UNIVERSITY OF STAVANGER

MASTER IN ECONOMICS AND BUSINESS ADMINISTRATION

Stavanger, spring semester 2011

Advisor: Associate Professor Lorán Chollete

CAN MUTUAL FUND MANAGERS BEAT THE MARKET?

By

Catherine Gola

Universitetet
i Stavanger

DET SAMFUNNSVITENSKAPELIGE FAKULTET,
HANDELSHØGSKOLEN VED UIS

MASTEROPPGAVE

STUDIEPROGRAM:	OPPGAVEN ER SKREVET INNEN FØLGENDE SPESIALISERINGSRETNING:
Master i økonomi og administrasjon	Anvendt Finans ER OPPGAVEN KONFIDENSIELL? (**NB**! Bruk rødt skjema ved konfidensiell oppgave)

TITTEL: Can mutual fund managers beat the market?

ENGELSK TITTEL:

FORFATTER(E)		VEILEDER:
Studentnummer: 929691 ……	Navn: Catherine Gola ……	Associate Professor Lorán Chollete

OPPGAVEN ER MOTTATT I TO – 2 – INNBUNDNE EKSEMPLARER

Stavanger, ……/…… 2011 Underskrift administrasjon:……

ABSTRACT

The purpose of this thesis is to analyze and understand whether fund managers have superior abilities when it comes to investing and managing capital in the stock market. The analysis is conducted on the basis of 55 Norwegian mutual funds over a time period that ranges from 01.01.2000-31.12.2010.

The dataset concerning the funds was obtained with the help of Morningstar, Storebrand, DnB NOR and Danske Invest. It is a unique dataset as far as the author is concerned, which has not been analyzed before. In addition, the data for the market index was supplied by Oslo Børs, and the risk-free rate was obtained from Norges Bank's website. The data was analyzed in two ways. Firstly, the whole dataset, also called an unbalanced dataset, was analyzed. In addition, to obtain more robust results, the dataset was modified to a balanced dataset, so that it included observations for all the funds over the same period of time.

Different portfolio performance measures have been calculated on the basis of the quarterly returns of the funds. These performance measures have been compared to the performance of the Oslo Børs Mutual Fund Index (OSEFX). The performance measures applied in the thesis are the Sharpe ratio, the Treynor ratio and Jensen's Alpha. In addition, the latter part of the thesis examines whether the excess return of each fund is accomplished on the basis of security selection abilities or market timing abilities. The models applied for this part of the analysis are the Henriksson-Merton market timing model and the Treynor-Mazuy model.

This thesis both confirms and rejects previous U.S. studies. The findings in this paper show that most of the funds are able to earn higher returns than the market. However, the results achieved when applying the Henriksson-Merton model and the Treynor-Mazuy model confirms previous research, which states that excessive earnings are not the result of market-timing abilities. The research performed in this thesis finds that about 50% of the fund managers in this study possess a certain skill when it comes to selecting undervalued securities.

PREFACE

This thesis is written as a finishing part of my Master's degree within economics and business administration, where I have specialized in finance.

Selecting a topic for this master thesis was not easy. I knew, however, that I had to write a paper within the field of portfolio management, as this is one of the fields within finance that interest me and motivates me the most. Examining whether, and how, mutual fund managers outperform the market is an interesting question. So many managers are able to do it, yet how?

Working on this thesis has been challenging, yet exciting. I have had to overcome obstacles and it has been a good learning experience. I would like to thank my advisor, Associate Professor Lorán Chollete, for guiding me through this experience and giving me good advice along the way. I would also like to thank Morningstar, Storebrand, DnB NOR, Danske Invest and Oslo Børs for providing me with all the necessary data. I would not have been able to complete this thesis without their help.

Last, but not least, I would like to thank my friends, family and my boyfriend for being supportive and understanding during this challenging process.

Stavanger, June 2011

Catherine Gola

INDEX

ABSTRACT I

PREFACE II

INDEX III

FIGURES AND TABLES V

TABLE OF EQUATIONS VI

1.0 INTRODUCTION 1

1.1 THE PROBLEM TO BE STUDIED 1

1.2 MOTIVATION 1

1.3 TYPES OF FUNDS 3

1.4 PREVIOUS FINDINGS 4

1.5 CONTRIBUTIONS OF THIS THESIS 6

2.0 THEORY 7

2.1 EFFICIENT MARKET HYPOTHESIS 7

2.1.1 FORMS OF EFFICIENT MARKET HYPOTHESIS 7

2.1.2 THE RANDOM WALK 8

2.1.3 MOMENTUM EFFECT 9

2.1.4 CRITICS OF THE EFFICIENT MARKET HYPOTHESIS 9

2.2 RISK AND RETURN 9

2.2.1 SYSTEMATIC RISK 10

2.2.2 UNSYSTEMATIC RISK 10

2.3 ARITHMETIC VERSUS GEOMETRIC MEAN 11

2.4 EXCESS RETURN 12

2.5 MODELS FOR PORTFOLIO EVALUATION 12

2.5.1 CAPITAL ASSET PRICING MODEL 12

2.5.2 JENSEN'S ALPHA 14

2.5.3 SHARPE RATIO 14

2.5.4 TREYNOR RATIO 15

2.6 MARKET TIMING ABILITIES 17

2.6.1 THE HENRIKSSON-MERTON MARKET TIMING MODEL 17

2.6.2 THE TREYNOR-MAZUY MODEL 19

3.0 METHODOLOGY 21

3.1 REGRESSION 21

3.2 ASSUMPTIONS OF THE REGRESSION 22

3.2.1 THE MEAN OF THE ERROR TERM IS ZERO 23

3.2.2 MULTICOLLINEARITY 23

3.2.3 AUTOCORRELATION 23

3.2.4 HETEROSKEDASTICITY 24

3.2.5 NORMAL DISTRIBUTION OF THE ERROR TERM 25
3.3 BALANCED VS. UNBALANCED DATASET 25
4.0 DATA 27
4.1 SELECTION OF TIME PERIOD 27
4.2 NORWEGIAN MUTUAL FUNDS 27
4.3 OSLO BØRS MUTUAL FUND INDEX 29
4.4 NORWEGIAN MUTUAL FUNDS AND OSEFX 30
4.5 RISK FREE RATE OF RETURN 31
5.0 EMPIRICAL FINDINGS 32
5.1 PORTFOLIO EVALUATION 32
5.1.1 SHARPE RATIO 34
5.1.2 TREYNOR RATIO 36
5.1.3 JENSEN'S ALPHA 38
5.1.3.1 REGRESSION ASSUMPTIONS 38
5.1.3.2 JENSEN'S ALPHA RESULTS 43
5.2 MARKET TIMING AND SECURITY SELECTION ABILITIES 48
5.2.1 THE HENRIKSSON-MERTON MARKET TIMING MODEL 48
5.2.1.1 REGRESSION ASSUMPTIONS 48
5.2.1.2 HENRIKSSON-MERTON RESULTS 53
5.2.2 TREYNOR – MAZUY MARKET TIMING MODEL 57
5.2.2.1 REGRESSION ASSUMPTIONS 57
5.2.2.2 TREYNOR – MAZUY RESULTS 61
6.0 CONCLUSION 66
7.0 REFERENCES 69
7.1 PUBLISHED ARTICLES 69
7.2 BOOKS 70
7.3 INTERNET 71
8.0 APPENDIX 72
8.1 NORMAL DISTRIBUTION OF THE ERROR TERM 72
8.1.1 UNBALANCED JENSEN'S ALPHA 72
8.1.2 BALANCED JENSEN'S ALPHA 77
8.1.3 UNBALANCED HENRIKSSON-MERTON 81
8.1.4 BALANCED HENRIKSSON-MERTON 86
8.1.5 UNBALANCED TREYNOR-MAZUY 90
8.1.6 BALANCED TREYNOR-MAZUY 95

FIGURES AND TABLES

Figure 1 - Investment in securities funds 2

Figure 2 - Unsystematic vs. systematic risk 10

Figure 3 - The Security Market Line 13

Figure 4 - The Capital Market Line 15

Figure 5 - Treynor's Characteristic Line 16

Figure 6 - Oslo Børs Mutual Fund Index 30

Figure 7 - OSEFX and average fund return 31

Figure 8 - Normal distribution of the error term, Jensen unbalanced 38

Figure 9 - Normal distribution of the error term, Jensen balanced 40

Figure 10 - Normal distribution of the error term, Henriksson-Merton unbalanced 48

Figure 11 - Normal distribution of the error term, Henriksson-Merton balanced 50

Figure 12 - Normal distribution of the error term, Treynor-Mazuy unbalanced 57

Figure 13 - Normal distribution of the error term, Treynor-Mazuy balanced 59

Table 1 - Fund Overview 28

Table 2 - Descriptive Statistics 33

Table 3 - Sharpe Ratio 34

Table 4 - Treynor Ratio 36

Table 5 - Unbalanced Jensen's Alpha assumptions 39

Table 6 - Balanced Jensen's Alpha assumptions 41

Table 7 - Results Jensen's Alpha, unbalanced 43

Table 8 - Results Jensen's Alpha, balanced 47

Table 9 - Unbalanced Henriksson-Merton assumptions 49

Table 10 - Balanced Henriksson-Merton assumptions 51

Table 11 - Results Henriksson-Merton model, unbalanced 53

Table 12 - Results Henriksson-Merton model, balanced 56

Table 13 - Unbalanced Treynor-Mazuy assumptions 58

Table 14 - Balanced Treynor-Mazuy assumptions 60

Table 15 - Results Treynor-Mazuy model, unbalanced 61

Table 16 - Results Treynor-Mazuy model, balanced 65

TABLE OF EQUATIONS

Equation 1 - Efficient Market Hypothesis **7**

Equation 2 - Random Walk theorem **8**

Equation 3 - Arithmetic mean **11**

Equation 4 - Geometric mean **11**

Equation 5 - Capital Asset Pricing Model **13**

Equation 6 - Beta **13**

Equation 7 - Jensen's Alpha **14**

Equation 8 - Sharpe Ratio **15**

Equation 9 - Treynor Ratio **17**

Equation 10 - Henriksson-Merton market-timing model **19**

Equation 11 - Treynor-Mazuy market-timing model **20**

Equation 12 - Linear regression model **21**

Equation 13 - R Squared **22**

Equation 14 - Variance Inflation Factor **23**

Equation 15 - Durbin-Watson test **24**

Equation 16 - Spearman correlation coefficient **24**

1.0 INTRODUCTION

1.1 THE PROBLEM TO BE STUDIED

The main focus of this thesis is to examine whether mutual fund managers are able to outperform the market. The problems that will be addressed in this paper are as follows:

- Do managers have the ability to select undervalued securities?
- Do managers have market timing abilities concerning when to buy/sell securities?

These problems will be addressed by examining different financial portfolio performance models, and applying them to a dataset comprising of quarterly returns of 55 Norwegian mutual equity funds over the past eleven years (01.01.2000-31.12.2010). All models that will be applied are all well-established models. The performance of the funds will be tested by applying the Sharpe Ratio and the Treynor Ratio measures, while the excess return and implication of either security selection skills or market-timing abilities, will be tested with Jensen's Alpha. In addition, whether the managers' have market-timing abilities and/or security selection skills will be measured with the Henriksson-Merton model and the Treynor-Mazuy model.

The thesis is divided into six chapters. The introduction includes a section about the motivation for this thesis and a section about previous findings. Section two focuses on the theoretic part of the thesis. In this section the models that will be used for the analysis of the fund will be presented. Chapter three, which is also a theoretical section, goes on to describing the methodology that will be applied to perform the analysis. Section four presents the data that will be analyzed in the thesis. It includes information about the funds, the reference index and the risk free rate that is used in the calculations. Finally, section five presents the results and section six concludes the thesis.

1.2 MOTIVATION

According to the Norwegian Fund and Asset Management Association (VFF), Norwegian market participants invested the largest amount in history at the end of 2010. The total assets under management increased from 399,6 billion NOK in 2009

to 498,8 billion NOK in 2010. A total of 41 billion NOK was invested in securities' funds in 2010, of which mutual equity funds made up 15,8 billion NOK. The following graph shows the division of the investments made in securities funds during 2010. One can see that the investments increased in each of the securities' funds, with the exception of the money markets funds, which decreased by 4,7 billion NOK.

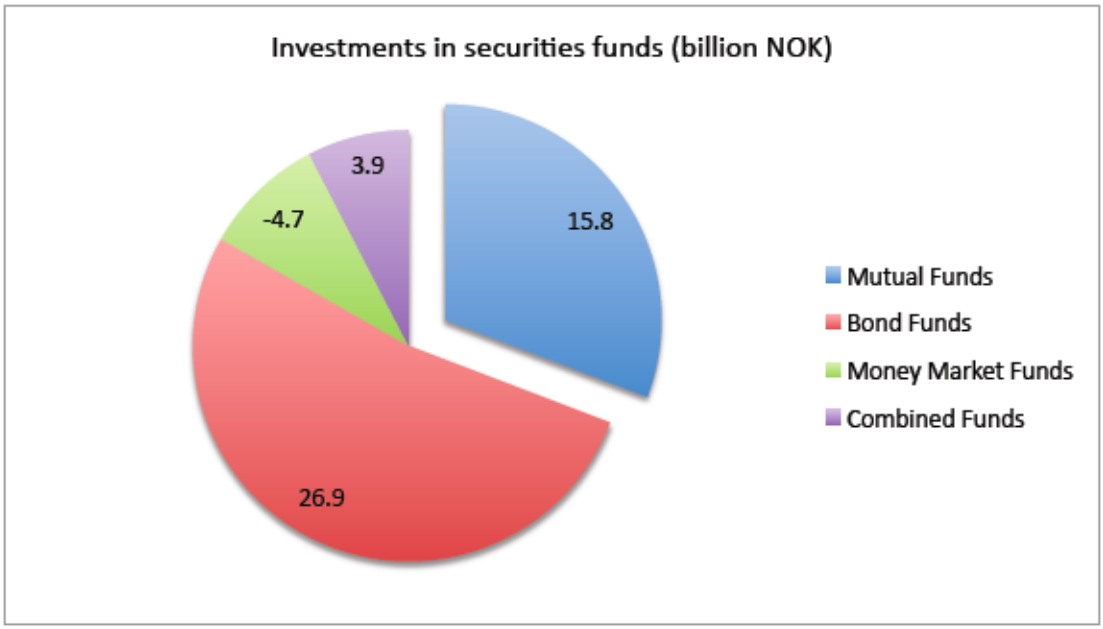


Figure 1 - Investment in securities funds

A mutual equity fund is a portfolio managed by an investment company, often according to certain stated objectives. It is defined as a fund that invests 80% or more of its capital in the stock market. A private investor can choose to allocate some of his capital in such funds, thereby trusting a professional fund manager to administer his wealth (Elton, Gruber, Brown and Goetzmann, 2007). The role of a mutual fund manager is to select securities for his portfolio which he believes are underpriced and diversified.

This thesis focuses on Norwegian mutual funds, which, according to the VFF, is a fund that invests 80% or more of its capital in the Norwegian stock market. All the funds in this thesis are open-end mutual funds. These types of funds allow for purchasing, and selling, securities directly to and from the mutual funds. The shares are priced using the net asset value, which is determined every day at the same time. The market value of the share is therefore, the net asset value less the transaction cost charged by the mutual fund manager (Elton et. al, 2007).

A lot of research about mutual fund managers has previously been conducted. The main focus of this research has, however, been on mutual fund managers in the U.S. This paper will apply these research methods to the Norwegian capital market. It will be interesting to examine whether the same conclusions that are drawn in the U.S. will apply here.

1.3 TYPES OF FUNDS

There are four main types of securities funds. These will be presented in this section.

- Mutual funds: As mentioned above, a mutual fund invests about 80% or more of its capital in the stock market. The fund invests the capital of a group of investors in financial assets. The objectives of the fund are usually predefined, which makes it possible for the investors to choose the level of risk they are willing to bear. The investment strategy of mutual funds varies. They are often grouped into different categories. Such categories can be international funds, which only invest in stocks abroad, or global funds, which invest in both domestic and foreign assets (VFF, 2011). Other mutual funds include specialty funds, which are funds that invest in for example one specific sector or one specific region; and index funds, which attempt to follow the same investment strategy as a major index.

- Bond funds: These are funds that usually invest in corporate or government debt. That is, they invest in commercial papers that yield returns. They are risky, but not as risky as the equity fund, and the longer one invests in such a fund, the higher is the level of risk. The objective of such a fund is generally to provide a steady income for the investor. According to VFF (2011) the period of investment in bond funds varies from 0-2 years, 2-4 years, and 4+ years.

- Money market funds: Money market funds are almost the same as bond funds. The only difference is that the fund cannot invest in commercial papers for longer than a year. This is the fund that has the lowest risk level of all the securities funds (VFF, 2011).

- Combined funds: This is a type of fund that invests in a combination of assets. An example can be to invest half of the capital in bonds and half of the equity

in stocks. The level of risk in such a fund depends on the share of capital that is invested in the stock market, as this is the type of investment that is the riskiest one (VFF, 2011).

1.4 PREVIOUS FINDINGS

A lot of contradicting empirical research about whether investors are able to outperform the market has been published over the years. Chang and Lewellen (1984) attempted to investigate whether managers of mutual funds possess significant market timing and security selection skills. To examine this they used the single-factor market model and Henriksson and Merton's model for testing market-timing abilities. The results from the regression they performed based on the single-factor market model indicated that there is little evidence of market-timing skills. The same applied when using the Henriksson-Merton model, where the findings showed that managers did not possess significant security selection skills.

Treynor (1965) states that the returns made from funds that are heavily invested in common stocks are to some extent determined by fluctuations in the financial markets, and this particular risk is often beyond the control of the fund managers. In their paper, "Can mutual funds outguess the market?", Treynor and Mazuy (1966) address the question as to whether fund managers are able to predict major changes in the stock market. They state that in order for a fund manager to be able to successfully anticipate the market fluctuations he has to consistently vary the volatility of the fund. In order to conduct proper research, Treynor and Mazuy (1966) performed their research based on 57 mutual funds, all differing in size, over the period 1953-1962. Their study concludes that there is no apparent evidence that any of the funds included in the research have been successful at outguessing the market. They state that even though it appears that the managers were not able to time the market, they may still provide higher rates of return than the market, based on security selection abilities.

According to Jensen (1968) portfolio performance has two dimensions:

1. The manager's ability to predict future security prices and thereby increase the return of his portfolio, and
2. The manager's ability to reduce risk by creating a well diversified portfolio

He states that, especially the second point concerning risk, makes it difficult to evaluate portfolio performance. This is due to the different levels of risk aversion among investors in the market. Different levels of risk, and its effect on the return of the securities, should therefore be taken into account when assessing portfolio performance. Jensen (1968) developed an extension of the capital asset pricing model (CAPM) that is used for testing whether fund managers earn excess return, and have security selection abilities and market-timing abilities. He concludes his paper by stating that the managers are not able to outperform the market index, even if one does not take transaction costs and management fees into account.

Sharpe (1966) states that a fund manager is not able to take into consideration the risk preference of all the investors in the market. His strategy must therefore be to select a preferable level of risk and expected return and thereafter invite investors to invest their capital in his fund. The reason as to why the performance of mutual funds may vary boils down to three important aspects; the manager's ability to select incorrectly priced securities, his ability to effectively diversify, and his ability to select the correct level of risk. The model used by Sharpe (1966), which takes into account average returns and risk, leads to the conclusion that the performance of funds are a result of the strategy maintained by the manager. That is, the portfolios with the highest risk levels are often the ones that obtain the highest average returns. In addition, he also mentions that the different levels of return obtained by the funds can be a result of the expense ratios. He implies that good fund managers actively diversify the securities in their portfolios and focus more on evaluating risk than on searching for underpriced shares.

Malkiel (1995) found that there is evidence of manager abilities to earn excess returns, and that they are therefore able to beat the market. However, when taking survivorship bias into account there is actually evidence that the funds tend to underperform according to the market index. Survivorship bias implies that mutual fund complexes, that is, companies that manage a large number of funds, will merge funds that are not doing well in the market into funds that are yielding a better performance. This will lead to the survivorship of only well performing funds, and the average of fund returns will be overly successful. Malkiel (1995) concludes his study by saying that most investors would be better off investing in low expense index funds instead of trusting a professional manager to better administer their capital.

In a more recent article, Malkiel (2003) states that very few fund managers are able to outperform the market index in the long run. According to the data published in this article, the funds that outperformed the index during one period had three times worse results during the next period.

1.5 CONTRIBUTIONS OF THIS THESIS

As mentioned above, this thesis focuses on applying well-established models to the dataset used in this study. To the knowledge of the author of this thesis, these models have previously not been applied to this dataset. It is a recent and unique dataset, which comprises of quarterly rates of return for each of the Norwegian funds listed on Oslo Børs. It ranges over an 11-year period, from 01.01.2000 to 31.12.2010.

The intention of this thesis is to test well-established theoretical models to a new dataset, and thereby either confirming or rejecting previous research.

2.0 THEORY

This section explains the theoretic part of the thesis.

2.1 EFFICIENT MARKET HYPOTHESIS

The efficient market hypothesis (EMH) is concerned with whether the share prices "fully reflect" all the information available about certain shares. That is, the market prices of the shares are always in equilibrium. According to Fama (1970), the statement that share prices "fully reflect" all available information is very general, and therefore, has no implications that can be empirically tested. Accordingly, one has to look at the expected return of a share in equilibrium as a function of its risk. The result of the model will be dependent on which return theory one applies. The general formula for the efficient market hypothesis will however, be as follows (Fama, 1970):

Equation 1 - Efficient Market Hypothesis

$$E(\tilde{p}_{j,t+1}\left|\Phi_t\right.) = \left[1 + E(\tilde{r}_{j,t+1}\left|\Phi_t\right.)\right]\tilde{p}_{j,t}$$

where

E	is the expected value operator,
$p_{j,t}$	is the price of security j at time t,
$p_{j,t+1}$	is the price of security j at time t+1,
$r_{j,t+1}$	is the one period percentage return, and
Φ_t	is a general symbol for the information that fully reflects the price at t

There are three forms of the efficient market hypothesis. These are explained in the following section.

2.1.1 Forms of Efficient Market Hypothesis

The *weak form* hypothesis states that all previous information is already reflected in the current share price. This implies that an investor would not gain any excess return by looking at previous prices, as this information is available and easily accessible to all investors.

The *semi-strong form* hypothesis states that all the information that is available in the market is already reflected in the price of the share. This type of the efficient market

hypothesis examines how fast the prices change when new information is made available to the public.

The final form of the efficient market hypothesis is the *strong form*. This form states that some investors have access to information that is not publicly available to the rest of the market. This includes information available to, amongst others, the management of the company, and can easily lead to insider trading.

2.1.2 The Random Walk

According to Malkiel (2003), the random walk theorem states that stock prices immediately reflect all new information. He states that the price changes occurring tomorrow result from the information that is made available tomorrow, and that it has nothing to do with the previous price changes of the shares. In addition, the price changes of the securities need to be unpredictable. The reason for this is that as the current price of a share fully reflects all available information in the market, price changes will only occur as a response to new information. The announcement of this new information therefore, also needs to be unpredictable or else it would already be incorporated in the current share price (Bodie, Kane and Marcus, 2009).

According to Fama (1970), a random walk arises when the preferences of each investor and the occurrence of new information produce equilibrium such that the returns of the shares are repeated through time. That is, the price changes of the shares are independent of each other. In addition, Fama (1970) states that the successive changes in the prices are identically distributed. Based on these two assumptions, he developed the random walk model:

Equation 2 - Random Walk theorem

$$f(r_{j,t+1}|\Phi_t) = f(r_{j,t+1})$$

which implies that the return $r_{j,t+1}$ given information Φ_t is equivalent to the market return $r_{j,t+1}$. In other words, the returns fully reflect the available information.

2.1.3 Momentum effect

Malkiel (2003) describes the momentum effect as the phenomenon of purchasing securities when there is evidence of positive serial correlations in the past. That is, investors base their decisions about which shares to invest in based on how they tend to perform. Some stocks usually continue to perform in the same way over a period of time, continuously yielding good or bad returns (Bodie et al., 2009).

Sharpe (1966), on the other hand, states that the historical behavior of share prices does not add any value when it comes to predicting future stock prices.

2.1.4 Critics of the Efficient Market Hypothesis

According to Malkiel (2003) evidence against the efficient market hypothesis arises when the returns of stocks are observed over short periods of time, such as days. Research states that when the stock prices are observed over a period of days instead of months or years there is evidence of positive serial correlations. Longer periods (months and years) on the other hand, show evidence of negative serial correlation. This implies that the results of the relationship between returns are based on the sample that is used during the observation period.

Malkiel (2003) also states that small-company stocks yield greater returns than large-company stocks over a longer period of time. This pattern is known as the size effect. This measure may be biased and the pattern can be viewed as an anomaly. He explains this by using the capital asset pricing model. He refers to the risk, which is measured by beta, and the return reflecting the risk. If there is any evidence that shares with the same level of risk yield different returns, this can be a result of market inefficiency. On the other hand, in his article, Malkiel (2003) refers to the finding of Fama and French where they suggest that the size of a company may be a better risk indicator than beta.

2.2 RISK AND RETURN

It is a well-known fact in finance that most investors are risk averse. This implies that if they are to invest in risky assets they expect a higher return. Risky assets are often associated with high volatility. That is, the return of risky assets is uncertain and the return might either be a gain or a loss. This is the reason as to why risk and return are two parallel variables. The higher risk an investor undertakes, the higher return he

will expect. This is logical, as an investor would be better off investing in risk-free assets had there been no excess gain from undertaking risk. According to Treynor (1965) the risk of investing in a diversified fund consists of two types of risk; the risk of market fluctuations and the fluctuations that are associated with the specific securities in the fund. These types of risks are often referred to as systematic and nonsystematic risk, and can be seen in the graph below.

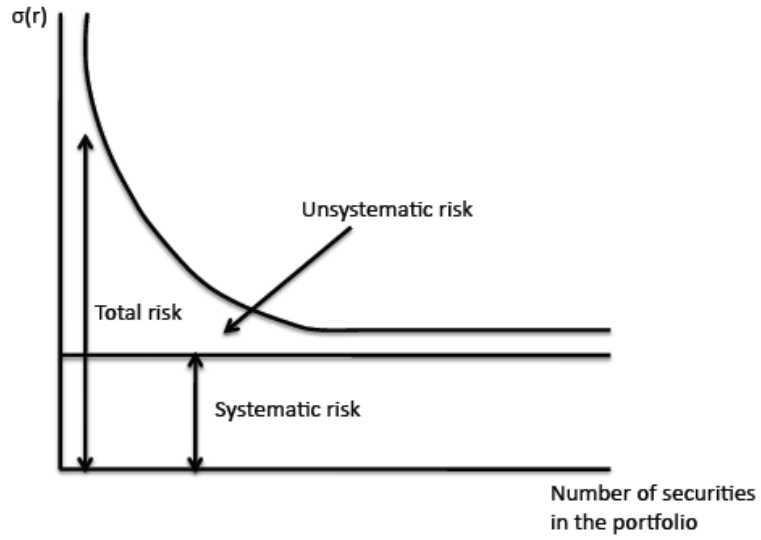


Figure 2 - Unsystematic vs. systematic risk

2.2.1 Systematic risk

Systematic risk is undiversifiable. It is often defined as market risk, which is influenced by unexpected changes in the market. This is why diversification, which means adding more assets to a portfolio in order to balance out the risk, will not limit the exposure to the market risk.

Systematic risk is often referred to as beta, β. This variable is described in more detail in section 2.5.1 about the capital asset pricing model.

2.2.2 Unsystematic risk

Unsystematic risk, which is often referred to as firm-specific risk, is diversifiable. It is a type of risk that is often associated with positive and negative firm-specific information. This is why, by adding more assets to ones portfolio, it is possible to reduce this risk. However, it is important to consider whether the assets in the portfolio are correlated, that is, how the assets move together. In order to achieve a well-diversified portfolio the risky assets included should be negatively correlated.

This implies that they should move in more or less opposite directions, so that if the return of one risky asset decreases there should be an increase in the return of another risky asset.

2.3 ARITHMETIC VERSUS GEOMETRIC MEAN

There are two ways of calculating the mean, or measure of central tendency, of the return of a fund. The *arithmetic* mean gives an equal weight to each security in the portfolio. The expected return will therefore, be the weight of each security times the securities' return:

Equation 3 - Arithmetic mean

$$E(r) = \sum_{s=1}^{n} p(s)r(s) = \frac{1}{n}\sum_{s=1}^{n} r(s)$$

where

n	is number of securities in the portfolio
$p(s)$	is weight of security s, and
$r(s)$	is the return of security s

The arithmetic mean is often used to estimate future expected returns.

Another method for calculating the mean of the returns of a fund is the *geometric* mean. This measure takes into consideration that the returns are dependent of each other, and is often used to calculate the actual performance of the portfolio as opposed to the expected return (Bodie et al., 2009). The geometric average is found by multiplying the returns of the securities and raising the product to the power of the total number of securities included in the portfolio:

Equation 4 - Geometric mean

$$\overline{R}_p = (\prod_{i=1}^{n} 1 + R_i)^{1/N} - 1$$

where

R_i	is the return of security i in the portfolio and,
N	is the number of securities in the portfolio

2.4 EXCESS RETURN

Excess return is the share of an investor's return, which is above the return level one would achieve had one invested in risk-free assets. The excess return will in this thesis be represented by the expression $r_p - r_f$, where r_p is the return earned by the portfolio, while r_f is the risk free return.

2.5 MODELS FOR PORTFOLIO EVALUATION

The very basic of fund performance evaluation involves comparing the returns of two funds. In order for the returns to give a realistic comparison they need to be comparable. That is, they need to have approximately the same risk level and face the same policies and objectives. Comparing the overall returns of funds shows how they perform compared to each other. This measure is, however, superficial, as it does not examine the skills of the manager in charge of the fund. It evaluates the fund and not the mutual fund investor. This section presents the models that will be used to measure the fund performance. Section 2.6 presents the models that are used to evaluate the abilities of the fund managers.

2.5.1 Capital Asset Pricing Model

William Sharpe, Jack Treynor and John Lintner individually developed the capital asset pricing model (CAPM) in the 1960s. It is a model that is used to calculate the required return on a risky asset, and it bases itself on five assumptions:

1. All investors are risk averse and want to maximize their wealth
2. All investors have the same expectations when it comes to their investment decisions, and they have a single-period horizon
3. All investors are able to choose their portfolios based on expected return and the variance of the return
4. There are no taxes and transaction costs
5. All securities are infinitely divisible

In addition, the paramount assumption of the CAPM is that the market is in equilibrium. That is, the return wholly reflects the risk of the asset. If not, one would be able to buy less risky assets and earn higher returns.

According to CAPM, the riskier the assets in the portfolio, the more return can be expected. This can be seen from the graph below. Point M on the security market line

(SML) is the market portfolio with an expected return, $E(r_M)$, and risk, β_M. If one were to take less risk than the market portfolio, one would expect to get lower returns. On the other hand, if one were to take on more risk than the market portfolio, one would expect to get higher returns.

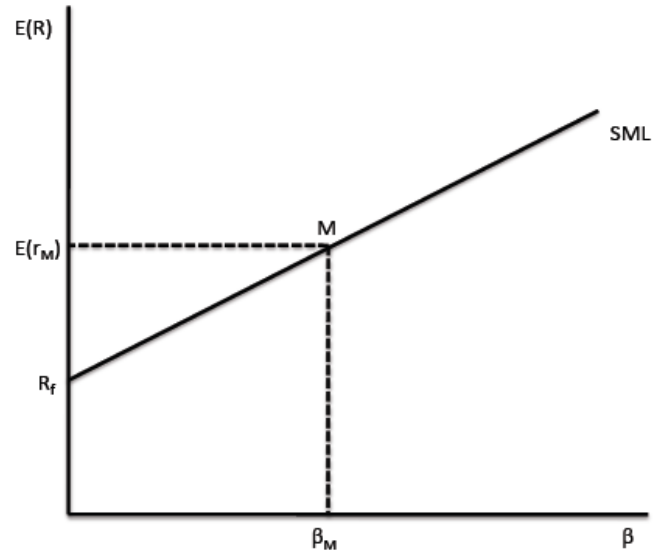


Figure 3 - The Security Market Line

The Capital Asset Pricing Model is illustrated by the following expression:

Equation 5 - Capital Asset Pricing Model

$$E(\tilde{R}_j) = R_f + \beta_j\left[E(\tilde{R}_M) - R_f\right]$$

where,

R_f is the risk-free return during one period

β_j is the risk measure, and

$E(\tilde{R}_M)$ is the expected market return during one period

That is, the required return is the sum of the return of a risk free asset, and a risk premium for the individual asset (Reilly and Brown, 2003).

As mentioned in the section about risk and return, β is the variable that represents the nonsystematic risk. It can be calculated by using the following formula:

Equation 6 - Beta

$$\beta_j = \frac{Cov(r_j, r_M)}{Var(r_M)}$$

where

$Cov(r_j, r_M)$ is the covariance between the return of an asset and the market return, and

$Var(r_M)$ is the variance of the market return

The beta value of the market portfolio is always assumed to be 1.

2.5.2 Jensen's Alpha

Jensen's alpha is based on the capital asset pricing model, mentioned above. It measures the average return made by a portfolio that is above the level of return predicted by the CAPM, based on the beta and the average return of that portfolio (Bodie et al., 2009). Jensen's alpha can be found by using the following formula:

Equation 7 - Jensen's Alpha

$$R_p - R_f = \alpha + \beta_p (R_m - R_f) + \varepsilon_p$$

where

$R_p - R_f$ is the return of the portfolio

$R_m - R_f$ is the return of the market benchmark

α is the share of additional return, and

β_p is the systematic risk of the returns

A significantly positive alpha value implies that the manager has the ability to either select undervalued assets or to time the market, or both (Reilly et al., 2003). However, Jensen (1968) states that even though one may be able to achieve positive alpha values, one cannot be certain whether this value is a result of luck or skill. In order to be certain of the result, one has to calculate the significance of the alpha value. If the alpha value is positive and significant one can interpret the result as being skills, and not luck.

2.5.3 Sharpe Ratio

The Sharpe ratio, or reward-to-volatility ratio, measures the excess return one would earn by investing in risky assets as opposed to investing in risk free assets. This is achieved by dividing the excess return of the portfolio by the standard deviation. That is, the total volatility over the sample period (Bodie et. al, 2009). According to Elton et. al (2007), this method makes it easier for an investor to choose a fund which will best represent his investment strategy. If an investor were to choose a fund with

lowest possible risk and highest possible return he would invest in the fund with the highest possible reward-to-volatility ratio.

The Sharpe ratio is often plotted against the Capital Market Line (CML). The perfect combination of risky and risk free assets lay on this line. If the fund manager were able to earn the same returns as the market, his portfolio would be on the CML. Investing in securities that has a risk and return level equivalent to those on the CML implies that the investor maximizes his profit. However, if he does better (worse) than the market, the return of the fund would be above (below) the CML.

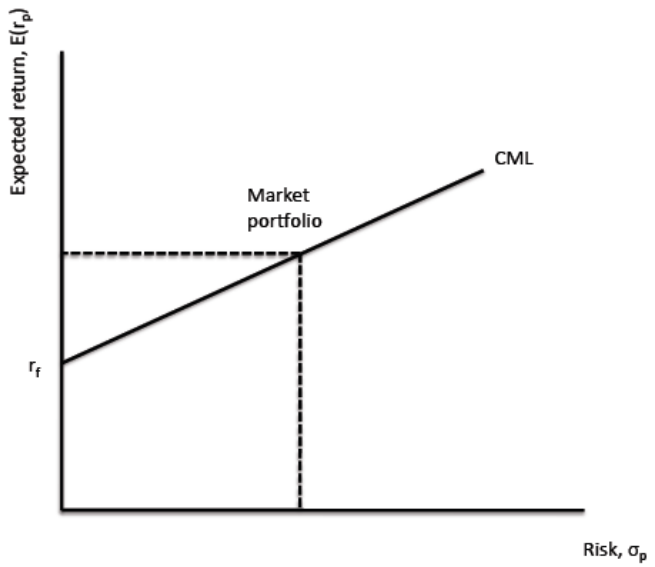


Figure 4 - The Capital Market Line

In order to calculate the Sharpe Ratio one can apply the following formula:

Equation 8 - Sharpe Ratio

$$\frac{(\bar{r}_p - \bar{r}_f)}{\sigma_p}$$

where

$(\bar{r}_p - \bar{r}_f)$ is the excess return over the sample period, and

σ_p is the standard deviation of the returns over the sample period

2.5.4 Treynor ratio

The Treynor measure does also measure the excess return per unit of risk. The model is based on the CAPM. The difference between the Sharpe ratio and this measure

however, is that the Treynor ratio uses the systematic risk as a variable as opposed to nonsystematic risk (Bodie et. al, 2009).

In order to differentiate between the market risk and the risk that is specific to the securities included in the portfolio, Treynor developed the characteristic line (Reilly and Brown, 2003). The characteristic line is illustrated below. When the values of the fund return are plotted against the values of the market return, and the volatility has been held constant, the observations will be scattered around the red line. The extent to which the observations are scattered around this line tells us how diversified the portfolio is. If the values lay above the red line, the fund earns excess return and if they lay below the red line, they are not earning excess return. If they lay on the red line, the fund is earning the same returns as the market portfolio (Treynor, 2007). According to Treynor (2007), when the fund manager is able to outguess the market with better than average success, the shape of the curve has to be concave. This happens because the manager has to vary the volatility of the fund systematically.

