects, and can provide valuable insight to how the funds fare in more vulnerable times.

6.6. Data collection

To carry out the evaluation of the mutual funds it is necessary to collect appropriate data, and identify the most suited methods. The theoretical framework presented in this paper, is provided from material from the University of Stavanger Library, and databases such as Scopus. Another approach for collecting theory was using relevant articles, books, working papers and thesis found from reference lists for similar subjects. The data for the funds was collected from Netfonds (Netfonds). The data are used for input in the models, and as such the methods are sensitive to unreliable data. It was therefore important to ensure that the data collection was as reliable as possible. A critical approach was used in the selection process of the data collection, verifying the price data from two independent sources to ensure its reliability.

7. Empirical results

This chapter presents the results obtained from the selected methods.

- Section 7.1 presents the descriptive statistics for the funds and benchmark.
- Section 7.2 presents the empirical results examining the fund manager's performance relative to the risk, represented by the Sharpe Ratio.
- Section 7.3 presents the results from using Jensen's Alpha.
- Section 7.4 presents a presentation of VaR.
- Section 7.5 presents the standard deviation.
- Section 7.6 presents a summary for the results.

7.1. Descriptive statistics

In this section, the funds and benchmarks returns are presented, illustrating how the fund and benchmark performed. The data is divided into sub-periods to get a better understanding of the development. In addition, a statistical data analysis conducted in excel is presented to supplement the descriptive statistics, and to verify the findings.

7.1.1. Total period

The descriptive statistics for the mutual funds and index are displayed in graph 16. The background for the lack of data for the fund DNB Global Emerging Markets is that the fund was not established until 2005.

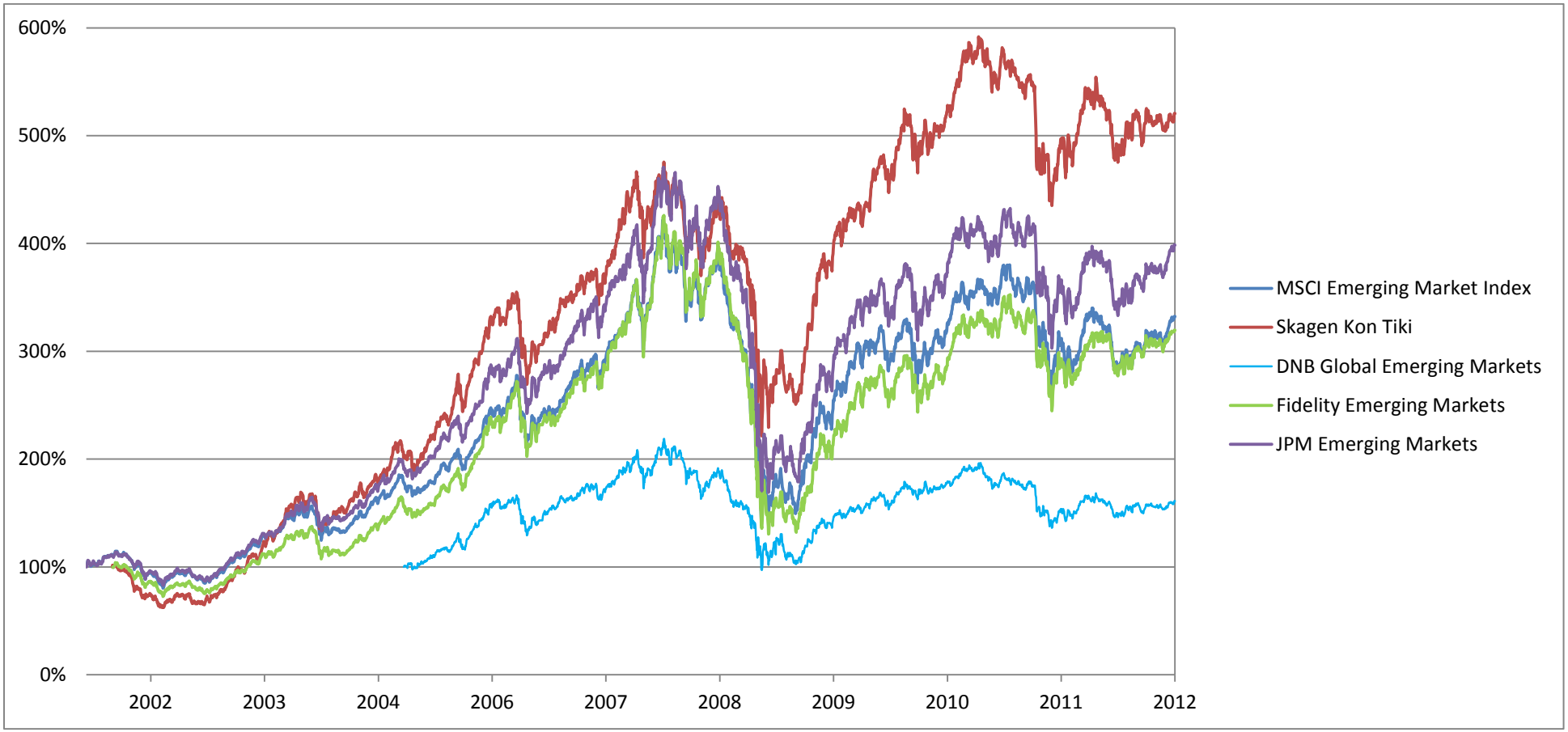


Figure 14: Cumulative returns for the funds and benchmark for complete period

The first impressions based on the figure above are that Skagen seem to have outperformed the other funds by some margin over the period, while DNB seems to perform poorest. The latter may not be the case, since cumulative returns can give misleading representations when a fund is established later. One should therefore not lay too much emphasis on this figure alone. JPM was the fund that seems to perform second best. It followed Skagen closely for longer parts, falling off the pace after the global financial crisis hit. Despite this, JPM finished second best, with respect to returns. Fidelity followed the benchmark closely for most of the period, trailing just below, or above.

7.1.2. Trend analysis

To identify when the funds perform well, and poorly, a trend analysis was performed. This will supplement the evaluation; shed light on the funds development, and contribute to an improved understanding of the funds' performance and risk.

The following trends were identified:

- JPM appears to fall most of the funds in a bear market. In a bull market, the fund seems to perform best, along with Skagen.
- Skagen seems performs best of the funds in bear markets, at the same time performing well in bull markets.
- DNB seem to perform worst in bull markets, but seem to perform better in market declines, indicating it may be less risky.
- Fidelity seems to perform similar to the benchmark index, following the MSCI for most of the period. Through bull and bear markets the two follow each other closely.

The trends are analyzed and discussed for the respective methods, for the complete- and sub-periods.

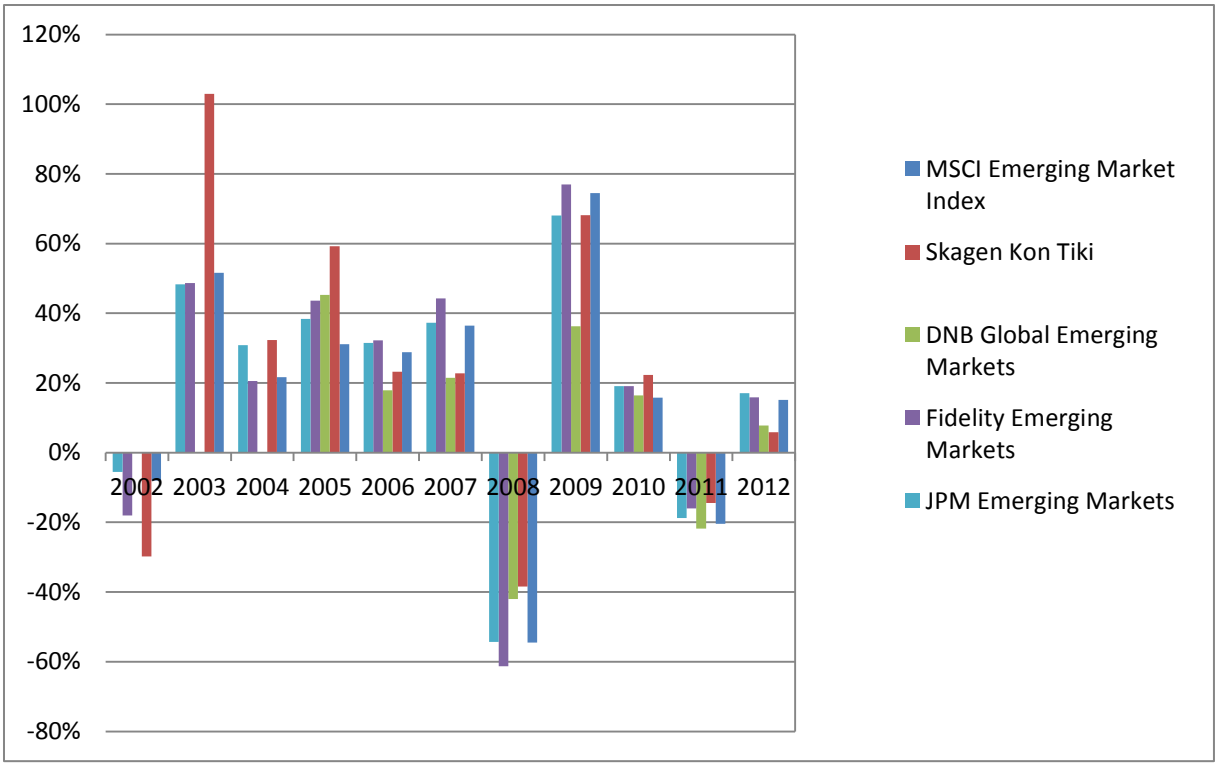


Figure 15: The average yearly returns

The collected data sample was a good period for the financial markets, resulting in eight years of positive returns and three years with negative returns. The yearly returns obtained through the period were rather volatile as illustrated by the figure above.

The three years with negative returns was for 2002, 2008 and 2011. Skagen fell least of the funds for the two latter. These observations support the trend that Skagen performs best in bear markets. In the negative period of 2002, Skagen fell most. This should not be emphasized too much, as the fund was established in April of 2002. It is natural for a new fund to be vulnerable in the establishment, as it needs time to construct an effective portfolio.

Figure 17 indicates that DNB did not perform as bad as one the first impressions might have led one to believe. Still, DNB did not performed well. As identified in the trend analysis, DNB do not perform well in bull markets. This is illustrated by the funds returns in 2006, 2007, 2012, but mainly 2009. In periods of marked decline such as 2008, DNB dropped the least, along with Skagen. Overall, DNB did not perform well compared to the other funds, and seem to perform worst with respect to returns.

Fidelity trailed the benchmark for most of the complete period, consistently being just below, or above the index. The fund seems to be volatile, this is supported by that the fund achieved

the highest return in 2006, 2007 and 2009, and fell most in 2008.

JPM does not obtain the highest yearly returns, but seems to perform well consistently in bull markets. At the same time the fund seems to perform poorly consistently, in bear markets. The exception occurring in 2002, for which the funds fell least.

7.1.3. Sub-periods

In this section the results are presented for three sub periods, to analyze the trends further, and to get a better understanding of the development. The results are presented for one period at a time, presenting the yearly- and cumulative returns. The data are divided into the following time period:

Table 2: The sub-periods

Period	Year
1	01.01.2002-01.01.2005
2	01.01.2005-01.01.2009
3	01.01.2009-01.01.2013

I. Period 1

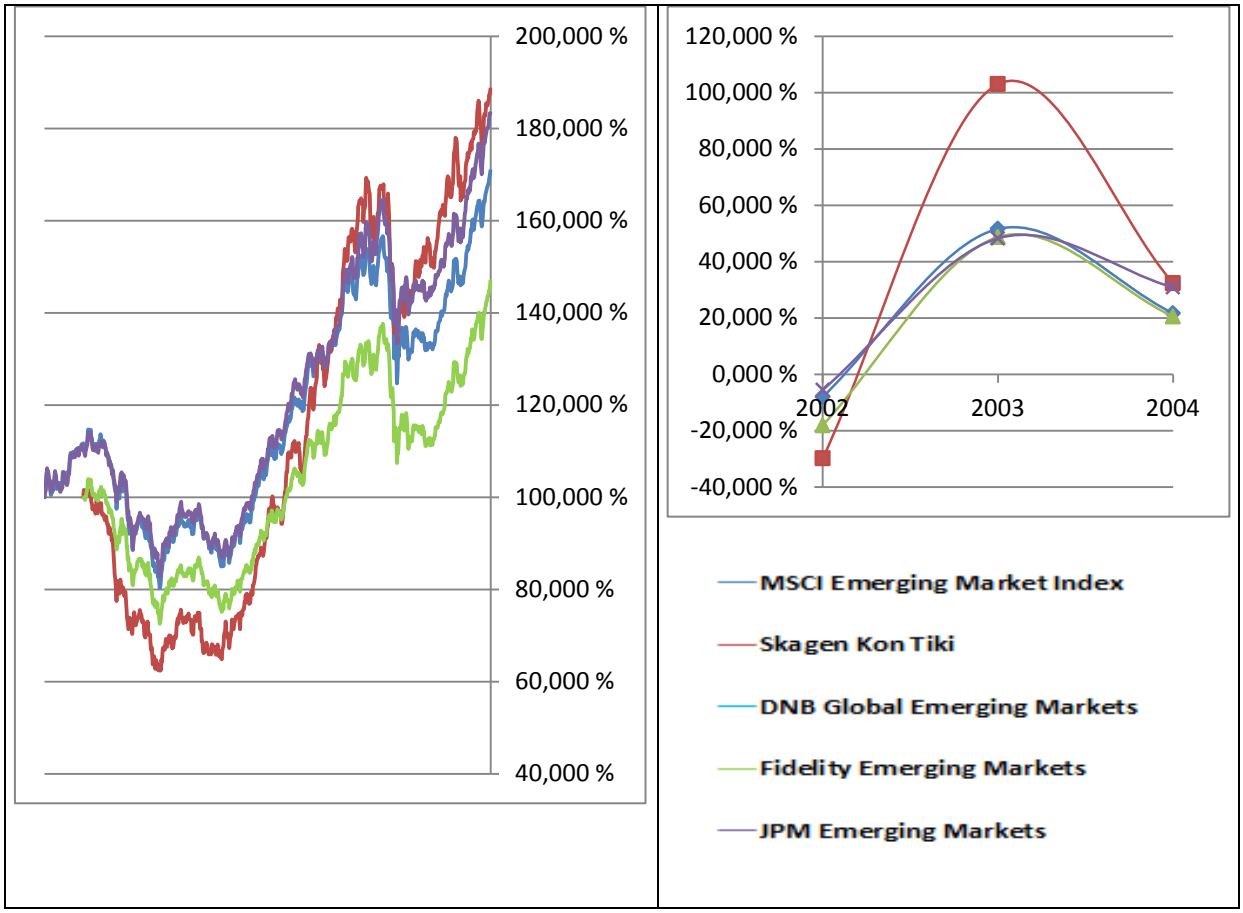


Figure 16: The funds and benchmarks returns for period 1

JPM and Skagen performed best for most of the first period, while Fidelity seems to perform worst. Skagen started the period worst, but during 2003 the fund clearly outperformed the other funds. This helped Skagen move closer to the other funds, and surpass most of them in 2004. Skagen performed best in 2003 and 2004, but due to their bad start, they finished the period just behind JPM.

With the exception of Fidelity, the other funds followed each other for most parts. Fidelity performed worst in the first period, falling behind the other funds in the second half on the period.

II. Period 2:

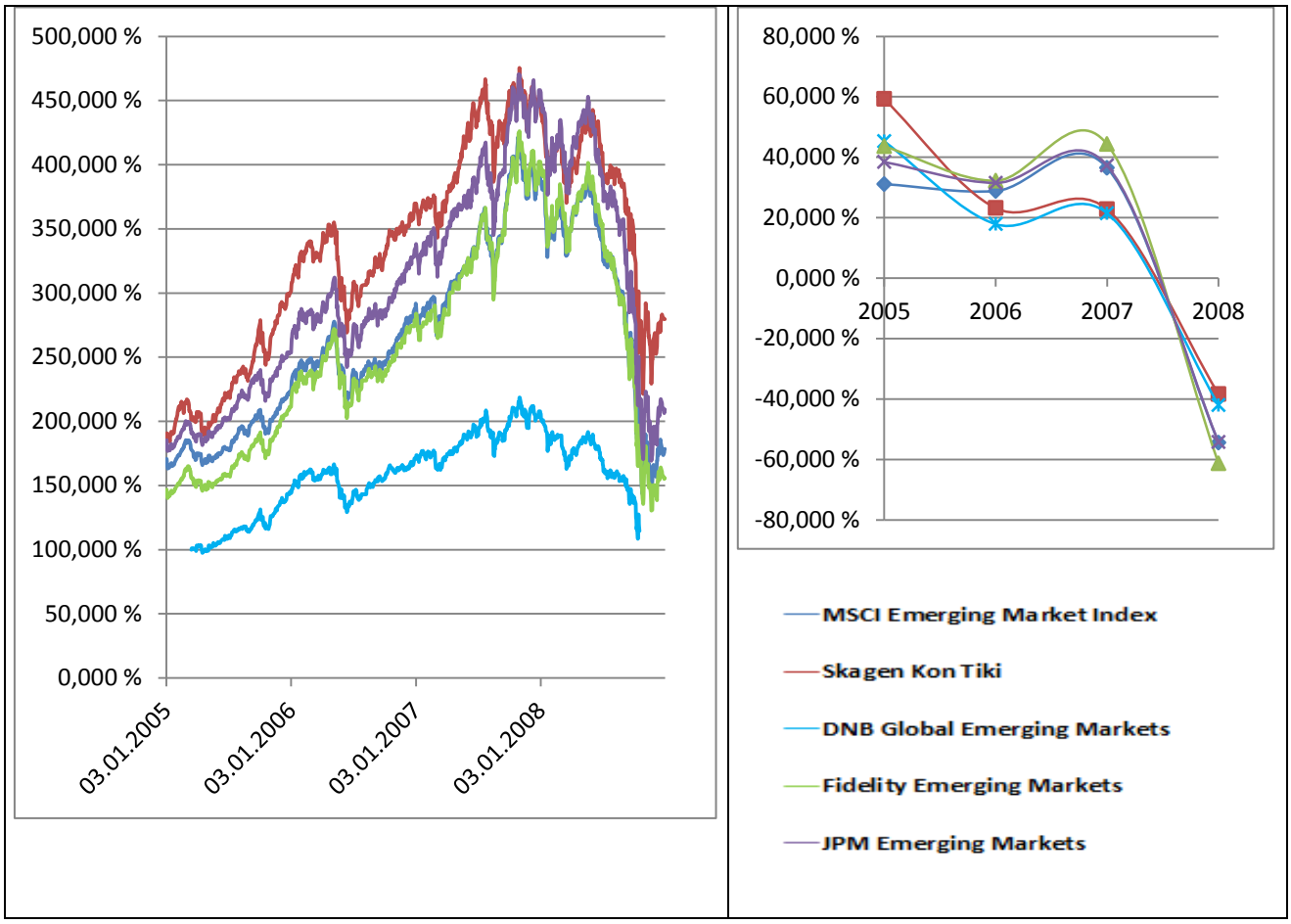


Figure 17: The funds and benchmarks returns for period 2

The global financial crisis struck at the end of this period, as illustrated by the steep decline. There was a boom in the financial markets leading up to the financial crisis, where all the funds obtained high returns. DNB is introduced in this period, but did not perform well for the first three years. It did however, not fall as steep as the other funds when the financial crisis hit. The trend for JPM seems to hold up for this period. The fund performs well in periods with a bull market, and fall steeply when there is a bear market. JPMs fell drastic in 2008, with a fall of 54.2 %.

The trend for Skagen was that the fund copes well in bear markets. This seems to hold up for the second period, as Skagen fell least, along with DNB when the financial crisis hit. More specific Skagen fell 38.3%, while DNB fell 42%. For the first year of the period, Skagen performed best. For the following two years the fund only managed to outperform DNB, and trailed the other funds. This led to JPM catch up with Skagen at the end of 2007.

Fidelity seems to be rather volatile in this period. The fund is at the top, or close to the top, with respect to returns for the first three years of this period. When the financial crisis struck, the fund fell most, with a fall of 61.2 %. Fidelity was a bit behind the benchmark at the start of the period, but caught up with, and surpassed the benchmark in 2007. Due to the funds drastic fall in 2008, it ended the period behind the MSCI index.

The MSCI index seems to perform medium for the second period, lying around the middle compared to the other funds. The MSCI obtained the lowest returns in 2005, resulting in that Fidelity caught up with, and surpassed the benchmark in 2007.

III. Period 3:

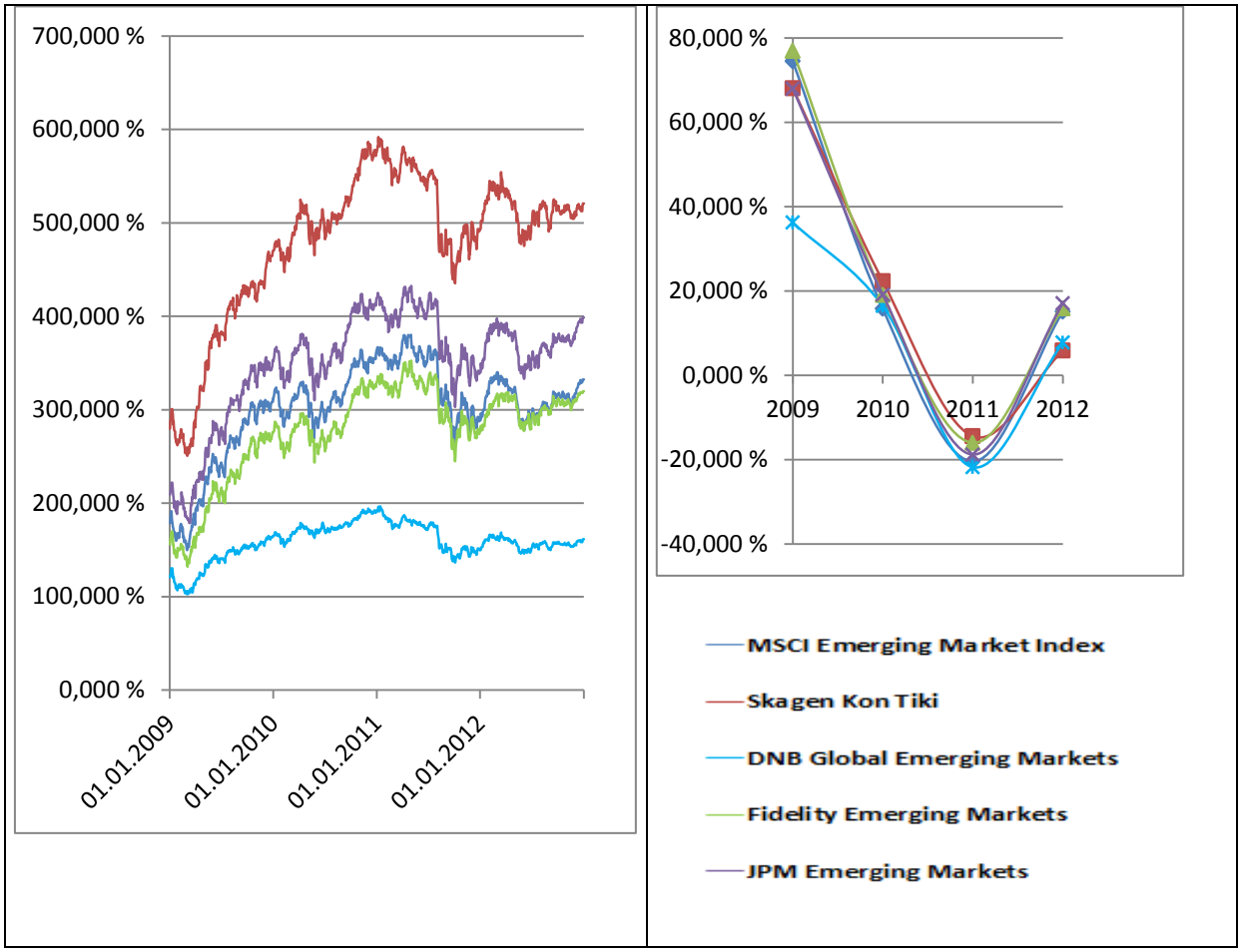


Figure 18: The funds and benchmarks returns for period 3

In the third period the markets experienced a boom after the financial crisis, as investors' regained faith in the markets. In this period all the funds obtained high returns, especially in 2009. Skagen seems to convincingly outperform the other funds when looking only at the

cumulative returns. This is however a bit misleading, something the figure for the yearly returns show. If anything, Skagen seem to perform more mediocre in this period. The reason for why Skagen seems to outperform the other funds is how the fund performed under the financial crisis.

DNB performed quite poorly in this period, obtaining the lowest returns in 2009 by some margin. The following three years the fund was at the bottom, or close to the bottom with respect to yearly returns. DNB was identified as a fund that performs well with bear markets. This was not supported in this period, as the fund performed poorly for the market decline in 2011.

JPM performed well in this period. The funds trend was strengthened by the findings in this period. The fund performed well in the three periods with positive returns, and poorly when the markets were down in 2011. Although the fund performed well in this period, JPM was unable to surpass Skagen. At the end of the period, JPM performed second best with respect to the returns. Fidelity and the MSCI performed similar. At the start of the period Fidelity performed just below the benchmark, before following it for most parts of the period.

7.1.4. Supplementary statistics

To supplement the descriptive statistics, a data analysis was conducted in excel to verify the finding and to complement the data. The summary of the findings is presented the table below.

Table 3: Summary of supplementary statistics

	MSCI	Skagen	DNB	Fidelity	JPM
Average	0,00050666	0,00068026	0,00033371	0,00053108	0,00058561
Median	0,00126925	0,00039922	0	0	0,00080065
Standard Deviation	0,01323978	0,0134881	0,01402286	0,01520354	0,0143898
Kurtosis	8,03653831	7,54461386	10,2408045	10,6482394	8,10124276
Skew	-0,3324624	-0,03200694	-0,1307306	-0,34779284	-0,2273475
Minimum	-0,09511194	-0,10600342	-0,10064022	-0,14507422	-0,11090909
Maximum	0,10597639	0,11659157	0,11026918	0,12817176	0,09558339
Sum	1,45361597	1,90541665	0,67809887	1,48702065	1,68069828
Observations	2869	2801	2032	2800	2870
Confidence interval 95 %	0,00048467	0,00049972	0,00061007	0,00056338	0,00052668
Confidence interval 99 %	0,00063712	0,00065691	0,00080205	0,00074059	0,00069234

DNB has the lowest average return over the period, while Skagen had the highest. This is the same result obtained in the descriptive findings. Fidelity has the highest standard deviation of the funds; further supporting the trend that Fidelity is a volatile fund. As expected the MSCI had the lowest standard deviation, which is only natural since a benchmark is well diversified. Skagen obtained the second lowest standard deviation, followed by DNB.

Fidelity and DNB are the funds with the highest kurtosis, both exceeding 10. The higher kurtosis a fund has, the greater the chance of extreme outcomes. Based on that Fidelity had the highest standard deviation, it was expected that the fund would be close to the top with respect to the kurtosis. It was a little surprise to see that JPM has a kurtosis of 8, while at the

same time obtaining the second highest standard deviation. It was also a surprise to find that Skagen had a lower kurtosis than the MSCI, given that the MSCI had the lowest standard deviation.

All the funds and the benchmark obtained a negative skew for the complete period. A negative skew is a good sign, indicating that a fund is more likely to obtain positive results than negative. This was expected based on the finding from the descriptive data, and points to the fact that all the funds overall managed to create positive returns for their customers. A negative skew, means that the distributions have a greater left tail than right. Fidelity is the fund with the lowest skew, obtaining a value of -0.3477.

The fund with the highest fall for one day is Fidelity with 14.5%, while the MSCI had the lowest daily fall. This is consistent with the findings that Fidelity has the highest standard deviation and MSCI the lowest. Fidelity had the highest daily returns, and JPM the lowest. This is somewhat surprising since JPM seem to be rather volatile.

7.1.5. Fund ranks

The average returns for the funds are calculated with the average geometric return. This is the most appropriate method for calculating returns when evaluating returns over a longer period. The funds are rated from 1-5, representing the number of funds in the evaluation. If a fund is given the position 1, it performed best. If a fund is given position 5, it performed worst. The results are presented in the table below.

Table 4: Ranking for the returns.

Fund	Position	Average return
Skagen Kon-Tiki	1	16.18 %
JPM EM	2	13.39 %
MSCI EMI	3	11.46 %
Fidelity EM	4	11.13 %
DNB GEM	5	6.15 %

Skagen clearly outperform the other funds with respect to the returns. To ensure that there is a significant difference between the results obtained in the ranking, a statistical test was performed. If there is no significant difference, the funds are given the same ranking. The test was performed using a Student t-test, with a critical value of 1%. The following hypothesis was used in the test:

$$H_0 = There\ is\ no\ significant\ difference\ between\ the\ result$$

$$H_1 = There\ is\ a\ significant\ difference\ between\ the\ result$$

The results obtained for the test are presented in table 5, and an improved ranking based on the test follows.

7.1.6. Improved ranking

The results for the test are illustrated below. To provide sufficient data points for the test, a continuous rolling annual return was used. Based on these data, the returns were tested.

Table 5: Results from t-test for the returns

Test	P-verdi	Data Points
Skagen vs JPM	2,72435E-46	2870
JPM vs MSCI	2,16457E-05	1783
MSCI vs Fidelity	0,41123957	2552
Fidelity vs DNB	0,000525302	2519

A low p-value was obtained when testing Skagen`s return relative to JPM. The null hypothesis was therefore rejected for the 1% significant level. For JPM relative to the MSCI the p-value was not as low. Still, it provided a sufficient degree of certainty to reject the null hypothesis. For the MSCI relative to the Fidelity, there was a relatively high p-value of 0.411. A p-value of 0.411 means there is not a significant difference between the results, and the null hypothesis is accepted. One can say that 41.1% of the changes can be explained by randomness. Last, Fidelity is tested relative to DNB, where the null hypothesis is rejected with a value of 0.05%.