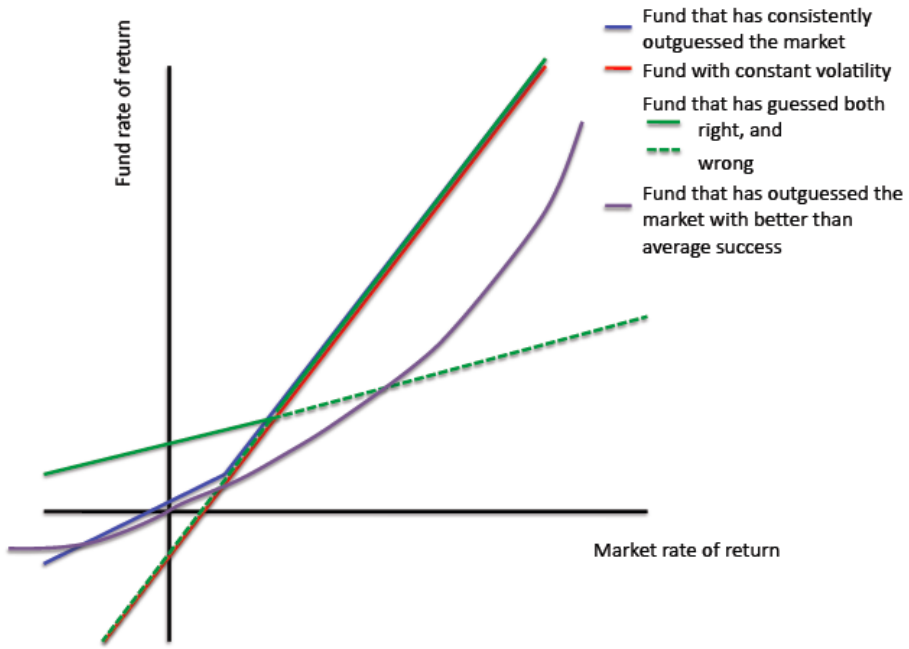


Figure 5 - Treynor's Characteristic Line

Because Treynor uses the systematic risk in his calculation, his characteristic line is comparable to the SML. This is a line that shows the relationship between risk and return. It illustrates that if one were to increase the expected return of ones portfolio,

one would also have to increase the level of risk involved in the investment (Reilly and Brown, 2003).

In order to calculate Treynor's Measure, one can apply the following formula:

Equation 9 - Treynor Ratio

$$\frac{(\bar{r}_p - \bar{r}_f)}{\beta_p}$$

where

$(\bar{r}_p - \bar{r}_f)$ is the excess return over the sample period, and

β_p is the systematic risk of the returns over the sample period

2.6 MARKET TIMING ABILITIES

According to Elton et. al (2007) a way in which a manager tries to reduce the risk of a fund is to adjust the beta based on whether the market is expected to go up or down. That is, if he expects the market to increase he will increase the beta in order to earn greater return. However, if he expects the market to decrease he will decrease the beta and, by doing so, expose the fund to less risk. The adjustment of beta is done by selling (purchasing) securities with high (low) betas if the market is expected to decrease (increase).

There are several models that can be used to evaluate a manager's performance. This thesis will apply the Henriksson-Merton and the Treynor-Mazuy market timing models. These models are presented in this section.

2.6.1 The Henriksson-Merton market timing model

The Henriksson-Merton model is based on a statistical model developed by Robert C. Merton and Roy D. Henriksson in 1981. It is a model where the manager attempts to predict when stocks and risk free assets outperform each other. This is called macroforecasting, and the purpose is to recognize when the risky assets are over-/under-priced when compared to fixed-income assets (Merton, 1981). The forecaster is, however, not able to predict how much the stocks and risk free assets will outperform each other. That is, he cannot predict the scale of the return.

The model is based on a manager's ability to forecast whether market stocks will yield greater returns than risk free assets and vice versa. Merton (1981) chose to define the model in the following way:

$Z_M(t) > R(t)$ which implies that the market stocks yield greater return than risk free assets, and;

$R(t) > Z_M(t)$ which implies that the risk free assets yield greater return than the market stocks

The purpose of the model is to be able to shift the proportions of capital invested in market stocks and in risk free assets according to the managers forecast.

The model can be depicted as the probability that a manager is able to develop an accurate forecast about which asset yields the highest return. Henriksson (1984) lets $\gamma(t)$ be the variable that describes the manager's forecast. He sets $\gamma(t) = 1$ if the manager forecasts, in period t-1, is $Z_M(t) > R(t)$, and he sets $\gamma(t) = 0$ if the managers forecast is $R(t) \geq Z_M(t)$. He then shows that the probabilities for $\gamma(t)$, which are conditional on the realized market return $Z_M(t) - R(t)$, are as follow:

$$p_1(t) = \text{probability}[\gamma(t) = 0 \; Z_M(t) \leq R(t)]$$
$$1 - p_1(t) = \text{probability}[\gamma(t) = 1 \; Z_M(t) \leq R(t)]$$

and

$$p_2(t) = \text{probability}[\gamma(t) = 1 \; Z_M(t) > R(t)]$$
$$1 - p_2(t) = \text{probability}[\gamma(t) = 0 \; Z_M(t) > R(t)]$$

These sets of formulas state that $p_1(t)$ is the probability of an accurate forecast given that the market stock return is greater than the return from the risk free asset, while $p_2(t)$ is the probability of an accurate forecast given that the risk free asset return is greater than the return from the market stock. As the model implies that the forecaster is not able to predict the value of the returns of the assets, Henriksson (1984) and Merton (1981) state that a necessary condition for the managers forecasts to have no value is that $p_1(t) + p_2(t) = 1$. This condition illustrates that the manager will not change his beliefs about the total returns of his market portfolio, and he will therefore, not spend extra time and money in order to collect excess information about the market stocks. If the manager would be able to make successful predictions about

whether the stocks and risk free assets will outperform each other, then $p_1(t) + p_2(t) > 1$ (Henriksson, 1984).

In order to analyze whether the investor has been able to accurately forecast which assets to involve in his portfolio, and when to buy and sell them, one can apply the following model

Equation 10 - Henriksson-Merton market-timing model

$$R_p - R_f = \alpha + \beta(R_m - R_f) + \gamma D + \varepsilon_p$$

where

D is the up-market returns or max(0, $R_m - R_f$)

α is the excess return

γ is the market timing skills, and

β is the market sensitivity

Its purpose is to determine whether managers have had any market timing and/or security selection skills. Performing a multiple regression tests this. The portfolio excess return, the dependent variable, is regressed against the market return and the return of an option. The option in this formula is represented by D. The value of the return of the option is 0 if the excess return in the market is smaller than or equal to 0, and 1 if the excess market return is above 0 (Christopherson, Carino and Ferson, 2009).

2.6.2 The Treynor-Mazuy Model

The basic idea of market timing abilities refers to predicting whether the value of a share is going to rise or fall in the next period. The purpose of such abilities is to make changes to the effective portfolio volatility (Treynor and Mazuy, 1966). This involves changing the share of investments made in volatile securities to less volatile securities when there is a fall in the market and vice versa. According to Coggin, Fabozzi and Rahman (1993), a manager with market timing abilities will hold a large fraction of the market portfolio when it yields great returns and a small fraction of the market portfolio when it yields lower returns.

The following model is used to examine whether a fund manager has market timing abilities and security selection skills. This regression model is based on the CAPM,

with the addition of a quadratic extension of the excess return (Christopherson, et al, 2009).

Equation 11 - Treynor-Mazuy market-timing model

$$R_p - R_f = \alpha + \beta(R_m - R_f) + \gamma(R_m - R_f)^2 + \varepsilon_p$$

where

α	is the excess return (intercept)
γ	is the market timing skills, and
β	is the market sensitivity

3.0 METHODOLOGY

This chapter explains the methodology that will be applied in order to check for a manager's ability when it comes to managing a fund effectively.

3.1 REGRESSION

Regression is an analytical tool that helps define how one or more variables influence a dependent variable.

In general, the model for linear regression contains two main variables. According to Stock and Watson (2007), the linear regression model can be expressed as follows:

Equation 12 - Linear regression model

$$Y_i = \beta_0 + \beta_1 X_1 + \varepsilon_i$$

where

Y_i is the dependent variable

X_i is the independent variable

β_0 is the intercept of the population regression line

β_1 is the slope of the regression line, and

ε_i is the error term, or residual, which contains all the information that cannot be predicted by the regression.

This regression model, which is an ordinary least square (OLS) regression model, focuses on determining a value for each of the coefficients so that all the observations are as close to the regression line as possible. Therefore, when one performs a regression, not only does one want to know the outcome of the independent and dependent variables, one wants to examine how well the model predicts the values of the dependent variable (Stock and Watson, 2007).

A way of measuring how well the model "fits" is to calculate the R^2. R^2 determines how much of the variance of the dependent variable, Y_i, is explained by the independent variables, X_i. Mathematically, the R^2 can be found by applying the following formula (Stock and Watson, 2007):

Equation 13 - R Squared

$$R^2 = \frac{\sum_{i=1}^{n}(\hat{Y}_i - \overline{Y})^2}{\sum_{i=1}^{n}(Y_i - \overline{Y})^2}$$

where

$\hat{Y}_i$ is the predicted dependent variable

Y_i is the dependent variable, and

$\overline{Y}$ is the average value of the predicted dependent variables

The R^2 is usually a value between 0 and 1, where 1 implies that the independent variables in the model predict the dependent variable very well.

In addition, the software produces a significance test. The significance test that will be applied in this thesis is the p-value. The p-value helps determine whether a hypothesis should be accepted or rejected. A p-value of 1% implies that the significance level of the regressor is highly significant. If the p-value is 5% one can interpret the significance level of the regressor to be significant. If the p-value is 10% the significance level is weak, and if it is greater than 10% it implies that the regressor is not significant (Keller and Warrack, 2003).

3.2 ASSUMPTIONS OF THE REGRESSION

In order to be able to perform a reliable OLS regression, one needs to take several assumptions into consideration:

1. The mean of the error term is zero, $E(u_i|X_i) = 0$
2. No multicollinearity; the independent and dependent variables are independently and identically distributed
3. No autocorrelation; the error terms of the regressors are independent of each other
4. Heteroskedasticity; the variance of the error terms is constant
5. The error term is normally distributed

Testing the error term of the regression is of importance. The error term, also called the disturbance, arises because all the independent variables of the regression are not able to capture every influence on the dependent variable (Greene, 2003).

Heteroscedasticity often arises in time-series data where the observations often are highly volatile. The reason for this, according to Greene (2003), is that the level of accuracy of the regression model may vary for such observations. In addition, he states that the level of dependent variables also may vary over time. Autocorrelation is also a disturbance that arises in time-series data. This implies that the observations used in the regression model often are dependent on each other. According to Greene (2003), the time-series data often appears to have a "memory" where the data for this period may be influenced by the data in the previous period.

3.2.1 The mean of the error term is zero

One should always assume that the mean of the error term is zero. This implies that the factors incorporated in the error term do not influence the independent variables (Stock and Watson, 2007).

3.2.2 Multicollinearity

Multicollinearity arises when there is evidence that one independent variable is linearly dependent on another independent variable. In this thesis, the presence of multicollinearity will be examined by looking at the variance inflation factor (VIF). VIF can be defined by the following formula

Equation 14 - Variance Inflation Factor

$$VIF = \frac{1}{1 - R_j^2}$$

According to Bohn and Stein (2009), a large VIF implies that the variable that is being tested has a large standard error, which in turn implies that the regressors in the analysis do not explain the value of the dependent variable very well. The value of VIF should never be greater than 10. However, if its value exceeds 5, there might be a presence of mild multicollinearity.

3.2.3 Autocorrelation

Autocorrelation implies that the error term of one observation is dependent on the error term of another observation. According to Stock and Watson (2007) there should be a lack of autocorrelation.

In order to test for autocorrelation one can use the Durbin-Watson test. The test can be defined as

Equation 15 - Durbin-Watson test

$$d = \frac{\sum_{i=2}^{n}(e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}$$

where

e_i is the error term

The values of the Durbin-Watson test range from 0 to 4 (Keller and Warrack, 2003). One can also look up the value of the variable in a Durbin-Watson table. In order to find the correct value one has to look for the number of observations included in the regression. If there is no such value presented in the table, one finds the closest possible lowest number of observations. In addition, one has to take into consideration how many independent variables are included in the regression model. As a rule of thumb, as long as the Durbin-Watson coefficient is around 2,5, there is no sign of autocorrelation.

3.2.4 Heteroskedasticity

According to Keller and Warrack (2003), the variance of the error term has to remain constant over time. If there is a violation of this condition, there is an occurrence of heteroskedasticity. One can examine whether there is a presence of heteroskedasticity by performing a Spearman correlation test. The Spearman correlation coefficient can be calculated by applying the following formula:

Equation 16 - Spearman correlation coefficient

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2 - 1)}$$

where

n is the number of paired ranks, and

d_i is the difference between paired ranks

This test is applied in order to accept or reject a hypothesis;

H_0: $\rho = 0$, there is no correlation between the residuals, i.e. homoskedasticity

H_1: $\rho \neq 0$, the residuals are correlated, i.e. heteroskedasticity

In order to be able to accept/reject H_0, one needs to check the significance of the Spearman variable. If there is a sign of heteroskedasticity the regressors may no longer be efficient. However, it is important to mention that heteroskedasticity is not a problem unless it is caused by missing variables, omitted variables or measurement errors (Pryce, 2002).

3.2.5 Normal distribution of the error term

One of the assumptions that should be met when it comes to OLS is that the residuals should be normally distributed (Gripsrud, Olsson and Silkoset, 2007). This assumption can be tested in several ways. In this thesis the residuals will be tested graphically using analytical software. The graphs produced are called Normal P-Plots of Regression Standardized Residuals. The residuals are believed to normally distributed if the variables more or less follow a straight line.

3.3 BALANCED VS. UNBALANCED DATASET

The dataset in this thesis has some limitations. This is a result of the fact that some of the funds were started after January 2000. In order to make the data more comparable and resolve this shortcoming, the data has been analyzed in two ways. The methods involve the terms unbalanced and balanced panel data. Unbalanced panel data implies that one uses the data sample that is collected for the whole period. That is, one does not take into consideration that there is some data missing for some of the periods. A balanced dataset on the other hand, only involves data that is complete. That is, it will eliminate the periods where some of the funds are missing data.

There are limitations to both methods. The unbalanced data method does not give a completely reliable picture as the sample is missing data. The balanced panel data method, on the other hand, reduces the sample size significantly.

In order to perform an analysis that is as accurate as possible, the dataset has been analyzed twice. For the second part of the analysis, the data has been modified so that it is balanced.

In order to transform the data to a balanced dataset, the period was reduced to 01.01.2004 – 31.12.2010. Most of the funds in the dataset had complete information during this period. Three funds were eliminated from the sample. These are the Danske Invest Norge Aksjer Inst II, Landkreditt Norge and Pareto Verdi. These funds were all started after January 2004.

4.0 DATA

The following section describes the data that is analyzed in this thesis.

4.1 SELECTION OF TIME PERIOD

The dataset comprises of observations during the time period 01.01.2000 – 31.12.2010. As the observations are made on a quarterly basis the sample size ranges from 44 quarterly periods in the unbalanced dataset to 28 quarterly periods in the balanced dataset. The funds which did not have observations for 28 quarterly periods were excluded from the balanced dataset. One of the reasons as to why this sample period was chosen is its recency. It is a relatively long time period, which includes market fluctuations. In addition, there was a financial crisis during this time period. An interesting aspect of this crisis is to see whether the managers were able to predict the fall in the market and secure good returns for their investors.

4.2 NORWEGIAN MUTUAL FUNDS

The data sample was collected with the help of Morningstar Norge AS. The data consists of quarterly returns from 2000 – 2010 for all the Norwegian mutual equity funds listed on Oslo Børs at the beginning of February 2011.

As is apparent from the table below, the funds were started at different periods in time, ranging from October 1996 to August 2006. All the Norwegian funds were included in the data sample, irrespective of when they were started. The problem with the lack of observations of the funds that were started after 01.01.2000 was solved by performing the analysis based on both unbalanced and balanced datasets, as mentioned in section 3.3.

The fee that is charged by the fund for managing the capital ranges from 0,28% for Storebrand Norge I to 2,70% for Alfred Berg Gambak. In addition to the management fee, each fund charges for buying and selling shares in the fund.

The minimum first time investment one can make in the funds varies from 100 NOK to 100.000.000 NOK. It appears that the funds with the lowest minimum first time investment amounts charge the highest management fees.

In addition, it is worth mentioning that all the funds seem to have a close to perfect correlation with the comparable index, OSEFX, where the correlation coefficients range from 0,85 to 0,99.

Fund	Established	Management fee	Minimum investment (NOK)	Correlation with OSEFX
Alfred Berg Aktiv	December 2005	0,70%	10.000.000	0,95
Alfred Berg Aktiv II	September 1997	1,50%	25.000	0,92
Alfred Berg Gambak	November 1990	2,70%	25.000	0,89
Alfred Berg Humanfond	December 1999	1,80%	2.000	0,97
Alfred Berg Norge	September 1990	1,20%	25.000	0,98
Alfred Berg Norge +	December 1997	0,70%	10.000.000	0,98
Alfred Berg Norge Etisk	April 2002	1,70%	5.000	0,99
Atlas Norge	January 1998	2,00%	50.000	0,94
Avanse Norge (I)	October 1966	1,80%	1.000	0,99
Avanse Norge (II)	December 1990	1,20%	1.000.000	0,99
Carnegie Aksje Norge	July 1995	1,50%	1.000	0,98
Danske Invest Norge I	December 1993	2,00%	1.000	0,99
Danske Invest Norge II	December 1993	1,25%	50.000	0,98
Danske Invest Norge Vekst	December 1993	1,75%	1.000	0,85
Danske Invest Norge Aksjer Inst I	February 2000	0,90%	3.000.000	0,99
Danske Invest Norge Aksjer Inst II	October 2005	0,90%	3.000.000	0,98
Delphi Norge	June 1994	2,00%	1.000	0,95
Delphi Vekst	October 1997	4,00%	1.000	0,91
DnB NOR Barnefond	February 1997	1,80%	1.000	0,98
DnB NOR Norge (I)	October 1981	1,80%	1.000	0,98
DnB NOR Norge (III)	February 1996	1,00%	2.500.000	0,98
DnB NOR Norge (IV)	November 2002	0,75%	10.000.000	0,98
DnB NOR Norge Selektiv (I)	April 1996	2,00%	1.000	0,98
DnB NOR Norge Selektiv (II)	December 1991	1,00%	2.500.000	0,98
DnB NOR Norge Selektiv (III)	June 1994	0,80%	10.000.000	0,98
DnB NOR SMB	Mars 1991	2,00%	1.000	0,94
Fondsfinans Aktiv	April 2000	1,00%	100.000	0,97
Fondsfinans Spar	December 2002	1,00%	100.000	0,97
Handelsbanken Norge	December 1994	2,00%	1.000	0,98
Holberg Norge	December 2000	1,50%	3.000	0,95
KLP AksjeNorge	September 1998	1,20%	3.000	0,98
Landkreditt Norge	June 2006	1,75%	300	0,97
NB Aksjefond	August 2006	2,00%	5.000	0,98
Nordea Avkastning	December 1981	2,00%	100	0,99
Nordea Kapital	January 1995	1,00%	1.000.000	0,99
Nordea Norge Verdi	December 1995	1,50%	10.000	0,97
Nordea SMB	March 1997	2,00%	100	0,91
Nordea Vekst	December 1981	2,00%	100	0,98
ODIN Norge	June 1992	2,00%	3.000	0,94
Orkla Finans Investment	January 1985	1,80%	2.000	0,97
Pareto Aksje Norge	September 2001	0,50%	100.000.000	0,94
Pareto Aktiv	August 2002	1,50%	500.000	0,93
Pareto Verdi	December 2005	2,00%	200.000	0,95
PLUSS Aksje	October 1996	1,20%	50.000	0,99
PLUSS Markedsverdi	January 1995	0,90%	50.000	0,99
Postbanken Norge	July 1995	1,80%	1.000	0,98
Storebrand Aksje Innland	July1996	0,60%	10.000.000	0,98
Storebrand Norge	September 1983	1,50%	100	0,99
Storebrand Norge I	April 2000	0,28%	100.000.000	0,98
Storebrand Optima Norge A	December 2000	1, 00%	10.000.000	0,98
Storebrand Vekst	September 1992	2,00%	100	0,87
Storebrand Verdi	December 1997	2,00%	100	0,96
Terra Norge	February 1998	2,00%	300	0,95
Terra SMB	February 1998	2,00%	1.000	0,95
WarrenWicklund Norge A	September 2003	2,00%	5.000	0,97

Table 1 - Fund Overview

The total number of the funds studied in this analysis is 55. However, in the balanced dataset, where the sample period was reduced to 01.01.2004-31.12.2010, the number of funds was reduced to 52.

This dataset is comparable to the one used by Treynor and Mazuy (1966), where they examined the market timing abilities of 57 open-end mutual fund managers over a ten year period ranging from 1953 – 1962. Just as in their paper, this thesis includes funds that vary in size. The market value of the assets varied from NOK 163,16 to NOK 178.778,27 on 31.12.2010. The difference in the dataset examined in this paper is that the observations are made on a quarterly basis, while the observations in Treynor and Mazuy's paper are annual.

This dataset is also comparable to the one used by Jensen (1968) when he evaluated the performance of open-end mutual funds over a ten-year period ranging from 1955-1964. The observations in Jensen's paper are also annual, as opposed to the data in this thesis, which is quarterly.

4.3 OSLO BØRS MUTUAL FUND INDEX

The comparable index to the Norwegian mutual equity funds is the Oslo Børs Mutual Fund Index (OSEFX). This index is a weighted version of the Oslo Børs Benchmark Index (OSEBX), which is a dividend-adjusted index that contains the most traded shares on the exchange. The adjustment of the weights of the securities in the OSEFX is done according to the Undertaking for Collective Investment in Transferable Securities (UCITS) Directive. A security can only make up 10% of the weight of the total market value of the index, and securities that make up 5% of the total market value of the index cannot exceed 40% of the total weight (Oslo Børs, 2011).

The graph below shows the movement of the index based on quarterly data from 2000 till the end of 2010. As one can see, there were three recessions in 2001, 2002 and 2008. These recessions occurred as a result of the burst of the "internet bubble" in 2001. As the dot com bubble burst in 2001, people who had invested in internet-related companies started losing money, and this lead to a crash in 2002. The recession in 2008 happened because of the financial crisis.

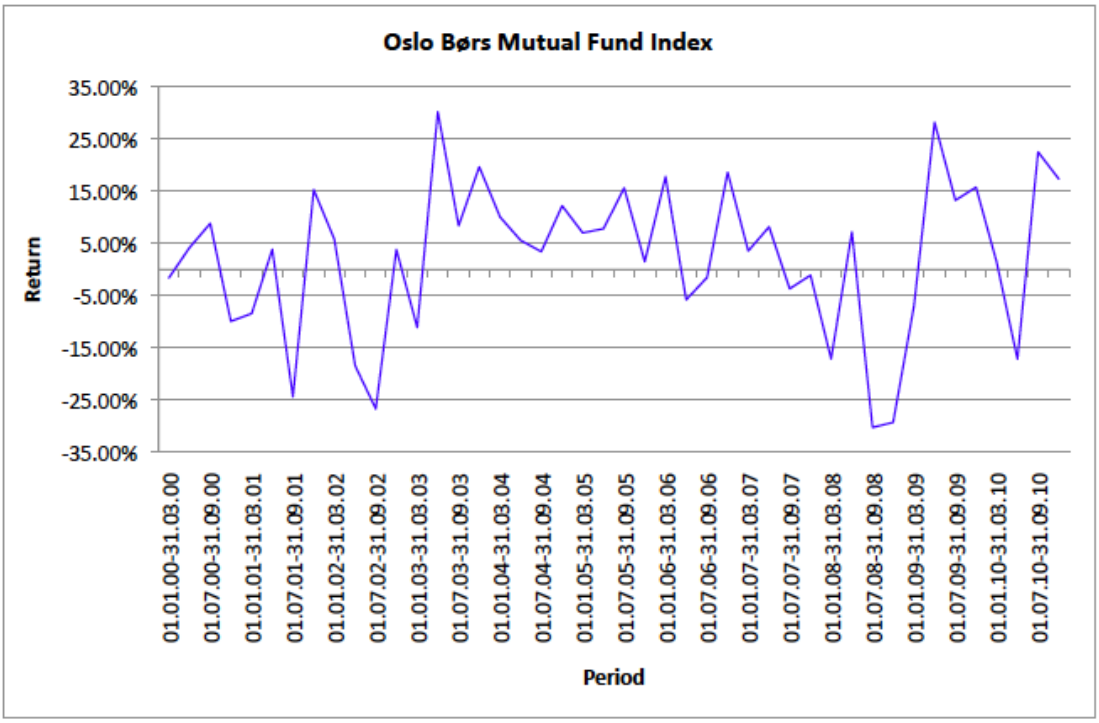


Figure 6 - Oslo Børs Mutual Fund Index

The OSEFX was chosen as the comparable index because it appears to be the index which is not only used as the comparable index by Morningstar, but also by most of the fund managers themselves.

4.4 NORWEGIAN MUTUAL FUNDS AND OSEFX

If one would simply take the average return of all the mutual funds included in the analysis in this thesis and compare it to the return of the index, one would see a trend where the average return of the funds would follow the index closely. This is also proven by looking at the correlation coefficients of the funds, which are close to 1. These are presented in table 1. The graph below illustrates how the total average return of the funds over the sample period varies with the return of the OSEFX over the sample period. Throughout the rest of the thesis, the calculations will be based on the performance of each individual fund.

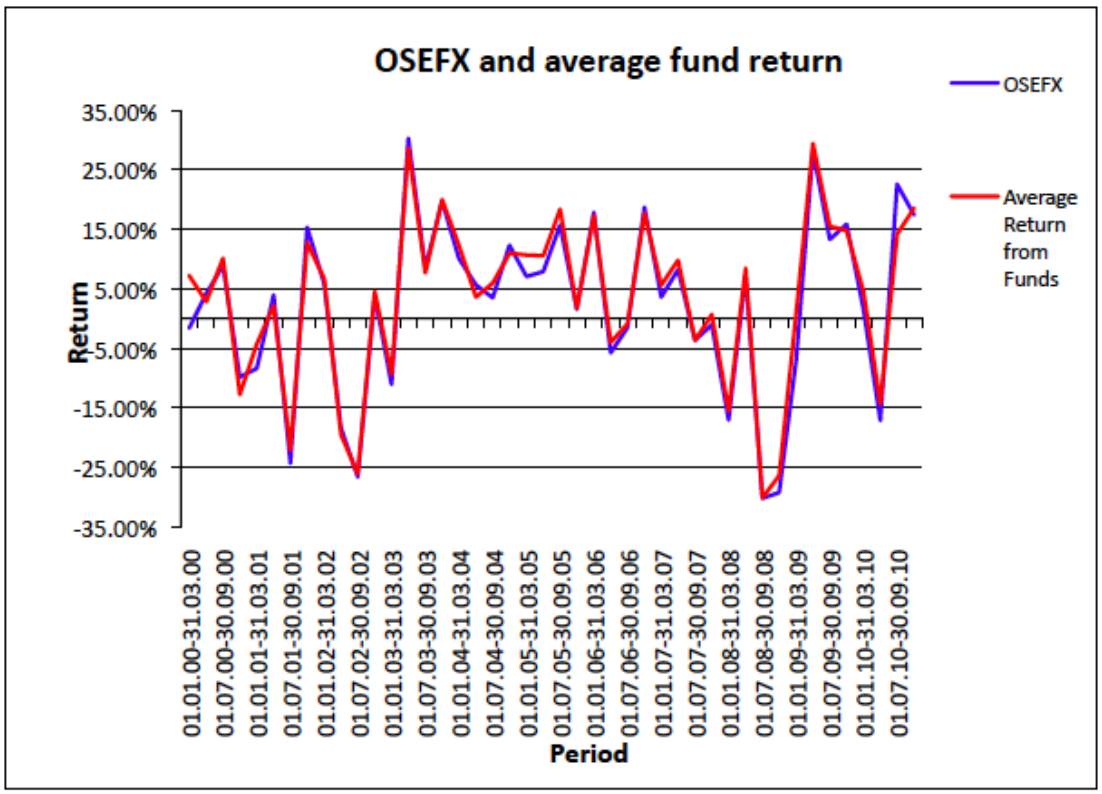


Figure 7 - OSEFX and average fund return

4.5 RISK FREE RATE OF RETURN

The risk-free rate of return used in this thesis is the quarterly Norwegian Inter Bank Offered Rate (NIBOR). Norwegian banks use this interest rate when they make loans to each other. This interest rate is influenced by the supply and demand in the capital market and is comparable to a three month Treasury Bill rate (Norges Bank, 2011). The reason for choosing the quarterly risk free rate is that the dataset for the funds comprises of quarterly returns.

Norges Bank provides the NIBOR on its website. The quarterly rate is represented on an annual basis, which implies that the rate needs to be transformed into quarterly rates. This was done by using the following formula (Bodie et. al., 2009):

$$(1 + r_{f,j})^{1/T} - 1$$

where

$r_{f,j}$ is the risk free rate in year j, and

T is the number of periods in one year

5.0 EMPIRICAL FINDINGS

Regression analysis was chosen as the main empirical approach in this thesis. The regression tool is well established and used by researchers within most fields of study. As mentioned earlier, the OLS method is often used to define how one or more independent variables influence a dependent variable. The two main questions addressed in this paper are "Do managers have the ability to select undervalued securities?" and "Do managers have market timing abilities concerning when to buy/sell securities?". In order to find the answers to these questions, one needs to determine whether there is a cause and effect relationship between the variables. The regression analysis helps finding such relationships, and determining to what extent these relationships actually exist.

5.1 PORTFOLIO EVALUATION

In order to be able to apply the models mentioned in section 2.5, one needs to determine several necessary variables, which are to be used in the calculations. The table below, Table 2 – Descriptive Statistics, summarizes the descriptive statistics involved in the calculations. These variables are used in all the models, that is, the Sharpe ratio and the Treynor ratio, which are applied to evaluate the performance of the funds.

Fund	Avg return	St. Dev	Avg return - r_f	Max return	Min return	No of periods
OSEFX	2,39%	14,78%	1,25%	30,26%	-30,24%	44
Alfred Berg Aktiv	3,28%	15,74%	2,15%	30,17%	-34,23%	44
Alfred Berg Aktiv II	3,79%	15,94%	2,65%	30,54%	-34,44%	44
Alfred Berg Gambak	4,25%	17,77%	3,12%	38,34%	-37,01%	44
Alfred Berg Humanfond	2,99%	14,76%	1,86%	28,21%	-32,11%	44
Alfred Berg Norge	3,52%	14,60%	2,39%	29,85%	-32,98%	44
Alfred Berg Norge +	3,58%	14,65%	2,45%	29,75%	-32,75%	44
Alfred Berg Norge Etisk	3,94%	15,42%	2,81%	27,94%	-34,22%	35
Atlas Norge	2,77%	15,60%	1,64%	30,43%	-30,18%	44
Avanse Norge (I)	2,61%	14,34%	1,48%	28,85%	-29,41%	44
Avanse Norge (II)	2,45%	14,36%	1,32%	29,14%	-29,34%	44
Carnegie Aksje Norge	3,44%	14,31%	2,31%	26,72%	-31,73%	44
Danske Invest Norge I	3,25%	13,42%	2,12%	29,60%	-25,45%	44
Danske Invest Norge II	3,50%	13,38%	2,37%	29,73%	-25,24%	44
Danske Invest Norge Vekst	3,19%	15,36%	2,05%	41,78%	-31,34%	44
Danske Invest Norske Aksjer Inst I	3,60%	13,75%	2,47%	29,33%	-24,93%	42
Danske Invest Norske Aksjer Inst II	2,75%	15,67%	1,62%	29,86%	-24,15%	16
Delphi Norge	3,99%	16,34%	2,86%	31,94%	-31,81%	44
Delphi Vekst	3,10%	15,58%	1,97%	30,15%	-31,31%	44
DnB NOR Barnefond	2,22%	12,94%	1,08%	26,44%	-25,18%	44
DnB NOR Norge (I)	2,94%	14,14%	1,81%	28,95%	-29,90%	44
DnB NOR Norge (III)	3,16%	14,14%	2,03%	29,23%	-29,77%	44
DnB NOR Norge (IV)	5,71%	13,85%	4,58%	29,30%	-29,83%	32
DnB NOR Norge Selektiv (I)	3,38%	14,95%	2,25%	34,48%	-29,36%	44
DnB NOR Norge Selektiv (II)	4,35%	14,13%	3,22%	27,67%	-28,93%	36
DnB NOR Norge Selektiv (III)	3,17%	14,03%	2,04%	26,79%	-29,24%	44
DnB NOR SMB	5,40%	18,37%	4,26%	43,55%	-35,44%	39
Fondsfinans Aktiv	3,33%	12,98%	2,20%	27,45%	-25,21%	42
Fondsfinans Spar	6,53%	14,40%	5,39%	34,98%	-29,12%	32
Handelsbanken Norge	2,94%	15,07%	1,80%	34,92%	-34,79%	44
Holberg Norge	4,20%	14,75%	3,07%	31,11%	-28,90%	40
KLP AksjeNorge	3,50%	14,59%	2,37%	32,73%	-34,93%	44
Landkreditt Norge	3,66%	15,35%	2,53%	30,60%	-24,94%	18
NB Aksjefond	2,82%	14,22%	1,69%	35,10%	-29,39%	44
Nordea Avkastning	2,73%	14,33%	1,60%	28,63%	-30,90%	44
Nordea Kapital	2,93%	14,21%	1,80%	28,59%	-30,07%	44
Nordea Norge Verdi	2,80%	13,35%	1,67%	31,50%	-27,03%	44
Nordea SMB	2,89%	15,63%	1,76%	35,79%	-32,28%	44
Nordea Vekst	2,34%	14,33%	1,21%	28,75%	-32,34%	44
ODIN Norge	3,75%	14,79%	2,61%	37,15%	-29,79%	44
Orkla Finans Investment	3,36%	14,66%	2,23%	29,68%	-31,97%	44
Pareto Aksje Norge	5,58%	13,54%	4,45%	32,97%	-32,00%	37
Pareto Aktiv	5,49%	12,60%	4,36%	32,14%	-31,88%	33
Pareto Verdi	3,25%	15,27%	2,12%	32,65%	-31,98%	20
PLUSS Aksje	3,01%	13,50%	1,88%	26,37%	-25,56%	44
PLUSS Markedsverdi	3,39%	13,51%	2,26%	28,16%	-27,87%	44
Postbanken Norge	2,82%	14,14%	1,69%	28,61%	-29,86%	44
Storebrand Aksje Innland	3,19%	14,14%	2,06%	28,51%	-32,37%	44
Storebrand Norge	2,99%	14,72%	1,86%	29,23%	-33,00%	44
Storebrand Norge I	3,43%	15,15%	2,30%	29,30%	-34,44%	42
Storebrand Optima Norge A	3,77%	15,12%	2,64%	29,00%	-35,16%	40
Storebrand Vekst	2,93%	16,47%	1,80%	45,96%	-31,47%	44
Storebrand Verdi	3,74%	13,65%	2,61%	25,92%	-33,66%	44
Terra Norge	2,87%	14,96%	1,74%	34,98%	-29,61%	44
Terra SMB	3,08%	14,49%	1,95%	38,79%	-27,60%	44
WarrenWicklund Norge A	6,07%	14,17%	4,94%	34,07%	-28,21%	28

Table 2 - Descriptive Statistics

5.1.1 Sharpe ratio

The Sharpe ratios for the average returns of the funds over period 01.01.2000 – 31.12.2010 are shown in the table below.

Fund	01.01.2000-31.12.2003	01.01.2004 – 31.12.2006	01.01.2007-31.12.2010	Total Period
OSEFX	-0,0682	0,9139	-0,0541	0,0848
Alfred Berg Aktiv	-0,0143	0,6962	0,0282	0,1368
Alfred Berg Aktiv II	0,0781	0,6847	0,0227	0,1665
Alfred Berg Gambak	0,0230	0,7984	0,0432	0,1755
Alfred Berg Humanfond	-0,0302	0,8884	0,0199	0,1257
Alfred Berg Norge	-0,0292	1,0771	0,0360	0,1635
Alfred Berg Norge +	-0,0300	1,0886	0,0415	0,1674
Alfred Berg Norge Etisk	0,0249	0,9456	0,0298	0,1820
Atlas Norge	-0,1310	0,9907	0,0118	0,1051
Avanse Norge (I)	-0,1037	0,9229	-0,0113	0,0790
Avanse Norge (II)	-0,1571	1,0659	-0,0019	0,0916
Carnegie Aksje Norge	-0,0150	1,0400	0,0028	0,1611
Danske Invest Norge I	-0,0406	1,0030	0,0462	0,1581
Danske Invest Norge II	-0,0178	1,0319	0,0605	0,1772
Danske Invest Norge Vekst	-0,0008	1,0624	-0,0513	0,1336
Danske Invest Norge Aksjer Inst I	-0,0440	1,0883	0,0529	0,1794
Danske Invest Norge Aksjer Inst II			0,0661	0,1032
Delphi Norge	0,0227	0,9359	0,0528	0,1750
Delphi Vekst	-0,0168	0,8659	0,0071	0,1262
DnB NOR Barnefond	-0,1114	0,9739	-0,0337	0,0838
DnB NOR Norge (I)	-0,0707	0,9582	0,0065	0,1282
DnB NOR Norge (III)	-0,0562	0,9821	0,0199	0,1435
DnB NOR Norge (IV)	0,5804	0,9965	0,0241	0,3304
DnB NOR Norge Selektiv (I)	-0,0087	1,0108	0,0157	0,1504
DnB NOR Norge Selektiv (II)	0,0622	1,0534	0,0323	0,2278
DnB NOR Norge Selektiv (III)	-0,0720	1,0394	0,0359	0,1453
DnB NOR SMB	0,0814	1,0217	0,0090	0,2321
Fondsfinans Aktiv	-0,0501	0,8959	0,0455	0,1693
Fondsfinans Spar	0,5138	0,9960	0,1054	0,3744
Handelsbanken Norge	-0,0874	1,0050	0,0196	0,1196
Holberg Norge	0,0318	1,0815	-0,0233	0,2079
KLP AksjeNorge	-0,0374	1,0951	0,0402	0,1624
Landkreditt Norge		0,4242	0,1056	0,1674
NB Aksjefond	-0,0536	1,0129	0,0020	0,1189
Nordea Avkastning	-0,0868	1,0480	-0,0019	0,1118
Nordea Kapital	-0,0784	1,0947	0,0160	0,1281
Nordea Norge Verdi	-0,0507	1,4269	-0,0372	0,1252
Nordea SMB	-0,0925	1,1218	-0,1185	0,1124
Nordea Vekst	-0,1074	0,9097	-0,0407	0,0845
ODIN Norge	0,0605	1,3222	-0,0562	0,1769
Orkla Finans Investment	0,0015	1,1069	0,0122	0,1518
Pareto Aksje Norge	0,2972	1,5168	0,0434	0,3288
Pareto Aktiv	0,6686	1,3964	0,0184	0,3456
Pareto Verdi		0,8422	0,0268	0,1387
PLUSS Aksje	-0,0586	0,8962	0,0586	0,1392
PLUSS Markedsverdi	-0,0084	1,0143	0,0471	0,1675
Postbanken Norge	-0,0943	0,9605	0,0073	0,1197
Storebrand Aksje Innland	-0,0637	1,0769	0,0065	0,1457
Storebrand Norge	-0,0819	1,0760	0,0119	0,1263
Storebrand Norge I	-0,0632	1,0714	0,0199	0,1518
Storebrand Optima Norge A	-0,0133	1,0300	0,0141	0,1743
Storebrand Vekst	-0,0587	0,7327	0,0649	0,1093
Storebrand Verdi	0,0356	1,0039	-0,0033	0,1913
Terra Norge	-0,1182	0,8610	0,0409	0,1162
Terra SMB	-0,0342	0,8188	0,0306	0,1343
WarrenWicklund Norge A		1,6956	0,1074	0,4049

Table 3 - Sharpe Ratio

The total sample period was divided into three time periods, so that the data is more comparable. The funds earning excess return have bold Sharpe ratios.

In the first period, which is from 01.01.2000-31.12.2003, most of the funds have a negative Sharpe values. This implies that the funds yielding negative values were not able to yield excess return during this period. This might be due to the burst of the "internet bubble" in 2001. Some of the Alfred Berg funds, Delphi Norge, some of the DnB NOR funds, Fondfinans Spar, Holberg Norge, Odin Norge, Orkla Finans Investment, two of the Pareto funds and Storebrand Verdi, did however manage to earn excess returns. In addition, most of the funds did better than the market index, which had a Share ratio of -0,0682.

During the second time period, 01.01.2004-31.12.2006, most of the funds were able to outperform the Oslo Børs Mutual Fund Index. All the funds produced positive Sharpe values, which implies that they earned excess return when compared to investing in a risk free asset. Some of the funds however, achieved a lower value than the OSEFX, which implies that the investors might have been better off had they invested in an index fund.

In the third period, 01.01.2007-31.13.2010, most of the funds achieved positive Sharpe values. Again, as in the first period, the market index had a negative ratio. The only funds that did not earn excess return by investing in risky assets are Avanse Norge (I) and (II), Danske Invest Norge Vekst, DnB NOR Barnefond, Holberg Norge, most of the Nordea funds, Odin Norge and Storebrand Verdi. This might be due to the financial crisis in 2008. However, with the exception of Nordea SMB and Odin Norge, the funds producing negative values did manage to perform better than the market index.

Over the total sample period it appears as though all the funds achieved Sharpe ratios, which are higher than the market index. There were three exceptions, the Avanse Norge I, DnB NOR Barnefond and Nordea Vekst. One should however, keep in mind that the ratios over the total sample period are not all directly comparable, as some of the funds do not include all the observations over the total sample period.

5.1.2 Treynor Ratio

Fund	01.01.2000-31.12.2003	01.01.2004 – 31.12.2006	01.01.2007-31.12.2010	Total period
OSEFX	-0,0107	0,0697	-0,0094	0,0125
Alfred Berg Aktiv	-0,0024	**0,0633**	**0,0050**	0,0214
Alfred Berg Aktiv II	**0,0142**	**0,0626**	**0,0040**	0,0268
Alfred Berg Gambak	**0,0044**	**0,0730**	**0,0078**	0,0292
Alfred Berg Humanfond	-0,0050	**0,0703**	**0,0035**	0,0191
Alfred Berg Norge	-0,0046	**0,0858**	**0,0064**	0,0245
Alfred Berg Norge +	-0,0048	**0,0869**	**0,0074**	0,0252
Alfred Berg Norge Etisk	**0,0052**	**0,0740**	**0,0053**	0,0286
Atlas Norge	-0,0229	**0,0826**	**0,0021**	0,0165
Avanse Norge (I)	-0,0164	**0,0868**	-0,0020	0,0119
Avanse Norge (II)	-0,0250	**0,0839**	-0,0003	0,0137
Carnegie Aksje Norge	-0,0024	**0,0818**	**0,0005**	0,0243
Danske Invest Norge I	-0,0064	**0,0785**	**0,0082**	0,0237
Danske Invest Norge II	-0,0028	**0,0810**	**0,0108**	0,0266
Danske Invest Norge Vekst	-0,0002	**0,0946**	-0,0094	0,0231
Danske Invest Norge Aksjer Inst I	-0,0075	**0,0866**	**0,0094**	0,0276
Danske Invest Norge Aksjer Inst II			**0,0118**	0,0183
Delphi Norge	**0,0038**	**0,0789**	**0,0095**	0,0274
Delphi Vekst	-0,0029	**0,0786**	**0,0013**	0,0206
DnB NOR Barnefond	-0,0177	**0,0776**	-0,0060	0,0126
DnB NOR Norge (I)	-0,0112	**0,0762**	**0,0012**	0,0193
DnB NOR Norge (III)	-0,0089	**0,0781**	**0,0035**	0,0216
DnB NOR Norge (IV)	**0,1028**	**0,0792**	**0,0043**	0,0496
DnB NOR Norge Selektiv (I)	-0,0014	**0,0813**	**0,0028**	0,0228
DnB NOR Norge Selektiv (II)	**0,0120**	**0,0835**	**0,0058**	0,0353
DnB NOR Norge Selektiv (III)	-0,0115	**0,0815**	**0,0064**	0,0219
DnB NOR SMB	**0,0153**	**0,0944**	**0,0017**	0,0381
Fondsfinans Aktiv	-0,0086	**0,0718**	**0,0083**	0,0265
Fondsfinans Spar	**0,0913**	**0,0808**	**0,0190**	0,0571
Handelsbanken Norge	-0,0138	**0,0794**	**0,0035**	0,0180
Holberg Norge	**0,0058**	**0,1007**	-0,0043	0,0336
KLP AksjeNorge	-0,0059	**0,0852**	**0,0072**	0,0244
Landkreditt Norge		**0,0606**	**0,0189**	0,0292
NB Aksjefond	-0,0085	**0,0806**	**0,0004**	0,0180
Nordea Avkastning	-0,0138	**0,0814**	-0,0003	0,0167
Nordea Kapital	-0,0125	**0,0850**	**0,0028**	0,0192
Nordea Norge Verdi	-0,0081	**0,1150**	-0,0068	0,0192
Nordea SMB	-0,0160	**0,1053**	-0,0222	0,0183
Nordea Vekst	-0,0172	**0,0720**	-0,0073	0,0128
ODIN Norge	**0,0098**	**0,1176**	-0,0105	0,0278
Orkla Finans Investment	**0,0002**	**0,0927**	**0,0022**	0,0231
Pareto Aksje Norge	**0,0579**	**0,1270**	**0,0080**	0,0530
Pareto Aktiv	**0,1129**	**0,1168**	**0,0034**	0,0538
Pareto Verdi		**0,1090**	**0,0049**	0,0242
PLUSS Aksje	-0,0093	**0,0695**	**0,0103**	0,0208
PLUSS Markedsverdi	-0,0013	**0,0786**	**0,0083**	0,0251
Postbanken Norge	-0,0149	**0,0764**	**0,0013**	0,0180
Storebrand Aksje Innland	-0,0101	**0,0860**	**0,0012**	0,0219
Storebrand Norge	-0,0130	**0,0835**	**0,0021**	0,0189
Storebrand Norge I	-0,0107	**0,0853**	**0,0036**	0,0234
Storebrand Optima Norge A	-0,0024	**0,0820**	**0,0025**	0,0237
Storebrand Vekst	-0,0112	**0,0621**	**0,0124**	0,0185
Storebrand Verdi	**0,0057**	**0,0880**	-0,0006	0,0294
Terra Norge	-0,0200	**0,0712**	**0,0074**	0,0181
Terra SMB	-0,0055	**0,0741**	**0,0067**	0,0209
WarrenWicklund Norge A		**0,1399**	**0,0197**	0,0617

Table 4 - Treynor Ratio

It appears that the Treynor ratios yield more or less the same results as the Sharpe ratio. The funds earning excess return have bold Treynor ratios.

During the first period, 01.01.2000 to 31.12.2003, most of the funds produce negative Treynor ratios. This implies that most of them were not able to earn excess returns. Again, the reason for this might be the burst of the "internet bubble" in 2001. However, again there were some funds that did succeed to do this. These funds were the Alfred Berg Aktiv, Alfred Berg Gambak, Alfred Berg Norge Etisk, Delphi Norge, DnB NOR Norge (IV), DnB NOR Norge Selektiv (II), DnB NOR SMB, Fondsfinans Spar, Holberg Norge, Odin Norge, Orkla Finans Invesment, Pareto Aksje Norge, Pareto Aktiv and Storebrand Verdi. In addition, of the remaining funds yielding negative values, most of them actually performed better than the index.

The second period produced better results. All the funds earned excess returns, and most of them were able to outperform the index, which produced a Treynor ratio of 0,0697. Alfred Berg Aktiv, Alfred Berg Aktiv II, Landkreditt Norge, PLUSS Aksje and Storebrand Vekst produced less excess return than the OSEFX during this period, which might imply that the investors in these funds would again be better off by investing in index funds.

During the third period, the Treynor ratio, just like the Sharpe ratio, for the OSEFX was negative. It yielded a value of -0,0094, making almost all the other funds better in terms of return. This might, again, have been due to the financial crisis, which occurred in 2008. The Treynor ratios, which are highlighted during the third period, managed to earn more than an investor would have had he invested in a risk free asset. In addition, even though some of the funds produced negative results, most of them still outperformed the OSEFX.

The Treynor ratios for the total period imply that all but one fund were able to outperform the market index. This fund is the Avanse Norge (I). Also here, one should keep in mind that all the funds are not directly comparable as not all of them include observations for the total sample period.

5.1.3 Jensen's alpha

5.1.3.1 Regression Assumptions

Unbalanced dataset

The normal distribution of the error term has been tested graphically. From the graph below it appears that the variables follow a more or less straight line. This implies that the error term of the Avanse Norge (I) fund, which is illustrated by the graph below, is normally distributed. This test has been performed for each of the funds in both the balanced and unbalanced datasets. They all seem to have close to normally distributed error terms. The rest of the graphs for the unbalanced dataset can be found in Appendix 8.1.1.

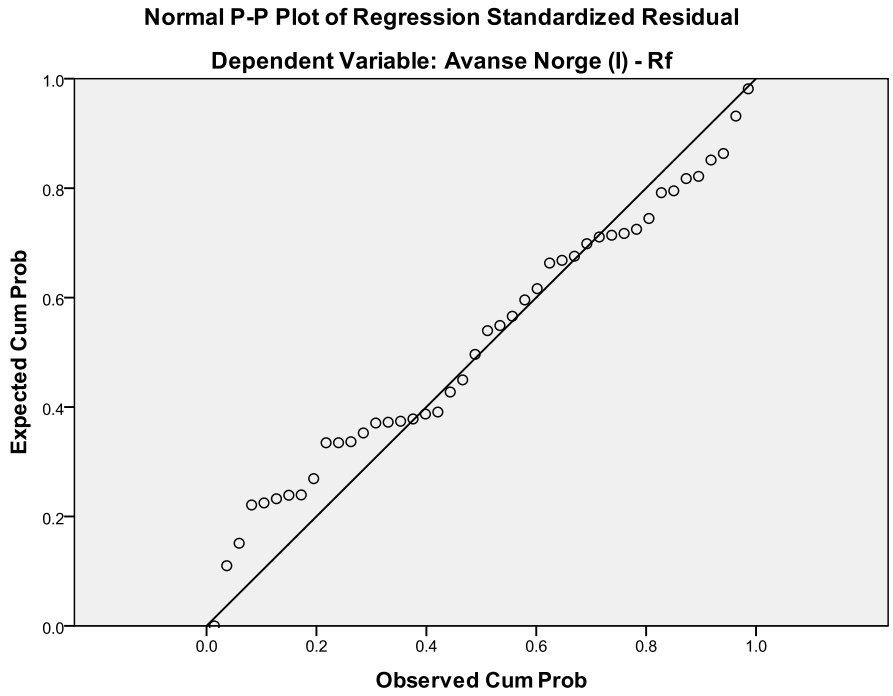


Figure 8 - Normal distribution of the error term, Jensen unbalanced

The table on the next page illustrates the regression assumptions, which were described in section 3.2, for the unbalanced data set for the Jensen's Alpha model.

Fund	Autocorrelation	Multicollinearity	Heteroskedasticity	
	Durbin-Watson	VIF	Spearman	Sig.
Alfred Berg Aktiv	1,777	1,000	0,908*	0,000
Alfred Berg Aktiv II	1,479	1,000	0,862*	0,000
Alfred Berg Gambak	1,785	1,000	0,855*	0,000
Alfred Berg Humanfond	2,570	1,000	0,958*	0,000
Alfred Berg Norge	2,397	1,000	0,978*	0,000
Alfred Berg Norge +	2,517	1,000	0,978*	0,000
Alfred Berg Norge Etisk	2,426	1,000	0,978*	0,000
Atlas Norge	1,671	1,000	0,921*	0,000
Avanse Norge (I)	2,119	1,000	0,959*	0,000
Avanse Norge (II)	1,854	1,000	0,980*	0,000
Carnegie Aksje Norge	2,547	1,000	0,978*	0,000
Danske Invest Norge I	2,051	1,000	0,977*	0,000
Danske Invest Norge II	2,130	1,000	0,977*	0,000
Danske Invest Norge Vekst	1,365	1,000	0,862*	0,000
Danske Invest Norge Aksjer Inst I	2,075	1,000	0,982*	0,000
Danske Invest Norske Aksjer Inst II	1,772	1,000	0,971*	0,000
Delphi Norge	1,823	1,000	0,911*	0,000
Delphi Vekst	1,911	1,000	0,867*	0,000
DnB NOR Barnefond	2,387	1,000	0,976*	0,000
DnB NOR Norge (I)	2,614	1,000	0,980*	0,000
DnB NOR Norge (III)	2,618	1,000	0,980*	0,000
DnB NOR Norge (IV)	2,594	1,000	0,970*	0,000
DnB NOR Norge Selektiv (I)	2,654	1,000	0,968*	0,000
DnB NOR Norge Selektiv (II)	2,661	1,000	0,979*	0,000
DnB NOR Norge Selektiv (III)	2,090	1,000	0,973*	0,000
DnB NOR SMB	1,520	1,000	0,899*	0,000
Fondsfinans Aktiv	1,918	1,000	0,939*	0,000
Fondsfinans Spar	1,752	1,000	0,953*	0,000
Handelsbanken Norge	2,121	1,000	0,978*	0,000
Holberg Norge	1,262	1,000	0,920*	0,000
KLP AksjeNorge	2,065	1,000	0,976*	0,000
Landkreditt Norge	1,664	1,000	0,948*	0,000
NB Aksjefond	1,674	1,000	0,969*	0,000
Nordea Avkastning	2,120	1,000	0,987*	0,000
Nordea Kapital	2,010	1,000	0,982*	0,000
Nordea Norge Verdi	1,855	1,000	0,950*	0,000
Nordea SMB	1,779	1,000	0,854*	0,000
Nordea Vekst	2,086	1,000	0,974*	0,000
ODIN Norge	2,105	1,000	0,899*	0,000
Orkla Finans Investment	2,427	1,000	0,958*	0,000
Pareto Aksje Norge	1,753	1,000	0,906*	0,000
Pareto Aktiv	1,876	1,000	0,910*	0,000
Pareto Verdi	1,965	1,000	0,947*	0,000
PLUSS Aksje	1,427	1,000	0,985*	0,000
PLUSS Markedsverdi	1,758	1,000	0,984*	0,000
Postbanken Norge	2,498	1,000	0,981*	0,000
Storebrand Aksje Innland	2,508	1,000	0,982*	0,000
Storebrand Norge	2,064	1,000	0,986*	0,000
Storebrand Norge I	2,282	1,000	0,980*	0,000
Storebrand Optima Norge A	2,032	1,000	0,979*	0,000
Storebrand Vekst	1,756	1,000	0,872*	0,000
Storebrand Verdi	2,340	1,000	0,950*	0,000
Terra Norge	1,678	1,000	0,914*	0,000
Terra SMB	1,893	1,000	0,941*	0,000
WarrenWicklund Norge A	1,798	1,000	0,940*	0,000

*significant at 1%

Table 5 - Unbalanced Jensen's Alpha assumptions

The Durbin-Watson measure in the unbalanced dataset needs to have a value between 1,344 and 2,656. It appears as though all the funds, with the exception of DnB NOR Selektiv (II) and Holberg Norge, are within this range. This implies that none of the funds, except for these two, show signs of autocorrelation.

The VIF values are all 1 in this dataset. This implies that there is no sign of multicollinearity.

All the Spearman correlation coefficients produced for the funds are close to 1, and they are all significant at 1 % significance level. This implies that we reject H_0, which in turn means that there is sign of heteroskedasticity in the dataset.

Balanced dataset

The p-plot for testing the normal distribution of the residuals was also produced for the funds in the balanced dataset. The plot below shows similar results as the plots that were produced for the unbalanced dataset.

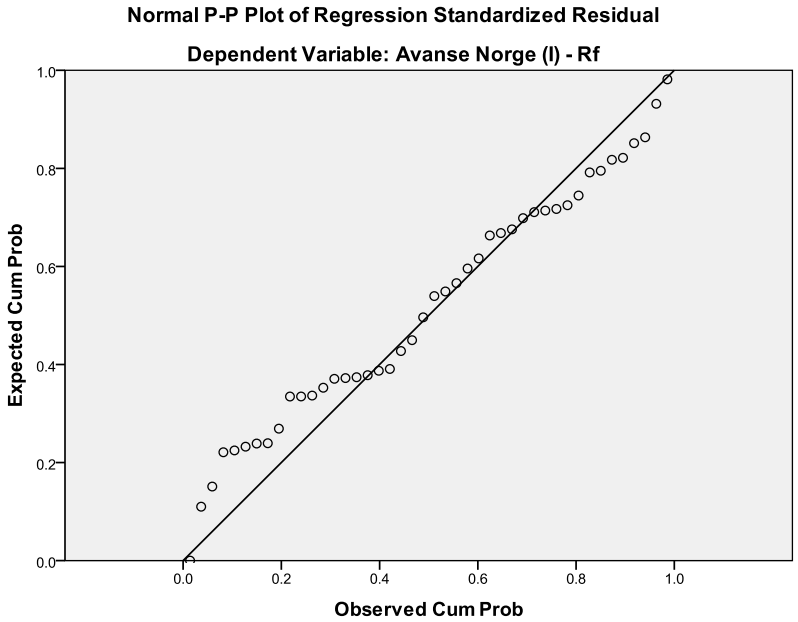


Figure 9 - Normal distribution of the error term, Jensen balanced

Here too, the error term of Avanse Norge (I) appears to be more or less normally distributed. The rest of the graphs can be found in Appendix 8.1.2.

The regression assumption results for the balanced dataset for the Jensen's Alpha model are shown in table 6 below.

Fund name	Autocorrelation	Multicollinearity	Heteroskedasticity	
	Durbin-Watson	VIF	Spearman	Sig.
Alfred Berg Aktiv	1,365	1,000	0,927*	0,000
Alfred Berg Aktiv II	1,345	1,000	0,928*	0,000
Alfred Berg Gambak	1,681	1,000	0,901*	0,000
Alfred Berg Humanfond	2,483	1,000	0,970*	0,000
Alfred Berg Norge	2,431	1,000	0,974*	0,000
Alfred Berg Norge +	2,446	1,000	0,975*	0,000
Alfred Berg Norge Etisk	2,536	1,000	0,969*	0,000
Atlas Norge	1,904	1,000	0,975*	0,000
Avanse Norge (I)	2,186	1,000	0,945*	0,000
Avanse Norge (II)	2,547	1,000	0,981*	0,000
Carnegie Aksje Norge	2,842	1,000	0,977*	0,000
Danske Invest Norge I	1,953	1,000	0,970*	0,000
Danske Invest Norge II	1,953	1,000	0,970*	0,000
Danske Invest Norge Vekst	1,638	1,000	0,894*	0,000
Danske Invest Norge Aksjer Inst I	2,032	1,000	0,977*	0,000
Delphi Norge	2,068	1,000	0,932*	0,000
Delphi Vekst	2,144	1,000	0,872*	0,000
DnB NOR Barnefond	2,444	1,000	0,967*	0,000
DnB NOR Norge (I)	2,601	1,000	0,966*	0,000
DnB NOR Norge (III)	2,591	1,000	0,966*	0,000
DnB NOR Norge (IV)	2,595	1,000	0,966*	0,000
DnB NOR Norge Selektiv (I)	2,700	1,000	0,962*	0,000
DnB NOR Norge Selektiv (II)	2,770	1,000	0,968*	0,000
DnB NOR Norge Selektiv (III)	2,770	1,000	0,972*	0,000
DnB NOR SMB	1,510	1,000	0,849*	0,000
Fondsfinans Aktiv	1,754	1,000	0,922*	0,000
Fondsfinans Spar	1,699	1,000	0,949*	0,000
Handelsbanken Norge	2,113	1,000	0,969*	0,000
Holberg Norge	1,174	1,000	0,867*	0,000
KLP AksjeNorge	2,085	1,000	0,970*	0,000
NB Aksjefond	1,608	1,000	0,950*	0,000
Nordea Avkastning	2,290	1,000	0,979*	0,000
Nordea Kapital	2,353	1,000	0,981*	0,000
Nordea Norge Verdi	1,778	1,000	0,921*	0,000
Nordea SMB	1,579	1,000	0,846*	0,000
Nordea Vekst	1,962	1,000	0,972*	0,000
ODIN Norge	2,132	1,000	0,846*	0,000
Orkla Finans Investment	2,408	1,000	0,962*	0,000
Pareto Aksje Norge	2,019	1,000	0,922*	0,000
Pareto Aktiv	2,027	1,000	0,924*	0,000
PLUSS Aksje	1,673	1,000	0,979*	0,000
PLUSS Markedsverdi	1,844	1,000	0,979*	0,000
Postbanken Norge	2,603	1,000	0,966*	0,000
Storebrand Aksje Innland	2,570	1,000	0,975*	0,000
Storebrand Norge	2,027	1,000	0,987*	0,000
Storebrand Norge I	2,380	1,000	0,963*	0,000
Storebrand Optima Norge A	2,384	1,000	0,964*	0,000
Storebrand Vekst	1,575	1,000	0,915*	0,000
Storebrand Verdi	2,447	1,000	0,930*	0,000
Terra Norge	1,774	1,000	0,941*	0,000
Terra SMB	1,854	1,000	0,901*	0,000
WarrenWicklund Norge A	1,798	1,000	0,940*	0,000

*significant at 1%

Table 6 - Balanced Jensen's Alpha assumptions

When it comes to the Durbin-Watson measure in the balanced data set, where the sample has been reduced to 28 periods, the values have to be within the range of 1,244 and 2,756 if there is to be no autocorrelation. In this dataset it appears as though all of the funds, with the exception of Carnegie Aksje Norge, DnB NOR Norge Selektiv (II) and (III) and Holberg Norge, are within this range. These are the only funds which may have some autocorrelation.

Again, the VIF values are equal to 1. As mentioned above, this implies that there is no evidence of multicollinearity.

The Spearman test does show evidence of heteroskedasticity in this version of the dataset as well. Again, all the variables are close to 1 and all of them are statistically significant at the 1% level.

5.1.3.2 Jensen's Alpha results

Unbalanced

Fund name	α	Significance	β	Significance	R^2
Alfred Berg Aktiv	0,009	0,258	1,007	0,000	0,897
Alfred Berg Aktiv II	0,014	0,151	0,991	0,000	0,845
Alfred Berg Gambak	0,018	0,163	1,069	0,000	0,790
Alfred Berg Humanfond	0,006	0,227	0,970	0,000	0,947
Alfred Berg Norge	0,012	0,005*	0,973	0,000	0,970
Alfred Berg Norge +	0,012	0,004*	0,975	0,000	0,968
Alfred Berg Norge Etisk	0,008	0,081	0,981	0,000	0,973
Atlas Norge	0,004	0,627	0,995	0,000	0,890
Avanse Norge (I)	-0,001	0,895	0,937	0,000	0,960
Avanse Norge (II)	0,001	0,759	0,957	0,000	0,972
Carnegie Aksje Norge	0,011	0,013**	0,951	0,000	0,962
Danske Invest Norge I	0,010	0,006*	0,894	0,000	0,972
Danske Invest Norge II	0,013	0,001*	0,891	0,000	0,970
Danske Invest Norge Vekst	0,009	0,449	0,891	0,000	0,733
Danske Invest Norge Aksjer Inst I	0,013	0,001*	0,896	0,000	0,971
Danske Invest Norge Aksjer Inst II	0,019	0,024*	0,882	0,000	0,966
Delphi Norge	0,015	0,064	1,046	0,000	0,895
Delphi Vekst	0,008	0,451	0,958	0,000	0,825
DnB NOR Barnefond	0,000	0,992	0,082	0,000	0,967
DnB NOR Norge (I)	0,006	0,107	0,942	0,000	0,969
DnB NOR Norge (III)	0,008	0,032**	0,942	0,000	0,969
DnB NOR Norge (IV)	0,012	0,021**	0,924	0,000	0,963
DnB NOR Norge Selektiv (I)	0,010	0,052	0,986	0,000	0,952
DnB NOR Norge Selektiv (II)	0,013	0,005*	0,912	0,000	0,969
DnB NOR Norge Selektiv (III)	0,009	0,040**	0,932	0,000	0,964
DnB NOR SMB	0,023	0,028**	1,119	0,000	0,885
Fondsfinans Aktiv	0,011	0,044**	0,830	0,000	0,932
Fondsfinans Spar	0,020	0,008*	0,945	0,000	0,934
Handelsbanken Norge	0,005	0,234	0,999	0,000	0,961
Holberg Norge	0,017	0,026**	0,914	0,000	0,902
KLP AksjeNorge	0,012	0,008*	0,970	0,000	0,967
Landkreditt Norge	0,021	0,028**	0,879	0,000	0,947
NB Aksjefond	0,005	0,276	0,940	0,000	0,955
Nordea Avkastning	0,004	0,252	0,958	0,000	0,975
Nordea Kapital	0,006	0,086	0,949	0,000	0,973
Nordea Norge Verdi	0,006	0,281	0,874	0,000	0,934
Nordea SMB	0,005	0,585	0,965	0,000	0,830
Nordea Vekst	0,000	0,964	0,949	0,000	0,959
ODIN Norge	0,014	0,068	0,943	0,000	0,888
Orkla Finans Investment	0,010	0,067	0,963	0,000	0,942
Pareto Aksje Norge	0,024	0,004*	0,844	0,000	0,886
Pareto Aktiv	0,014	0,103	0,811	0,000	0,867
Pareto Verdi	0,013	0,273	0,874	0,000	0,898
PLUSS Aksje	0,007	0,023**	0,902	0,000	0,977
PLUSS Markedsverdi	0,011	0,001*	0,902	0,000	0,976
Postbanken Norge	0,005	0,197	0,941	0,000	0,968
Storebrand Aksje Innland	0,009	0,030**	0,941	0,000	0,967
Storebrand Norge	0,018	0,000*	0,980	0,000	0,977
Storebrand Norge I	0,010	0,033**	0,983	0,000	0,963
Storebrand Optima Norge A	0,012	0,016**	0,967	0,000	0,961
Storebrand Vekst	0,006	0,638	0,971	0,000	0,764
Storebrand Verdi	0,015	0,012**	0,891	0,000	0,927
Terra Norge	0,005	0,459	0,961	0,000	0,904
Terra SMB	0,008	0,265	0,931	0,000	0,904
WarrenWicklund Norge A	0,032	0,001*	0,896	0,000	0,906

*significant at 1% **significant at 5%

Table 7 - Results Jensen's Alpha, unbalanced

From the table above it appears that almost all of the funds, with the exception of Avanse Norge (I), were able to outperform the market. There are however, only some funds that have an alpha value which is statistically significant at a 1% significance level. These are Alfred Berg Norge, Alfred Berg Norge +, Danske Invest Norge I and II, Danske Invest Norge Aksjer Inst I and II, DnB NOR Norge Selektiv (II), Fondsfinans Spar, KLP AksjeNorge, Pareto Aksje Norge, PLUSS Markedsverdi, Storebrand Norge and WarrenWicklund Norge A. In addition, thirteen funds have positive alpha values at a 5% significance level. These are Carnegie Aksje Norge, DnB NOR Norge (III) and (IV), DnB NOR Norge Selektiv (III), DnB NOR SMB, Fondsfinans Aktiv, Holberg Norge, Landkreditt Norge, PLUSS Aksje, Storebrand Aksje Innland, Storebrand Norge I, Storebrand Optima Norge A and Storebrand Verdi. This implies that the managers of the funds mentioned above have either security selection skills or market timing abilities.

If one compares the alpha measure for the unbalanced dataset with the Sharpe and Treynor measure for the total sample period one can see that all the funds, which achieved significantly positive alpha values, also outdid the market index. This is reasonable, as a market timing or security selection ability should be rewarded with excess return.

From the beta values one can see that there are only four funds that undertake higher levels of risk than the market index. As previously mentioned, the market portfolio is assumed to have a beta equal to 1. The funds that are facing higher levels of risk are Alfred Berg Aktiv, Alfred Berg Gambak, Delphi Norge and DnB NOR. These have beta values of 1,007, 1,069, 1,046 and 1,119 respectively. When comparing these funds to the Sharpe and Treynor ratios it does not appear that they have superior excess returns than all the other funds. The Sharpe ratio for the whole period ranges from 0,0790 to 0,4049 for all the fund. The above-mentioned funds have Sharpe ratios ranging from 0,1368 to 0,2321. This implies that even though the managers are undertaking more risk than the other funds, they do not benefit excessively from it compared to other funds.

When looking at the beta value in relation to the Treynor ratio, one gets more or less the same results. The ratios for Alfred Berg Aktiv, Alfred Berg Gambak, Delphi Norge and DnB NOR SMB range from 0,0214 to 0,0381, while the rest of the funds

have Treynor ratios in the range of 0,0119 to 0,0617. This measure too, implies that these funds do not get rewarded for undertaking higher levels of risk.

The R^2 ranges from 0,733 to 0,977. This implies that the independent variables for the fund with the lowest value of R^2 explain 73,3% of the dependent value, while the independent variables of the fund with the highest value of R^2 explain 97,7% of the dependent variable. The remaining percentage is explained by other variables not included in the regression model. This is usually reflected in the error term.

Balanced

The table below shows the results of the regression that was performed using the balanced dataset. These results show that all the mutual funds have positive alpha values. This implies that the managers were all able to either select the correct securities or time the market. However, also in this case only some of the funds have positive alpha values, which are statistically significant at a 1% significance level. These are Alfred Berg Norge, Alfred Berg Norge +, Danske Invest Norge I and II, Danske Invest Norge Aksjer Inst I, Delphi Norge, DnB NOR Norge Selektiv II and III, Fondsfinans Spar, PLUSS Aksje, PLUSS Markedsverdi, Storebrand Norge and Warren Wicklund Norge A. In addition, several funds achieved positive alpha values that are statistically significant at a 5% significance level. These are Atlas Norge, Avanse Norge (II), Carnegie Aksje Norge, DnB NOR Norge (III) and (IV), DnB NOR Norge Selektiv (I), Fondsfinans Aktiv, KLP AksjeNorge, Nordea Kapital, Pareto Aksje Norge, Storebrand Aksje Innland, Storebrand Norge I and Storebrand Optima Norge A. Many of these funds are the same that achieved statistically significant results when applying the Jensen's Alpha model to the unbalanced dataset.

Again, if one compares the alpha measure for the balanced data set with the Sharpe and Treynor measure for the third sample period one can see that all the funds, with the exception of Avanse Norge (II), which achieved significantly positive alpha values also outdid the market index.

The beta values are above that of the market index for some of the funds in the balanced version of Jensen's Alpha as well. These funds are the Alfred Berg Aktiv, Alfred Berg Gambak, DnB NOR SMB and Handelsbanken Norge. The beta values are 1,007, 1,069, 1,087 and 1,009 respectively. Again, when looking at the beta values

in relation to the Sharpe and Treynor ratios, the funds do not appear to be rewarded for the extra risk. The Sharpe ratios for all the funds range from -0,1185 to 0,1074, while they range from 0,0090 to 0,0432 for the above-mentioned funds. The Treynor ratios for all the funds range from -0,0222 to 0,0197, while they range from 0,0017 to 0,0078 for the above-mentioned funds.

R^2 implies that the regressors explain from 82,7% to 97,7% of the dependent variable. The remainder is explained by variables that are not included in the model. These variables are reflected in the error term.

Fund name	α	Significance	β	Significance	R^2
Alfred Berg Aktiv	0,009	0,258	1,007	0,000	0,897
Alfred Berg Aktiv II	0,014	0,151	0,991	0,000	0,845
Alfred Berg Gambak	0,019	0,091	1,069	0,000	0,890
Alfred Berg Humanfond	0,006	0,224	0,990	0,000	0,969
Alfred Berg Norge	0,014	0,010*	0,998	0,000	0,968
Alfred Berg Norge +	0,015	0,006*	0,998	0,000	0,968
Alfred Berg Norge Etisk	0,008	0,129	0,986	0,000	0,966
Atlas Norge	0,013	0,028**	0,981	0,000	0,959
Avanse Norge (I)	0,003	0,674	0,919	0,000	0,941
Avanse Norge (II)	0,009	0,040**	0,959	0,000	0,976
Carnegie Aksje Norge	0,012	0,016**	0,976	0,000	0,971
Danske Invest Norge I	0,014	0,008*	0,881	0,000	0,963
Danske Invest Norge II	0,016	0,003*	0,875	0,000	0,962
Danske Invest Norge Vekst	0,009	0,297	0,887	0,000	0,889
Danske Invest Norge Aksjer Inst I	0,017	0,002*	0,891	0,000	0,961
Delphi Norge	0,017	0,035*	0,968	0,000	0,925
Delphi Vekst	0,010	0,289	0,866	0,000	0,868
DnB NOR Barnefond	0,005	0,238	0,815	0,000	0,965
DnB NOR Norge (I)	0,011	0,057	0,917	0,000	0,957
DnB NOR Norge (III)	0,013	0,026**	0,919	0,000	0,957
DnB NOR Norge (IV)	0,014	0,018**	0,922	0,000	0,957
DnB NOR Norge Selektiv (I)	0,013	0,032**	0,908	0,000	0,954
DnB NOR Norge Selektiv (II)	0,015	0,010*	0,902	0,000	0,958
DnB NOR Norge Selektiv (III)	0,015	0,009*	0,909	0,000	0,961
DnB NOR SMB	0,024	0,088	1,087	0,000	0,836
Fondsfinans Aktiv	0,016	0,027**	0,803	0,000	0,918
Fondsfinans Spar	0,023	0,004*	0,918	0,000	0,930
Handelsbanken Norge	0,010	0,155	1,009	0,000	0,947
Holberg Norge	0,019	0,069	0,860	0,000	0,855
KLP AksjeNorge	0,015	0,016**	0,977	0,000	0,956
NB Aksjefond	0,006	0,385	0,967	0,000	0,943
Nordea Avkastning	0,008	0,088	0,949	0,000	0,971
Nordea Kapital	0,011	0,019**	0,938	0,000	0,972
Nordea Norge Verdi	0,009	0,232	0,830	0,000	0,908
Nordea SMB	0,011	0,375	0,967	0,000	0,827
Nordea Vekst	0,003	0,582	0,959	0,000	0,954
ODIN Norge	0,013	0,207	0,866	0,000	0,861
Orkla Finans Investment	0,010	0,118	0,948	0,000	0,946
Pareto Aksje Norge	0,022	0,020**	0,905	0,000	0,891
Pareto Aktiv	0,017	0,054	0,870	0,000	0,892
PLUSS Aksje	0,012	0,005*	0,882	0,000	0,977
PLUSS Markedsverdi	0,012	0,008*	0,925	0,000	0,974
Postbanken Norge	0,011	0,054	0,917	0,000	0,957
Storebrand Aksje Innland	0,014	0,018**	0,929	0,000	0,959
Storebrand Norge	0,023	0,000*	0,970	0,000	0,977
Storebrand Norge I	0,015	0,017**	0,949	0,000	0,952
Storebrand Optima Norge A	0,014	0,030**	0,951	0,000	0,975
Storebrand Vekst	0,010	0,424	0,957	0,000	0,833
Storebrand Verdi	0,014	0,084	0,928	0,000	0,916
Terra Norge	0,012	0,129	0,989	0,000	0,930
Terra SMB	0,010	0,358	0,922	0,000	0,864
WarrenWicklund Norge A	0,032	0,001*	0,896	0,000	0,906

*significant at 1% **significant at 5%

Table 8 - Results Jensen's Alpha, balanced

5.2 MARKET TIMING AND SECURITY SELECTION ABILITIES

The market timing abilities and security selection skills of the management of each fund is tested by applying the Henriksson-Merton market timing model and the Treynor-Mazuy model. The results achieved by applying both models are presented below.