Based on the test, there is one change in the ranking. This was for Fidelity and the MSCI, for which the results does not seem to be significant different. The funds are therefore given a shared ranking of 3.

Table 6: New ranking for returns

Fund	Position
Skagen Kon-Tiki	1
JPM EM	2
MSCI EMI	3
Fidelity EM	3
DNB GEM	5

7.1.7. Summary descriptive statistics

In this sub-section the returns for the funds were analyzed, and a ranking provided at the end. In addition, a trend analysis was conducted to find the funds trends. These were discussed throughout for the descriptive study and for the sub-periods.

Overall, Skagen outperformed the other funds with respect to the return. JPM performed closest to Skagen, while the MSCI and Fidelity performed similar, ranking third. DNB performed worst of the funds overall by some margin. There was only one change as a result of the t-test, placing both Fidelity and the MSCI in a shared third ranking.

7.2. Sharpe Ratio

This section presents the Sharpe Ratio, to analyze whether the funds returns are due to good investment decisions, or a result of taking on more risk. This indicates how well the funds have performed relative to the risk they have been exposed to. First, the results for the Sharpe Ratio are presented for the complete period, followed by a presentation for the sub-periods. Last, the funds are ranked with respect to the Sharpe Ratio, and a statistical test is performed to ensure the results validity.

7.2.1. Total time period

The continuous Sharpe Ratio is an approximation, with data lines drawn between the yearly Sharpe Ratio points to get a more intuitive understanding of the development. Despite being an approximation, the figure provides insight, and aids in getting an overview of the development of the funds Sharpe Ratios.

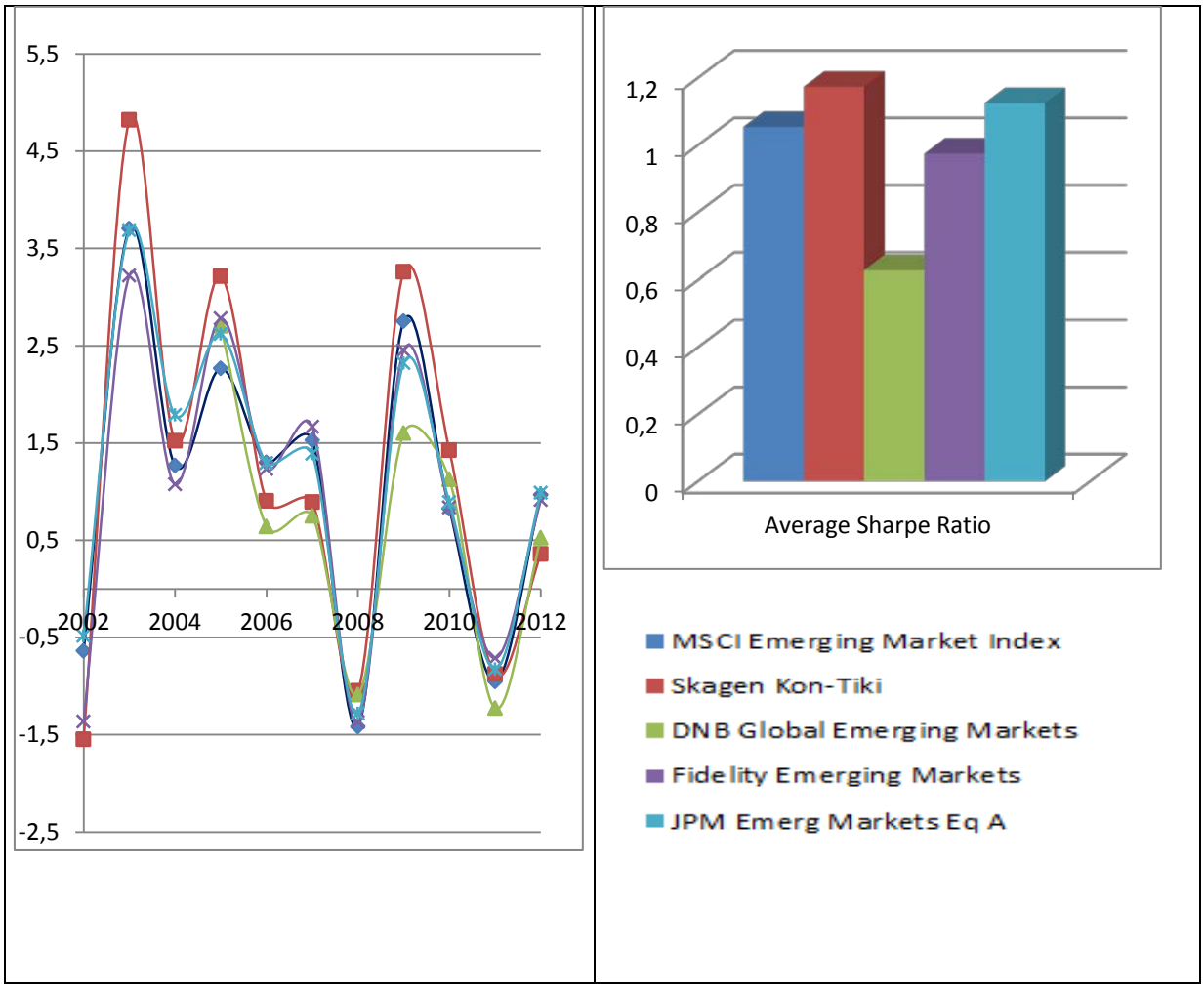


Figure 19: Continuous and average Sharpe Ratio for the funds and benchmark

The empirical study showed that Skagen outperformed the other funds with respect to the returns. It was interesting to analyze if this was a result of Skagen taking on excessive risk, or superior ability. Skagen obtained a high Sharpe Ratio for many years. A high Sharpe Ratio is a good sign, indicating that a fund has achieved high returns relative to the risk. Skagen achieved the highest average Sharpe Ratio of 1.17. With the exception of 2002 and 2012, the fund was close to, or at the top with respect to the yearly Sharpe Ratio. In 2003, 2005 and 2009, Skagen had the highest Sharpe Ratio. These results indicate that Skagen not only performed well with respect to returns, but also relative to the risk.

DNB performed worst of the funds with respect to returns. The fund was not very volatile; it was therefore interesting to determine if DNB would rank higher for the Sharpe Ratio. This was not the case, as the fund continued to perform poorly, obtained the lowest average Sharpe Ratio of 0.628.

JPM performed second best in the empirical section, following Skagen with respect to the Sharpe Ratio. JPM did not really outperform the other funds for any years, but performs consistently which resulted at an average Sharpe Ratio of 1.12. This resulting in that JPM obtained the second highest Sharpe Ratio.

The MSCI obtained the third highest Sharpe Ratio, with an average Sharpe Ratio of 1.05. Fidelity trailed MSCI for most of the period with respect to the returns. This was also the case for the Sharpe Ratio, although the margin seems to be slightly higher for the Sharpe Ratio. This was somewhat expected, as the MSCI was not very volatile with the lowest standard deviation. At the end of the period, Fidelity finished behind the MSCI, with an average Sharpe Ratio of 0.97.

7.2.2. Sub periods

This section presents the results for the sub-periods, to get a better understanding of the development.

I. Period 1:

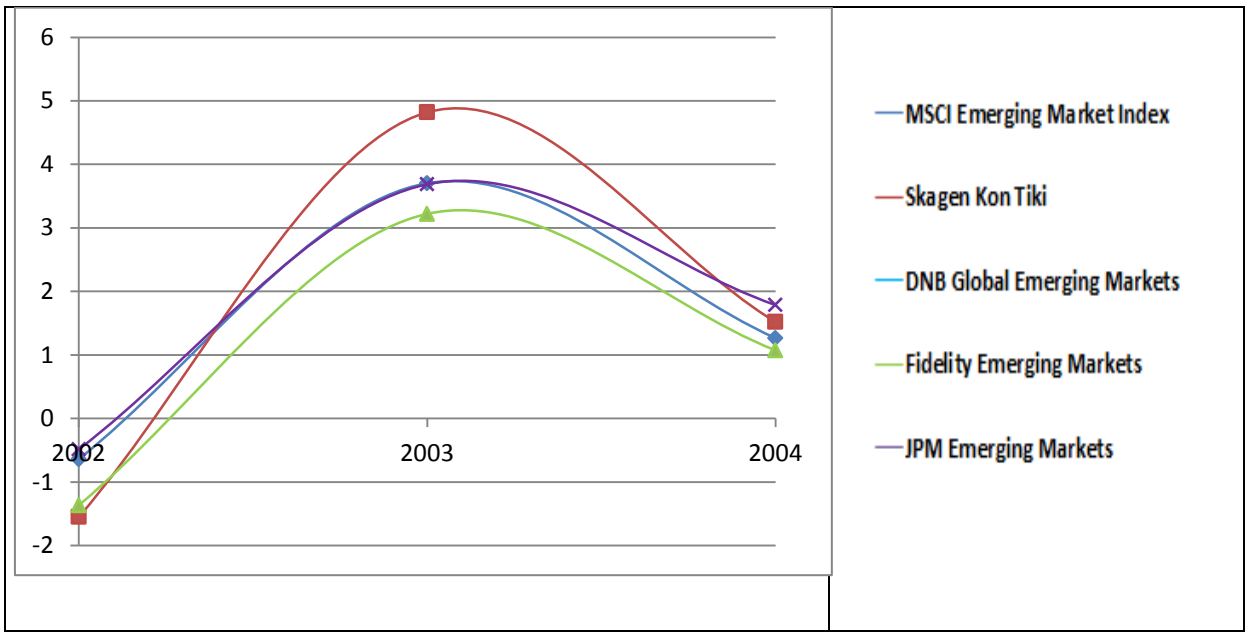


Figure 20: Sharpe Ratio for period 1

As a result of the market decline in 2002, the funds started the period with a negative Sharpe Ratio. This might be a result of the burst of the "Internet bubble" in 2001, where there was a fall in the financial markets. The first year, Skagen performed quite poorly with respect to the Sharpe Ratio. In the following year the fund achieved the highest Sharpe Ratio, outperforming the other funds by some margin. This was as a result of Skagens high returns that year. The fund also performed well in 2004, only surpassed by JPM.

Fidelity performed worst of the funds, obtaining the lowest Sharpe Ratio in 2003, 2004, while barely surpassing Skagen in 2002. This was expected based on that Fidelity had the lowest average Sharpe Ratio. JPM and the MSCI followed each other closely for most parts of the period, with the exception of 2004 when JPM surpassed the MSCI. This period contained some unusual high Sharpe Ratio; this was a result of the boom in the stock markets. MSCI and Skagen obtained returns of respective 51.5% and 103% in 2003.

II. Period 2:

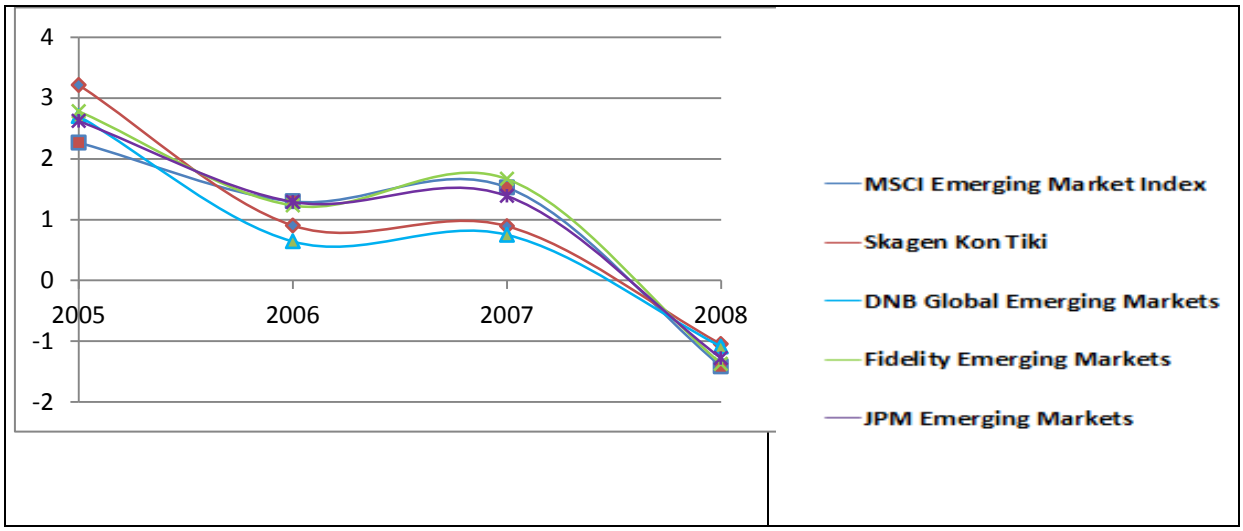


Figure 21: Sharpe Ratio for period 2

This period started with a high positive Sharpe Ratio for the funds and benchmark. This period includes the global financial crisis, an interesting event for the evaluation. This is the background for the steep decline in the Sharpe Ratio for the funds from 2007 till 2009. In 2005, Skagen yet again outperformed the other funds with respect to the Sharpe Ratio. The following two years the fund did not perform well, only obtaining a higher Sharpe Rate than DNB. In 2008 when the global financial crisis swept the financial markets, Skagen performed best of the funds with a Sharpe Ratio of -1.05. This supports the trend that Skagen seems to perform well relative to the other funds in bear markets. Perhaps the most interesting thing to notice in this period was that the MSCI performed worst in 2008, with a Sharpe Ratio of -1.41. A surprising fact, as one would expect the benchmark to perform better in bear markets due to their diversification.

DNB performed poorly for the two first years, obtaining the lowest Sharpe Ratio for 2006 and 2007. The fund did however, perform relatively well in 2008 only being beaten by Skagen. DNB performed medium in 2005, performing very similar as JPM and Fidelity. Fidelity performed relatively well the first three years, but fell most of the funds when the financial crisis struck. This was as expected since Fidelity is a volatile fund. For 2008, the fund obtained a Sharpe Ratio of -1.37. JPM followed the Fidelity closely throughout the period, and obtained a Sharpe Ratio of -1.28 in 2008.