5.2.1 The Henriksson-Merton market timing model

5.2.1.1 Regression Assumptions

Unbalanced

The regression assumptions for the unbalanced dataset that has been used to test for security selection and market timing abilities involve testing for normal distribution of the error term. This has been done graphically.

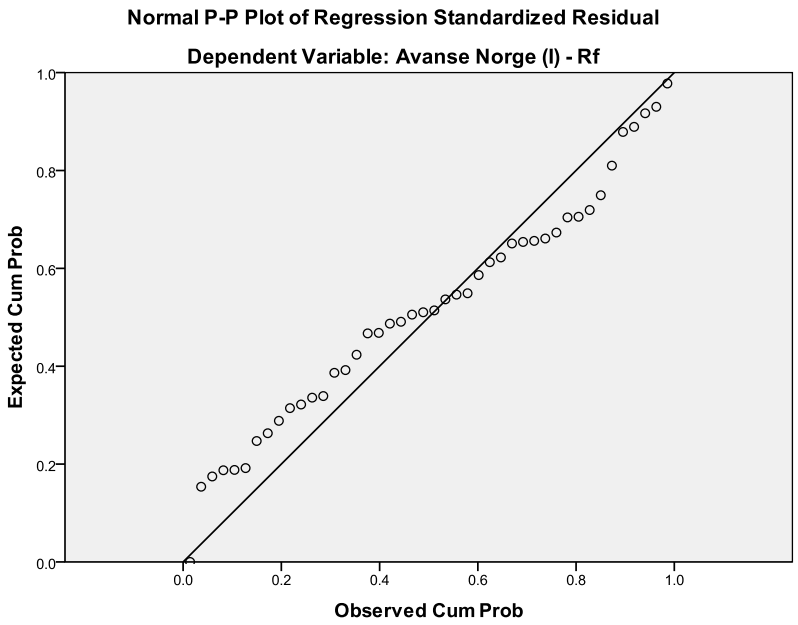


Figure 10 - Normal distribution of the error term, Henriksson-Merton unbalanced

From the graph is appears that the error terms of Avanse Norge (I) are close to normally distributed, as here too, the observations seem to follow a more or less straight line. This test has been performed for each of the funds in both the balanced and unbalanced datasets. They all seem to have more or less normally distributed error terms. The rest of the graphs for the unbalanced dataset can be found in Appendix 8.1.3.

The table below presents the results for the rest of the regression assumptions for the unbalanced dataset.

Fund name	Autocorrelation	Multicollinearity	Heteroskedasticity	
	Durbin-Watson	VIF	Spearman	Sig.
Alfred Berg Aktiv	1,782	3,248	0,855*	0,000
Alfred Berg Aktiv II	1,503	3,248	0,805*	0,000
Alfred Berg Gambak	1,872	3,248	0,793*	0,000
Alfred Berg Humanfond	2,438	3,248	0,925*	0,000
Alfred Berg Norge	2,356	3,248	0,946*	0,000
Alfred Berg Norge +	2,428	3,248	0,946*	0,000
Alfred Berg Norge Etisk	1,941	3,381	0,949*	0,000
Atlas Norge	1,666	3,248	0,874*	0,000
Avanse Norge (I)	1,843	3,248	0,923*	0,000
Avanse Norge (II)	1,770	3,248	0,943*	0,000
Carnegie Aksje Norge	2,676	3,248	0,942*	0,000
Danske Invest Norge I	2,051	3,248	0,940*	0,000
Danske Invest Norge II	2,129	3,248	0,941*	0,000
Danske Invest Norge Vekst	1,439	3,248	0,806*	0,000
Danske Invest Norge Aksjer Inst I	2,074	3,536	0,951*	0,000
Danske Invest Norske Aksjer Inst II	1,702	3,183	0,900*	0,000
Delphi Norge	1,920	3,248	0,856*	0,000
Delphi Vekst	2,052	3,248	0,795*	0,000
DnB NOR Barnefond	2,316	3,248	0,944*	0,000
DnB NOR Norge (I)	2,579	3,248	0,954*	0,000
DnB NOR Norge (III)	2,589	3,248	0,954*	0,000
DnB NOR Norge (IV)	2,554	3,606	0,955*	0,000
DnB NOR Norge Selektiv (I)	2,587	3,248	0,935*	0,000
DnB NOR Norge Selektiv (II)	2,593	3,320	0,955*	0,000
DnB NOR Norge Selektiv (III)	2,039	3,248	0,936*	0,000
DnB NOR SMB	1,520	3,276	0,862*	0,000
Fondsfinans Aktiv	1,956	3,356	0,910*	0,000
Fondsfinans Spar	1,753	3,606	0,933*	0,000
Handelsbanken Norge	2,143	3,248	0,941*	0,000
Holberg Norge	1,255	3,317	0,885*	0,000
KLP AksjeNorge	2,000	3,248	0,937*	0,000
Landkreditt Norge	1,509	3,234	0,796*	0,000
NB Aksjefond	1,612	3,248	0,932*	0,000
Nordea Avkastning	2,012	3,248	0,953*	0,000
Nordea Kapital	1,838	3,248	0,946*	0,000
Nordea Norge Verdi	1,867	3,248	0,904*	0,000
Nordea SMB	1,794	3,248	0,796*	0,000
Nordea Vekst	2,002	3,248	0,941*	0,000
ODIN Norge	2,157	3,248	0,853*	0,000
Orkla Finans Investment	2,281	3,248	0,922*	0,000
Pareto Aksje Norge	1,662	3,381	0,881*	0,000
Pareto Aktiv	1,833	3,521	0,890*	0,000
Pareto Verdi	1,833	3,409	0,900*	0,000
PLUSS Aksje	1,331	3,248	0,956*	0,000
PLUSS Markedsverdi	1,626	3,248	0,956*	0,000
Postbanken Norge	2,418	3,248	0,955*	0,000
Storebrand Aksje Innland	2,522	3,248	0,954*	0,000
Storebrand Norge	1,914	3,248	0,951*	0,000
Storebrand Norge I	2,278	3,356	0,952*	0,000
Storebrand Optima Norge A	2,085	3,317	0,954*	0,000
Storebrand Vekst	1,755	3,248	0,841*	0,000
Storebrand Verdi	2,525	3,248	0,926*	0,000
Terra Norge	1,672	3,248	0,857*	0,000
Terra SMB	1,888	3,248	0,899*	0,000
WarrenWicklund Norge A	1,831	3,129	0,911*	0,000

*significant at 1%

Table 9 - Unbalanced Henriksson-Merton assumptions

The Durbin-Watson measure for the unbalanced data for the Henriksson-Merton model has to be within the range of 1,398 and 2,602 if there is not to be any sign of autocorrelation. All funds, with the exception of Carnegie Aksje Norge, Holberg Norge and PLUSS Aksje, fall within this range. This implies that these are the only funds where there is evidence of autocorrelation.

The VIF value, which is used to test for multicollinearity, for most of the funds is around 3,248. Some of the funds, however, have differing VIF values. These range from 3,129 to 3,606. However, as mentioned in section 3.2.2, as long as the VIF is below 5 there is no evidence of multicollinearity in the data sample.

Significant positive Spearman correlation coefficients imply that there is evidence of heteroskedasticity in the data sample.

Balanced

The normal distribution of the error term of the balanced dataset has also been tested graphically.

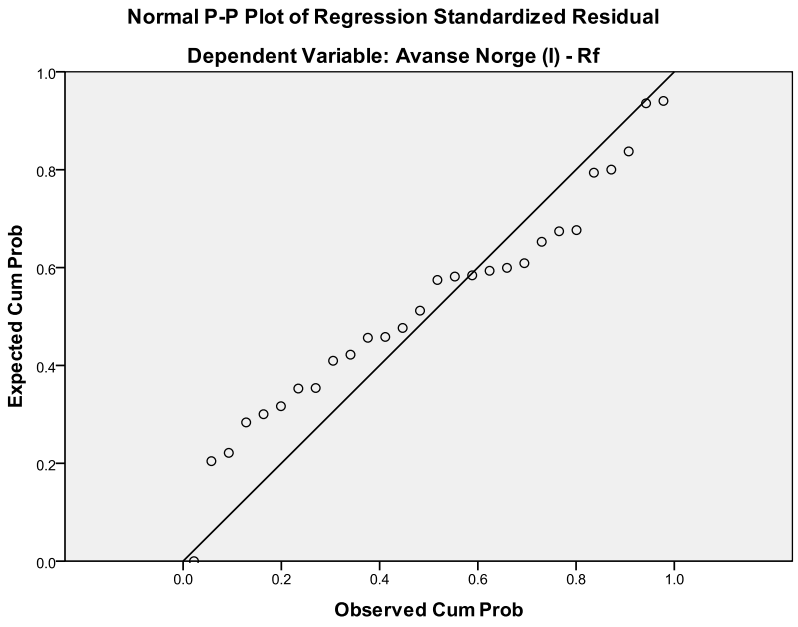


Figure 11 - Normal distribution of the error term, Henriksson-Merton balanced

Also in the balanced dataset it appears as though the error term for Avanse Norge (I) is more or less normally distributed. The graphs for the remaining funds can be found in Appendix 8.1.4. All the error terms seem to be close to normally distributed.

Fund name	Autocorrelation	Multicollinearity	Heteroskedasticity	
	Durbin-Watson	VIF	Spearman	Sig.
Alfred Berg Aktiv	1,329	3,129	0,894*	0,000
Alfred Berg Aktiv II	1,300	3,129	0,895*	0,000
Alfred Berg Gambak	1,662	3,129	0,869*	0,000
Alfred Berg Humanfond	1,918	3,129	0,946*	0,000
Alfred Berg Norge	2,085	3,129	0,952*	0,000
Alfred Berg Norge +	2,142	3,129	0,953*	0,000
Alfred Berg Norge Etisk	1,840	3,129	0,942*	0,000
Atlas Norge	1,897	3,129	0,950*	0,000
Avanse Norge (I)	1,737	3,129	0,916*	0,000
Avanse Norge (II)	2,159	3,129	0,956*	0,000
Carnegie Aksje Norge	2,793	3,129	0,956*	0,000
Danske Invest Norge I	1,966	3,129	0,942*	0,000
Danske Invest Norge II	1,980	3,129	0,942*	0,000
Danske Invest Norge Vekst	1,561	3,129	0,877*	0,000
Danske Invest Norge Aksjer Inst I	2,006	3,129	0,951*	0,000
Delphi Norge	2,071	3,129	0,897*	0,000
Delphi Vekst	2,273	3,129	0,823*	0,000
DnB NOR Barnefond	2,260	3,129	0,946*	0,000
DnB NOR Norge (I)	2,470	3,129	0,952*	0,000
DnB NOR Norge (III)	2,463	3,129	0,952*	0,000
DnB NOR Norge (IV)	2,446	3,129	0,952*	0,000
DnB NOR Norge Selektiv (I)	2,529	3,129	0,941*	0,000
DnB NOR Norge Selektiv (II)	2,577	3,129	0,948*	0,000
DnB NOR Norge Selektiv (III)	2,563	3,129	0,952*	0,000
DnB NOR SMB	1,528	3,129	0,815*	0,000
Fondsfinans Aktiv	1,751	3,129	0,897*	0,000
Fondsfinans Spar	1,645	3,129	0,926*	0,000
Handelsbanken Norge	2,101	3,129	0,939*	0,000
Holberg Norge	1,172	3,129	0,835*	0,000
KLP AksjeNorge	0,960	3,129	0,937*	0,000
NB Aksjefond	0,944	3,129	0,920*	0,000
Nordea Avkastning	1,891	3,129	0,955*	0,000
Nordea Kapital	1,897	3,129	0,960*	0,000
Nordea Norge Verdi	1,771	3,129	0,886*	0,000
Nordea SMB	1,610	3,129	0,805*	0,000
Nordea Vekst	1,849	3,129	0,948*	0,000
ODIN Norge	2,189	3,129	0,805*	0,000
Orkla Finans Investment	1,750	3,129	0,938*	0,000
Pareto Aksje Norge	1,905	3,129	0,900*	0,000
Pareto Aktiv	1,931	3,129	0,902*	0,000
PLUSS Aksje	1,709	3,129	0,959*	0,000
PLUSS Markedsverdi	1,571	3,129	0,958*	0,000
Postbanken Norge	2,472	3,129	0,952*	0,000
Storebrand Aksje Innland	2,546	3,129	0,958*	0,000
Storebrand Norge	1,599	3,129	0,963*	0,000
Storebrand Norge I	2,331	3,129	0,944*	0,000
Storebrand Optima Norge A	2,332	3,129	0,945*	0,000
Storebrand Vekst	1,705	3,129	0,889*	0,000
Storebrand Verdi	2,551	3,129	0,913*	0,000
Terra Norge	1,693	3,129	0,912*	0,000
Terra SMB	1,866	3,129	0,861*	0,000
WarrenWicklund Norge A	1,831	3,129	0,911*	0,000

*significant at 1%

Table 10 - Balanced Henriksson-Merton assumptions

In the balanced dataset for the Henriksson-Merton model, the Durbin-Watson measure has to be within the range of 1,325 and 2,675 if there is not to be evidence of autocorrelation. All funds, with the exception of Alfred Berg Aktiv II, Carnegie Aksje Norge and Holberg Norge, fall within this range.

The VIF value is constant for all the funds because the sample size remains constant. The value is 3,129, which is well within the required range of less than 5. This means that there is no evidence of multicollinearity in the balanced data sample.

As the Spearman correlation coefficients are close to 1 for each of the funds, and all of them are statistically significant at 1% significance level, there is an implication that there is heteroskedasticity in this dataset as well.

5.2.1.2 Henriksson-Merton Results

Unbalanced

Fund	α	Sig.	β	Sig.	γ	Sig.	R^2
Alfred Berg Aktiv	0,019	0,147	1,086	0,000	-0,177	0,326	0,900
Alfred Berg Aktiv II	0,035	0,035**	1,146	0,000	-0,352	0,115	0,854
Alfred Berg Gambak	0,050	0,019**	1,309	0,000	-0,543	0,059	0,808
Alfred Berg Humanfond	0,017	0,055	1,051	0,000	-0,182	0,132	0,950
Alfred Berg Norge	0,024	0,001*	1,060	0,000	-0,198	0,025**	0,973
Alfred Berg Norge +	0,024	0,001*	1,061	0,000	-0,196	0,033**	0,971
Alfred Berg Norge Etisk	0,027	0,000*	1,112	0,000	-0,291	0,002*	0,980
Atlas Norge	0,017	0,226	1,089	0,000	-0,213	0,252	0,893
Avanse Norge (I)	0,011	0,127	1,023	0,000	-0,195	0,049**	0,964
Avanse Norge (II)	0,006	0,362	0,992	0,000	-0,078	0,365	0,972
Carnegie Aksje Norge	0,023	0,002*	1,038	0,000	-0,198	0,045**	0,965
Danske Invest Norge I	0,010	0,112	0,893	0,000	0,004	0,959	0,972
Danske Invest Norge II	0,011	0,080	0,880	0,000	0,025	0,766	0,970
Danske Invest Norge Vekst	0,030	0,150	1,046	0,000	-0,351	0,217	0,743
Danske Invest Norge Aksjer Inst I	0,014	0,046**	0,901	0,000	-0,010	0,910	0,971
Danske Invest Norge Aksjer Inst II	0,022	0,128	0,901	0,000	-0,047	0,781	0,966
Delphi Norge	0,037	0,009*	1,202	0,000	-0,354	0,058	0,904
Delphi Vekst	0,030	0,086	1,120	0,000	-0,367	0,114	0,835
DnB NOR Barnefond	0,008	0,206	0,919	0,000	-0,129	0,122	0,969
DnB NOR Norge (I)	0,015	0,023**	1,006	0,000	-0,147	0,096	0,971
DnB NOR Norge (III)	0,017	0,010*	1,006	0,000	-0,146	0,100	0,971
DnB NOR Norge (IV)	0,022	0,012**	1,002	0,000	-0,159	0,151	0,965
DnB NOR Norge Selektiv (I)	0,021	0,016**	1,068	0,000	-0,184	0,114	0,955
DnB NOR Norge Selektiv (II)	0,026	0,001*	1,006	0,000	-0,208	0,025**	0,974
DnB NOR Norge Selektiv (III)	0,019	0,007*	1,010	0,000	-0,177	0,061	0,967
DnB NOR SMB	0,025	0,174	1,131	0,000	-0,026	0,910	0,885
Fondsfinans Aktiv	0,017	0,076	0,873	0,000	-0,097	0,439	0,933
Fondsfinans Spar	0,020	0,107	0,945	0,000	0,002	0,992	0,934
Handelsbanken Norge	0,014	0,082	1,060	0,000	-0,138	0,193	0,963
Holberg Norge	0,022	0,108	0,944	0,000	-0,069	0,689	0,902
KLP AksjeNorge	0,022	0,003*	1,044	0,000	-0,168	0,075	0,969
Landkreditt Norge	0,026	0,113	0,910	0,000	-0,074	0,698	0,947
NB Aksjefond	0,012	0,142	0,990	0,000	-0,112	0,300	0,956
Nordea Avkastning	0,014	0,019**	1,030	0,000	-0,164	0,038**	0,978
Nordea Kapital	0,017	0,007*	1,025	0,000	-0,172	0,037**	0,976
Nordea Norge Verdi	0,014	0,123	0,936	0,000	-0,139	0,256	0,936
Nordea SMB	0,015	0,372	1,038	0,000	-0,165	0,476	0,832
Nordea Vekst	0,006	0,422	0,993	0,000	-0,100	0,338	0,960
ODIN Norge	0,027	0,042**	1,038	0,000	-0,214	0,229	0,891
Orkla Finans Investment	0,031	0,001*	1,114	0,000	-0,343	0,005*	0,953
Pareto Aksje Norge	0,038	0,007*	0,946	0,000	-0,226	0,200	0,891
Pareto Aktiv	0,028	0,051	0,925	0,000	-0,231	0,219	0,873
Pareto Verdi	0,025	0,227	0,956	0,000	-0,184	0,463	0,902
PLUSS Aksje	0,011	0,045**	0,930	0,000	-0,062	0,401	0,977
PLUSS Markedsverdi	0,016	0,005*	0,938	0,000	-0,082	0,274	0,976
Postbanken Norge	0,012	0,069	0,993	0,000	-0,120	0,187	0,969
Storebrand Aksje Innland	0,020	0,004*	1,020	0,000	-0,180	0,046**	0,970
Storebrand Norge	0,024	0,000*	1,027	0,000	-0,107	0,174	0,979
Storebrand Norge I	0,023	0,006*	1,072	0,000	-0,202	0,056	0,966
Storebrand Optima Norge A	0,025	0,004*	1,055	0,000	-0,201	0,067	0,964
Storebrand Vekst	0,000	0,994	0,929	0,000	0,095	0,742	0,765
Storebrand Verdi	0,033	0,001*	1,021	0,000	-0,295	0,023**	0,935
Terra Norge	0,010	0,409	0,997	0,000	-0,082	0,624	0,904
Terra SMB	0,009	0,471	0,937	0,000	-0,014	0,930	0,904
WarrenWicklund Norge A	0,047	0,002*	1,007	0,000	-0,252	0,183	0,913

*significant at 1% **significant at 5%

Table 11 - Results Henriksson-Merton model, unbalanced

Table 11 describes the results produced by the Henriksson-Merton market-timing model. In the unbalanced dataset it appears that all the funds have positive alpha values. 28 of the funds have significant positive alpha values. Alfred Berg Norge, Alfred Berg Norge +, Alfred Berg Etisk, Carnegie Aksje Norge, Delphi Norge, DnB NOR Norge (III), DnB NOR Norge Selektiv (II) and (III), KLP Aksje Norge, Nordea Kapital, Orkla Finans Investment, Pareto Aksje Norge, PLUSS Markedsverdi, Storebrand Aksje Innland, Storebrand Norge, Storebrand Norge I, Storebrand Optima Norge A, Storebrand Verdi and Warren Wicklund Norge A have positive alpha values at 1% significance level. In addition Alfred Berg Aktiv, Alfred Berg Gambak, Danske Invest Norge Aksjer Inst I, DnB NOR Norge (I) and (IV), DnB NOR Norge Selektiv (I), Nordea Avkastning, ODIN Norge and PLUSS Aksje have positive alpha values at 5% significance level. This implies that the managers of these funds have been able to select undervalued securities.

It appears as though the beta values for the unbalanced dataset have increased from those produced by the Jensen's Alpha model. Most of the funds now have betas above 1, and all the beta values are statistically significant at 1% level. This implies that they undertake higher levels of risk than the market portfolio.

The gamma values, which describe a managers market timing abilities, differ from the alpha values. Most of these values are negative, and Alfred Berg Norge Etisk and Orkla Finans Investment are the only two funds that have statistically significant negative values at 1%. Alfred Berg Norge, Alfred Berg Norge +, Avanse Norge (I), Carnegie Aksje Norge, DnB NOR Norge Selektiv (II), Nordea Avkastning, Nordea Kapital, Storebrand Aksje Innland and Storebrand Verdi have negative gamma values at 5% significance level. All the above-mentioned funds, with the exception of Avanse Norge (I), have positive security selection abilities at either 1% and 5% significance level. Danske Invest Norge I and II, Fondsfinans Spar and Storebrand Vekst have positive gamma values. These values, however, are not statistically significant.

The R^2 appears to be ranging from 0,743 to 0,980. According to these values the regressors explain from 74,3% to 98% of the dependent variable. The remainder is reflected in the error term.

Balanced

Table 12 below, shows the Henriksson-Merton model results for the balanced dataset. The alpha values produced by applying the model to the balanced dataset are all positive, with the exception of Storebrand Vekst. The funds that produced statistically significant alpha values at 1% are Alfred Berg Humanfond, Alfred Berg Norge, Alfredberg Norge +, Alfred Berg Etisk, Carnegie Aksje Norge, DnB NOR Norge (III) and (IV), DnB NOR Norge Selektiv I, II and III, KLP Aksje Norge, Nordea Avkastning, Nordea Kapital, Orkla Finans Investment, Storebrand Aksje Innland, Storebrand Norge, Storebrand Norge I, Storebrand Optima Norge A, Storebrand Verdi, and Warren Wicklund Norge A. In addition, Atlas Norge, Avanse Norge II, Danske Invest Norge Aksjer Inst I, Delphi Norge, DnB NOR Norge (I), Fondsfinans Spar, Handelsbanken Norge, Pareto Aksje Norge, PLUSS Markedsverdi and Postbanken Norge have significantly positive alpha values at 5%. As mentioned above, when the alpha value is positive at 1% and 5% significance level there is an implication that the fund managers have security selection abilities.

The beta values appear to have increased in respect to the beta values produced for Jensen's Alpha. Again, most of the funds appear to have beta values above 1. They range from 0,811 for Storebrand Vekst, to 1,178 for Alfred Berg Gambak. All the beta values are statistically significant at 1%.

As in the unbalanced data sample, most of the gamma values appear to be negative. The exceptions are Danske Invest I and II, PLUSS Aksje, Storebrand Vekst and Terra SMB. These do however, not have statistically significant positive values. Alfred Berg Norge Etisk is the only fund that has a statistically significant negative gamma value at 1%. In addition, Alfred Berg Humanfond, Alfred Berg Norge, Alfred Berg Norge +, Avanse Norge (II), Carnegie Aksje Norge, DnB NOR Selektiv (I), (II) and (III), Nordea Avkastning, Nordea Kapital, Orkla Finans Investment, Storebrand Aksje Innland and Storebrand Verdi have significantly negative timing abilities at a 5% significance level. Again there is an implication that none of the fund managers have market timing abilities. However, even though the managers of the above-mentioned funds do not possess market-timing abilities, it appears that all of them, with the exception of Avanse Norge (II), have security selection skills.

The R^2 values predicted by the Henriksson-Merton model suggest that the model fits pretty well. The values range from 0,829 for Nordea SMB to 0,984 for Pareto Aksje Norge. This means that the regressors explain 82,9% to 98,4% of the dependent variable. The remainder is explained by independent variables that are not included in this analysis. These are reflected in the error term.

Fund	α	Sig.	β	Sig.	γ	Sig.	R^2
Alfred Berg Aktiv	0,013	0,402	1,058	0,000	-0,071	0,731	0,917
Alfred Berg Aktiv II	0,012	0,438	1,066	0,000	-0,079	0,709	0,915
Alfred Berg Gambak	0,033	0,075	1,178	0,000	-0,247	0,321	0,894
Alfred Berg Humanfond	0,022	0,009*	1,105	0,000	-0,262	0,020**	0,975
Alfred Berg Norge	0,030	0,001*	1,114	0,000	-0,262	0,022**	0,974
Alfred Berg Norge +	0,031	0,001*	1,115	0,000	-0,267	0,020**	0,974
Alfred Berg Norge Etisk	0,026	0,003*	1,119	0,000	-0,303	0,008*	0,975
Atlas Norge	0,021	0,037**	1,041	0,000	-0,136	0,315	0,960
Avanse Norge (I)	0,019	0,074	1,044	0,000	-0,282	0,058	0,949
Avanse Norge (II)	0,021	0,004**	1,048	0,000	-0,201	0,037**	0,980
Carnegie Aksje Norge	0,028	0,001*	1,090	0,000	-0,259	0,015**	0,977
Danske Invest Norge I	0,013	0,131	0,874	0,000	0,014	0,901	0,963
Danske Invest Norge II	0,014	0,104	0,861	0,000	0,031	0,793	0,962
Danske Invest Norge Vekst	0,021	0,171	0,974	0,000	-0,197	0,343	0,893
Danske Invest Norge Aksjer Inst I	0,019	0,043**	0,901	0,000	-0,023	0,850	0,961
Delphi Norge	0,032	0,019**	1,081	0,000	-0,255	0,159	0,931
Delphi Vekst	0,029	0,082	1,002	0,000	-0,309	0,163	0,878
DnB NOR Barnefond	0,014	0,056	0,883	0,000	-0,154	0,128	0,968
DnB NOR Norge (I)	0,023	0,017**	1,005	0,000	-0,201	0,113	0,961
DnB NOR Norge (III)	0,025	0,010*	1,008	0,000	-0,202	0,112	0,961
DnB NOR Norge (IV)	0,026	0,008*	1,012	0,000	-0,204	0,109	0,961
DnB NOR Norge Selektiv (I)	0,028	0,005*	1,019	0,000	-0,252	0,048**	0,961
DnB NOR Norge Selektiv (II)	0,030	0,002*	1,013	0,000	-0,252	0,037**	0,965
DnB NOR Norge Selektiv (III)	0,029	0,002*	1,013	0,000	-0,237	0,045**	0,967
DnB NOR SMB	0,030	0,214	1,129	0,000	-0,094	0,769	0,837
Fondsfinans Aktiv	0,021	0,085	0,839	0,000	-0,083	0,606	0,919
Fondsfinans Spar	0,027	0,037**	0,951	0,000	-0,074	0,661	0,930
Handelsbanken Norge	0,026	0,023**	1,132	0,000	-0,277	0,074	0,953
Holberg Norge	0,024	0,183	0,894	0,000	-0,077	0,746	0,855
KLP AksjeNorge	0,027	0,009*	1,067	0,000	-0,205	0,134	0,960
NB Aksjefond	0,013	0,253	1,022	0,000	-0,126	0,427	0,944
Nordea Avkastning	0,021	0,009*	1,043	0,000	-0,213	0,043**	0,976
Nordea Kapital	0,023	0,003*	1,028	0,000	-0,203	0,046**	0,976
Nordea Norge Verdi	0,017	0,192	0,888	0,000	-0,134	0,447	0,910
Nordea SMB	0,020	0,354	1,033	0,000	-0,150	0,610	0,829
Nordea Vekst	0,008	0,411	0,997	0,000	-0,087	0,533	0,955
ODIN Norge	0,027	0,116	0,971	0,000	-0,239	0,298	0,867
Orkla Finans Investment	0,029	0,008*	1,087	0,000	-0,316	0,029**	0,956
Pareto Aksje Norge	0,034	0,036**	0,990	0,000	-0,193	0,359	0,984
Pareto Aktiv	0,029	0,054	0,959	0,000	-0,201	0,318	0,896
PLUSS Aksje	0,011	0,103	0,878	0,000	0,008	0,927	0,977
PLUSS Markedsverdi	0,016	0,035**	0,955	0,000	-0,068	0,502	0,974
Postbanken Norge	0,023	0,016**	1,006	0,000	-0,203	0,109	0,961
Storebrand Aksje Innland	0,030	0,002*	1,049	0,000	-0,272	0,027**	0,966
Storebrand Norge	0,033	0,000*	1,041	0,000	-0,160	0,102	0,979
Storebrand Norge I	0,031	0,003*	1,066	0,000	-0,264	0,054	0,959
Storebrand Optima Norge A	0,028	0,008*	1,059	0,000	-0,244	0,082	0,957
Storebrand Vekst	-0,010	0,639	0,811	0,000	0,330	0,243	0,842
Storebrand Verdi	0,035	0,010*	1,085	0,000	-0,355	0,050**	0,928
Terra Norge	0,017	0,213	1,024	0,000	-0,080	0,658	0,931
Terra SMB	0,009	0,630	0,915	0,000	0,017	0,944	0,865
WarrenWicklund Norge A	0,047	0,002*	1,007	0,000	-0,252	0,183	0,913

*significant at 1% **significant at 5%

Table 12 - Results Henriksson-Merton model, balanced

5.2.2 Treynor – Mazuy market timing model

5.2.2.1 Regression Assumptions

Unbalanced

It appears that the error term of Avanse Norge (I) seems to be more or less normally distributed in this case too, as the observations seem to follow the line.

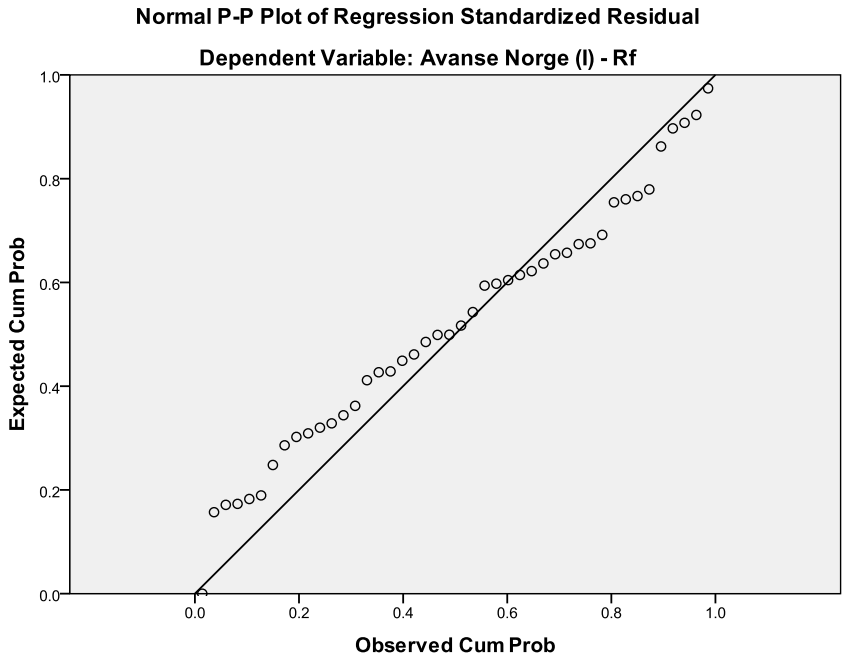


Figure 12 - Normal distribution of the error term, Treynor-Mazuy unbalanced

The graphs for the error terms of the remaining fund can be found in attachment 8.1.5. All the error terms appear to be normally distributed.

The Durbin-Watson measure has to be within the range of 1,398 and 2,602. It appears that all the funds, with the exception of Danske Invest Norge Vekst, Holberg Norge and PLUSS Aksje are within this range. This implies that these three funds may have some degree autocorrelation.

The VIF value appears to be constant for almost all of the funds. Although some of the funds have differing VIF values they are all below 5. This implies that there is no sign of multicollinearity in this sample.

The Spearman correlation coefficient appears to be relatively close to 0 for all the funds. These values are however, not statistically significant.

Fund name	Autocorrelation	Multicollinearity	Heteroskedasticity	
	Durbin-Watson	VIF	Spearman	Sig.
Alfred Berg Aktiv	1,764	1,086	0,004	0,982
Alfred Berg Aktiv II	1,472	1,086	-0,022	0,887
Alfred Berg Gambak	1,820	1,086	-0,042	0,785
Alfred Berg Humanfond	2,445	1,086	0,052	0,739
Alfred Berg Norge	2,352	1,086	0,050	0,746
Alfred Berg Norge +	2,484	1,086	0,052	0,737
Alfred Berg Norge Etisk	1,925	1,073	0,086	0,624
Atlas Norge	1,650	1,086	0,023	0,883
Avanse Norge (I)	1,918	1,086	0,022	0,887
Avanse Norge (II)	1,776	1,086	0,054	0,726
Carnegie Aksje Norge	2,642	1,086	0,063	0,685
Danske Invest Norge I	2,054	1,086	0,052	0,739
Danske Invest Norge II	2,134	1,086	0,052	0,736
Danske Invest Norge Vekst	1,390	1,086	-0,015	0,922
Danske Invest Norge Aksjer Inst I	2,073	1,090	0,043	0,786
Danske Invest Norske Aksjer Inst II	1,746	1,206	-0,132	0,625
Delphi Norge	1,841	1,086	-0,011	0,944
Delphi Vekst	1,991	1,086	-0,056	0,719
DnB NOR Barnefond	2,287	1,086	0,052	0,738
DnB NOR Norge (I)	2,512	1,086	0,068	0,659
DnB NOR Norge (III)	2,526	1,086	0,069	0,657
DnB NOR Norge (IV)	2,480	1,023	0,264	0,144
DnB NOR Norge Selektiv (I)	2,583	1,086	0,056	0,718
DnB NOR Norge Selektiv (II)	2,537	1,074	0,110	0,521
DnB NOR Norge Selektiv (III)	1,940	1,086	0,068	0,662
DnB NOR SMB	1,517	1,104	-0,018	0,915
Fondsfinans Aktiv	1,934	1,090	0,001	0,994
Fondsfinans Spar	1,771	1,023	0,236	0,193
Handelsbanken Norge	2,130	1,086	0,045	0,770
Holberg Norge	1,257	1,095	-0,017	0,918
KLP AksjeNorge	2,008	1,086	0,045	0,770
Landkreditt Norge	1,605	1,164	-0,061	0,810
NB Aksjefond	1,611	1,086	0,047	0,759
Nordea Avkastning	1,951	1,086	0,066	0,671
Nordea Kapital	1,792	1,086	0,061	0,694
Nordea Norge Verdi	1,862	1,086	0,040	0,797
Nordea SMB	1,777	1,086	-0,064	0,681
Nordea Vekst	1,937	1,086	0,079	0,610
ODIN Norge	2,143	1,086	-0,038	0,807
Orkla Finans Investment	2,328	1,086	0,034	0,825
Pareto Aksje Norge	1,667	1,073	0,061	0,721
Pareto Aktiv	1,810	1,022	0,220	0,218
Pareto Verdi	1,830	1,128	0,011	0,965
PLUSS Aksje	1,326	1,086	0,068	0,661
PLUSS Markedsverdi	1,588	1,086	0,073	0,637
Postbanken Norge	2,359	1,086	0,070	0,653
Storebrand Aksje Innland	2,449	1,086	0,064	0,681
Storebrand Norge	1,877	1,086	0,072	0,642
Storebrand Norge I	2,203	1,090	0,053	0,740
Storebrand Optima Norge A	2,038	1,095	0,062	0,703
Storebrand Vekst	1,769	1,086	-0,008	0,958
Storebrand Verdi	2,546	1,086	0,050	0,748
Terra Norge	1,665	1,086	0,004	0,980
Terra SMB	1,893	1,086	0,024	0,878
WarrenWicklund Norge A	1,802	1,138	0,168	0,393

Table 13 - Unbalanced Treynor-Mazuy assumptions

Balanced

As can be seen from the graph below, the error term for Avanse Norge (I) appears to be more or less normally distributed in this dataset as well.

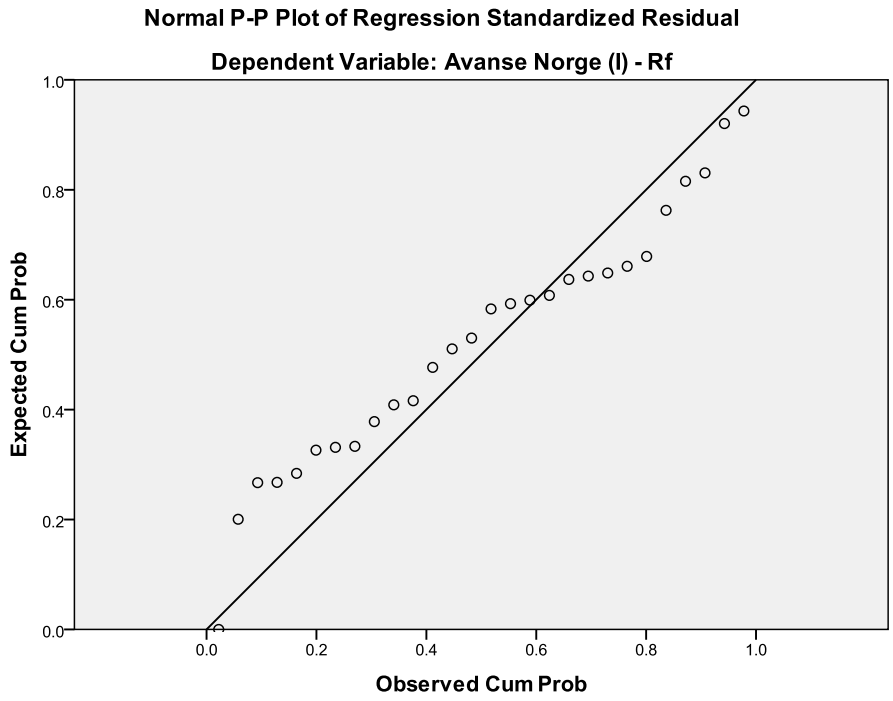


Figure 13 - Normal distribution of the error term, Treynor-Mazuy balanced

As for all the error terms in the other data samples, the distribution of the error term of the remaining funds of the balanced dataset in the Treynor-Mazuy market timing model, appear to be just about normal. These graphs can be found in appendix 8.1.6.

The Durbin-Watson value for the balanced dataset has to be within the range of 1,325 and 2,675. Alfred Berg Aktiv, Alfred Berg Aktiv II, Carnegie Aksje Norge and Holberg Norge did not fall within this range. There is, therefore, evidence of autocorrelation in the data of these four funds. All the remaining funds achieved values within the required range.

The VIF values are constant at 1,138, which is well below 5. As previously mentioned, this implies that there is no evidence of multicollinearity.

The Spearman coefficients for the funds are ranging from 0,028 to 0,233. These values imply that there is a sign of some heteroskedasticity. However, none of these values are statistically significant.

All the results are summarized in table 14 below.

Fund name	Autocorrelation	Multicollinearity	Heteroskedasticity	
	Durbin-Watson	VIF	Spearman	Sig.
Alfred Berg Aktiv	1,292	1,138	0,161	0,413
Alfred Berg Aktiv II	1,255	1,138	0,163	0,409
Alfred Berg Gambak	1,620	1,138	0,135	0,493
Alfred Berg Humanfond	1,875	1,138	0,194	0,323
Alfred Berg Norge	2,032	1,138	0,204	0,299
Alfred Berg Norge +	2,096	1,138	0,205	0,296
Alfred Berg Norge Etisk	1,764	1,138	0,195	0,320
Atlas Norge	1,880	1,138	0,207	0,291
Avanse Norge (I)	1,841	1,138	0,164	0,404
Avanse Norge (II)	2,154	1,138	0,209	0,287
Carnegie Aksje Norge	2,694	1,138	0,208	0,288
Danske Invest Norge I	1,987	1,138	0,192	0,329
Danske Invest Norge II	2,003	1,138	0,192	0,329
Danske Invest Norge Vekst	1,468	1,138	0,153	0,436
Danske Invest Norge Aksjer Inst I	2,002	1,138	0,201	0,304
Delphi Norge	1,997	1,138	0,148	0,451
Delphi Vekst	2,243	1,138	0,080	0,686
DnB NOR Barnefond	2,170	1,138	0,186	0,343
DnB NOR Norge (I)	2,285	1,138	0,221	0,259
DnB NOR Norge (III)	2,278	1,138	0,221	0,259
DnB NOR Norge (IV)	2,281	1,138	0,221	0,259
DnB NOR Norge Selektiv (I)	2,385	1,138	0,212	0,278
DnB NOR Norge Selektiv (II)	2,418	1,138	0,220	0,261
DnB NOR Norge Selektiv (III)	2,391	1,138	0,224	0,251
DnB NOR SMB	1,523	1,138	0,083	0,676
Fondsfinans Aktiv	1,742	1,138	0,128	0,518
Fondsfinans Spar	1,662	1,138	0,183	0,352
Handelsbanken Norge	2,076	1,138	0,180	0,361
Holberg Norge	1,168	1,138	0,097	0,624
KLP AksjeNorge	1,923	1,138	0,189	0,336
NB Aksjefond	1,476	1,138	0,180	0,359
Nordea Avkastning	1,758	1,138	0,210	0,283
Nordea Kapital	1,772	1,138	0,213	0,277
Nordea Norge Verdi	1,762	1,138	0,162	0,410
Nordea SMB	1,600	1,138	0,057	0,771
Nordea Vekst	1,724	1,138	0,229	0,240
ODIN Norge	2,188	1,138	0,028	0,886
Orkla Finans Investment	1,830	1,138	0,186	0,344
Pareto Aksje Norge	1,889	1,138	0,174	0,377
Pareto Aktiv	1,916	1,138	0,167	0,394
PLUSS Aksje	1,650	1,138	0,219	0,263
PLUSS Markedsverdi	1,481	1,138	0,233	0,234
Postbanken Norge	2,287	1,138	0,221	0,259
Storebrand Aksje Innland	2,382	1,138	0,212	0,279
Storebrand Norge	1,462	1,138	0,232	0,236
Storebrand Norge I	2,190	1,138	0,219	0,262
Storebrand Optima Norge A	2,207	1,138	0,220	0,261
Storebrand Vekst	1,742	1,138	0,166	0,397
Storebrand Verdi	2,447	1,138	0,180	0,359
Terra Norge	1,676	1,138	0,182	0,353
Terra SMB	1,893	1,138	0,126	0,521
WarrenWicklund Norge A	1,802	1,138	0,168	0,393

Table 14 - Balanced Treynor-Mazuy assumptions

5.2.2.2 Treynor – Mazuy Results

Unbalanced

Fund	α	Sig.	β	Sig.	γ	Sig.	R^2
Alfred Berg Aktiv	0,015	0,136	0,922	0,000	-0,292	0,325	0,900
Alfred Berg Aktiv II	0,027	0,037**	0,961	0,000	-0,569	0,121	0,854
Alfred Berg Gambak	0,037	0,026**	1,025	0,000	-0,848	0,073	0,806
Alfred Berg Humanfond	0,013	0,064	0,995	0,000	-0,288	0,146	0,950
Alfred Berg Norge	0,019	0,000*	0,955	0,000	-0,339	0,019**	0,974
Alfred Berg Norge +	0,020	0,000*	0,957	0,000	-0,335	0,026**	0,972
Alfred Berg Norge Etisk	0,020	0,000*	0,957	0,000	-0,481	0,001*	0,980
Atlas Norge	0,009	0,411	0,984	0,000	-0,215	0,482	0,891
Avanse Norge (I)	0,005	0,341	0,923	0,000	-0,256	0,106	0,963
Avanse Norge (II)	0,004	0,455	0,951	0,000	-0,113	0,426	0,972
Carnegie Aksje Norge	0,019	0,001*	0,933	0,000	-0,340	0,035**	0,966
Danske Invest Norge I	0,009	0,052	0,896	0,000	0,035	0,795	0,972
Danske Invest Norge II	0,011	0,026**	0,895	0,000	0,072	0,598	0,970
Danske Invest Norge Vekst	0,022	0,170	0,861	0,000	-0,575	0,218	0,743
Danske Invest Norge Aksjer Inst I	0,013	0,012**	0,896	0,000	-0,013	0,929	0,971
Danske Invest Norge Aksjer Inst II	0,020	0,089	0,880	0,000	-0,026	0,923	0,966
Delphi Norge	0,027	0,012**	1,018	0,000	-0,530	0,085	0,903
Delphi Vekst	0,020	0,136	0,930	0,000	-0,540	0,157	0,833
DnB NOR Barnefond	0,004	0,384	0,852	0,000	-0,182	0,184	0,969
DnB NOR Norge (I)	0,012	0,015**	0,927	0,000	-0,267	0,064	0,972
DnB NOR Norge (III)	0,014	0,005*	0,928	0,000	-0,265	0,066	0,971
DnB NOR Norge (IV)	0,019	0,005*	0,916	0,000	-0,297	0,090	0,966
DnB NOR Norge Selektiv (I)	0,016	0,022**	0,974	0,000	-0,244	0,204	0,954
DnB NOR Norge Selektiv (II)	0,022	0,000*	0,894	0,000	-0,363	0,015**	0,974
DnB NOR Norge Selektiv (III)	0,015	0,005*	0,916	0,000	-0,300	0,052	0,967
DnB NOR SMB	0,025	0,079	1,115	0,000	-0,078	0,837	0,885
Fondsfinans Aktiv	0,013	0,075	0,825	0,000	-0,087	0,671	0,932
Fondsfinans Spar	0,017	0,069	0,949	0,000	0,106	0,667	0,934
Handelsbanken Norge	0,010	0,091	0,988	0,000	-0,213	0,221	0,963
Holberg Norge	0,019	0,067	0,910	0,000	-0,075	0,789	0,902
KLP AksjeNorge	0,017	0,002*	0,957	0,000	-0,249	0,109	0,969
Landkreditt Norge	0,022	0,090	0,875	0,000	-0,046	0,883	0,947
NB Aksjefond	0,009	0,149	0,931	0,000	-0,171	0,337	0,956
Nordea Avkastning	0,010	0,022**	0,943	0,000	-0,281	0,030**	0,978
Nordea Kapital	0,013	0,008*	0,934	0,000	-0,282	0,037**	0,976
Nordea Norge Verdi	0,009	0,178	0,865	0,000	-0,167	0,408	0,935
Nordea SMB	0,011	0,415	0,953	0,000	-0,237	0,533	0,832
Nordea Vekst	0,005	0,410	0,938	0,000	-0,207	0,224	0,960
ODIN Norge	0,020	0,058	0,931	0,000	-0,236	0,420	0,889
Orkla Finans Investment	0,021	0,003*	0,938	0,000	-0,486	0,016**	0,950
Pareto Aksje Norge	0,034	0,002*	0,824	0,000	-0,402	0,159	0,892
Pareto Aktiv	0,024	0,031**	0,799	0,000	-0,433	0,148	0,876
Pareto Verdi	0,021	0,203	0,855	0,000	-0,298	0,466	0,902
PLUSS Aksje	0,010	0,024**	0,897	0,000	-0,101	0,404	0,977
PLUSS Markedsverdi	0,015	0,001*	0,893	0,000	-0,167	0,176	0,977
Postbanken Norge	0,010	0,044**	0,928	0,000	-0,237	0,110	0,970
Storebrand Aksje Innland	0,016	0,002*	0,924	0,000	-0,331	0,024**	0,971
Storebrand Norge	0,022	0,000*	0,971	0,000	-0,185	0,151	0,979
Storebrand Norge I	0,019	0,003*	0,864	0,000	-0,365	0,033	0,967
Storebrand Optima Norge A	0,022	0,001*	0,945	0,000	-0,396	0,025**	0,966
Storebrand Vekst	-0,001	0,972	0,986	0,000	0,285	0,545	0,767
Storebrand Verdi	0,028	0,000*	0,859	0,000	-0,599	0,004*	0,940
Terra Norge	0,008	0,419	0,955	0,000	-0,106	0,699	0,904
Terra SMB	0,008	0,404	0,931	0,000	0,003	0,991	0,904
WarrenWicklund Norge A	0,042	0,000*	0,864	0,000	-0,476	0,132	0,914

*significant at 1% **significant at 5%

Table 15 - Results Treynor-Mazuy model, unbalanced

From the table above, it appears that almost all the fund managers have securities selection skills. However, the positive alpha values are only statistically significant at 1% level for some of the funds. These funds are the Alfred Berg Norge, Alfred Berg Norge +, Alfred Berg Norge Etisk, Carnegie Aksje Norge, DnB NOR Norge (III) and (IV), DnB NOR Norge Selektiv (II) and (III), KLP Aksje Norge, Nordea Kapital, Orkla Finans Investment, Pareto Aksje Norge, PLUSS Markedsverdi, Storebrand Aksje Innland, Storebrand Norge, Storebrand Norge I, Storebrand Optima Norge A, Storebrand Verdi and Warren Wicklund Norge A. In addition, some funds have alpha values that are statistically significant at 5%. These are Alfred Berg Aktiv II, Alfred Berg Gambak, Danske Invest Norge II, Danske Invest Norge Aksjer Inst I, Delphi Norge, DnB NOR Norge (I), DnB NOR Norge Selektiv (I), Nordea Avkastning, Pareto Verdi and Postbanken Norge.

Both the Treynor-Mazuy and the Henriksson-Merton models produced similar results concerning security selection abilities for the unbalanced datasets. All the funds with significantly positive alpha values in the Treynor-Mazuy model also have significantly positive alpha values in the Henriksson-Merton model. In addition, the Treynor-Mazuy model included Danske Invest Norge II and Pareto Aktiv as funds with managers that possess security selection abilities.

The beta values appear to be mostly below 1, which is the expected risk of the market portfolio. The fund with the lowest beta value is Pareto Aktiv. This fund has a beta of 0,799. Three funds have beta values above 1. These are Alfred Berg Gambak, Delphi Norge and DnB NOR Selektiv. These have beta values of 1,025, 1,018 and 1,115 respectively. All the beta values are statistically significant at 1%.

The gamma values, which indicate whether the managers have market-timing abilities, are mostly negative. There are some exceptions yielding positive values. These are Danske Invest (I) and (II), Fondsfinans Spar, Storebrand Vekst and Terra SMB. The values of these funds are however, not statistically significant at either 1% or 5% significance level. Alfred Berg Norge Etisk and Storebrand Verdi have statistically significant negative timing values at 1% significance level. This implies that the managers do not have timing abilities. They do however, have positive alpha values, which means that there is an implication that the managers have positive security selection abilities. In addition, Alfred Berg Norge, Alfred Berg Norge +,

Carnegie Aksje Norge, DnB NOR Selektiv (II), Nordea Avkastning, Nordea Kapital, Orkla Finans Investment, Storebrand Aksje Innland and Storebrand Optima Norge A have negative timing abilities at 5% significance level. All the funds that are significant at 5%, with the exception of Nordea Avkastning, have positive selection abilities.

The Treynor-Mazuy model produced almost the same results for the unbalanced dataset about market timing ability as the Henriksson-Merton model. That is, both models showed that Danske Invest I and II, Fondsfinans Spar and Storebrand Vekst produced positive gamma values. In addition, the Treynor-Mazuy model included Terra SMB. All these market-timing values were not statistically significant.

In addition, both models produced significantly negative gamma values, at a 1% and a 5% level, for the same funds. In addition, the Henriksson-Merton model produced a statistically significant negative value for Avanse Norge (I), while Treynor-Mazuy produced a statistically significant negative value for Storebrand Optima Norge A.

The R^2 appears to fall within the range of 0,743 – 0,980. The fund yielding the lowest R^2 value is Danske Invest Norge Vekst, while the fund yielding the highest R^2 value is Alfred Berg Norge Etisk. This implies that the regressors explain between 74,3% and 98% of the dependent variables. The remaining percentage is explained by variables that are not included in the model. These are reflected by the error term.

Balanced

Table 16 below shows that almost all the fund managers, with the exception of Storebrand Vekst, have security selection abilities. However, not all the funds have statistically significant values. The funds that do have statistically significant values at a 1% significance level are Alfred Berg Norge, Alfred Berg Norge +, Alfred Berg Norge Etisk, Avanse Norge (II), Carnegie Aksje Norge, Delphi Norge, DnB NOR Norge (I), (III) and (IV), DnB NOR Norge Selektiv (I), (II) and (III), KLP Aksje Norge, Nordea Avkastning, Nordea Kapital, Storebrand Aksje Innland, Storebrand Norge, Storebrand Norge I, Storebrand Optima Norge, Storebrand Verdi and Warren Wicklund Norge A. In addition, some funds achieved statistically significant alpha values at a 5% significance level. These are Alfred Berg Gambak, Alfred Berg Humanfond, Atlas Norge, Danske Invest Norge II, Danske Invest Norge Aksjer Inst,

DnB NOR Barnefond, Fondsfinans Spar, Handelsbanken Norge, Orkla Finans Investment, Pareto Aksje Norge, Pareto Aktiv, PLUSS Aksje and PLUSS Markedsverdi. The managers of all these funds have security selection abilities.

The Treynor-Mazuy model and the Henriksson-Merton model produced almost the same results when it comes to security selection skills. The Treynor-Mazuy model, however, also included Danske Invest Norge II, Pareto Aktiv and PLUSS Aksje as funds that have superior selection abilities. In addition, the Henriksson-Merton model included Alfred Berg Gambak and DnB NOR Barnefond.

Most of the beta values are below 1. This implies that a majority of the funds undertake less risk than the market portfolio. Fondsfinans Aktiv achieved the lowest beta value, 0,796. Four funds have betas above 1. These are Alfred Berg Aktiv, Alfred Berg Aktiv II, Alfred Berg Gambak and DnB NOR SMB. These achieved values of 1,013, 1,016, 1,032 and 1,073 respectively.

The market timing ability measure, gamma, shows that only three fund managers have positive timing abilities. The funds that achieved positive values are Danske Invest Norge (I) and (II), Storebrand Vekst and Terra SMB. These values were however, not statistically significant.

Alfred Berg Norge Etisk, Carnegie Aksje Norge and Storebrand Aksje Innland achieved negative gamma values at 1% significance level. In addition, Alfred Berg Humanfond, Alfred Berg Norge, Alfred Berg Norge +, DnB NOR Norge (I), (III) and (IV), DnB NOR Norge Selektive (I), (II) and (III), Nordea Avkastning, Nordea Kapital, Orkla Finans Investment, Postbanken Norge, Storebrand Norge I, Storebrand Optima Norge A and Storebrand Verdi achieved statistically significant negative values at 5%. All of these funds have security selection abilities at a 1% and 5% significance level.

R^2 ranges from 0,829 for Nordea SMB to 0,980 for Avanse Norge II and Storebrand Aktiv. This implies that 82,9% - 98% of the dependent variable is explained by the regressors. The remainder is explained by independent variables that are not included in the model.

Fund	α	Sig.	β	Sig.	γ	Sig.	R^2
Alfred Berg Aktiv	0,013	0,269	1,013	0,000	-0,208	0,549	0,917
Alfred Berg Aktiv II	0,012	0,307	1,016	0,000	-0,224	0,526	0,916
Alfred Berg Gambak	0,031	0,035**	1,032	0,000	-0,546	0,188	0,897
Alfred Berg Humanfond	0,016	0,012**	0,959	0,000	-0,451	0,016**	0,975
Alfred Berg Norge	0,025	0,000*	0,967	0,000	-0,462	0,015**	0,975
Alfred Berg Norge +	0,026	0,000*	0,966	0,000	-0,474	0,013**	0,975
Alfred Berg Norge Etisk	0,020	0,002*	0,950	0,000	-0,535	0,005*	0,976
Atlas Norge	0,018	0,025**	0,966	0,000	-0,216	0,341	0,960
Avanse Norge (I)	0,012	0,160	0,892	0,000	-0,412	0,101	0,947
Avanse Norge (II)	0,016	0,005*	0,938	0,000	-0,321	0,047	0,980
Carnegie Aksje Norge	0,023	0,000*	0,945	0,000	-0,469	0,008*	0,978
Danske Invest Norge I	0,013	0,064	0,884	0,000	0,053	0,786	0,963
Danske Invest Norge II	0,014	0,041**	0,880	0,000	0,080	0,683	0,962
Danske Invest Norge Vekst	0,019	0,108	0,858	0,000	-0,437	0,206	0,896
Danske Invest Norge Aksjer Inst I	0,018	0,014**	0,889	0,000	-0,035	0,862	0,961
Delphi Norge	0,029	0,008*	0,935	0,000	-0,498	0,099	0,933
Delphi Vekst	0,024	0,061	0,826	0,000	-0,603	0,102	0,882
DnB NOR Barnefond	0,012	0,050**	0,796	0,000	-0,277	0,101	0,969
DnB NOR Norge (I)	0,021	0,006*	0,888	0,000	-0,428	0,040**	0,964
DnB NOR Norge (III)	0,023	0,003*	0,890	0,000	-0,430	0,040**	0,964
DnB NOR Norge (IV)	0,024	0,002*	0,893	0,000	-0,433	0,039**	0,964
DnB NOR Norge Selektiv (I)	0,024	0,002*	0,875	0,000	-0,489	0,020**	0,963
DnB NOR Norge Selektiv (II)	0,026	0,001*	0,870	0,000	-0,479	0,016**	0,967
DnB NOR Norge Selektiv (III)	0,025	0,000*	0,878	0,000	-0,460	0,018**	0,969
DnB NOR SMB	0,029	0,127	1,073	0,000	-0,211	0,696	0,837
Fondsfinans Aktiv	0,018	0,057	0,796	0,000	-0,103	0,701	0,918
Fondsfinans Spar	0,024	0,019**	0,913	0,000	-0,076	0,788	0,930
Handelsbanken Norge	0,020	0,026**	0,978	0,000	-0,462	0,075	0,953
Holberg Norge	0,022	0,121	0,852	0,000	-0,119	0,765	0,855
KLP AksjeNorge	0,023	0,006*	0,954	0,000	-0,340	0,138	0,960
NB Aksjefond	0,009	0,306	0,956	0,000	-0,155	0,560	0,944
Nordea Avkastning	0,017	0,006*	0,923	0,000	-0,384	0,028**	0,976
Nordea Kapital	0,019	0,002*	0,914	0,000	-0,363	0,032**	0,977
Nordea Norge Verdi	0,013	0,191	0,817	0,000	-0,191	0,517	0,909
Nordea SMB	0,017	0,328	0,951	0,000	-0,243	0,623	0,829
Nordea Vekst	0,008	0,294	0,944	0,000	-0,227	0,329	0,956
ODIN Norge	0,020	0,147	0,845	0,000	-0,305	0,430	0,865
Orkla Finans Investment	0,021	0,012**	0,915	0,000	-0,493	0,043**	0,954
Pareto Aksje Norge	0,030	0,018**	0,882	0,000	-0,346	0,326	0,895
Pareto Aktiv	0,025	0,035**	0,847	0,000	-0,353	0,294	0,896
PLUSS Aksje	0,012	0,031**	0,881	0,000	-0,008	0,956	0,977
PLUSS Markedsverdi	0,015	0,013**	0,916	0,000	-0,139	0,414	0,974
Postbanken Norge	0,021	0,005*	0,888	0,000	-0,430	0,039**	0,964
Storebrand Aksje Innland	0,026	0,000*	0,892	0,000	-0,550	0,006*	0,969
Storebrand Norge	0,020	0,000*	0,949	0,000	-0,307	0,059	0,980
Storebrand Norge I	0,028	0,001*	0,913	0,000	-0,549	0,014**	0,963
Storebrand Optima Norge A	0,026	0,002*	0,917	0,000	-0,515	0,025**	0,960
Storebrand Vekst	-0,004	0,812	0,997	0,000	0,606	0,200	0,844
Storebrand Verdi	0,031	0,004*	0,880	0,000	-0,723	0,015**	0,934
Terra Norge	0,015	0,150	0,979	0,000	-0,145	0,631	0,931
Terra SMB	0,008	0,587	0,928	0,000	0,088	0,829	0,865
WarrenWicklund Norge A	0,042	0,000*	0,864	0,000	-0,476	0,132	0,914

*significant at 1% **significant at 5%

Table 16 - Results Treynor-Mazuy model, balanced

6.0 CONCLUSION

A mutual fund manager's abilities are frequently evaluated by comparing the return of the managed fund with the market index. This thesis has focused on applying different performance measures in order to evaluate the performance of the fund. The fund managers' abilities, however, have been evaluated by applying models, which analyze security selection skills and market timing abilities.

The Sharpe ratio and the Treynor ratio were applied in order to evaluate whether the funds earned excess return during the sample period.

For the Sharpe ratio the period was broken down into three time periods; 01.01.2000-31.12.2003; 01.01.2004-31.12.2006; and 01.01.2007-31.12.2010. The Sharpe ratios showed that during the first period only 14 out of 51 managed to earn excess returns. The OSEFX however, produced a negative Sharpe ratio, as did the remaining 37 funds. Many of these funds still managed to perform better than the index. During the second period, all the funds produced positive values. 42 out of 54 funds managed to outperform the market index. The third period again produced a negative Sharpe ratio for the index. This time, 44 funds were able to earn excess returns, and all the funds, with the exception of Nordea SMB and Odin Norge, were able to outperform the market index. The total sample period shows that 52 out of 55, or about 95%, of the funds outperformed the market.

The Treynor ratios were examined in the same way. Again, the period was broken down into three time periods. During the first period, 01.01.2000-31.12.2003, again 14 out of 51 funds managed to earn excess return. The OSEFX achieved a negative value of -0,0107. The remaining 37 funds also produced negative values, but 21 of these still managed to outperform the market index. During the second period, 01.01.2004-31.12.2006, all the funds produced positive values. 49 out of 54 funds managed to outperform the market index. During the third period, 01.01.2007-31.12.2010, the OSEFX again produced a negative Treynor ratio. A majority of funds were able to outperform the market index, with Danske Invest Norge Vekst, Nordea SMB and ODIN Norge as the exceptions. 44 out of 55 funds managed to earn excess return. The total sample period shows that 54 out of 55, or about 98%, of the fund managers were able to outperform the market.

Even though, according to figure 7, there is a decline in both the average return of the funds, and the OSEFX in 2001 and 2008, this is only reflected in the first period for both ratios. The decline in 2008 is not reflected in the Sharpe and Treynor ratios for the third period. The reason for this may be that the third period ranges from 01.01.2007-31.12.2010, and thereby also including the period where the market stabilized.

Applying Jensen's Alpha tested the mangers' skills. With the help of this model one is able to measure whether the manager has a certain skill when it comes to administering a fund. The Jensen's measure showed that some fund managers had skills above those of other managers. Applying the model to an unbalanced dataset gave results showing that 26 out of 55, or about 47%, of the fund managers had some sort of fund management skill. It also showed that even though some of the funds were willing to undertake a higher level of risk, they were not rewarded for it when compared to other funds.

Applying Jensen's Alpha to the balanced dataset showed that 26 out of 52, or 50%, of the fund managers had some sort of fund management skills. The beta values again, showed that even though some funds undertook higher levels of risk than the market portfolio, they were not rewarded by higher excess returns compared to other funds.

The Henriksson-Merton and the Treynor-Mazuy models were applied in order to test for what kind of skills the fund managers' possess.

The application of the Henriksson-Merton model to the unbalanced dataset showed that 28 out of 55, or 51%, of fund managers have security selection abilities. In addition, the model showed that 11 out of 55, or 20%, definitely did not possess market-timing abilities. When applying the same model to the balanced dataset, the results were similar. 30 out of 52, or about 58%, of fund managers appear to have security selection abilities, while 14 out of 52, or about 27%, of funds definitely did not possess market-timing abilities.

The Treynor-Mazuy produced similar results as the Henriksson-Merton model. In the unbalanced dataset 29 out of 55, or about 53%, of the funds had positive security selection abilities, and 11 out of 55, or 20%, of the fund had definite negative market-timing abilities. Applying the Treynor-Mazuy model to the balanced dataset showed

that 35 out of 52, or about 67%, of the funds had positive security selection abilities, and 19 out of 52, or about 37%, had definite negative market-timing abilities.

Jensen (1968) argued that fund managers were not able to outperform the market index even if one did not include the transactions costs. However, applying different portfolio evaluation models to this unique Norwegian dataset produced a different result. According to the results achieved by the Sharpe and Treynor ratios one can conclude that most of the mutual fund managers have been able to earn higher returns than the market index. It appears that the market index performed worse than most of the funds included in this study, contrary to what Malkiel (1995) concluded in his study. Jensen's Alpha shows that about 50% of the funds earn excess return, which implies that around 50% of the fund managers have either security selection abilities, market timing abilities or just are plain lucky. The application of the Henriksson-Merton and the Treynor-Mazuy models, all yielding negative gamma values, confirmed both Treynor and Mazuy's (1966) and Chang and Lewellen's (1984) conclusions that the managers are not able to time the market. But according to this study, one cannot confirm Chang and Lewellen's (1984) findings that the fund managers do not possess security selection skills. Both the Henriksson-Merton model and the Treynor-Mazuy model produced results that indicate that about 50% of the fund managers were actually able to select underpriced stocks.

7.0 REFERENCES

7.1 PUBLISHED ARTICLES

Chang, E. C. and Lewellen, W. G. (1984). Market Timing and Mutual Fund Investment Performance. *The Journal of Business*, Vol. 57, No. 1, pp. 57-72.

Coggin, D. T., Fabozzi, F. J. and Rahman, S. (1993). The Investment Performance of U.S. Equity Pension Fund Managers: An Empirical Investigation. *The Journal of Finance*, Vol. 48, No. 3, pp. 1039-1055.

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, Vol. 25, No. 2, pp. 383-417.

Henriksson, R. D. (1984). Market Timing and Mutual Fund Performance: An Empirical Investigation. *The Journal of Business*, Vol. 57, No. 1, pp. 73-96.

Jensen, M. C. (1968). The Performance of Mutual Funds in the Period 1945-1964. *The Journal of Finance*, Vol. 23, No. 2, pp. 389-416.

Malkiel, B. G. (1995). Returns form Investing in Equity Mutual Funds 1971 to 1991. *The Journal of Finance*, Vol. L, No. 2, pp. 549-572.

Malkiel, B. G. (2003). The Efficient Market Hypothesis and Its Critics. *The Journal of Economic Perspectives*, Vol. 17, No. 1, pp. 59-82.

Merton, R. C. (1981). On Market Timing and Investment Performance. I. An Equilibrium Theory of Value for Market Forecasts. *The Journal of Business*, Vol. 54, No. 3, pp. 363-406.

Pryce, G. (2002). Heteroscedasticity: Testing and correcting in SPSS.

Sharpe, W. F. (1966). Mutual Fund Performance. *The Journal of Business*, Vol. 39, No. 1, pp. 119-138.

Treynor, J. L. (1965). How to Rate Management of Investment Funds. *Harvard Business Review*, Vol. 43, No.1, pp. 63-75.

Treynor, J. L. and Mazuy, K. K. (1966). Can Mutual Funds Outguess the Market?. *Harvard Business Review*, Vol. 44, No. 4, pp.131-136.

7.2 BOOKS

Bodie, Z., Kane, A. and Marcus, A. J. (2009). *Investments* (Eight International Edition). Singapore: McGraw Hill.

Bohn, J. R. and Stein, R. M. (2009). *Active Credit Portfolio Management in Practice*. Hoboken, New Jersey: John Wiley and Sons.

Christopherson, J. A., Carino, D. R. and Ferson, W. E. (2009). *Portfolio Performance Measurement and Benchmarking*. USA: McGraw Hill.

Elton, E. J., Gruber, M. J., Brown, S. J. and Goetzmann, W. N. (2007). *Modern Portfolio Theory and Investment Analysis* (Seventh edition). Hoboken, New Jersey: John Wiley and Sons, Inc.

Greene, W. H. (2003). *Econometric Analysis* (Fifth Edition). Upper Saddle River, New Jersey: Prentice Hall, Pearson Education International.

Keller, G. and Warrack, B. (2003). *Statistics for Management and Economics*. California: Thomsons Learning, Inc.

Gripsrud, G., Olsson, U. H. and Silkoset, R. (2007). *Metode og dataanalyse: Med focus på beslutninger i bedrifter*. Kristiansand: Høgskoleforlaget.

Reilly, F. K. and Brown, K. C. (2003). *Investment Analysis and Portfolio Management* (Seventh edition). Mason, Ohio: Thomson South-Western.

Stock, J. H. and Watson, M. W. (2007). *Introduction to Econometrics* (Second Edition). Boston, Massachusetts: Pearson Education, Inc.

Treynor, J. L. (2007). *Treynor on Institutional Investing*. Hoboken, New Jersey: John Wiley and Sons.