III. Period 3:

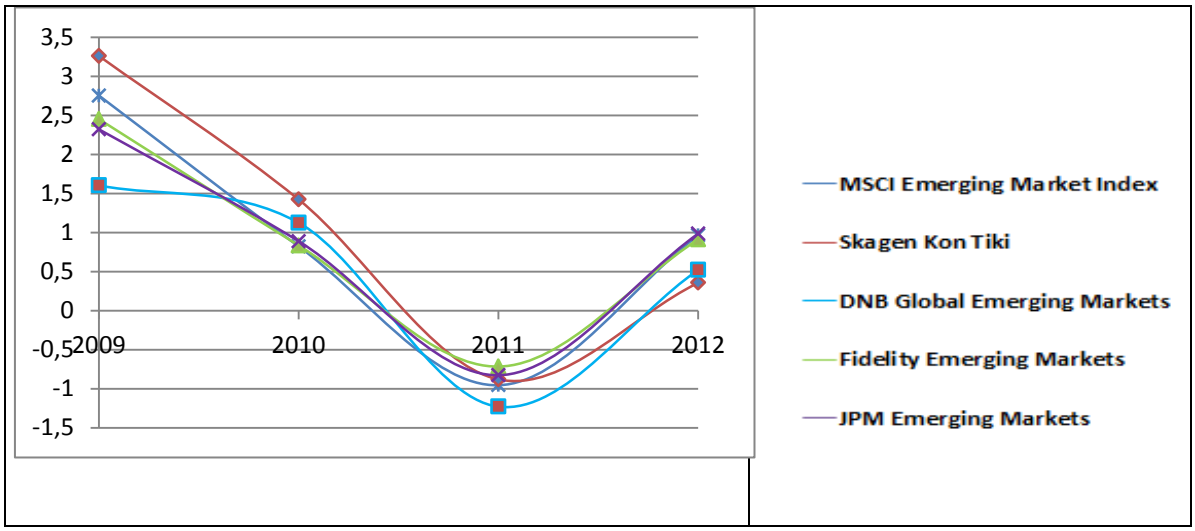


Figure 22: Sharpe Ratio for period 3

The third period started with a positive Sharpe Ratio for the funds. The background for the high Sharpe Ratio is that the financial markets stabilized, as the investor's confidence in the markets increased. This resulted in a bull market for the first two years. Skagen obtained the highest Sharpe Ratio for the first two years. In 2009 the fund obtained a Sharpe Ratio of 3.26, followed by the MSCI. In 2010, the Sharpe Ratio fell compared to 2009. Skagen still obtained a Sharpe Ratio of respectable 1.42. Due to extensive turmoil in the financial markets in 2011, there was a decline. Skagen did not perform well the last two years of this period. JPM, Fidelity and the MSCI followed each other closely throughout the period. The funds performed poorly in 2010, but performed better the last two years, outperforming both Skagen and DNB.

7.2.3. Sharpe Ratio rating

The average Sharpe Ratios are calculated by taking the average of the yearly Sharpe Ratio. The results are presented in table 8.

Table 7: Ranking for the Sharpe Ratio

Fund	Position	Average Sharpe Ratio
Skagen Kon-Tiki	1	1.17
JPM EM	2	1.125
MSCI EMI	3	1.054
Fidelity EM	4	0.974
DNB GEM	5	0.628

7.2.4. Improved ranking

A statistical t-test was performed for the Sharpe Ratio ranking, to ensure the validity of the ranking. Based on this test the following results were obtained.

Table 8: Statistical test for the Sharpe Ratio

Test	P-value	Data points
Skagen vs JPM	3.39607E-46	2552
JPM vs MSCI	7.22564E-12	2552
MSCI vs Fidelity	0.384470232	2551
Fidelity vs DNB	8.82839E-10	2551

For the first test a low p-value was obtained, presenting statistical evidence that there is a significant difference between the results. One can therefore reject the null hypothesis for a 1% significant level. For JPM relative to the MSCI the p-value was not as low, still, providing a sufficient degree of certainty to reject the null hypothesis. For the MSCI relative to the Fidelity, there was a relatively high p-value of 0.3844. A p-value of 0.3844 means there is no significant difference between the Sharpe Ratio results, and one cannot reject the null hypothesis. One can say that 38.44% of the changes can be explained by randomness. Last, Fidelity is tested relative to DNB, where the null hypothesis is rejected.

Based on this test, there was one change in the ranking. The Sharpe Ratio results for Fidelity and MSCI does not seem to be significant different, and are therefore given the same ranking.

Table 9: Final ranking for the Sharpe Ratio

Fund	Position
Skagen Kon-Tiki	1
JPM EM	2
MSCI EMI	3
Fidelity EM	3
DNB GEM	5

7.2.5. Summary Sharpe Ratio

Overall, Skagen outperformed the other funds with respect to the Sharpe Ratio. JPM performed closest to Skagen, while the MSCI and Fidelity performed similar, ranking third. DNB performed worst overall and by some margin. There was only one change as a result of the t-test, ranking Fidelity and the MSCI in a shared third position.

7.3. Jensen`s Alpha

This section presents Jensen's Alpha to give an indication of the fund managers' ability to outperform the market. First, Jensen's Alpha is presented for the complete period, providing an overview of the funds development. Thereafter, Jensen's Alpha is presented for the three sub-periods, and a ranking is provided. There was not performed a statistical test for this method, due to limited time.

The MSCI cannot be rated for this performance measure since it is the benchmark, and therefore part of the equation for Jensens Alpha. To ensure that one could use this performance measure in the overall ranking, a simplification had to be made. It was decided to rank the MSCI for third position, since the benchmark seemed to perform overall third best.

7.3.1. Total period

The continuous Jensen Alpha and the average Jensen Alpha is presented in figure 25. For the continuous Jensen Alpha, data lines are drawn between the yearly Jensen Alpha points.

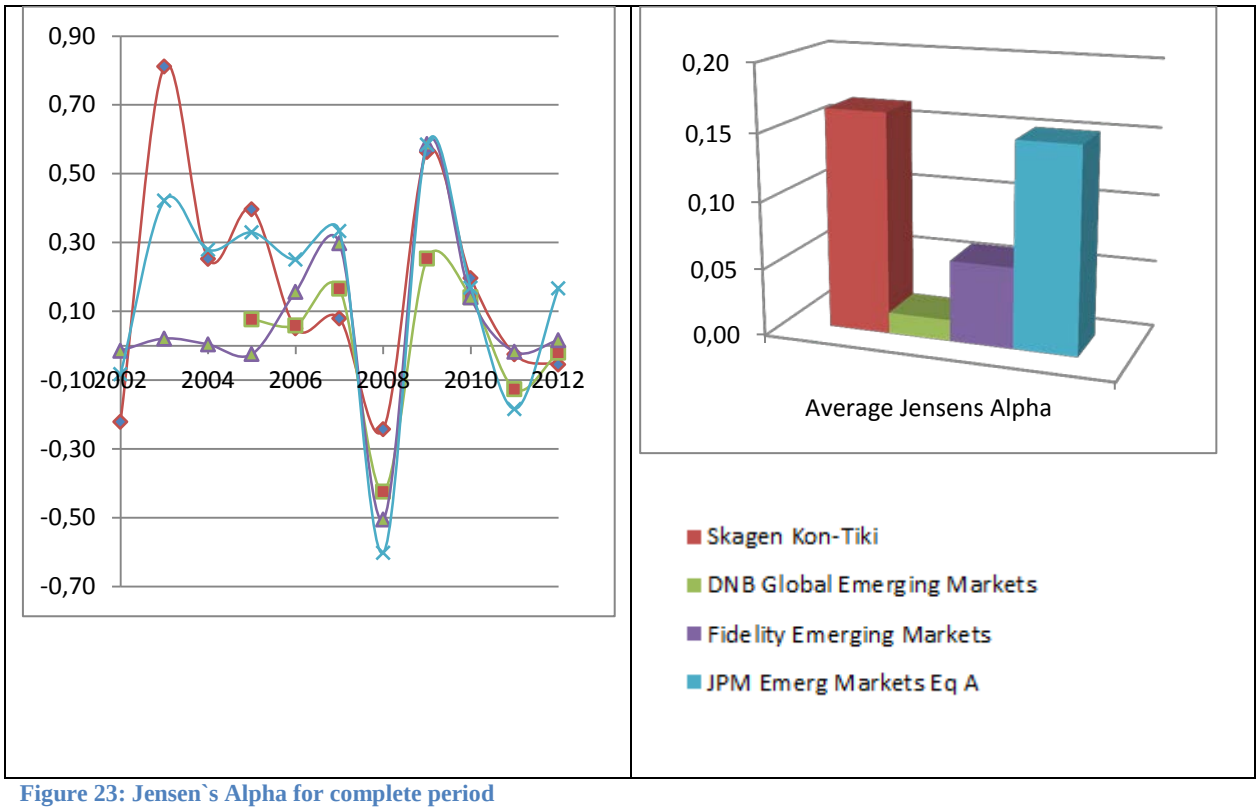


Figure 23: Jensen`s Alpha for complete period

Skagen had the highest average Jensen's Alpha with an average of 0.16. Based on the results for the returns and Sharpe Ratio, this was not surprising. A positive number for Jensen`s Alpha is a good sign, indicating that a fund is outperforming the benchmark. The higher Jensen value a fund gets, the better the funds perform.

JPM followed Skagen for long periods for the Sharpe Ratio and returns, and yet again performed close to Skagen. At the end of the period, JPM obtained the second highest average Alpha with 0.151. DNB performed worst of the funds with respect to returns, and for the Sharpe Ratio. The fund continued to perform poorly, obtaining the lowest average Alpha value with 0.015. Fidelity obtained low values for Alpha the first four years, but despite reversing the trend and performing better for the remaining years, the fund only outperformed DNB. These order in which the funds perform are similar to those obtained for the return, and Sharpe Ratio.

7.3.2. Sub periods

This section presents the results for the three sub-periods, to get a better understanding of the development of the funds Sharpe Ratio.

I. Period 1:

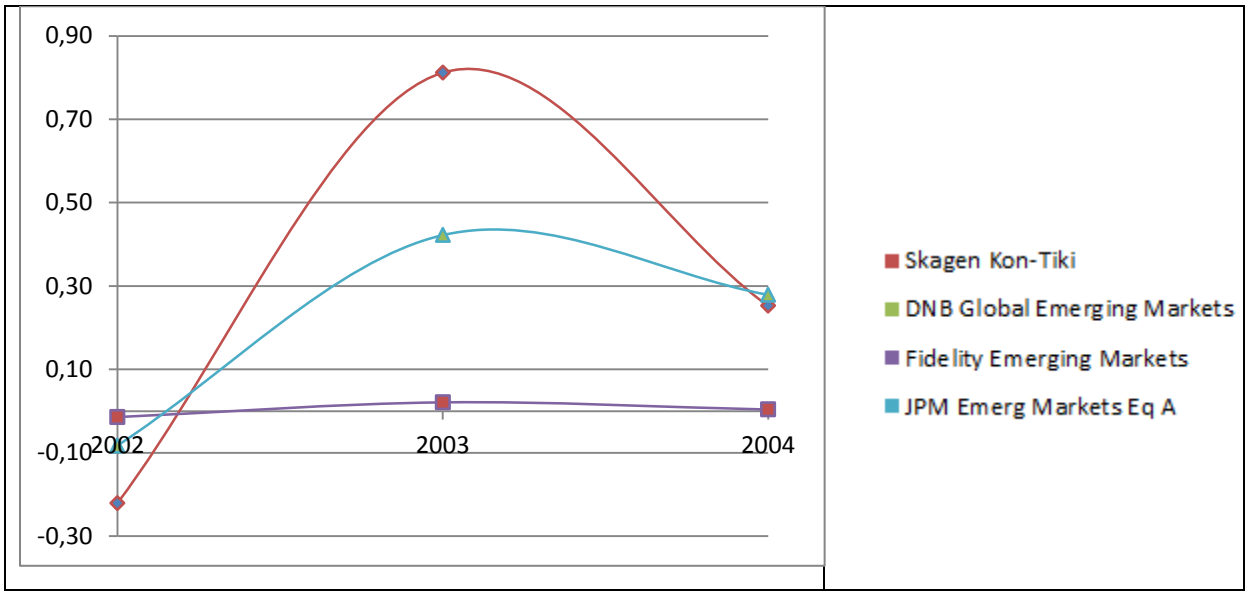


Figure 24: Jensen's Alpha for period 1

The period started with negative Alpha values for the funds. Skagen performed worst of the funds in 2002, which was as expected based from earlier finding. The following two years

Skagen performed better, especially in 2003 when the fund obtained the highest Alpha value. JPM also obtained high Alpha values, performing second best for the two first years, before obtaining the highest Alpha value in 2004. Fidelity obtained a low Alpha value for the first three years. This was expected; as the descriptive study found that Fidelity followed the MSCI closely for most parts of the complete period.

II. Period 2:

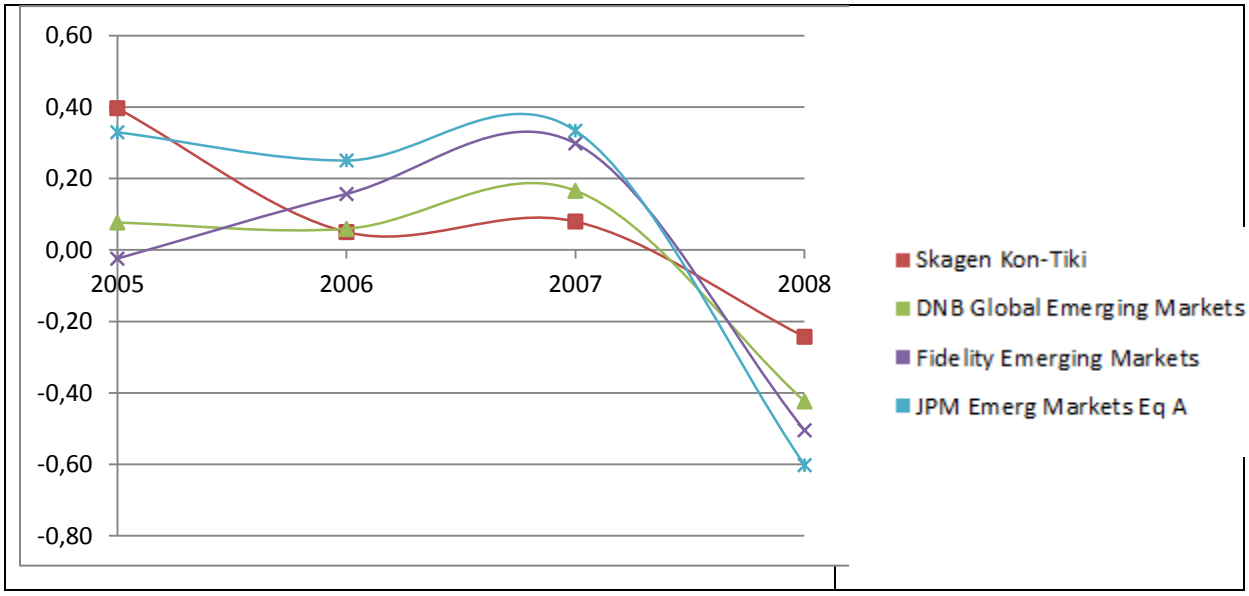


Figure 25: Jensen's Alpha for period 2

Skagen started this period on top, obtaining the highest Alpha value in 2005. They did not do well in 2006 and 2007, and ended up performing worst for these years. This is similar to the findings for Sharpe Ratio. In 2008 when the financial crisis hit, Skagen clearly outperformed the other funds. The fund obtained an Alpha value of -0.24, some margin higher than DNB who performed second best with -0.423. This supports the findings that Skagen cope well in bear markets.