7.3 INTERNET

NIBOR: http://www.norges-bank.no/templates/article____11598.aspx#nibor

Oslo Børs: www.oslobors.no

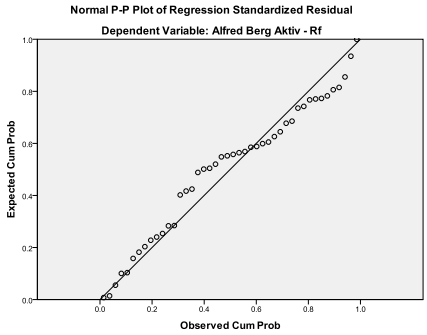
VFF – Investments in 2010:
http://vff.no/500+milliarder+kroner+i+verdipapirfond.9UFRHKWS.ips

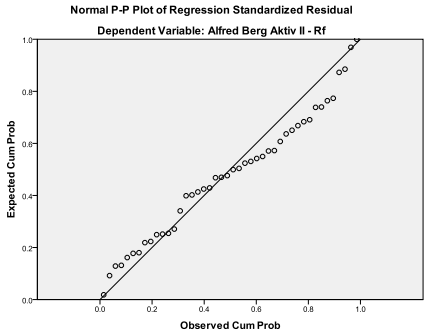
VFF – Definition of funds:
http://www.altomfond.no/Fondshandboken/Hva_er_verdipapirfond+/

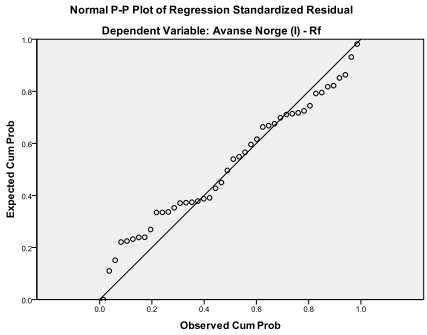
8.0 APPENDIX

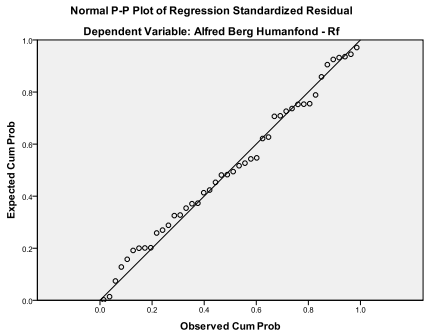
8.1 NORMAL DISTRIBUTION OF THE ERROR TERM

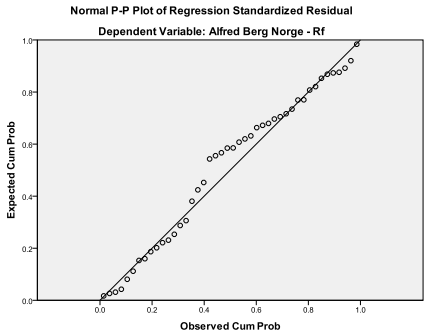
8.1.1 Unbalanced Jensen's Alpha

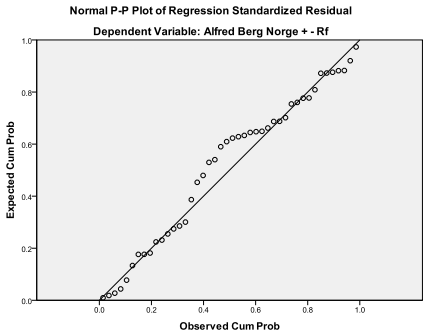


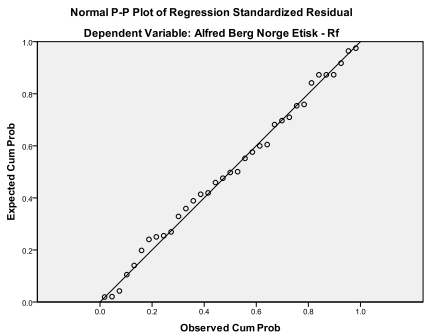


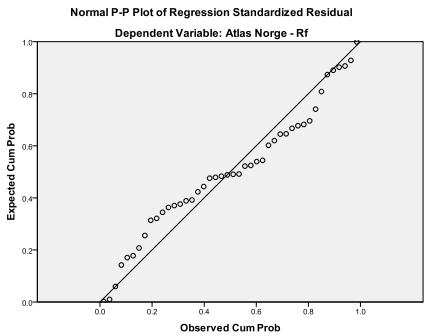


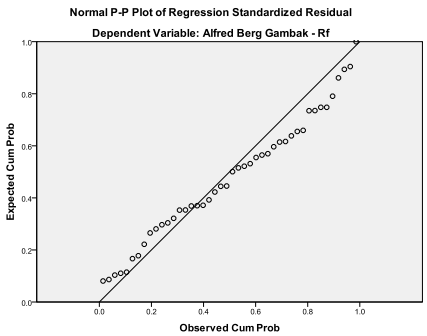


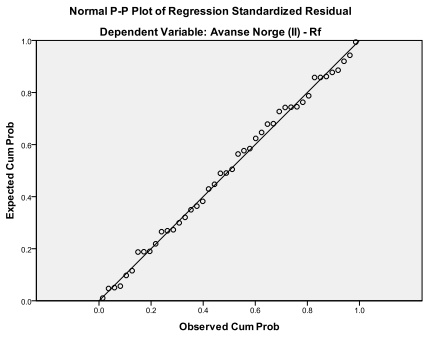


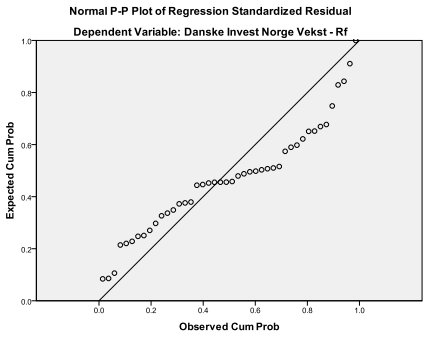


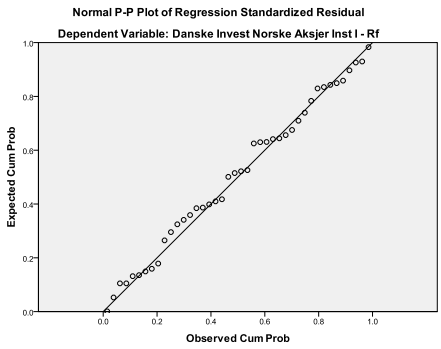


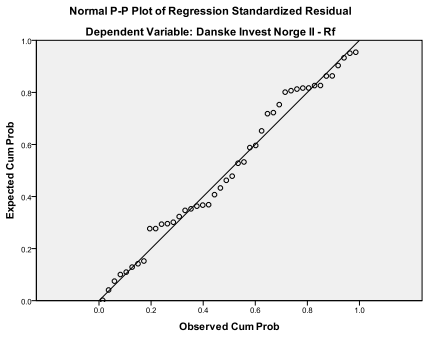


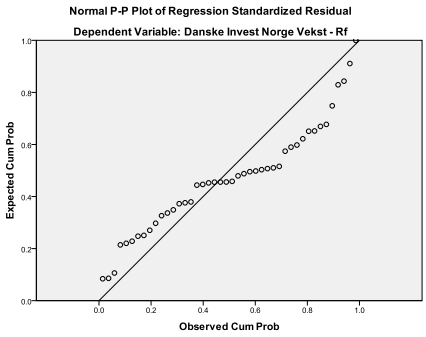


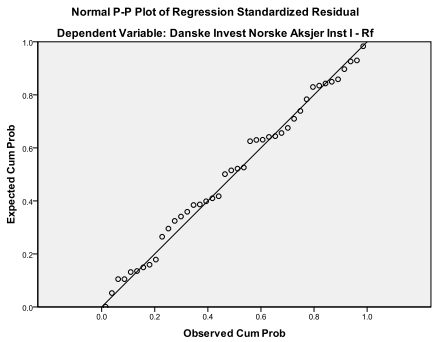

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Avanse Norge (II) - Rf
Expected Cum Prob
Observed Cum Prob

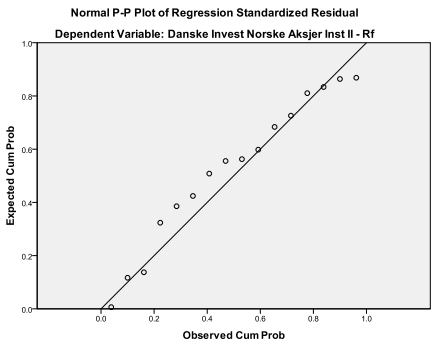

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge Vekst - Rf
Expected Cum Prob
Observed Cum Prob

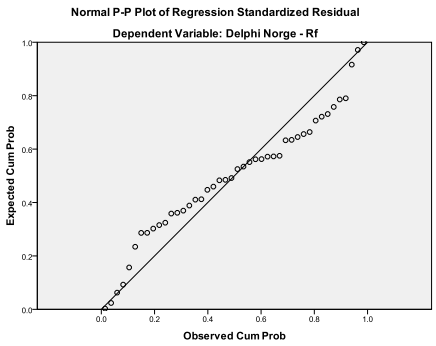

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norske Aksjer Inst I - Rf
Expected Cum Prob
Observed Cum Prob

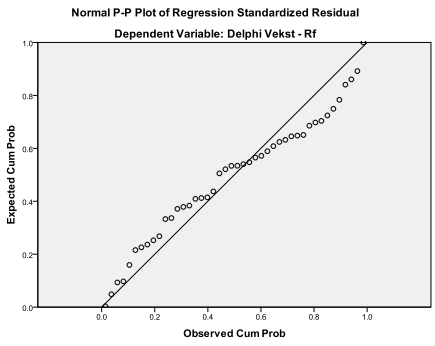

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge II - Rf
Expected Cum Prob
Observed Cum Prob

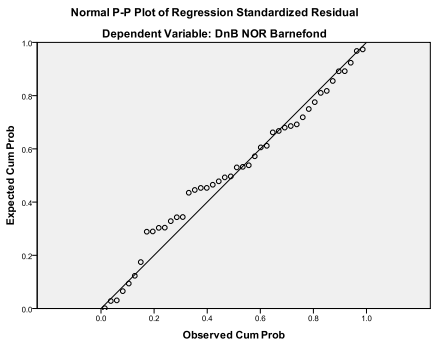

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge Vekst - Rf
Expected Cum Prob
Observed Cum Prob

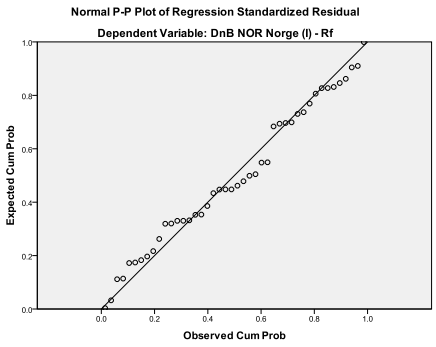

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norske Aksjer Inst I - Rf
Expected Cum Prob
Observed Cum Prob

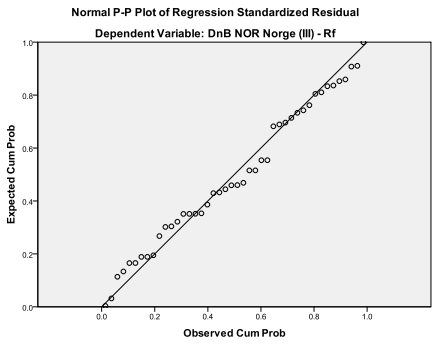

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norske Aksjer Inst II - Rf
Expected Cum Prob
Observed Cum Prob

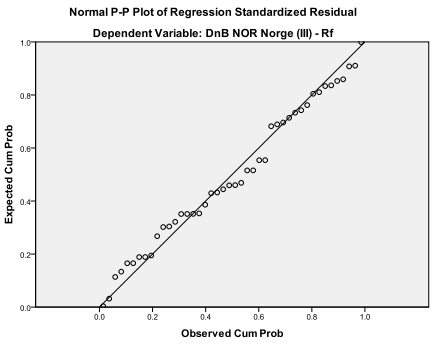

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Norge - Rf
Expected Cum Prob
Observed Cum Prob

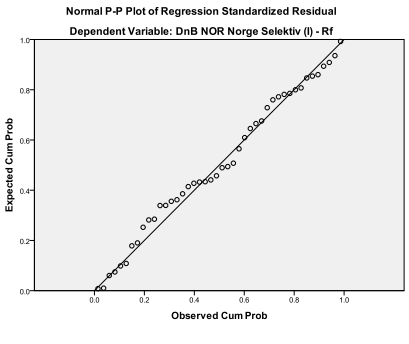

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Vekst - Rf
Expected Cum Prob
Observed Cum Prob

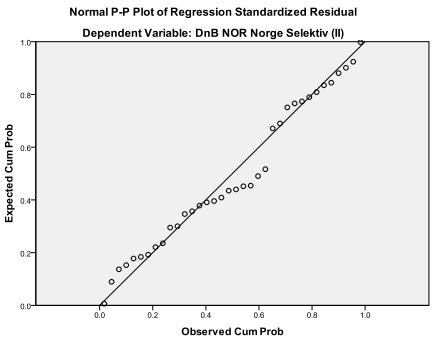

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Barnefond
Expected Cum Prob
Observed Cum Prob

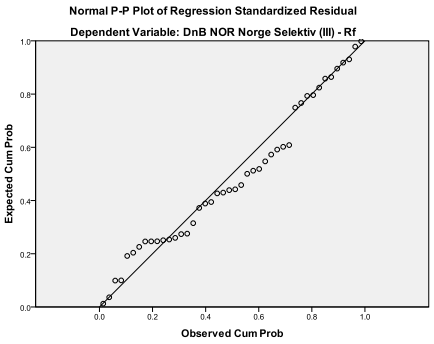

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (I) - Rf
Expected Cum Prob
Observed Cum Prob

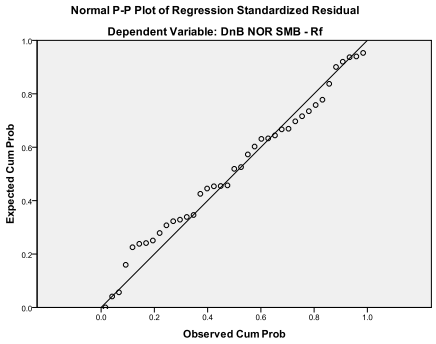

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (III) - Rf
Expected Cum Prob
Observed Cum Prob

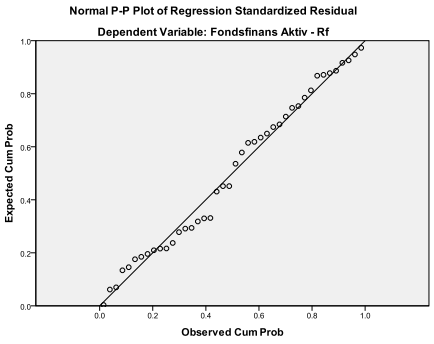

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (III) - Rf
Expected Cum Prob
Observed Cum Prob

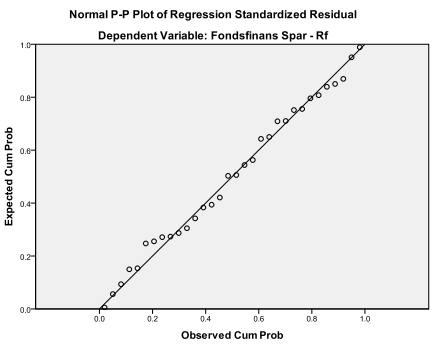

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (I) - Rf
Expected Cum Prob
Observed Cum Prob

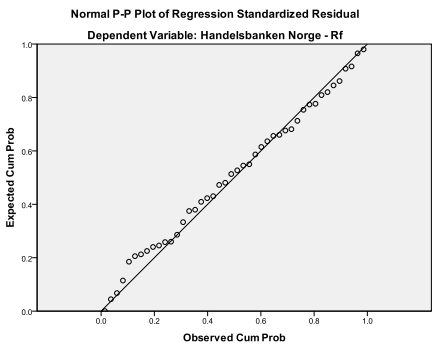

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (II)
Expected Cum Prob
Observed Cum Prob

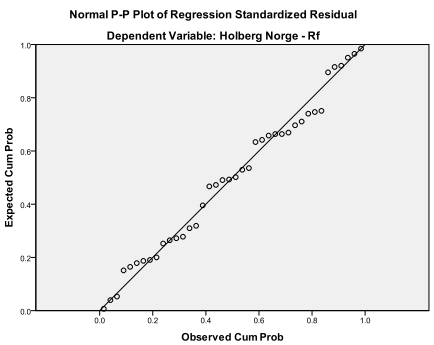

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (III) - Rf
Expected Cum Prob
Observed Cum Prob

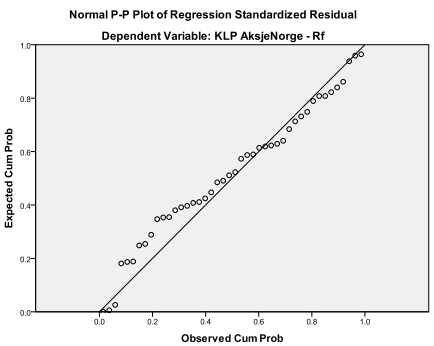

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR SMB - Rf
Expected Cum Prob
Observed Cum Prob

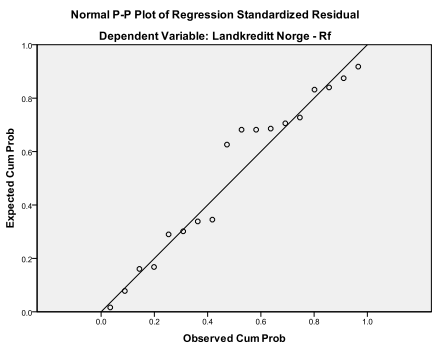

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

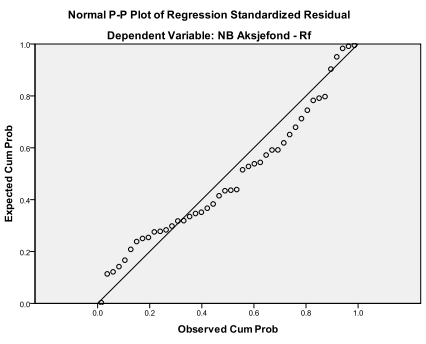

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Spar - Rf
Expected Cum Prob
Observed Cum Prob

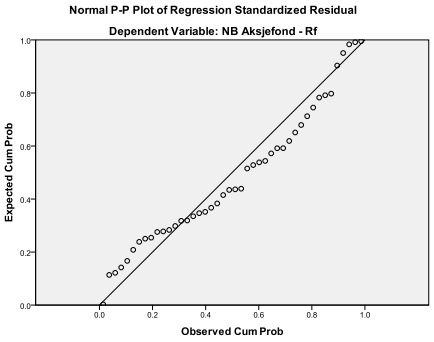

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Handelsbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

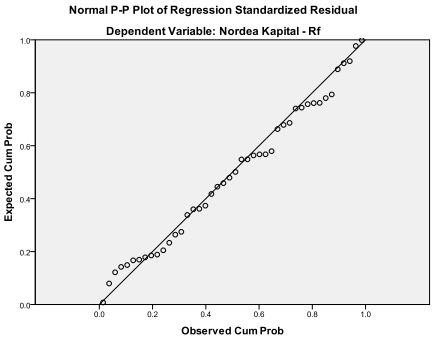

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Holberg Norge - Rf
Expected Cum Prob
Observed Cum Prob

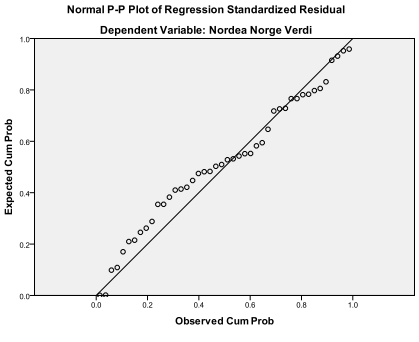

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: KLP AksjeNorge - Rf
Expected Cum Prob
Observed Cum Prob

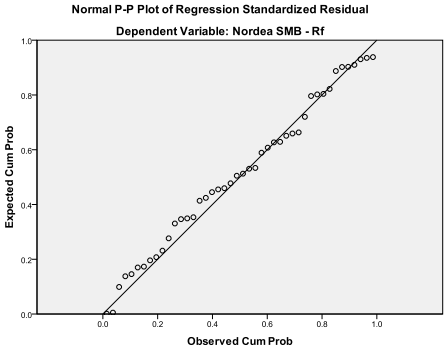

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Landkreditt Norge - Rf
Expected Cum Prob
Observed Cum Prob

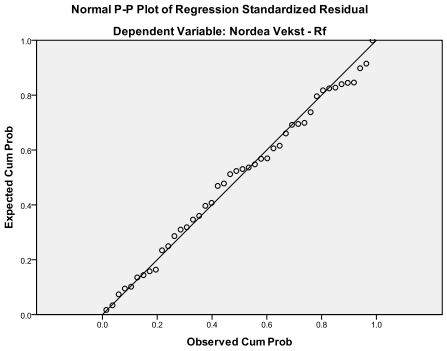

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: NB Aksjefond - Rf
Expected Cum Prob
Observed Cum Prob

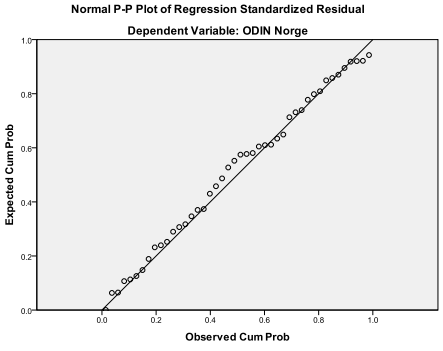

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: NB Aksjefond - Rf
Expected Cum Prob
Observed Cum Prob

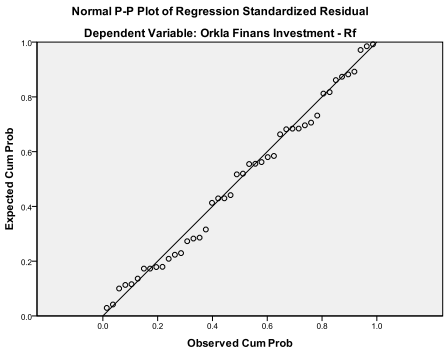

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Kapital - Rf
Expected Cum Prob
Observed Cum Prob

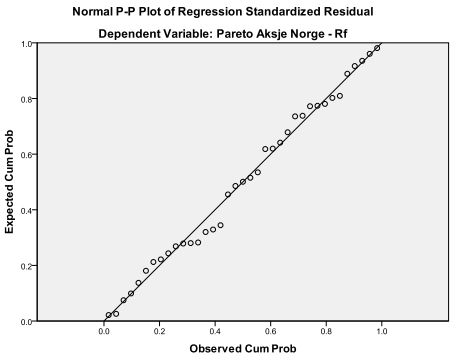

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Norge Verdi
Expected Cum Prob
Observed Cum Prob

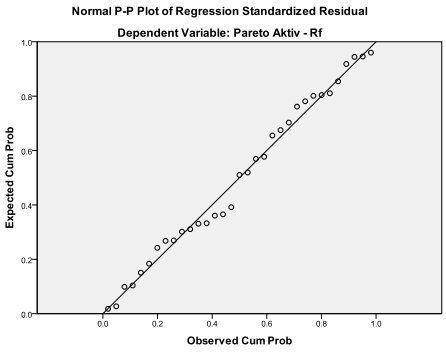

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea SMB - Rf
Expected Cum Prob
Observed Cum Prob

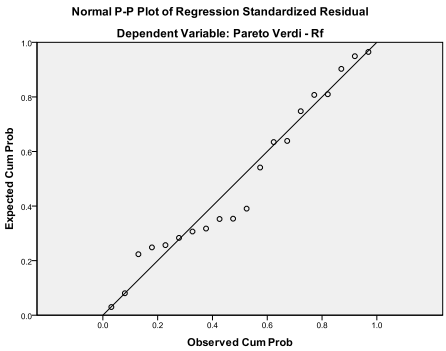

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Vekst - Rf
Expected Cum Prob
Observed Cum Prob

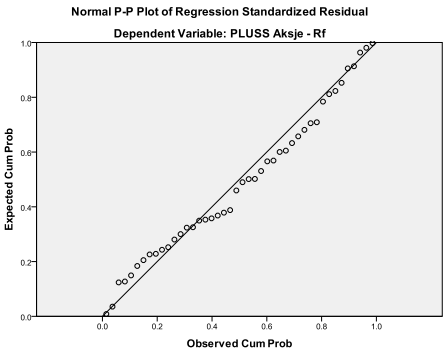

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: ODIN Norge
Expected Cum Prob
Observed Cum Prob

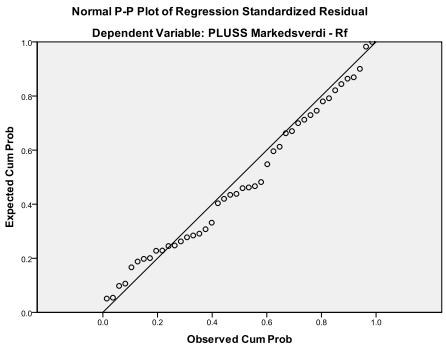

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Orkla Finans Investment - Rf
Expected Cum Prob
Observed Cum Prob

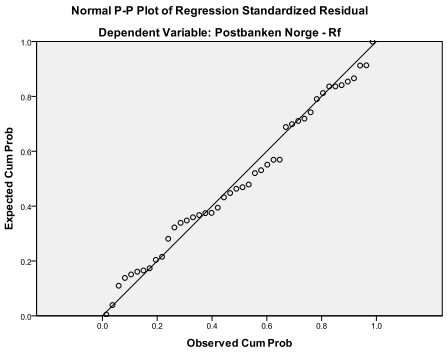

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aksje Norge - Rf
Expected Cum Prob
Observed Cum Prob

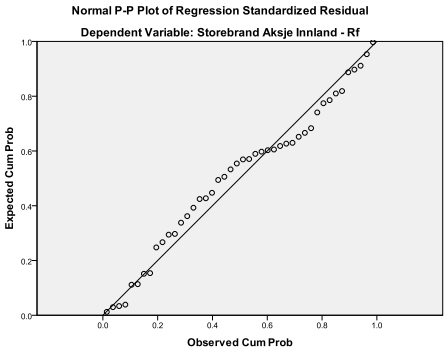

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

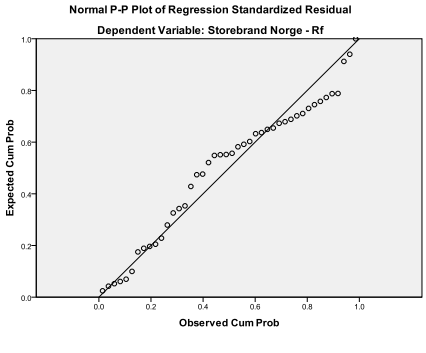

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Verdi - Rf
Expected Cum Prob
Observed Cum Prob

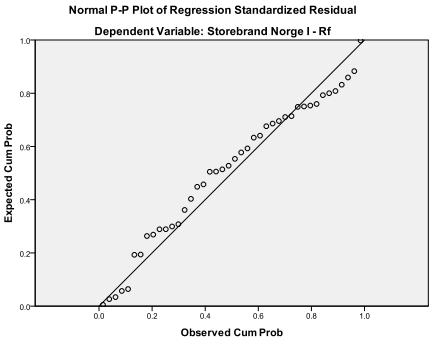

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Aksje - Rf
Expected Cum Prob
Observed Cum Prob

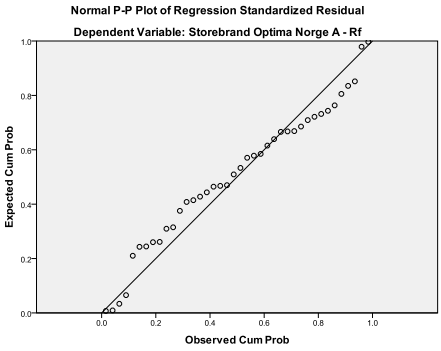

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Markedsverdi - Rf
Expected Cum Prob
Observed Cum Prob

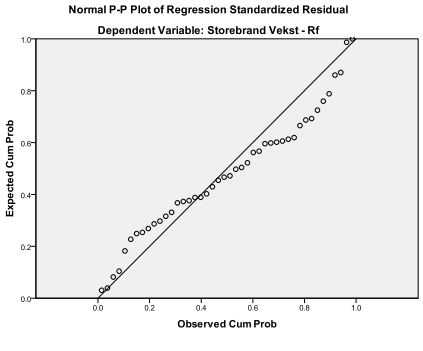

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Postbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

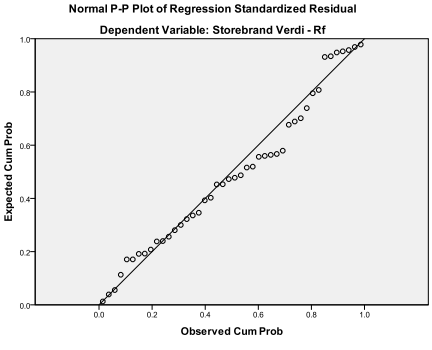

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Aksje Innland - Rf
Expected Cum Prob
Observed Cum Prob

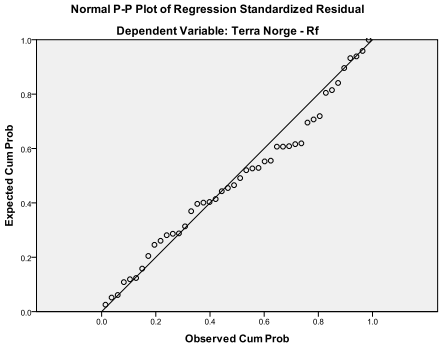

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge - Rf
Expected Cum Prob
Observed Cum Prob

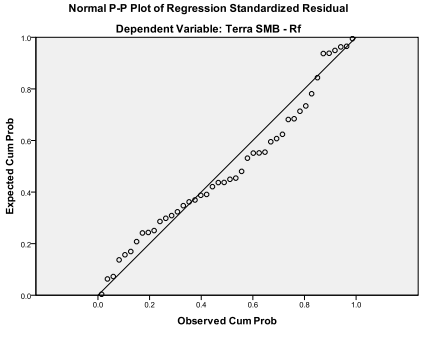

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge I - Rf
Expected Cum Prob
Observed Cum Prob

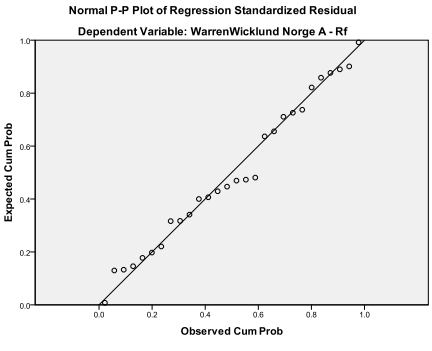

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Optima Norge A - Rf
Expected Cum Prob
Observed Cum Prob


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Vekst - Rf
Expected Cum Prob
Observed Cum Prob

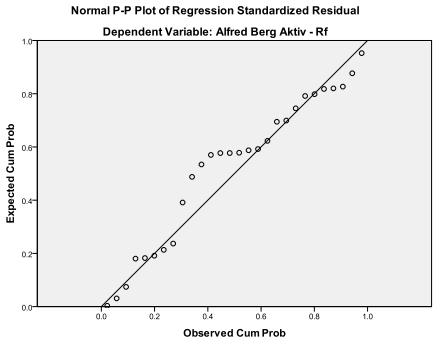

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Verdi - Rf
Expected Cum Prob
Observed Cum Prob

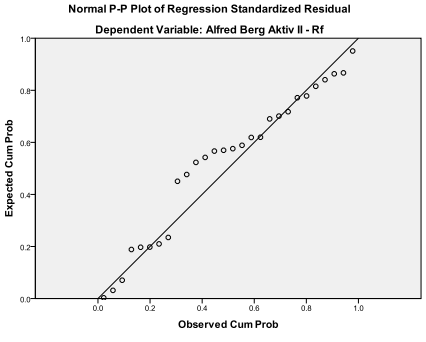

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra Norge - Rf
Expected Cum Prob
Observed Cum Prob

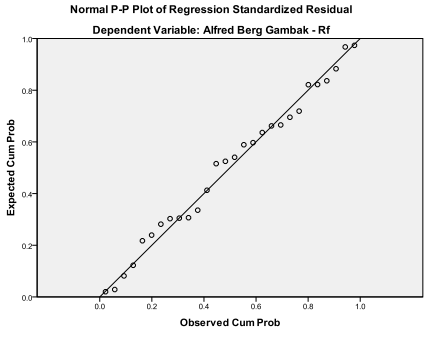

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra SMB - Rf
Expected Cum Prob
Observed Cum Prob

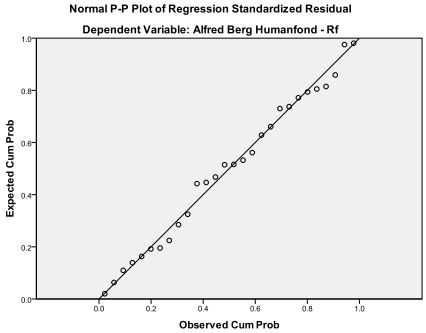

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: WarrenWicklund Norge A - Rf
Expected Cum Prob
Observed Cum Prob

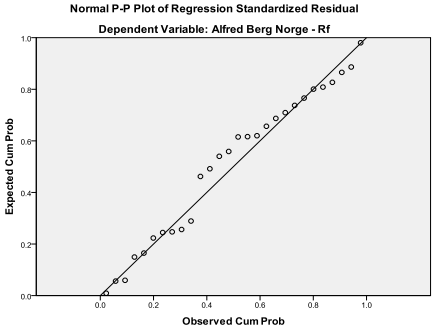
8.1.2 Balanced Jensen's Alpha

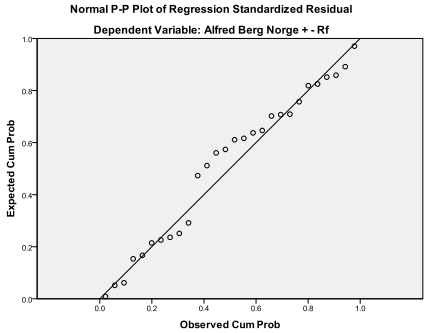


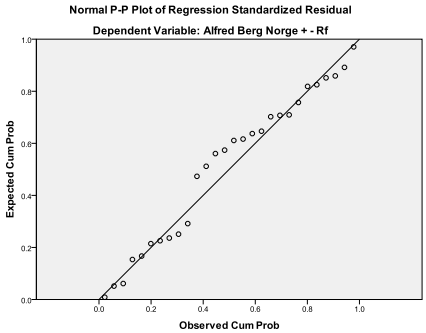


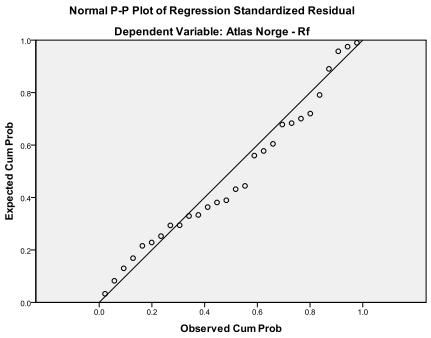


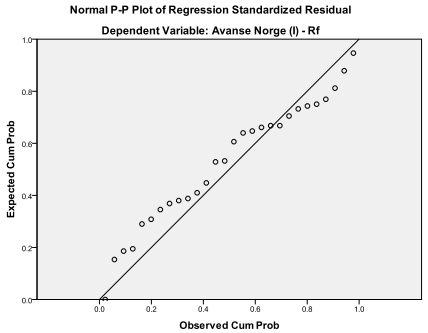


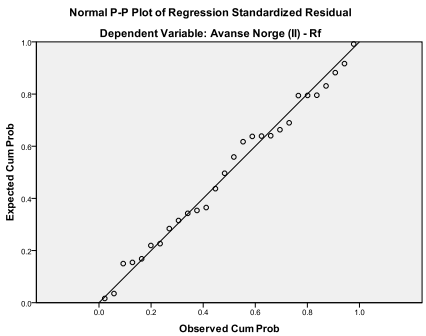


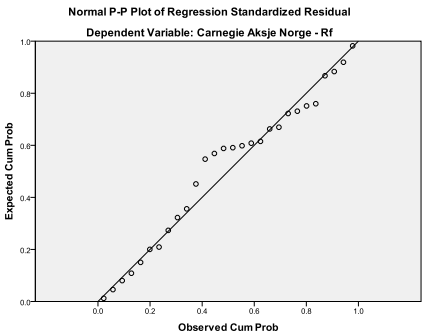


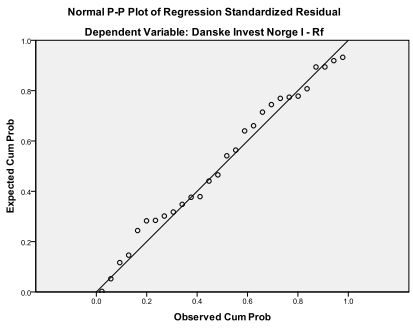


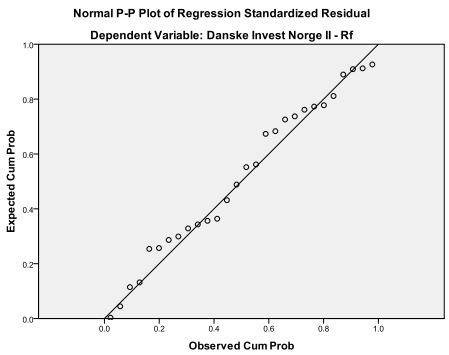


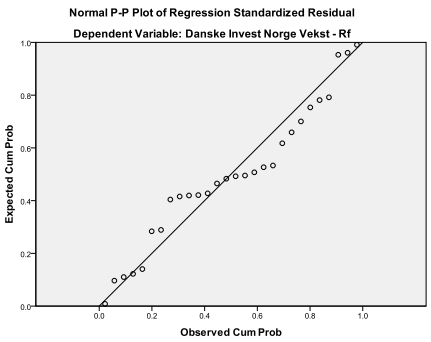


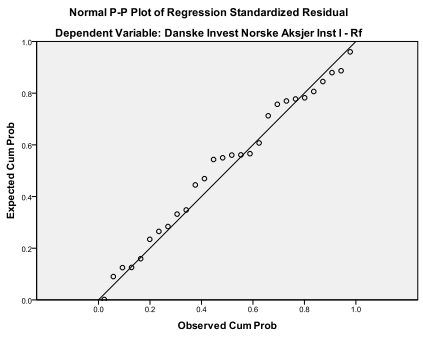


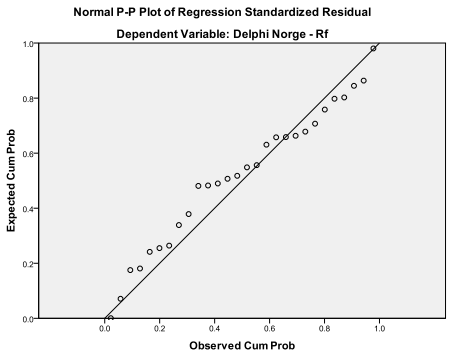


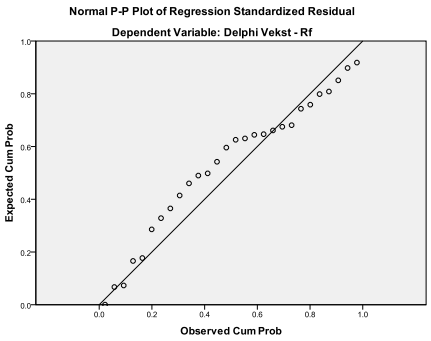


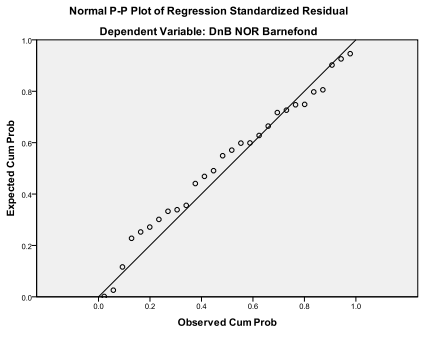

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge II - Rf
Expected Cum Prob
Observed Cum Prob

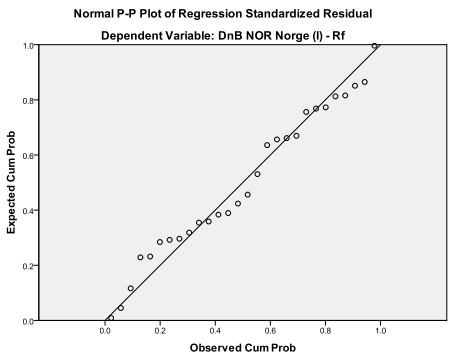

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge Vekst - Rf
Expected Cum Prob
Observed Cum Prob

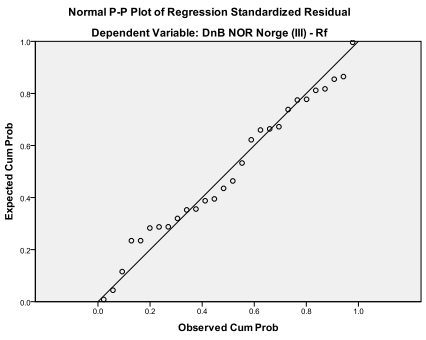

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norske Aksjer Inst I - Rf
Expected Cum Prob
Observed Cum Prob