DNB performed second worst for the first three years, before finishing second in 2008. The trend for JPM seemed to be that the fund performs well in bull markets, and poorly in bear markets. This seems to be the case for this period, as JPM performed well for the three years in bull markets, before falling most in 2008. Fidelity obtained higher values than what was expected. As Fidelity was identified to follow the benchmark closely throughout the total period, one would expect a rather low Alpha value given that Jensen is calculated relative to

the benchmark. Fidelity performed well in 2006 and 2007, while performed poorly in 2005 and 2008.

III. Period 3:

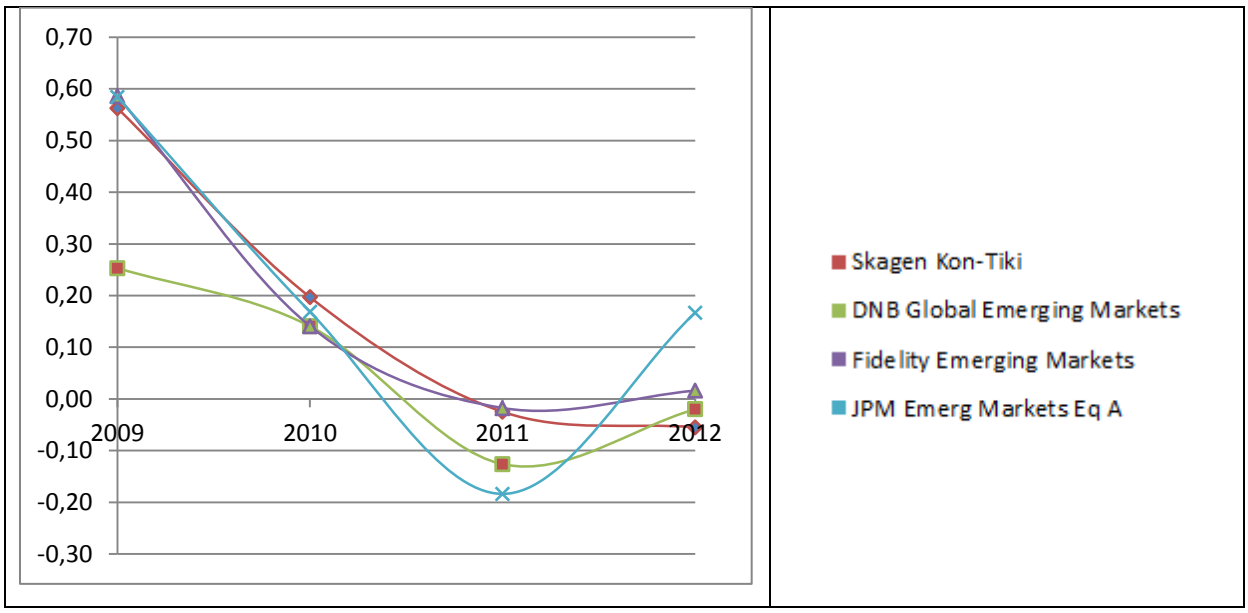


Figure 26: Jensen's Alpha for period 3

This period started with relatively high Alpha values. All the funds performed quite similar in 2009, with the exception of DNB. Skagen again performed well, for most of the period. For 2012, fund obtained the lowest Alpha value. DNB yet again performed poorly, being close to, or at the bottom for most years. In this period JPM performed well, with the exception of 2011, where the fund performed worst, obtaining an Alpha value of -0.18. This was expected since the trend for JPM is to perform poor in bear markets, and well in bull markets. Fidelity performed competitive in this period compared to the other funds, being close to, or at the top for the first three years. Despite this, Fidelity did not obtain high Alpha values for the last two years.

7.3.3. Jensen's Alpha ranking

The average Alpha values are presented in the table below.

Table 10: Ranking for Jensen`s Alpha

Fund	Position	Average Jensen Alpha
Skagen	1	0.16
JPM	2	0.151
MSCI	3	
Fidelity	4	0.060
DNB	5	0.015

7.3.4. Summary Jensen's Alpha

Overall, Skagen outperformed the other funds with respect to Jensen's Alpha. JPM performed closest to Skagen, while Fidelity ranked third. DNB performed worst overall and by some margin. Due to limited time, there was performed a statistical test for this method. Based on the results, only Skagen and JPM seem to be somewhat.

7.4. Value at Risk

The Value at Risk is presented to complement the standard deviation as a risk measure. This method will not be used as a basis to provide a rank as in the previous sections. Rather it is presented as a supplement to the qualitative evaluation and if necessary aid the standard deviation for assessing the risk.

First, a short presentation of the funds worst 1%, 5 % and daily changes are provided. Thereafter, the development of VaR is presented. The funds 500 days 99% VaR for is presented first, followed by the 250 days 99% VaR. The 500-day VaR is not very sensitive to short-term changes, therefore the 250 days 99% VaR added. This will help getting a better understanding of how the VaR changes through the period.

7.4.1. Worst daily changes

This section provides an overview of the funds and benchmarks lowest 1%, 5% and the worst daily return. It illustrates the percentage value the funds' portfolios can lose daily with a 99% probability. In addition, the worst daily change for the period is added to shed light on to how bad the worst daily losses were. One should remember that the numbers presented in the table does not express the absolute certainty, but is a probabilistic estimate of the VaR.

Table 11: Worst 1%, 5% and daily changes

	Worst 1 % of Daily changes	**Worst 5% of Daily changes**	**Worst Daily change**
MSCI EMI	-3.98 %	-2.01 %	-9.51 %
Skagen Kon-Tiki	-3.78%	-2.04%	-10.60 %
DNB EM	-4.36%	-2.11%	-10.06 %
Fidelity EM	-4.41%	-2.37%	-14.50 %
JPM EM	-3.96%	-2.12%	-11.09 %

Figure 27 and 28, presents VaR for the funds and benchmark.