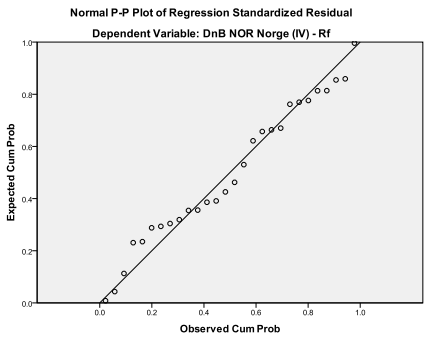

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Norge - Rf
Expected Cum Prob
Observed Cum Prob

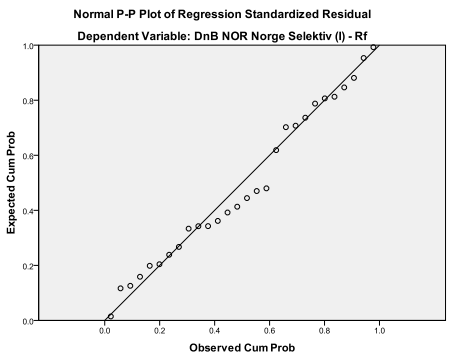

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Vekst - Rf
Expected Cum Prob
Observed Cum Prob

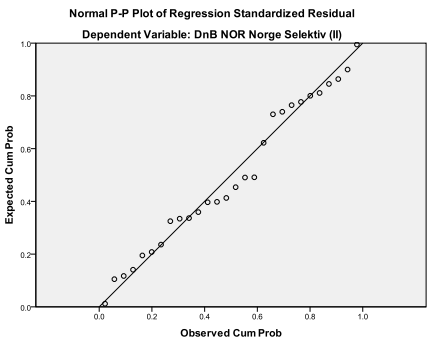

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Barnefond
Expected Cum Prob
Observed Cum Prob

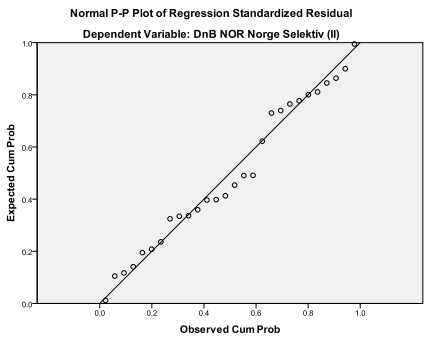

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (I) - Rf
Expected Cum Prob
Observed Cum Prob

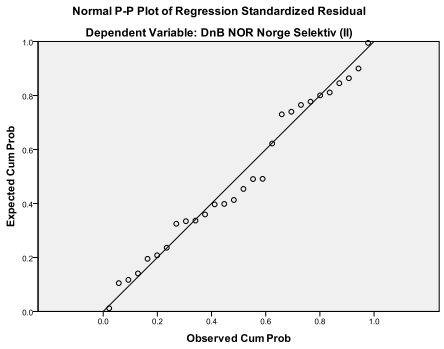

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (III) - Rf
Expected Cum Prob
Observed Cum Prob

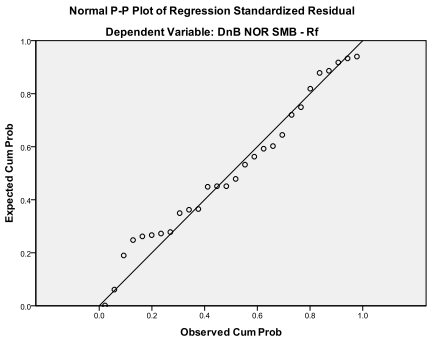

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (IV) - Rf
Expected Cum Prob
Observed Cum Prob

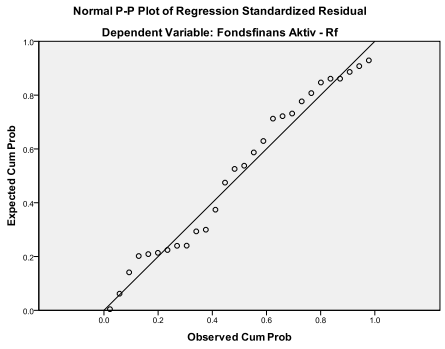

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (I) - Rf
Expected Cum Prob
Observed Cum Prob

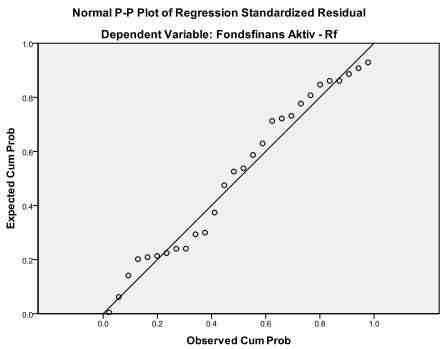

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (II)
Expected Cum Prob
Observed Cum Prob

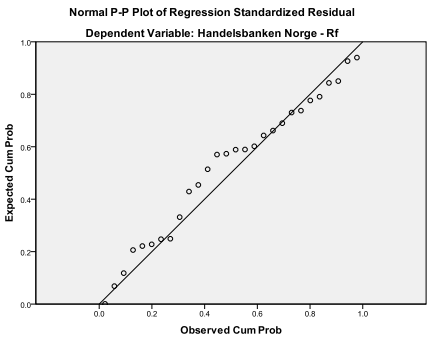

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (II)
Expected Cum Prob
Observed Cum Prob

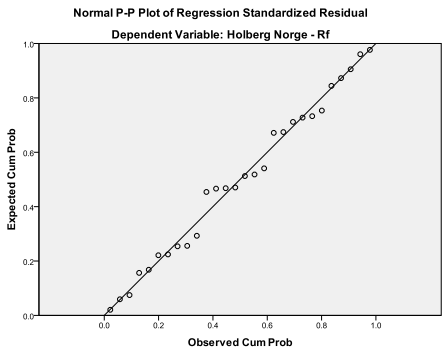

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (II)
Expected Cum Prob
Observed Cum Prob

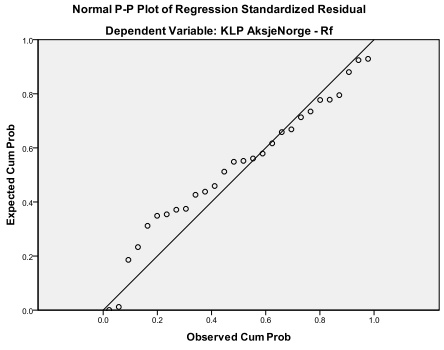

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR SMB - Rf
Expected Cum Prob
Observed Cum Prob

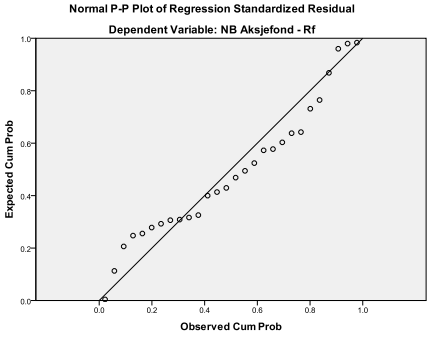

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

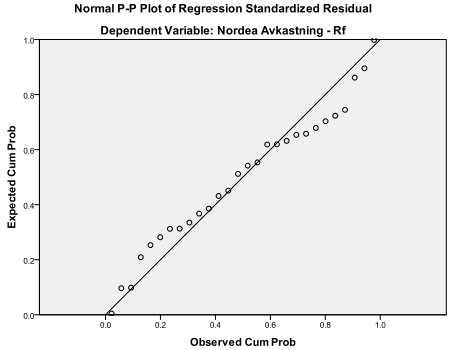

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

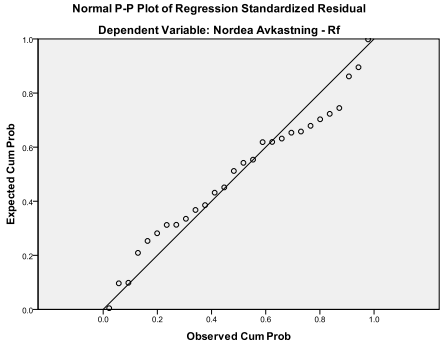

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Handelsbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

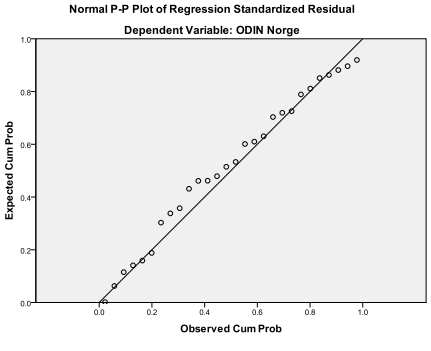

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Holberg Norge - Rf
Expected Cum Prob
Observed Cum Prob

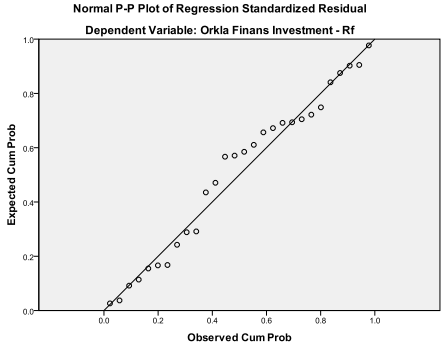

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: KLP AksjeNorge - Rf
Expected Cum Prob
Observed Cum Prob

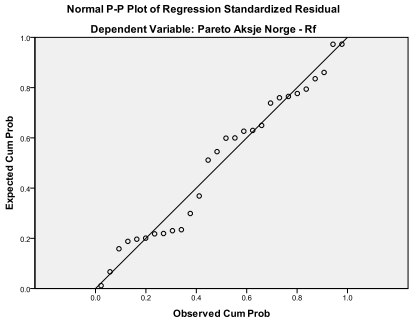

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: NB Aksjefond - Rf
Expected Cum Prob
Observed Cum Prob

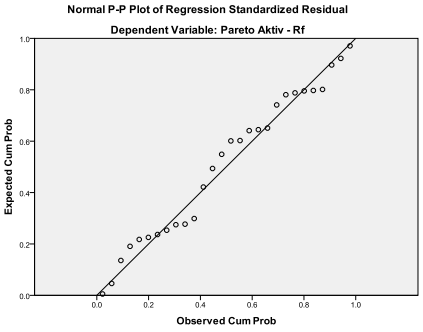

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Avkastning - Rf
Expected Cum Prob
Observed Cum Prob

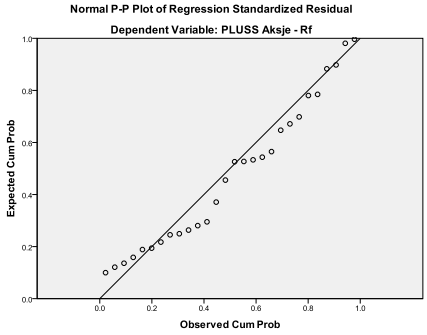

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Avkastning - Rf
Expected Cum Prob
Observed Cum Prob

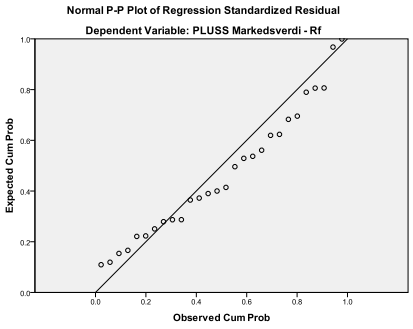

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: ODIN Norge
Expected Cum Prob
Observed Cum Prob

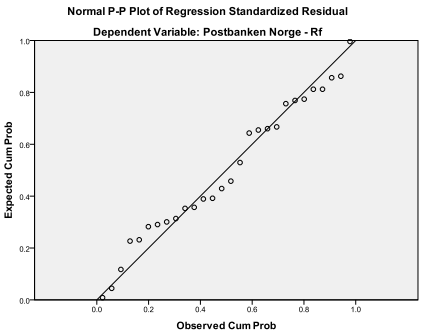

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Orkla Finans Investment - Rf
Expected Cum Prob
Observed Cum Prob

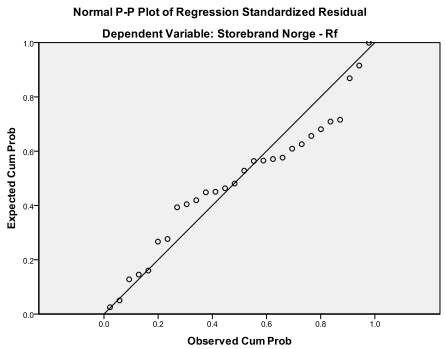

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aksje Norge - Rf
Expected Cum Prob
Observed Cum Prob

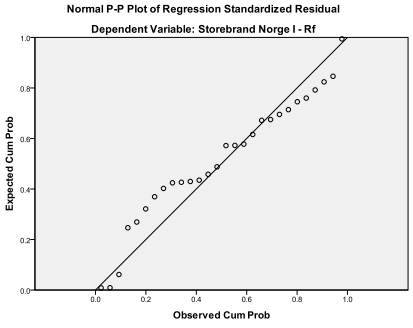

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

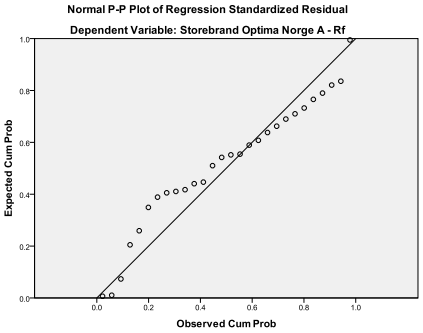

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Aksje - Rf
Expected Cum Prob
Observed Cum Prob

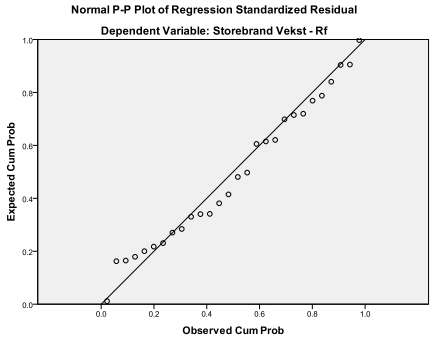

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Markedsverdi - Rf
Expected Cum Prob
Observed Cum Prob

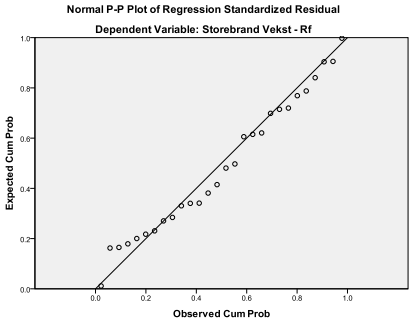

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Postbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

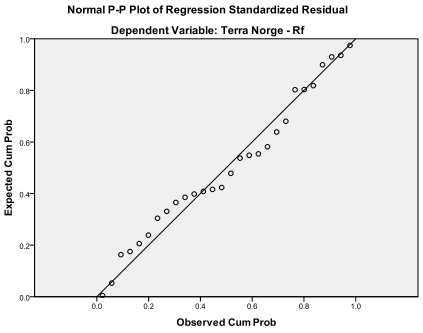

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge - Rf
Expected Cum Prob
Observed Cum Prob

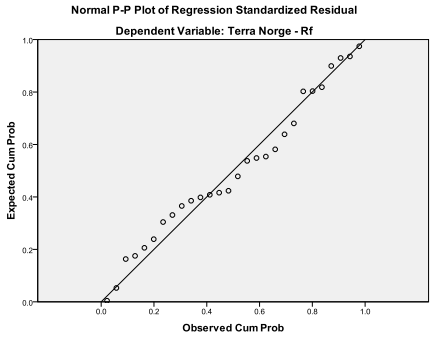

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge I - Rf
Expected Cum Prob
Observed Cum Prob

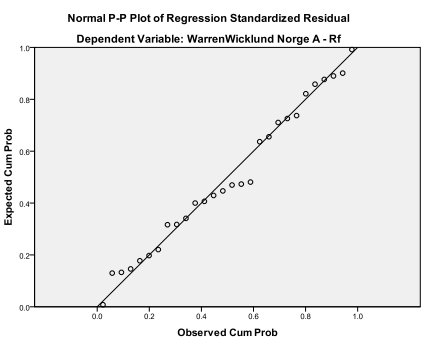

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Optima Norge A - Rf
Expected Cum Prob
Observed Cum Prob


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Vekst - Rf
Expected Cum Prob
Observed Cum Prob

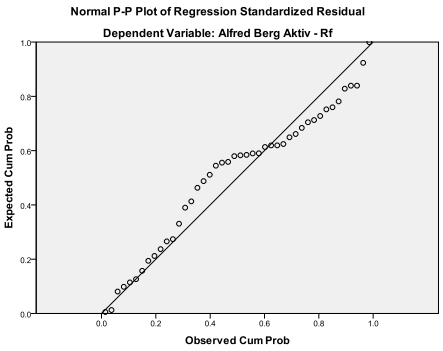

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Vekst - Rf
Expected Cum Prob
Observed Cum Prob

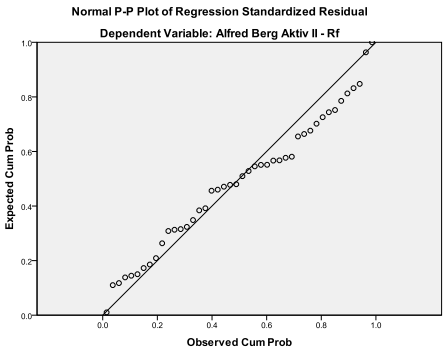

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra Norge - Rf
Expected Cum Prob
Observed Cum Prob

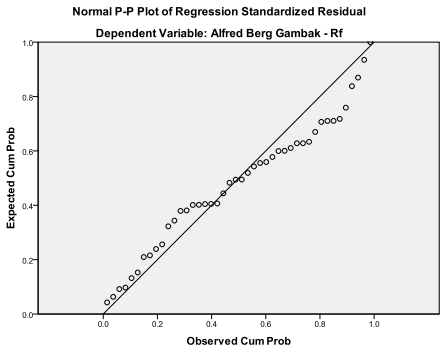

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra Norge - Rf
Expected Cum Prob
Observed Cum Prob

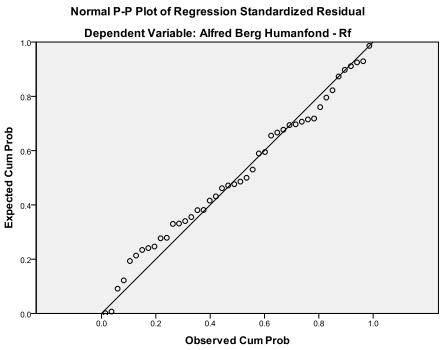

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: WarrenWicklund Norge A - Rf
Expected Cum Prob
Observed Cum Prob

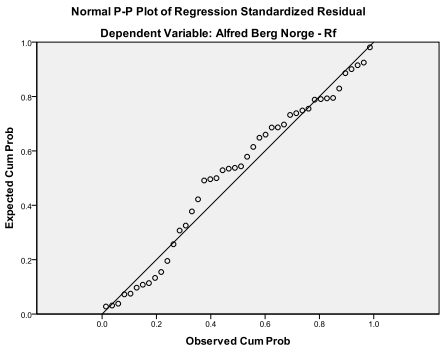
8.1.3 Unbalanced Henriksson-Merton

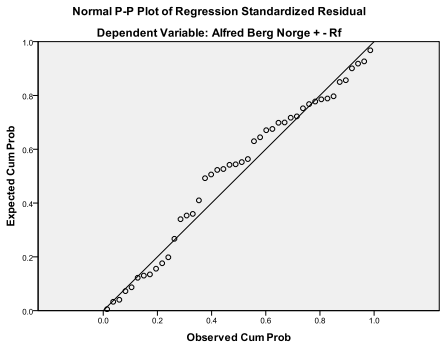


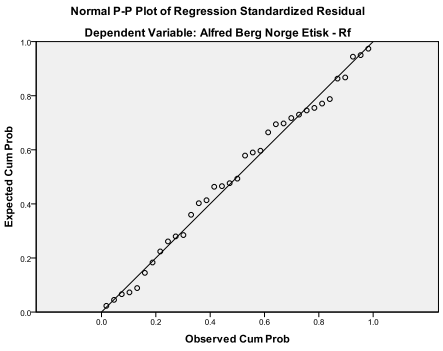


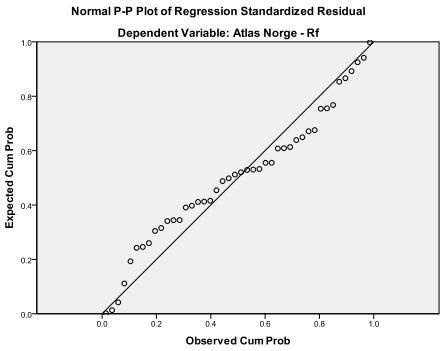


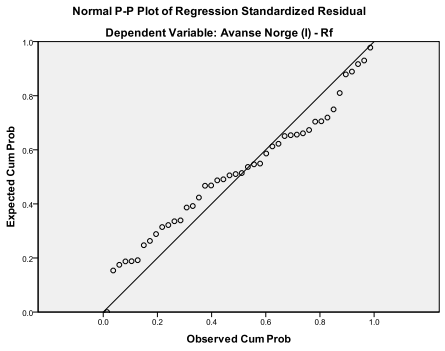


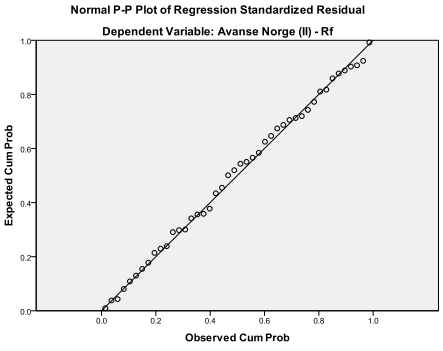


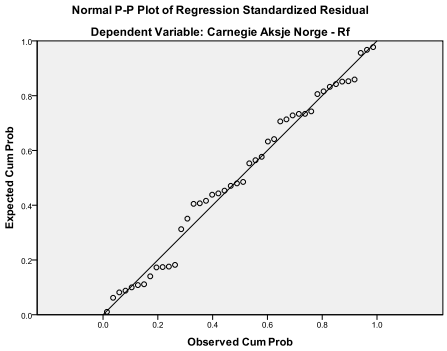


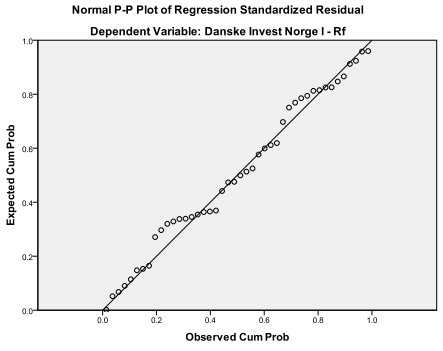


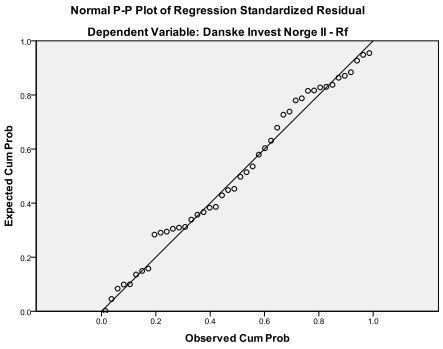


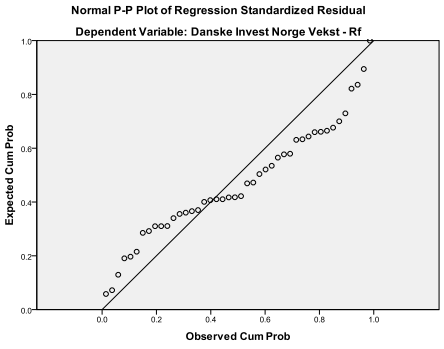


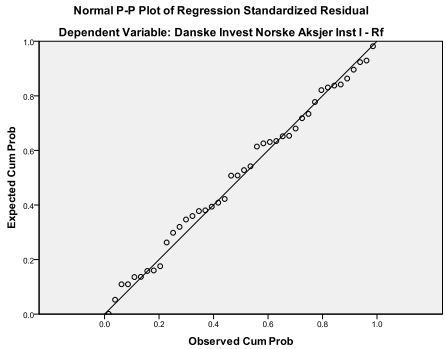


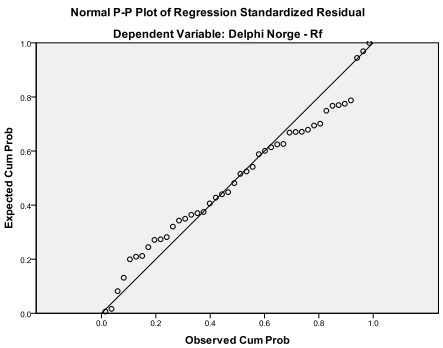


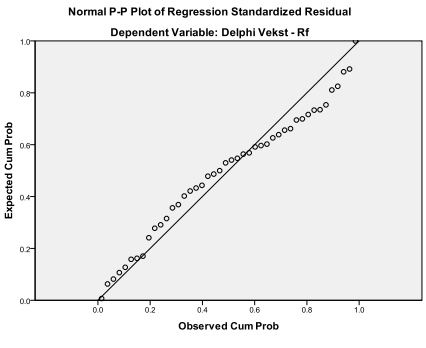


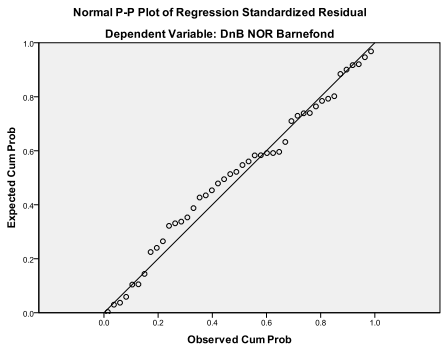

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge II - Rf
Expected Cum Prob
Observed Cum Prob

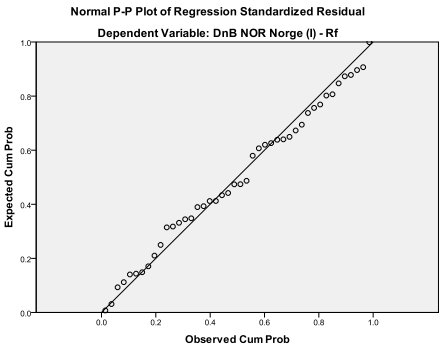

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge Vekst - Rf
Expected Cum Prob
Observed Cum Prob

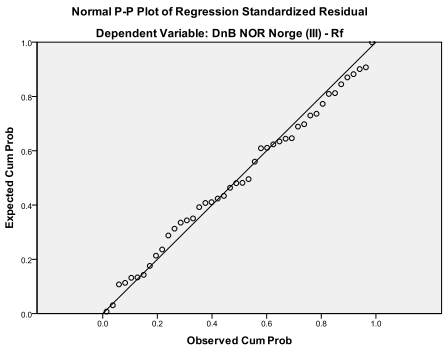

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norske Aksjer Inst I - Rf
Expected Cum Prob
Observed Cum Prob

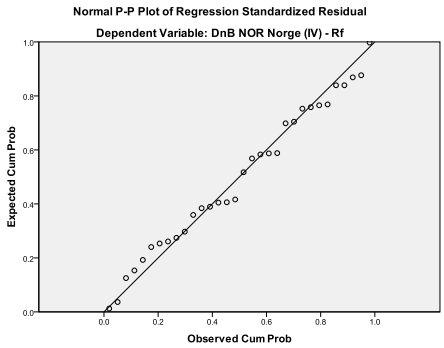

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Norge - Rf
Expected Cum Prob
Observed Cum Prob

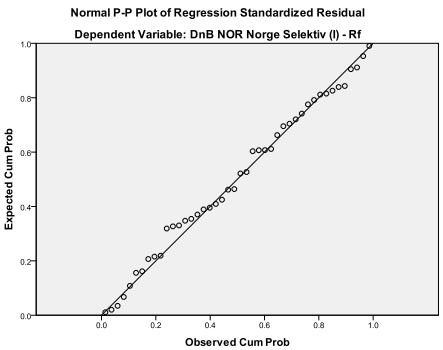

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Vekst - Rf
Expected Cum Prob
Observed Cum Prob

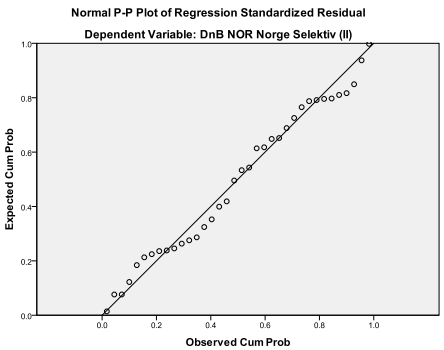

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Barnefond
Expected Cum Prob
Observed Cum Prob

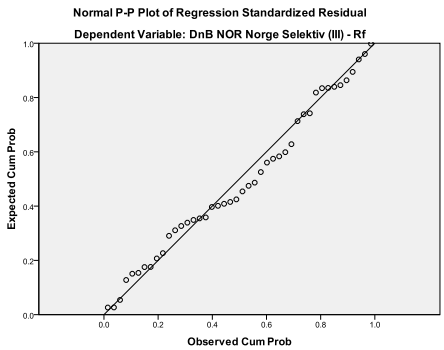

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (I) - Rf
Expected Cum Prob
Observed Cum Prob

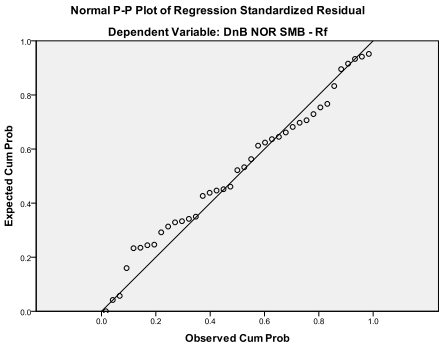

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (III) - Rf
Expected Cum Prob
Observed Cum Prob

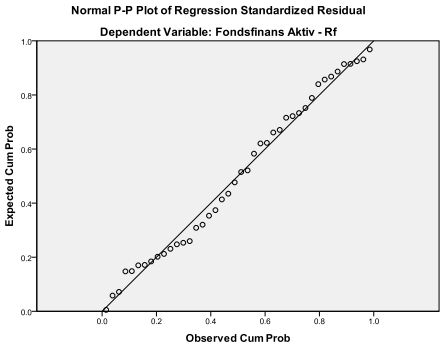

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (IV) - Rf
Expected Cum Prob
Observed Cum Prob

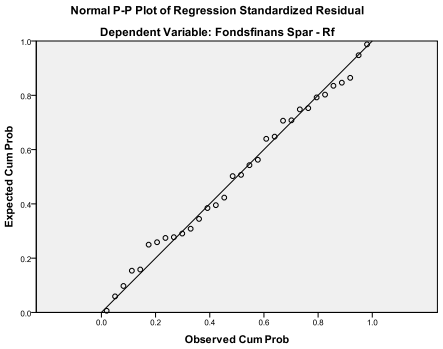

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (I) - Rf
Expected Cum Prob
Observed Cum Prob

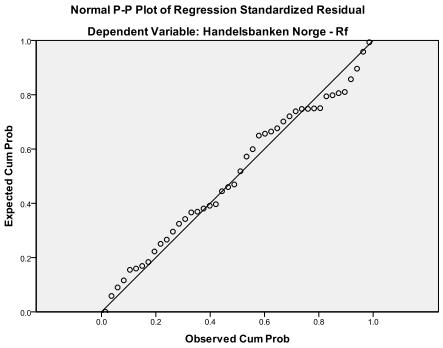

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (II)
Expected Cum Prob
Observed Cum Prob

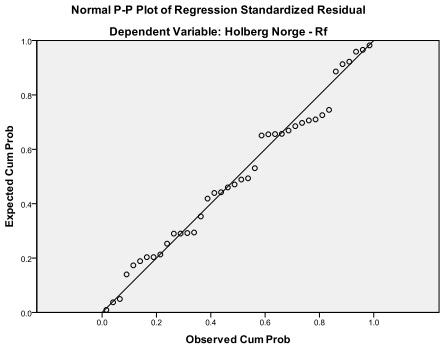

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (III) - Rf
Expected Cum Prob
Observed Cum Prob

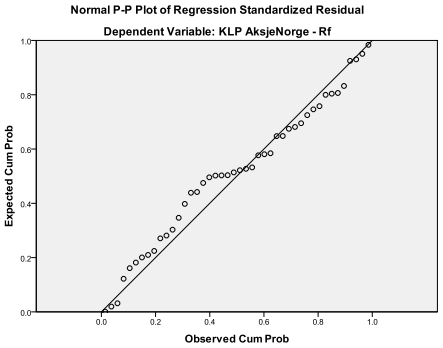

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR SMB - Rf
Expected Cum Prob
Observed Cum Prob

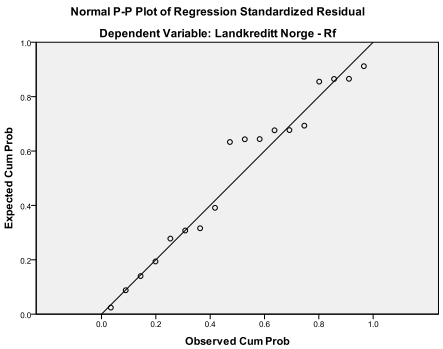

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

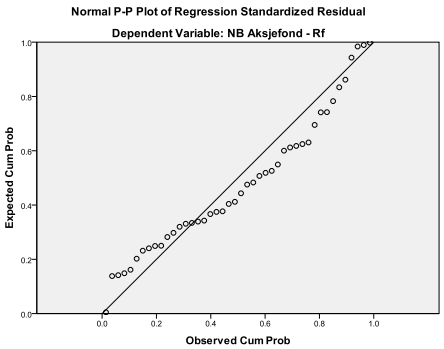

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Spar - Rf
Expected Cum Prob
Observed Cum Prob

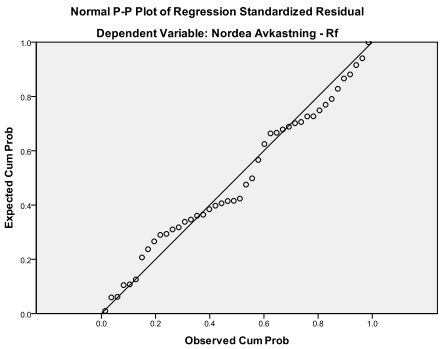

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Handelsbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

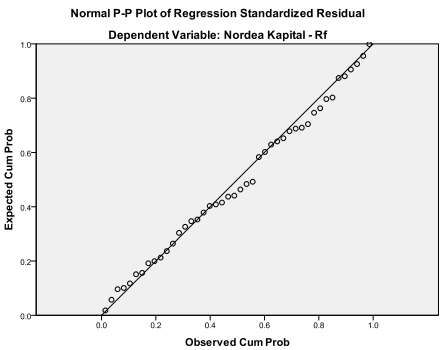

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Holberg Norge - Rf
Expected Cum Prob
Observed Cum Prob

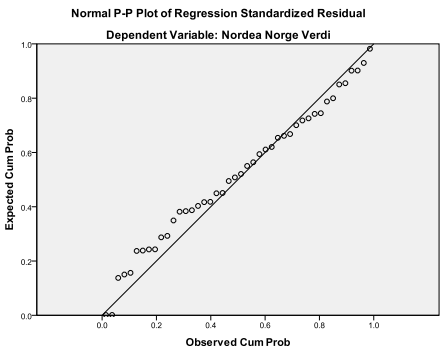

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: KLP AksjeNorge - Rf
Expected Cum Prob
Observed Cum Prob

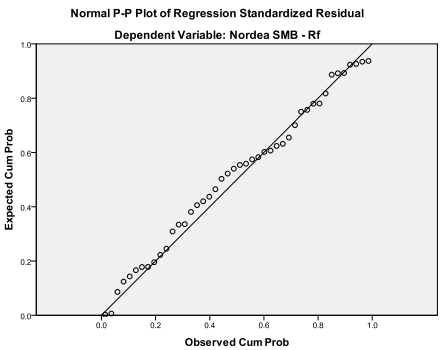

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Landkreditt Norge - Rf
Expected Cum Prob
Observed Cum Prob

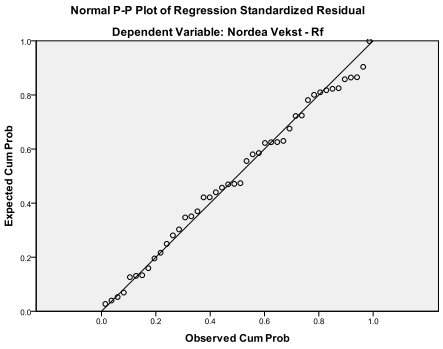

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: NB Aksjefond - Rf
Expected Cum Prob
Observed Cum Prob

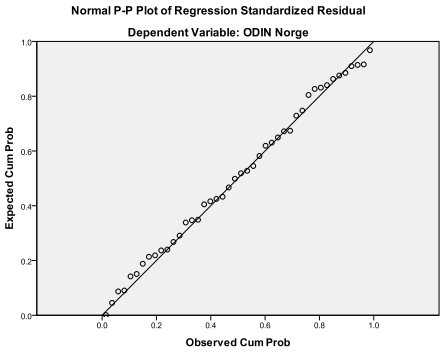

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Avkastning - Rf
Expected Cum Prob
Observed Cum Prob