7.4.2. 500-days 99% VaR

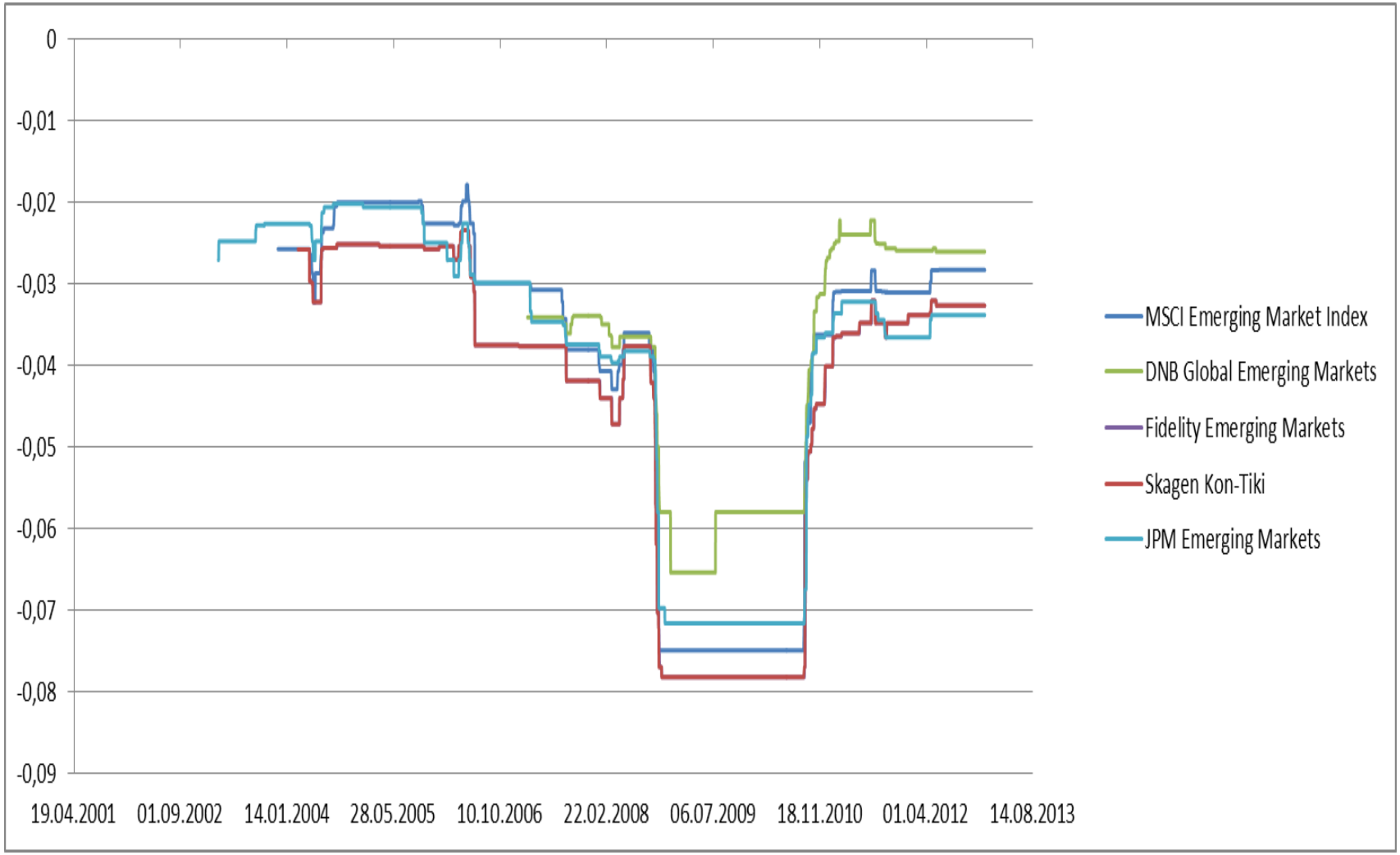


Figure 27: 500-days 99% VaR

7.4.3. 250-days 99% VaR

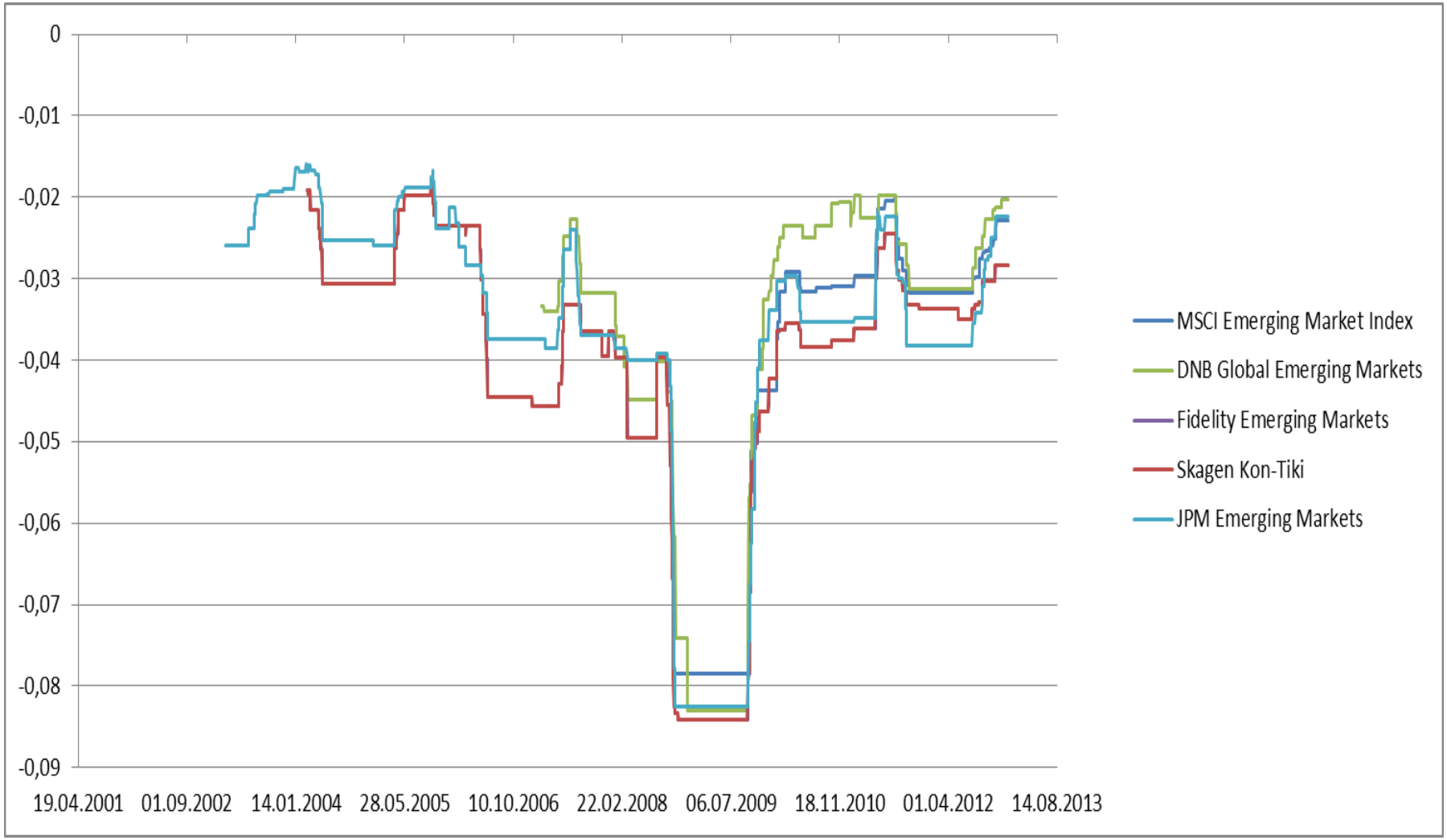


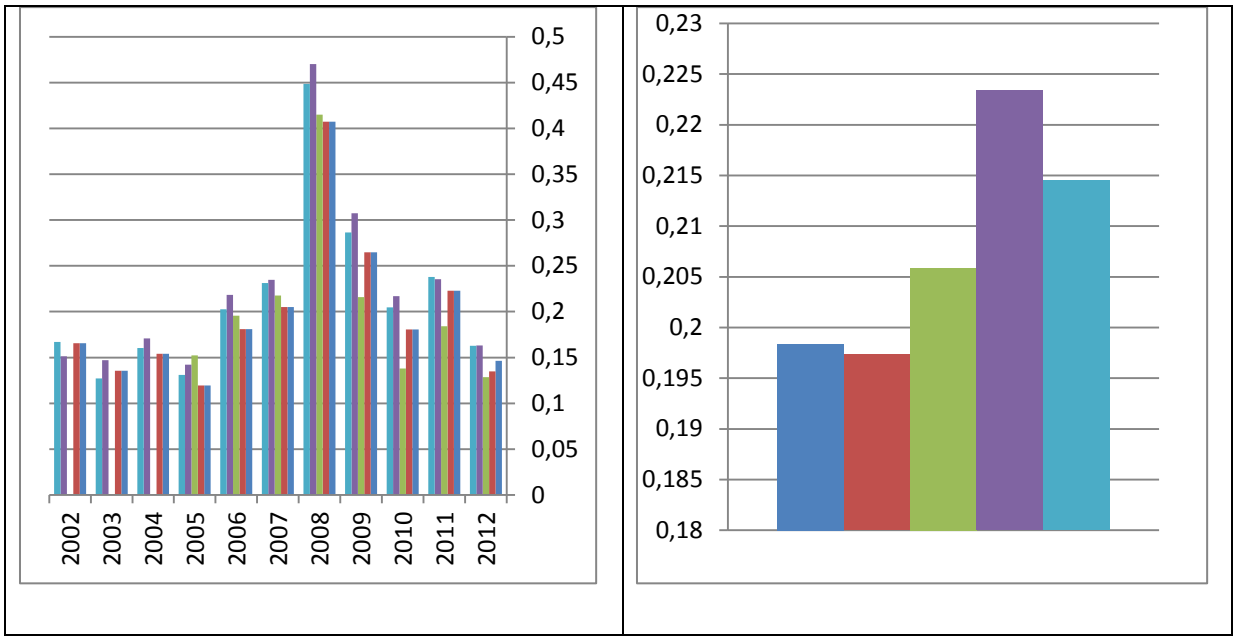
Figure 28: 250-days 99% VaR

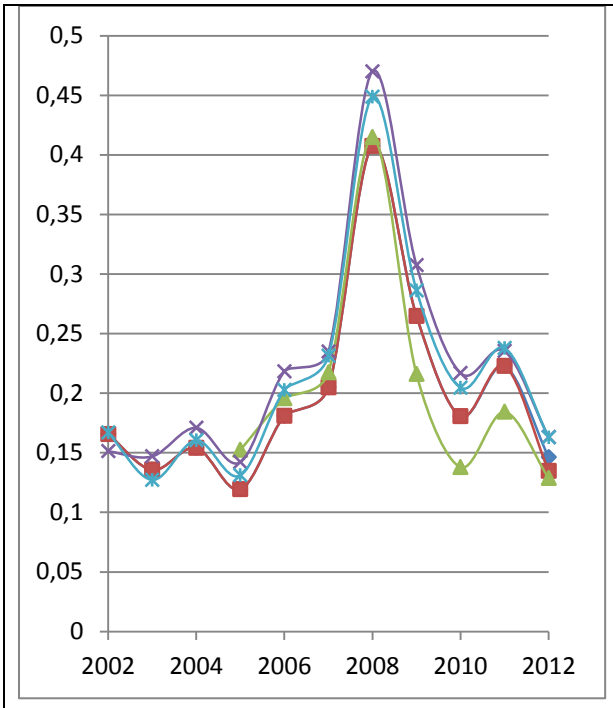
7.5. Standard deviation

The standard deviation is one of five principal risk measures, presented to give valuable insight to the funds risk. This chapter presents the standard deviation for the complete period, evaluating the standard deviation based on a more overall approach. Thereafter, a ranking is provided, and a statistical test performed.

7.5.1. Total time period

The standard deviation is presented in the figure below with an overview of the average, yearly and continuous standard deviation. For the continuous standard deviation, data lines are drawn between the yearly standard deviation points.





Explanation for the graphs

The colored lines in the graphs are represented by the following funds:

- MSCI Emerging Market Index
- Skagen Kon Tiki
- DNB Global Emerging Markets
- Fidelity Emerging Markets
- JPM Emerging Markets

Figure 29: The funds and benchmarks standard deviation for complete period.

Fidelity obtained the highest average standard deviation, constantly lying at the top with the risk measure. A higher standard deviation implies more risk, and is not a good sign. Overall the fund obtained a standard deviation of 0.223. Somewhat surprising Skagen achieved the lowest average standard deviation with 0.1973. One would expect the benchmark to have the lowest average standard deviation since it being an index will have a better diversification. The MSCI did not finish far behind, obtaining an average standard deviation of 0.1983. This is not in accordance with the descriptive test, presented in figure 3. In this test MSCI had a slightly lower standard deviation than Skagen. The results for this test, was for the daily standard deviation, while the test performed in this section is for the yearly standard deviation. The background for the differences was different data samples in the descriptive test. The MSCI had 2869 observations, while had Skagen 2801. Still, the results provide insight to the funds standard deviation. Most emphasis is placed on the results presented in this section, as they are more comparative given that the data samples are more alike.

JPM had the second highest average standard deviation, with 0.215. This was expected based on the trends that stated that JPM is a volatile fund, performing well in bull markets and poor in bear markets. Overall, DNB has had the lowest standard deviation for the last four years with three of these years being significantly lower than the other funds. There seem to be a

steady development for the fund with respect to risk reduction. DNB obtained the third highest standard deviation, with an average of 0.205.

7.5.2. Standard deviation ranking

The average yearly standard deviations are presented in table 7.

Table 12: Standard deviation ranking

Fund	Position	Average standard deviation
Skagen	1	0.1973
MSCI	2	0.1983
DNB	3	0.205
JPM	4	0.214
Fidelity	5	0.223

7.5.3. Improved standard deviation ranking

A statistical t-test was performed for the standard deviation ranking, to ensure the validity of the ranking. The following results were obtained from the test.

Table 13: T-test results for standard deviation

Test	P-verdi	Data points
Skagen vs MSCI	0,021871332	2551
MSCI vs DNB	1,18682E-37	1782
DNB vs JPM	1,18577E-13	1782
JPM vs Fidelity	2,70381E-21	2550

There is not a significant difference between Skagen and MSCI standard deviation, as illustrated by the p-value of 0.0218. This was expected since the results for the standard deviation are similar. For slightly more data points the MSCI achieved a lower standard

deviation than Skagen, as illustrated by figure 3. The statistical test supports the findings, and points towards that the two are likely to perform similar.

The other tests resulted in low p-values, presenting statistical evidence that there is a significant difference between the results. Based on the test, there is one change in the ranking. The results for Skagen and MSCI does not seem to be significant different, and therefore share the first position in the ranking.

Table 14: Ranking for standard deviation after t-test

Fund	Position
Skagen	1
MSCI	1
DNB	3
JPM	4
Fidelity	5

7.5.4. Summary standard deviation

The results for the average standard deviation seemed to be relatively close. After the statistical test, there was one change in the ranking, placing Skagen and MSCI in the same position. It was a surprising to find that Skagen obtained approximate the same standard deviation as the benchmark. Some of this can be explained by the fund did not fall as much when the financial crisis hit. Another surprise was to find that Fidelity performed worst with respect to the standard deviation. One would expect to find JPM with a higher standard deviation, as the trend for the fund was being volatile, performing well in bull markets, and poorly in bear markets. DNB obtained the third lowest standard deviation, and was ranked in third. DNB was identified to be less volatile, and this is the first test for which the fund did not rank last.

7.6. Final ranking

This section presents a summary of the ranking the funds obtained for the four performance measures. First the summary of the ranking is presented, followed by the adjusted ranking after the test was performed.

7.6.1. Ranking summary

This section presents the summary of the fund evaluation before the statistical test was conducted. First the ranking summary is presented, followed by a discussion of the results.

Table 15: Final summary of ranking before t-test

Fund	Returns	Sharpe Ratio	Jensen's Alpha	Standard deviation	Total
MSCI EMI	3	3	3	2	11
Skagen Kon-Tiki	1	1	1	1	4
DNB GEM	5	5	5	3	18
JPM EM	2	2	2	4	10
Fidelity EM	4	4	4	5	17

Based on the summary in table 17, the final rating for the funds is presented in table 18.

Table 16: Final rating before the t-test

Fund	Final rating
Skagen Kon-Tiki	1
JPM EM	2
MSCI EMI	3
Fidelity EM	4
DNB GEM	5

Skagen performed best throughout the period, finishing at the top for all four measures. JPM performed second best overall, performing second best for all methods, except for the standard deviation. MSCI performed third best overall, finishing third for all the methods, with the exception of the standard deviation, where it performed second best. Fidelity performed fourth best overall, finishing fourth for the first three measures. For the standard deviation the fund performed worst, obtaining the highest standard deviation. As expect DNB performed worst overall, consistently obtaining poor rankings for the performance measures. DNB performed worst for the first three performance measures, before ranking third for the standard deviation. What is interesting to note from the summary, is that all the funds obtained the same rank for the first three performance measures. This consistency in the performance measures is a good sign indicating that there may be significant differences in funds performances.

7.6.2. Ranking after test

This section presents the final summary of the fund evaluation after the test was performed.

Table 17: Final ranking summary after t-test

Fund	Returns	Sharpe Ratio	Jensen's Alpha	Standard deviation	Total
MSCI EMI	3	3	3	1	10
Skagen Kon-Tiki	1	1	1	1	4
DNB GEM	5	5	5	3	18
JPM EM	2	2	2	4	10
Fidelity EM	3	3	4	5	15

Based on the summary above, the final rating for the funds is presented in table 20.

Table 18: Final ranking after t-test

Fund	Final rating
Skagen Kon-Tiki	1
JPM EM	2
MSCI EMI	2
Fidelity EM	4
DNB GEM	5

Skagen performed best both before and after the test, finishing at the top for all four measures. There was one change in the overall ranking after the statistical test was performed. This resulted in that JPM and the MSCI obtained the second position. JPM seems to perform well in bull markets, while performing poorly in bear markets. The benchmark is less volatile, not obtaining the highest averages, but performs better than the JPM in bear markets. This is due to the benchmarks diversification factors. JPM finished in second position for the first three performance measures, but only finished in fourth position for the standard deviation. MSCI performed relatively ok for most of the performance measures, obtaining the third position for the first three performance measures. The benchmark obtained the first position, along with Skagen for the standard deviation. Something that contributed to that the MSCI overall was ranked in a shared second place. Fidelity followed the benchmark closely for larger periods. The fund obtained a third ranking for the first two performance measures, before ranking fourth and fifth for the last two rankings. This resulted in that the fund overall was given a fourth position. DND was by far the fund that performed worst. The fund obtained the fifth position for the first three performance measures, before obtaining the third place for the standard deviation. Overall, this resulted in that the fund was ranked last in fifth place.

8. Discussion

8.1. Introduction

The financial markets are as complex as ever due to an accelerating development in technology and complex financial instruments available to investors. This has contributed to the world becoming more financially integrated, which has affected the risk picture for finance. There have been several incidents over the years where financial institutions greed has led to collapses either by taking on excessive risk or not understanding the effects of new complex financial instruments. Sophisticated investment instruments typically include fixed income securities, derivatives and credit default swaps, (CDS). These financial instruments have received a lot of criticism. Many claim that the CDS exacerbated the global financial crisis in 2008. The criticism for the CDSs is that the marked have been allowed to become too large, lacking the necessary regulation. Warren Buffet widely regarded as the most successful investor of all time, described derivatives the following way in Berkshire Hathaway's annual report for 2002:

"I view derivatives as time bombs, both for the parties that deal in them and the economic system."

In addition to more sophisticated instruments, there have been several incidents associated with operational risk, where rogue traders have shaken the financial markets. A rogue trader is an authorized employee of a financial institution who makes unauthorized trades on behalf of the company. Example of an incident associated with rogue trading is the Societe Generale`s scandal, where a trader inflicted the bank with a loss exceeding €4.9 billion. Perhaps the most famous rogue trader is Nick Leeson who worked for Barings Bank. In 1995 his unauthorized trading caused the collapse of Barings Bank, United Kingdom's oldest investment bank.

These examples illustrate a few of the new challenges the financial markets face. To manage these challenges the financial industry has development more complex and improved approaches to assess and manage enterprise-wide risks. One approach that has evolved greatly the last 20 years is risk management. Today, risk management is used to identify investment opportunities, potential hazards and for organizational learning. In portfolio theory, risk management focuses on the interactions between the risks the portfolio is exposed to. A rational investor will try to maximize a portfolio`s expected return, at the same time reducing the portfolio`s standard deviation as low as possible. That is, an investor will strive to

determine the efficient portfolio. The fund managers work in an industry where they need to take risks in order to obtain returns. The funds should invest in assets complementing the portfolio and at the same time avoiding unnecessary risk. There are a variety of quantitative methods for determining the risk and to ensure the fund stay within determined risk profile. Despite the development in risk management, it does contain a potential weakness. This is that the "traditional" approach for risk management does not incorporate the uncertainty perspective. As discussed in chapter 3, this is a potential pitfall. The financial markets are increasingly complex, and new events can occur that has not happened earlier with respect to events, complexity and magnitude.

8.2. Uncertainty approach

The goal of this paper was to perform an evaluation of some mutual funds. The traditional approach for fund evaluations is centered on a quantitative evaluation, often neglecting the uncertainty perspective. In these approaches the risk is based on strong assumptions. This can result in a misleading evaluation, by for instance putting too much emphasis on a small data sample, or on historic data. Aven (2010) argues that historical data can provide insight into risk, and one may obtain good predictions about the future. There is however, in principle a huge step going from history to risk as assumption transforming the data to the future may be challenged. To fully express risk one need to look beyond historically based data. Risk it to a large extent about the aspects not included in the traditional approaches such as surprises. Sensitivity analysis is required to show how the results depend on key assumptions (Aven 2010). In the sensitivity analysis one can vary assumptions. It is important to keep in mind that due to different background knowledge, two individuals performing such an analysis can obtain different results.

It has been argued that the uncertainty perspective deserves a more central role in the financial industry and for fund evaluations. The (A,C,U) perspective is incorporated into the evaluation by the qualitative evaluation, discussing central elements that the evaluation is based on. The qualitative evaluation is the tool used to assess the uncertainty related to the underlying factors, and provide a better overall evaluation for funds. Figure 30 presents the proposed approach for incorporating Avens (A,C,U) perspective for a mutual fund evaluation. The layout for the uncertainty factors were collected from Janbu (Janbu 2009).

The figure below will be used as a basis for the qualitative evaluation, using a systematic approach to discuss the uncertainty associated with the central elements such as the methods, data, theory and results. The discussion will be centered on the three uncertainty factors. Based on Avens (A,C,U) perspective the uncertainty is purely epistemic. For the epistemic uncertainty three sources of uncertainty are evaluated:

I. Model uncertainty
II. Parameter uncertainty
III. Completeness uncertainty

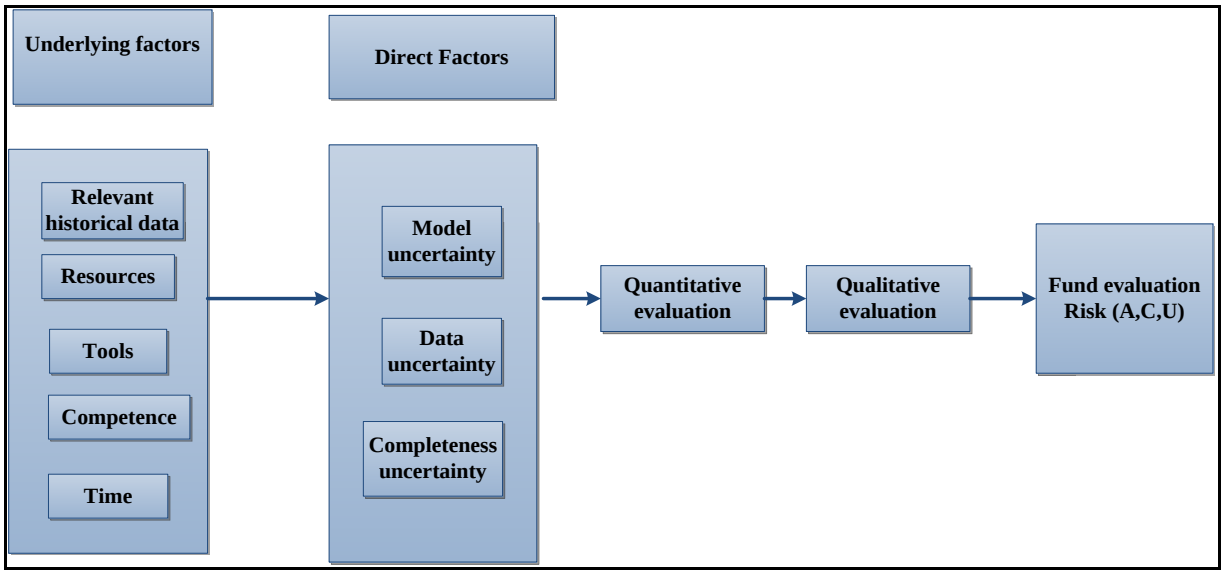


Figure 30: Approach for applying (A,C,U) perspective

The underlying factors are evaluated in the quantitative fund evaluation. These are subject to uncertainties, which are often neglected in fund evaluations. To incorporate Avens (A,C,U) perspective in the fund evaluation, a qualitative evaluation is performed. In the qualitative evaluation the underlying factors are assessed with respect to the uncertainties. There will be more underlying factors than what is illustrated in the figure above. Still the figure is intuitive and presents the suggested tool for the fund evaluation.

8.2.1. Assessing uncertainty

Before the starting the discussion, the uncertainty classification is introduced. This provides a tool to assess the uncertainty factors. To reflect these, a semi-quantitative method is used. The method is adjusted to include consideration of both risk and vulnerability. Furthermore, the methods offer practicality and may serve as a screening of uncertainty factors (Flage and Aven 2009). The effect on risk and vulnerability depends on two dimensions:

- Degree of uncertainty
- Sensitivity of the relevant risk and/or vulnerability indices to changes in the uncertain quantities.

The uncertainty classifications are divided into the following categories: minor, moderate and significant uncertainty. The assessment will be subject to the assessors' background knowledge. The following description is used as a guideline:

Table 19: Uncertainty classification (Flage and Aven 2009)

Minor uncertainty	**Moderate uncertainty**	**Significant uncertainty**
All of the following conditions are met:	*Conditions between those characterizing significant and minor uncertain, e.g.:*	*One or more of the following conditions are met:*
The phenomena involved are well understood; the models used are known to give predictions with the required accuracy.	The phenomena involved are well understood, but the models used are considered simple/crude.	The phenomena involved are not well understood; models are non-existent or known/believed to give poor predictions.
The assumptions made are seen as very reasonable.	Some reliable data are available.	The assumptions made represent strong simplifications.
Much reliable data are		Data are not available, or

available.		are unreliable.
There is a broad agreement among experts.		There is a lack of agreement/consensus among experts.

The sensitivity classifications are divided into the following categories: minor, moderate and significant sensitivity. The following description is used as a guideline:

Table 20: Sensitivity classification (Flage and Aven 2009)

Minor sensitivity	**Moderate sensitivity**	**Significant sensitivity**
Unrealistically large changes in base case values needed to bring about altered conclusions.	Relatively large changes in base values needed to bring about altered conclusions.	Relatively small changes in base values result in altered conclusions

The three epistemic uncertainty sources are discussed and assessed for the effects on risk, and vulnerability. The discussion is related to the sub-objectives, which were as follows:

Objective 1

The first objective of this thesis is to evaluate the funds and benchmarks returns.

Objective 2

The second objective is to evaluate the funds returns relative to the risk. One will investigate how the funds have performed relative to the risk they exposed their portfolio`s too.

Objective 3

The third objective it to analyze the risk the funds have and are exposed to.

8.3. Model uncertainty

The model uncertainty is an important subject since the results for a fund evaluation are based on models. One must remember that a model is inevitably a simplification of the reality or situation it is designed to represent (Jin, Lundteigen et al. 2012). Being a simplification, it is only natural there are uncertainty surrounding the models. The subject of model uncertainty however, makes evaluating funds more challenging, and is one of the factors that contribute to mixed findings on performance persistence of mutual funds (Stephen J. Brown 1995). Two individuals performing a fund evaluation may produce different results, as their background knowledge will differ.

8.3.1. Effects on risk

This section presents the background for the model uncertainty levels placed.

Objective 1 is related to the funds returns. The models used to describe the returns are the arithmetic average returns and the geometric average returns. These are reliable models for which there is an agreement among experts to utilize for calculating returns. The arithmetic returns can be used for shorter periods, while the geometric is more suited to measure returns over a longer time period. Object 1 is given a minor uncertainty level based on that the models provide the required accuracy.

Objective 2 was related to the evaluation of the funds return relative to the risk. A moderate uncertainty factor was placed for this objective, as a result of the Sharpe Ratio being a simple model. Despite this, the model gives insight to how the funds have performed relative to the risk, and provides some reliable data.

Objective 3 is related to the risk the funds have been exposed to. The model used to represent the risk was the standard deviation, and supplemented with a descriptive test as illustrated in figure 3. Elements such as kurtosis and skew provide further insight as to how the funds performed. In addition, the 250, 500 days 99% VaR was presented. It is given a moderate uncertainty level, as the models are simple, yet provide valuable insight to the risk.

8.3.2. Effects on vulnerability

This section presents the background for the model uncertainty levels placed for the effects on sensitivity and/or vulnerability.

Objective 1 was related to the funds returns, which was calculated using the geometric average return. There was one change in the ranking after the statistical test was performed, indicating there was a significant difference between the other funds returns over the period. Objective 1 was given a moderate vulnerability level since there would need to be relatively large changes in the base values to bring about a change in the ranking for the returns.

Objective 2 was related to evaluation of the funds returns relative to the risk. Overall, with the exception of MSCI relative to Fidelity, the results for the p-values were very low. This indicates that there was a significant difference between the results for the Sharpe Ratio. One change was performed, ranking the MSCI and Fidelity with a shared third position. The p-value of 0.38 provided significant statistical evidence that the results were similar. Despite this change, due to the low p-values obtained, a relatively large change would be required to alter the ranking. Objective 2 was given a moderate vulnerability level, based on the statistical test.

Objective 3 was related to the risk for the funds. The effect on vulnerability was given a moderate vulnerability level, as a result of the statistical test. There was one change in the ranking, with the MSCI and Skagen sharing the first position. The other results showed low p-values, indicating that there are significant differences between the funds.

8.3.3. Summary of model uncertainty

The table below illustrates the summary of the model uncertainty, based on the discussion above.

Table 21: Assessment of the model uncertainty

Elements	Effect on risk	Effect on vulnerability
Objective 1	Minor	Moderate
Objective 2	Moderate	Moderate
Objective 3	Moderate	Moderate

8.4. Parameter uncertainty

The parameter uncertainty is related to uncertainty of parameter values used in methods and models. The models in the financial industry are the investors' tools to analyze and evaluate data. The parameter uncertainty is therefore highly relevant for the performance evaluation. Several parameter values are used as inputs for the methods and models used in the evaluation. The parameter value that there is less consensus regarding is the risk-free rate. When there is less consensus related to parameters, the uncertainty is more exposed to the assessors' background knowledge.

8.4.1. Effects on risk

This section presents the background for the parameter uncertainty levels placed.

Objective 1 was related to the funds returns, which was calculated using the geometric average return. There is a broad agreement among experts to the parameters validity used in the models. The parameters used for the geometric return are the price changes for a fund. Furthermore, this phenomenon is well understood, and there is a sufficient degree of data available to be used in the method. Based on this objective 1 was given a minor uncertainty level.

Objective 2 was related to evaluation of the funds returns relative to the risk. The parameters used in this method are the risk-free rate, standard deviation, and the respective methods returns. There is consensus for the parameter representation of the standard deviation and the returns, while there is less agreement for the risk-free rate.

The LIBOR rate is along with the Euribor regarded as the benchmark for the short-term interest rate. The questions that arise associated with this parameter are:

- What is the most representative risk-free rate?

-What fixed risk-free interest rate should one use in the model, between the alternatives such as the monthly, yearly, or the n-year fixed interest rate?

The yearly LIBOR rate was used in this paper for the risk-free rate. Another person with different background knowledge may have used a different risk-free rate than that used in this paper. Based on these arguments objective 2 was given a moderate uncertainty level.

Objective 3 was related to the evaluation of the risk for the funds. The methods used to evaluate the risk are the standard deviation, kurtosis, skew and VaR. Most emphasis was laid on the standard deviation, while the three latter complemented the results. The uncertainty level is low for the standard deviation due to agreement among experts. There is less agreement for the parameters associated with the VaR, kurtosis and skew. There are a variety of parameter values one can use for the VaR models, and there is a lack of agreement among experts as to which of the methods is most suitable for a risk representation. Since the VaR, kurtosis and skew are more supplements to the risk evaluation, and not emphasized too much, the discussion relating to the parameter of these will be limited. The overall assessment is placed as moderate.

8.4.2. Effect of vulnerability

This section presents the background for the parameter uncertainty levels placed for the vulnerability.

The parameters for the method are the historic prices for the funds, and the statistical test illustrated there was a significant difference between the funds. Overall, there was one change in the ranking after the statistical test was performed. Objective 1 was given a moderate vulnerability level, since relatively large changes in the values would be required to change the ranking for the returns.

Objective 2 was related to the evaluation of the funds return relative to the risk. The parameter value that there was most uncertainty related to for the Sharpe Ratio was the standard deviation. A relatively large change is required in standard deviation to change the ranking, based on the fact that the statistical test obtained low p-values. One change was performed after the test, ranking the MSCI and Fidelity in a shared third position. As a result of this a moderate vulnerability level was placed for the second objective.

Objective 3 was related to the risk for the funds. The methods used to measure this were the standard deviation, skew, kurtosis and VaR. The three latter are more sensitive to changes in the parameters. The standard deviation results for the funds also seemed to be quite similar as illustrated by table 14. Therefore a significant level was placed for the effects on vulnerability, as a relatively small change in the base values could alter the conclusions. If this were to occur, there would be changes in the final ranking for the funds risk rating.

8.4.3. Summary of parameter uncertainty

The table below illustrates the summary of the parameter uncertainty, based on the discussion above.

Table 22: Assessment of the parameter uncertainty

Elements	Effect on risk	Effect on vulnerability
Objective 1	Minor	Moderate
Objective 2	Moderate	Moderate
Objective 3	Moderate	Significant

8.5. Completeness uncertainty

The completeness uncertainty is about factors that are not properly included in the analysis. One distinguishes between the known uncertainty, and the unknown uncertainty (Jin, Lundteigen et al. 2012).

In a performance evaluation it is not possible to include all the available models. In the start phase of this thesis, the main purpose was clarified and supplemented with three sub-objectives. These simplified the evaluation process, and aided in choosing suitable performance measures. Despite trying to find the most suitable methods for the evaluation, there were other methods that could have been used.

8.5.1. Known uncertainty level

The known completeness uncertainty is uncertainty arising from factors that are known, but deliberately not included. Reasons for exclusion factors may a result of not understanding the limitations of time or cost constraints, lack of models, lack of data to support the models, or lack of competence in using the models. The known completeness uncertainty reflects assumptions and simplifications that have been made in a trade-off of costs, available resources, competence of analysts, and the state of knowledge about the system and its operating environment (Jin, Lundteigen et al. 2012).

Effect on risk

Objective 1 was related to the funds returns. A minor uncertainty level is placed for the first objective, as several suitable tools are applied in gaining insight to the funds and benchmarks returns. Although there are other ways to evaluate the funds returns, a sufficient effort was put into the evaluation. Graphs were drawn for the complete period, identifying trends and to gaining perspective of how the funds performed. The funds trends were analyzed more closely for the sub-periods to gain insight to how the funds performed in bear and bull markets. In addition, a statistical test was performed in excel to provide a summary, to verify the findings.

Objective 2 was related to the evaluation of the return relative to the risk. A medium uncertainty level was placed for this objective, as there were other relevant methods for the

evaluation. When dealing with limitations, one has to make a trade-off. It was decided that the Sharpe Ratio was a sufficient representation for the objective, offering a simple and practical approach for evaluation the objective.

Objective 3 was related to the evaluation of the funds risk, and a moderate uncertainty level was placed for this objective. There were many performance measures one could use to evaluate the funds risk. The standard deviation was used to represent the risk, and supplemented with the VaR, kurtosis and skew. One had to make a trade-off, and the models used presented a simple and intuitive tool to evaluate the funds risk.

Effects on vulnerability

The assessments related to the effects on vulnerability were challenging to judge and due to limited time the assessment is basic.

Objective 1 was given a moderate vulnerability level since relatively large changes would be needed to alter the conclusion. The trade-offs were well thought out, and this reduced the vulnerability associated with this objective.

Objective 2 was given a moderate vulnerability level, due to using a simple model for representing the returns relative to the risk. Despite using a simple model, it provides valuable insight as to how the funds performed with respect to the objective.

Objective 3 was given a moderate vulnerability level since there was a lack of models to represent the risk. The standard deviation was used, supplemented with the VaR, skew and kurtosis. To evaluate the risk it would be more ideal to have a better had time to incorporate a suitable VaR approach.

8.5.2. Unknown uncertainty level

The unknown completeness uncertainty is related to uncertainty arising from factors that are not known or identified. The factors are truly unknown, and are therefore difficult to account for or make judgments about (Jin, Lundteigen et al. 2012).

This uncertainty level was challenging to assess, since the contribution to this uncertainty is invisible. To simplify this assessment, the objectives were given the same moderate unknown

uncertainty level for the effects on risk, and vulnerability. The reason for this is that there are several factors that one cannot identify, or predict. For instance, not many people could have foreseen how fast and complex the financial crisis in 2007 would turn out to be. Not to mention that it would occur. Events such as this can and most likely will continue to occur in the financial markets. This is something investors, fund customers and investment banks must learn to manage.

8.5.3. Summary of completeness uncertainty

The table below illustrates the summary of the completeness uncertainty, based on the discussion above.

Table 23: Assessment of the completeness uncertainty

Elements	**Known Uncertainty level**		**Unknown Uncertainty Level**	
	Effect on risk	*Effect on vulnerability*	*Effect on risk*	*Effect on vulnerability*
Objective 1	Minor	Moderate	Moderate	Moderate
Objective 2	Moderate	Moderate	Moderate	Moderate
Objective 3	Moderate	Moderate	Moderate	Moderate

8.6. Reflection

Due to limited time, it was not possible to conduct a thorough assessment of the uncertainties. Therefore a basic uncertainty assessment was performed; to shed light on if that were any particular aspects that needed to be identified.

The background knowledge is an important subject when performing an assessment such as this. Two analysts may end up with different values based on different background knowledge when for instance varying assumptions in the vulnerability analysis.

The results obtained for the three sources of uncertainty were mainly assessed with moderate uncertainty levels. For model uncertainty, objective 1 was placed with a minor uncertainty level. With the exception of this, the other objectives were given a moderate uncertainty level.

For the parameter uncertainty, objective 1 was given a minor uncertainty level related to the effect on risk. For objective 3 the effects on vulnerability were given a significant uncertainty level. This was based on that the parameter values were assessed as being vulnerable to changes in base values. With the exception of these, the uncertainty levels were given a moderate uncertainty level.

The results for the completeness uncertainty, was divided into the known- and unknown uncertainty levels. For the known uncertainty, objective 1 was given a minor uncertainty level for the effect on risk. The backgrounds for this assessment was that the trade-offs were well thought, thus reducing the uncertainty. Objective 3 was given a significant uncertainty level for the effect on vulnerability, as it was evaluated that the risk was more vulnerable to changes in the base case values.

9. Conclusion

The risk associated with the financial industry is continuously evolving due to new financial instruments, and an accelerating development in technology. This along with other factors has contributed to that the financial industry are facing some different challenges related to risk. The financial institutions and banks form an essential part of the community, and lay the foundation for the economic interaction in the markets. It is therefore important that the financial industry incorporate sufficient tools to understand and manage the risk associated with their products.

The main purpose of this thesis was to perform a mutual fund evaluation for Skagen Kon-Tiki and some emerging markets funds, with an emphasis on the funds' performance relative to the underlying risk. To perform the evaluation, finance theory, fundamental statistics and modern portfolio theory was applied.

Three sub-objectives were added to aid in the performance evaluation and to clarify the evaluation focus. These objectives were structured to support the main purpose. The first sub-objective was related to the funds returns, ignoring the risk. The second sub-objective was to evaluate the funds returns relative to the risk, and the third sub-objective was to evaluate the funds relative to the risk.

A data sample for 4 funds and one benchmark was selected and studied over a time period of 11 years, ranging from 01 January 2002 to 31 December 2012. The evaluation was divided into three periods to compare the funds performance`s before, during and after the global financial crisis relative to the sub-objectives.

Different performance measures such as VaR, Sharpe Ratio, Jensen's Alpha, standard deviation and the geometric average return were used to evaluate the fund's performances. The four latter, were ranked and a statistical t-test conducted to ensure the results validity.

In addition, to aid in the challenges the financial industry is facing, it is proposed to use Avens (A,C,U) perspective as a tool to incorporate the uncertainty. To incorporate Avens proposed (A,C,U) a qualitative evaluation was performed. This provided a more complete evaluation and shed light on the uncertainty perspective that is often neglected in fund evaluations.

The results obtained for the quantitative and qualitative evaluation, illustrated that Skagen outperformed the other funds and the benchmark. It was not a surprise to find that the fund performed well, as Skagen has received several awards for investment excellence. Skagen rated highest for all of the four performance measures, providing sound foundation to put the fund on top in this evaluation. Skagen seems to be a fund suitable for both speculators, hedgers or less risk adverse investors. Based on the findings in this evaluation, Skagen Kon-Tiki deserves its current gold rating from Morningstar. The fund is suited for speculators, and more risk adverse investors. One should however, not place too much capital in one fund. Rather it is recommended that the investor supplement their portfolio with other funds and/or stocks to gain a better diversification.

JPM and MSCI shared the second place after the statistical test. JPM seems to be a fund that performs well in bull markets, and poorly in bear markets. On the basis of this characteristic, JPM seems to be a suitable fund for speculators, or risk willing investors. Based on the evaluation JPM deserves its current rating of silver. An investor should supplement JPM with other funds and/or stocks to diversify their portfolios, as the fund seems to be relatively risky.

The MSCI obtained the same ranking overall, but seems to be better suited a more risk adverse investor. The MSCI seems to perform better in bear markets, and obtained the lowest standard deviation with Skagen. Fidelity followed the benchmark for larger periods, and performed quite similar for the returns. When the fund was evaluated against the standard deviation it performed poorly, indicating the fund carries more risk. Based on the overall evaluation, Fidelity deserves its current rating of bronze. As with the other funds, an investor should diversify if he decides to buy this fund. DNB performed worse overall, finishing last for the first three performance measures. The fund performed slightly better for the standard deviation, ranking as third. DNB did not have a ranking in Morningstar, and as such cannot be evaluated relative to this.

9.1. Further research

This work has been written within a limited period of time, resulting in limitations for the theory, models and calculations. With respect to these limitations several topics, methods and ideas had to be narrowed. This section presents some of these topics, methods and ideas that can be used for further research.

It was argued that the traditional approach for fund evaluation does not incorporate the uncertainty perspective, which may be a potential pitfall. The main contribution of this work was to perform a mutual fund evaluation and to present a new method for performing mutual fund evaluations. This was inspired by using Avens proposed (A,C,U) perspective.

Another tool used in the writing process, was a model for decision-making under uncertainty. This is presented in the figure below. This can be used as a basis for introducing a new model, more suited for mutual fund rating. Still, the model was useful in the writing process and for incorporating the (A,C,U) perspective. Due to limited time, some work related to this model was not incorporated into the thesis. Future work can be related to developing this figure, developing more suited for the financial industry.

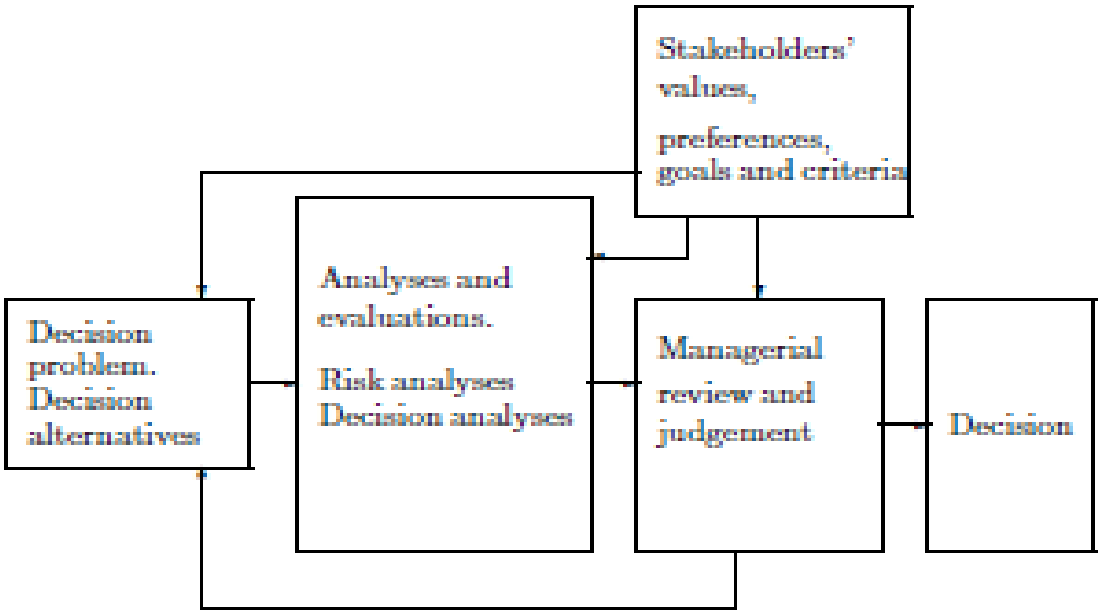


Figure 1.3: A model for decision-making under uncertainty (Aven 2003)

Figure 31: A model for decision-making under uncertainty (Aven 2003)

A method that had to be restricted was the VaR, which can be a useful method to evaluate the risk. A chapter was presented for the VaR, as it was useful supplement in the evaluation for the funds risk. If more time were available, there would be more focus on developing a suitable VaR approach for the fund evaluations.

Furthermore, future work related to fund evaluations might have a more focus on the uncertainty perspective. This is a wide subject and a topic for a master in itself. It is suggested that one can perform a qualitative evaluation, with a more thorough assessment of the uncertainty perspective.

Last, it is proposed to combine figures of 30 and with model for decision-making under uncertainty in figure 31. Combining these can be used to propose a new and improved tool for the financial industry.

10. Reference List:

Aven, T. (2008). Risk Analysis-Assessing Uncertainties beyond Expected Values and Probabilities.

Aven, T. (2010). Misconceptions of Risk, Wiley.

Aven, T. (2013). "Practical implications of the new risk perspectives." Reliability Engineering & System Safety 115: 136-145.

Bank, K. F. K. (2013). "Cost of capital." Retrieved 12.02.2013, 2013, from http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki Pages/Cost of Capital.aspx.

Bell, M. (2012). "The Risk Assessment Spectrum: A Critical Tool for Investors Pt2." from http://www.pertrac.com/blog/the-risk-assessment-spectrum-a-critical-tool-for-investors-pt2/.

Berenson, M. L., et al. (2009). Basic Business Statistics
Concepts and Applications, Pearson.

Bernardo A. E, O. L. (2000). "Gain, Loss, and Asset Pricing." Journal of Political Economy 108: 144-172.

Bodie, K., & Marcus (2009). Investments.

Bodie, Z., et al. (2011). Investments and Portfolio Management.

Carhart, M. M. (1997). "On Persistence in Mutual Fund Performance." 52 1: 57-82.

Dahl, R. E. (2009). Value at Risk analysis with Monte Carlo simulation, University of Stavanger. Master.

Dictionary, B. (2013). "Investment trust." Retrieved 03.04.2013, 2013, from http://www.businessdictionary.com/definition/investment-trust.html.

Dictionary, B. (2013). "Uncertainty." Retrieved 08.05.2013, from http://www.businessdictionary.com/definition/uncertainty.html - ixzz2SswhD100

Dybvig P. H, J. E. I. (1982). "Mean-Variance Theory In Complete Markets." Journal of Business 55: 233-251.

Euronomist (2013). "Efficient Market Hypothesis vs Modern Portfolio Theory." Retrieved 10.05.2013, 2013, from http://euronomist.blogspot.no/2013/02/efficient-market-hypothesis-vs-modern.html.

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work.

Fama, E. F. (1991). "Efficient Capital Markets: 2." Journal of Finance 46.

Fama, E. F. and K. R. French (2004). "The Capital Asset Pricing Model: Theory and Evidence." Journal of Economic Perspectives 18(3): 25-46.

Finansdepartementet (1997). Fremtidig forvaltning av Statens Petroleumsfond. Finansdepartementet.

Flage, R. and T. Aven (2009). "Expressing and communicating uncertainty in relation to quantitative risk analysis." 2.

Fondene, S. (07.03.2013). "Ordliste." from https://http://www.skagenfondene.no/kundeservice/Ordliste/.

Fondene, S. "Slik skaper vi resultater." Retrieved 25.03.2013, from https://http://www.skagenfondene.no/Om-oss/Investeringsfilosofi/.

Fondene, S. (2013). "Status Report - March 2013." Retrieved 15.05.2013, 2013, from https://http://www.skagenfunds.com/Global/2.0_PDFs/2.4_Status_Report/International/SKAGEN_Kon-Tiki/2013/20130331_SKAGEN-Kon-Tiki-March.pdf.

Gardiner, P. D. (2005). Project Management: A strategic Planning Approach, Palgrave.

Gibson, D. (2010). Managing Risk in Information Systems, Jones & Bartlett Learning.

Gruber, M. (1996). "Another puzzle: The growth in actively managed mutual funds." Journal of Finance 52: 783-810.

Haslem, J. A. (2003). Mutual Funds: Risk and Performance Analysis for Decision Making. Blackwell Publishing.

Hertz, D. B. (1964). "Risk Analysis in Capital Investment." Harvard Business Review January/February: 95-106.

Holton, G. A. (2002). History of Value-at-Risk: 1922-1998. Boston.

Investopedia (2013). "Definition of MSCI Emerging Markets Index." Retrieved 20.03.2013, from http://www.investopedia.com/terms/e/emergingmarketsindex.asp.

Investopedia (2013). "Hybrid Funds." Retrieved 03.04.2013, 2013, from http://www.investopedia.com/terms/h/hybridfund.asp.

Janbu, A. F. (2009). Treatment of Uncertainties in Reliability Assessment of Safety Instrumented Systems. Department of Production and Quality Engineering NTNU. Master.

Jin, H., et al. (2012). "Proceedings of the Institution of Mechanical Engineers, Part O." Journal of Risk and Reliability 226(6): 646-655.

Kupiec, P. (1995). "Techniques for Verifying the Accuracy of Risk Management Models." Journal of Derivatives 3.

Lindstrøm, E. (2010). "Implications of Parameter Uncertainty on Option Prices." Advances in Decision Sciences 2010.

M. Drouin, G. P., J. Lehner, G. Martinez-Guridi, J. LaChance, T. Wheeler (2009). Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making, United States Nuclean Regulatory Commission.

Mahoney, J. M. (1996). "Forecasting Biases in Value-at-Risk Estimations: Evidence from Foreign Exchange and Global Equity Portfolios. ."

Managementstudyguide. "Portfolio Management - Meaning and Important Concepts." Retrieved 30.03.2013, from http://www.managementstudyguide.com/portfolio-management.htm.

Methods, R. (2013). "Types of distributions." Retrieved 08.02.2013, 2013, from http://allpsych.com/researchmethods/distributions.html.

Morningstar (2013). "Forstå Morningstars Rating." Retrieved 02.04.2013, 2013, from http://www.morningstar.no/no/news/85452/forst%C3%A5-morningstars-rating.aspx.

Netfonds. "Netfonds." 30.03.2013, from http://www.netfonds.no.

Norway, P. S. A. Risk reduction principles, Petroleum Safety Authority Norway.

Ong, M. K. (2006). Risk Managament- A modern Perspective.

Paul Newbold, W. L. C., Betty M. Thorne (2003). "Statistics for Business and Economics." Fifth Edition.

Pearson, T. J. L. N. D. (1996). Risk measurement: an introduction to value at risk. Mimeo.

Prenhall (2013). "Capital Asset Pricing Model (CAPM)." Retrieved 15.03.2013, 2013, from http://www.prenhall.com/divisions/bp/app/cfl/RR/images/SMLGraph.gif.

Rate, T. L. I. O. (2013). "Historical LIBOR Rate Information." Retrieved 15.03.2013, 2013, from http://www.fedprimerate.com/libor/libor_rates_history.htm.

Rollett, A. D. and P. Manohar (2004). The Monte Carlo Method.

Shleifer, A. (2000). Inefficient Markets: An Introduction to Behavioral Finance, Oxford University Press.

Simons, R. (2000). Performance Measurement and Control Systems for Implementing Strategy Text and Cases, Prentice Hall.

Skagenfondene (2013). "Skagen Kon-TIki." Retrieved 20.02.2013, 2013, from https://http://www.skagenfunds.com/is/Funds-and-prices/SKAGEN-Kon-Tiki/.

Stephen J. Brown, W. N. G. (1995). "Performance Persistence." The Journal of Finance L(2): 679-698.

Sørensen, L. Q. (2009). Mutual Fund Performance at the Oslo Stock Exchange Norwegian School of Economics and Business Administration, NHH. Doctor.

Tor, H. (1993). Kapital Markedet-Teori, statistikk og norsk praksis. Oslo, Ad Notam Gyldendal as.

Turtle, B. (2013). "CAPM foundations." Retrieved 10.02.2013, 2013, from http://www.bionicturtle.com/how-to/article/capm-foundations.