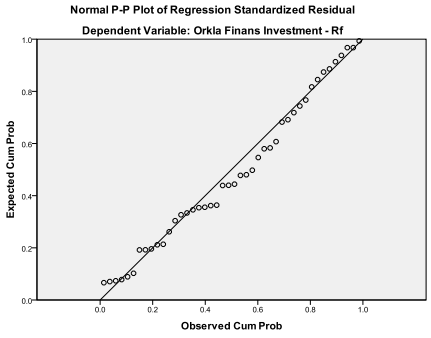

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Kapital - Rf
Expected Cum Prob
Observed Cum Prob

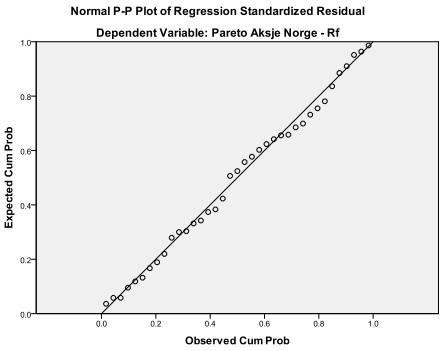

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Norge Verdi
Expected Cum Prob
Observed Cum Prob

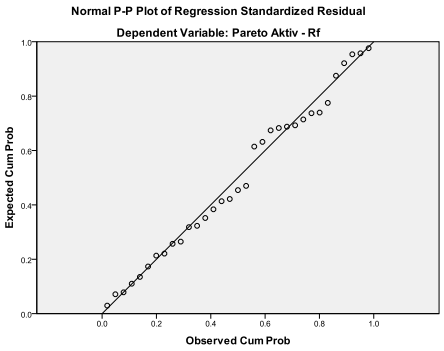

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea SMB - Rf
Expected Cum Prob
Observed Cum Prob

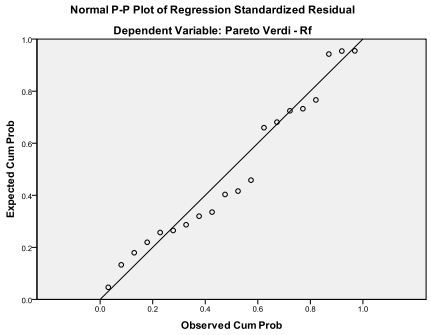

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Vekst - Rf
Expected Cum Prob
Observed Cum Prob

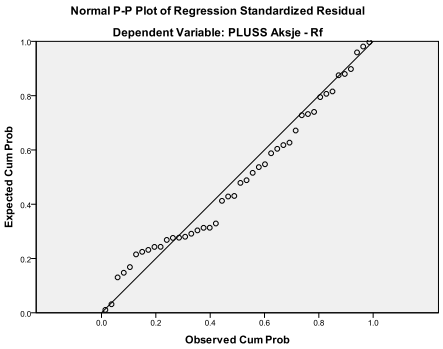

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: ODIN Norge
Expected Cum Prob
Observed Cum Prob

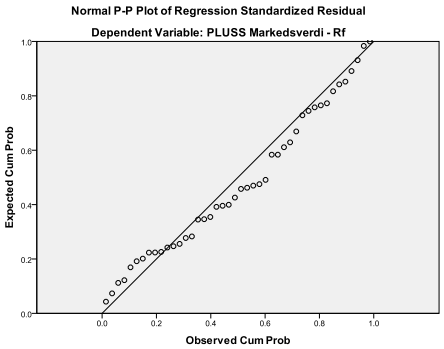

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Orkla Finans Investment - Rf
Expected Cum Prob
Observed Cum Prob

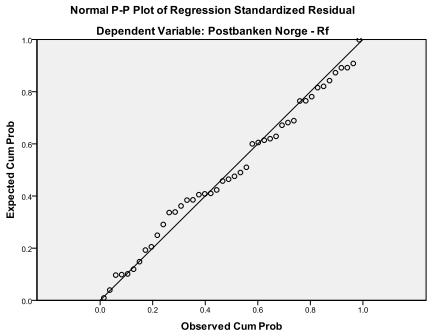

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aksje Norge - Rf
Expected Cum Prob
Observed Cum Prob

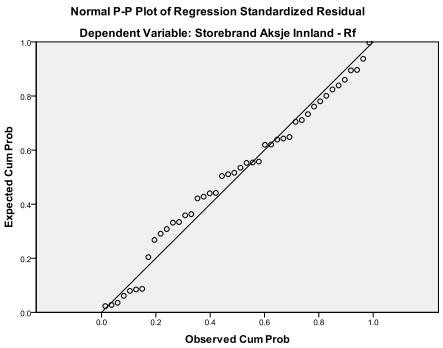

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

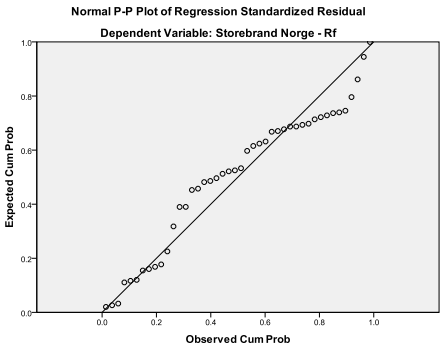

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Verdi - Rf
Expected Cum Prob
Observed Cum Prob

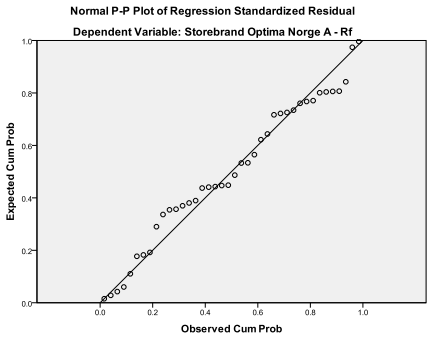

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Aksje - Rf
Expected Cum Prob
Observed Cum Prob

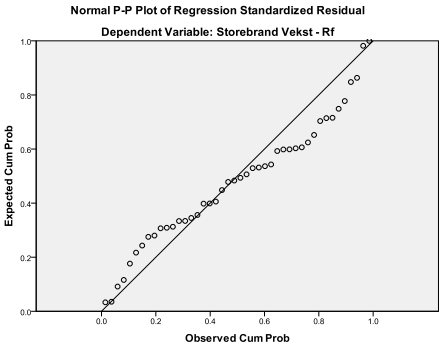

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Markedsverdi - Rf
Expected Cum Prob
Observed Cum Prob

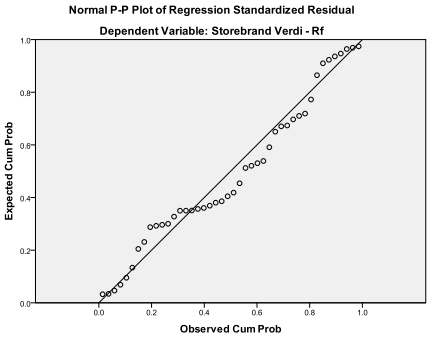

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Postbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

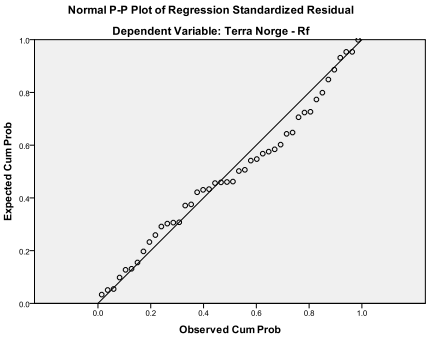

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Aksje Innland - Rf
Expected Cum Prob
Observed Cum Prob

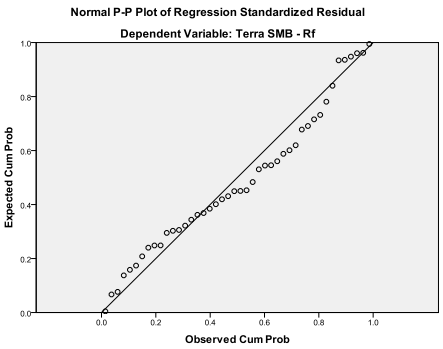

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge - Rf
Expected Cum Prob
Observed Cum Prob

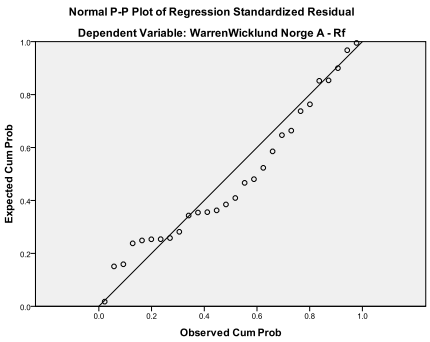

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Optima Norge A - Rf
Expected Cum Prob
Observed Cum Prob


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Vekst - Rf
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

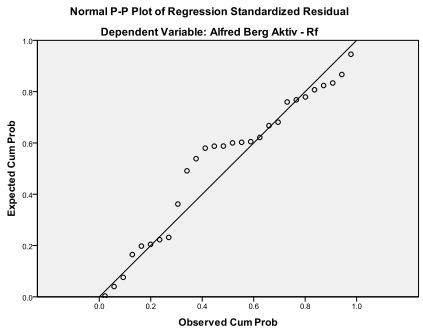

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Verdi - Rf
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

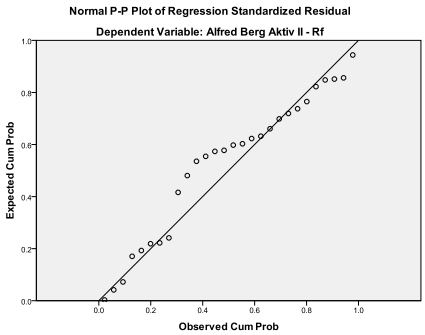

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra Norge - Rf
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

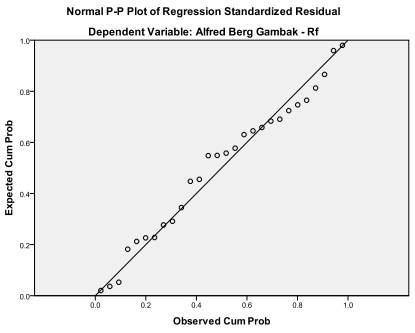

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra SMB - Rf
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

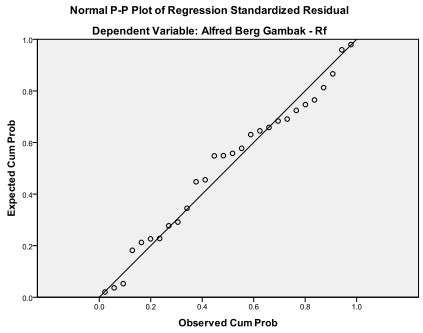

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: WarrenWicklund Norge A - Rf
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

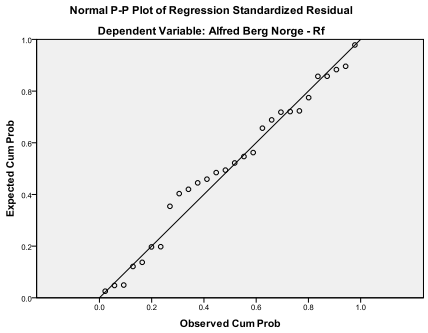
8.1.4 Balanced Henriksson-Merton

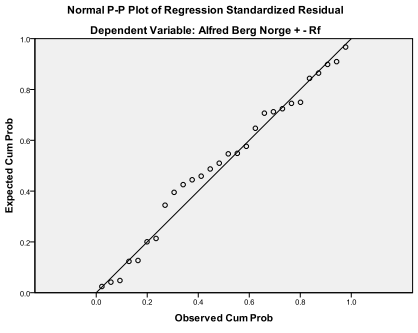


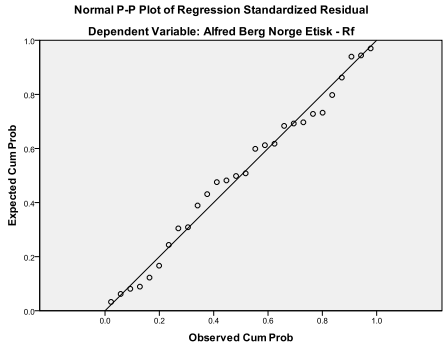


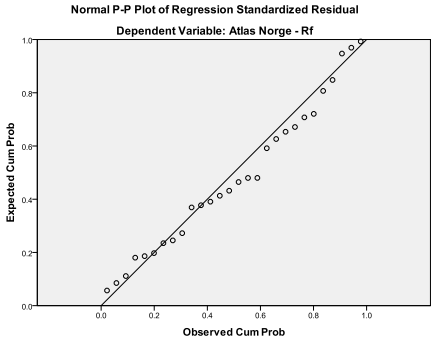


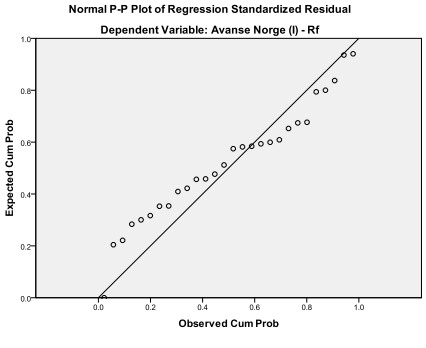


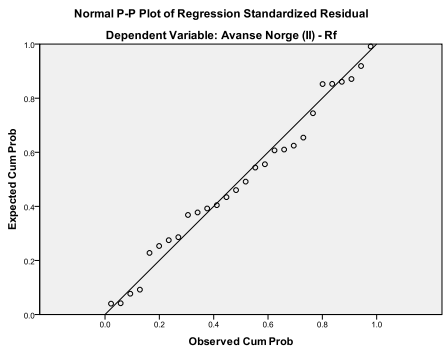


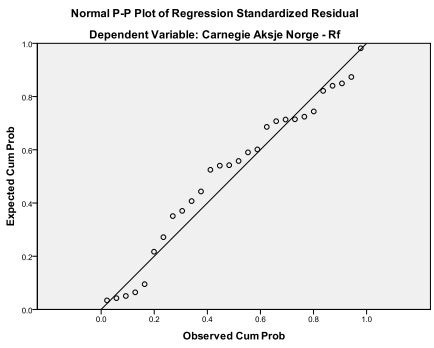


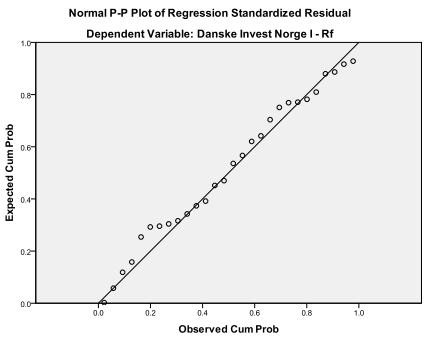


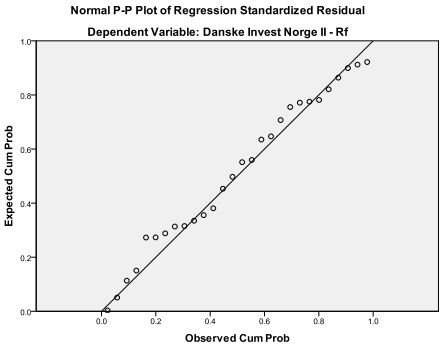


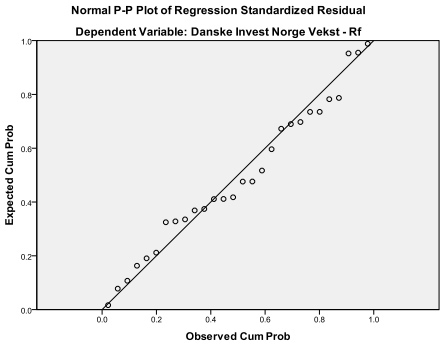


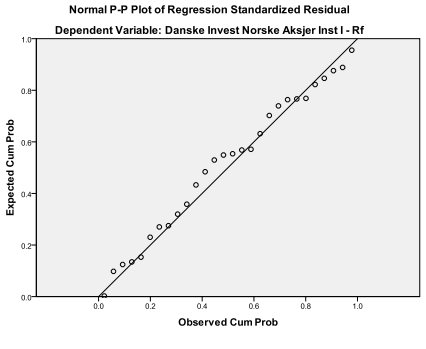


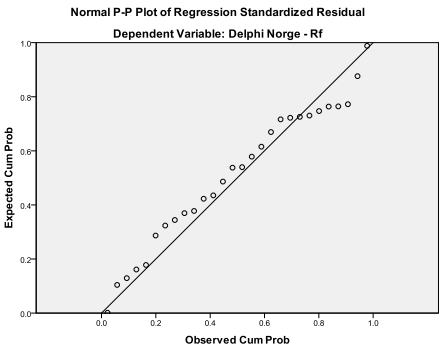


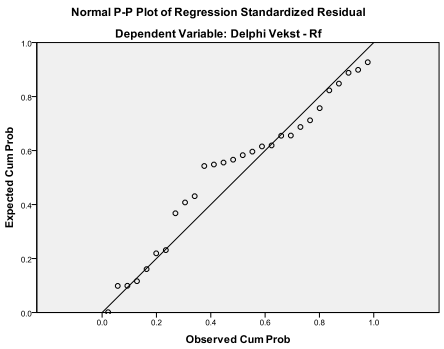


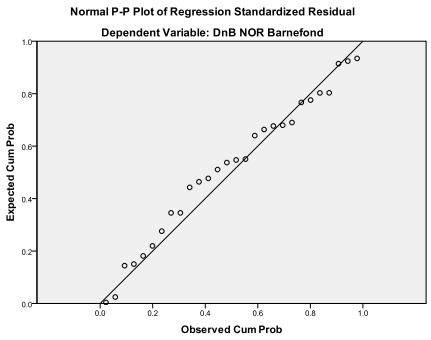

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge II - Rf
Expected Cum Prob
Observed Cum Prob

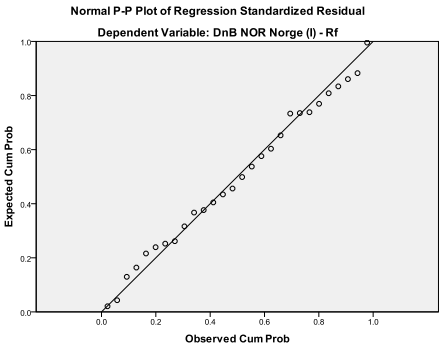

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge Vekst - Rf
Expected Cum Prob
Observed Cum Prob

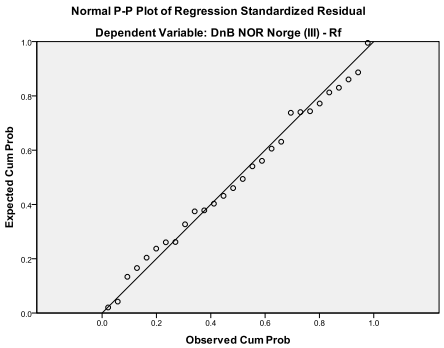

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norske Aksjer Inst I - Rf
Expected Cum Prob
Observed Cum Prob

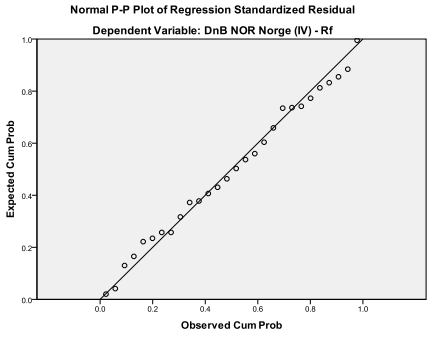

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Norge - Rf
Expected Cum Prob
Observed Cum Prob

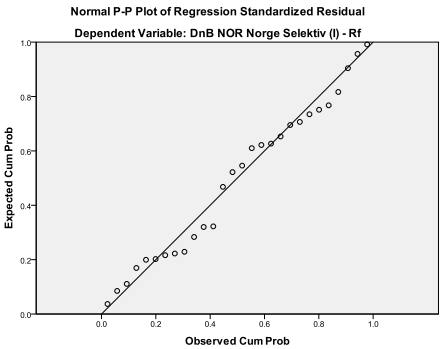

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Vekst - Rf
Expected Cum Prob
Observed Cum Prob

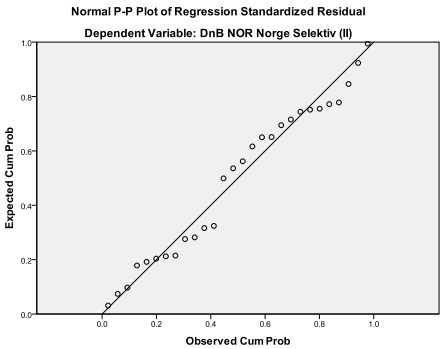

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Barnefond
Expected Cum Prob
Observed Cum Prob

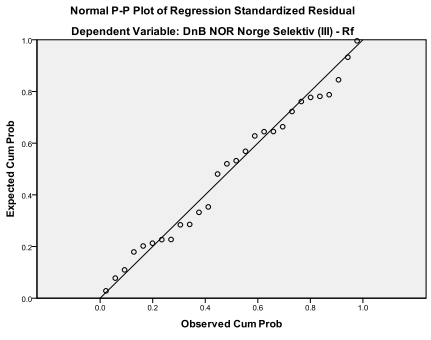

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (I) - Rf
Expected Cum Prob
Observed Cum Prob

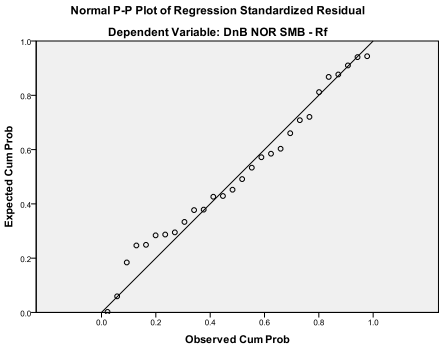

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (III) - Rf
Expected Cum Prob
Observed Cum Prob

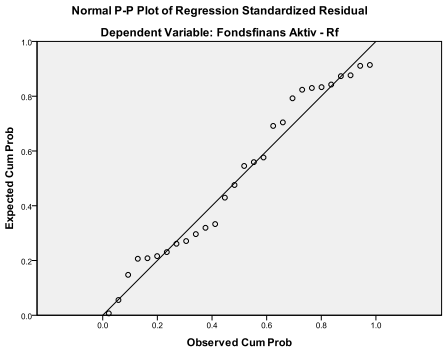

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (IV) - Rf
Expected Cum Prob
Observed Cum Prob

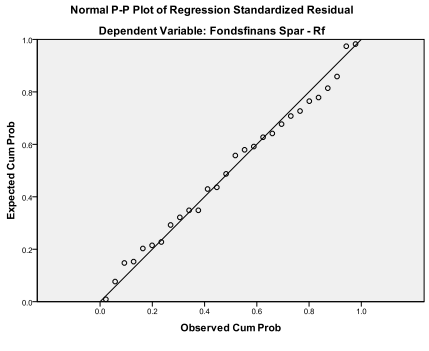

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (I) - Rf
Expected Cum Prob
Observed Cum Prob

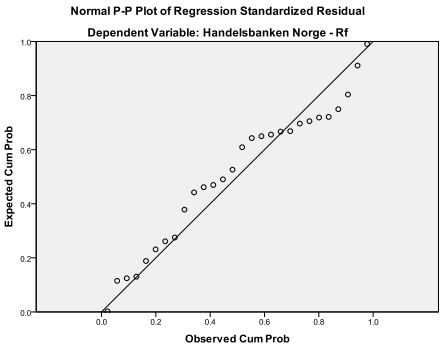

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (II)
Expected Cum Prob
Observed Cum Prob

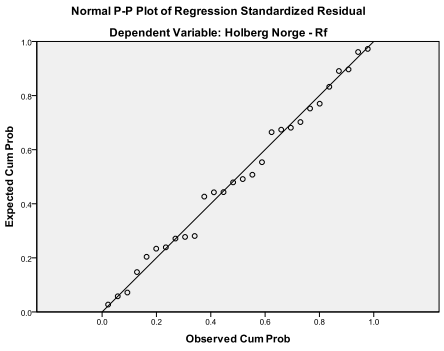

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (III) - Rf
Expected Cum Prob
Observed Cum Prob

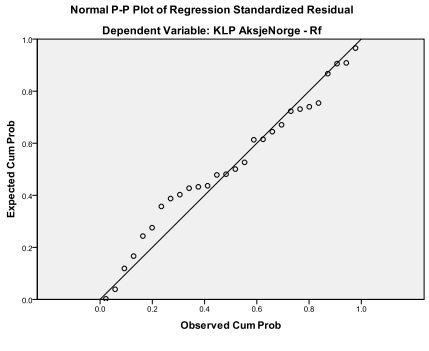

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR SMB - Rf
Expected Cum Prob
Observed Cum Prob

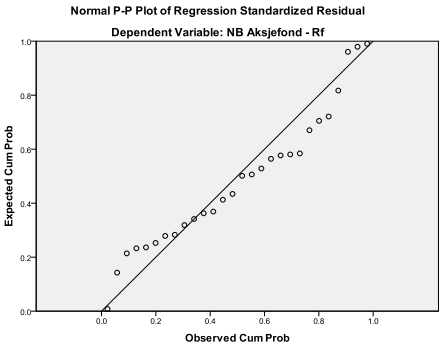

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

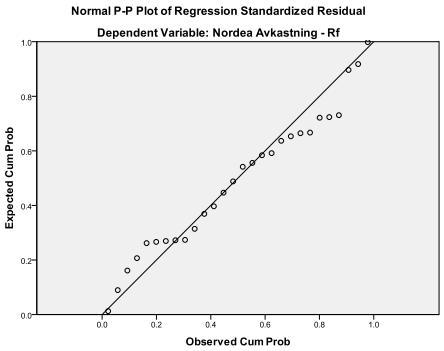

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Spar - Rf
Expected Cum Prob
Observed Cum Prob

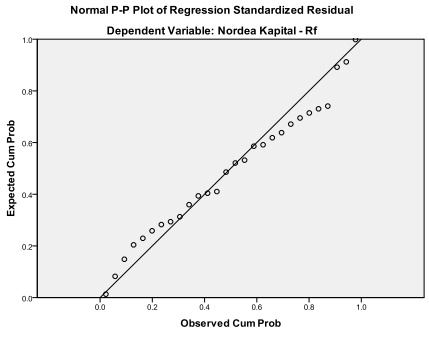

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Handelsbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

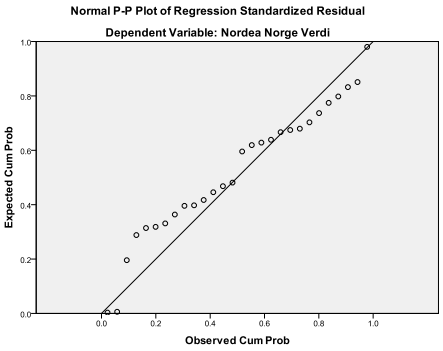

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Holberg Norge - Rf
Expected Cum Prob
Observed Cum Prob

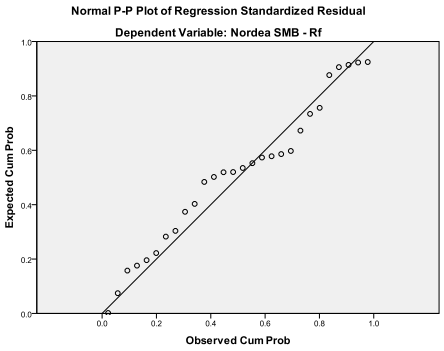

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: KLP AksjeNorge - Rf
Expected Cum Prob
Observed Cum Prob

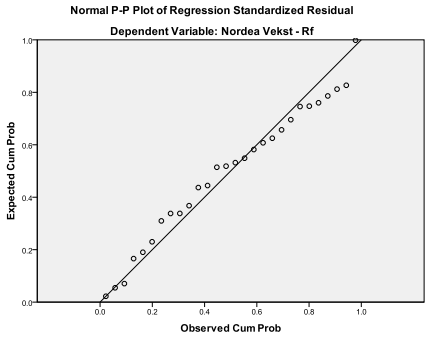

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: NB Aksjefond - Rf
Expected Cum Prob
Observed Cum Prob

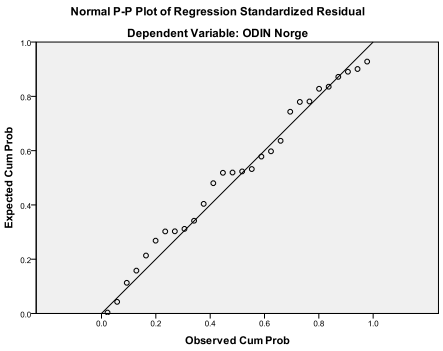

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Avkastning - Rf
Expected Cum Prob
Observed Cum Prob

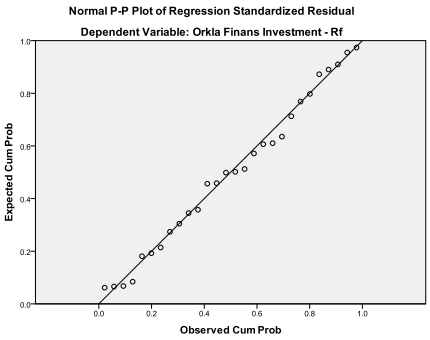

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Kapital - Rf
Expected Cum Prob
Observed Cum Prob

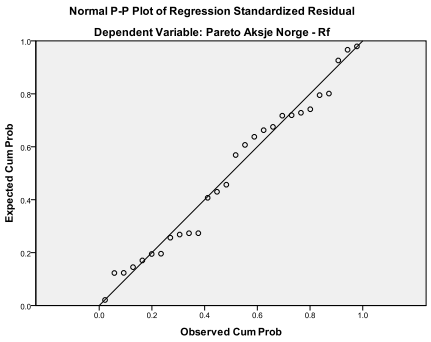

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Norge Verdi
Expected Cum Prob
Observed Cum Prob

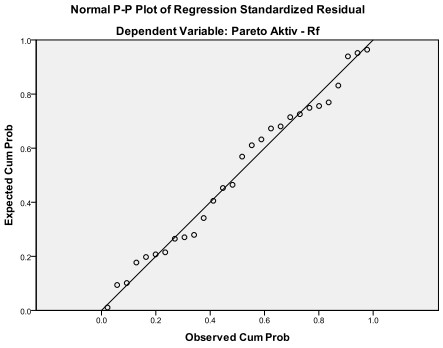

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea SMB - Rf
Expected Cum Prob
Observed Cum Prob

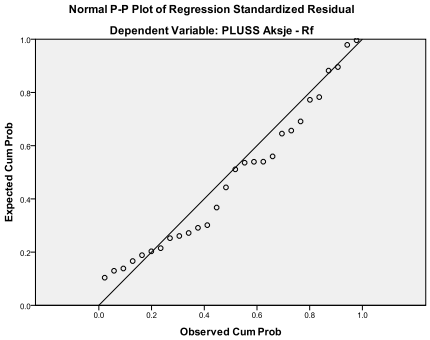

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Vekst - Rf
Expected Cum Prob
Observed Cum Prob

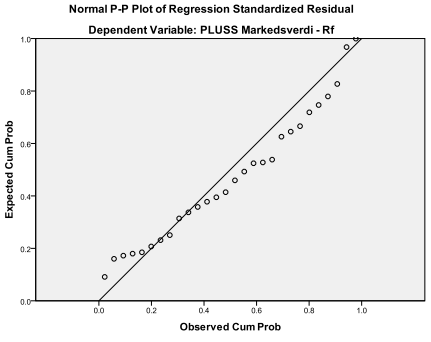

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: ODIN Norge
Expected Cum Prob
Observed Cum Prob

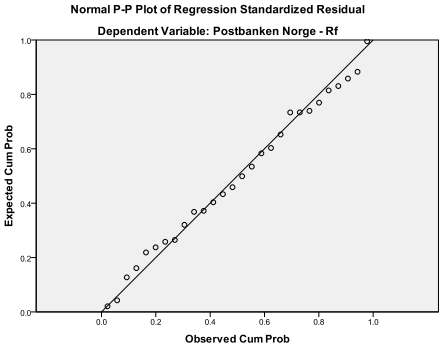

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Orkla Finans Investment - Rf
Expected Cum Prob
Observed Cum Prob

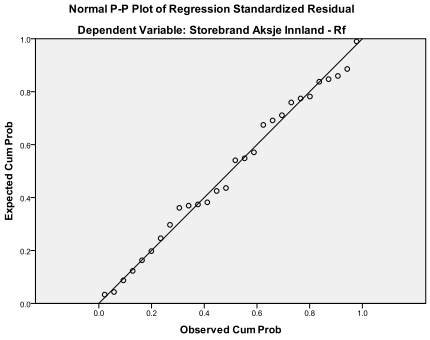

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aksje Norge - Rf
Expected Cum Prob
Observed Cum Prob

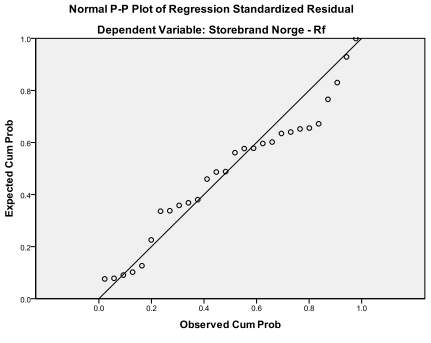

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

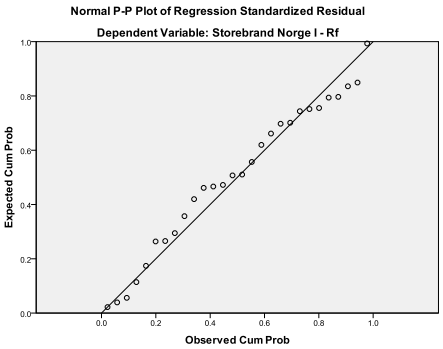

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Aksje - Rf
Expected Cum Prob
Observed Cum Prob

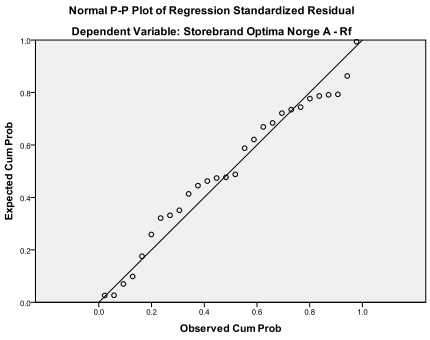

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Markedsverdi - Rf
Expected Cum Prob
Observed Cum Prob

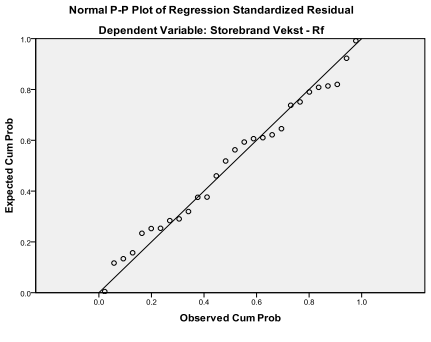

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Postbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Aksje Innland - Rf
Expected Cum Prob
Observed Cum Prob

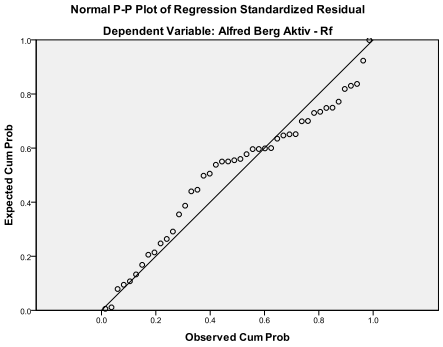

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge - Rf
Expected Cum Prob
Observed Cum Prob

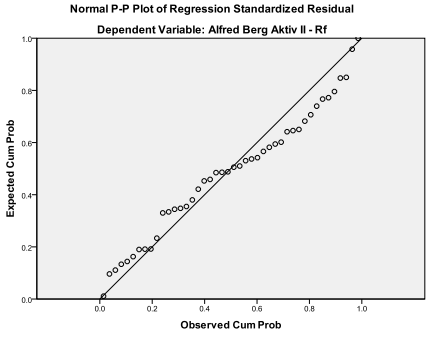

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge I - Rf
Expected Cum Prob
Observed Cum Prob

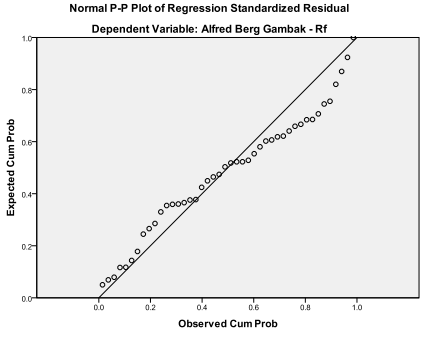

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Optima Norge A - Rf
Expected Cum Prob
Observed Cum Prob

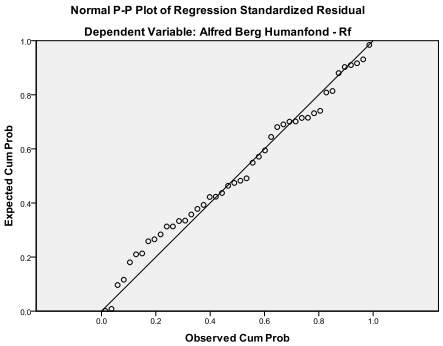

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Vekst - Rf
Expected Cum Prob
Observed Cum Prob

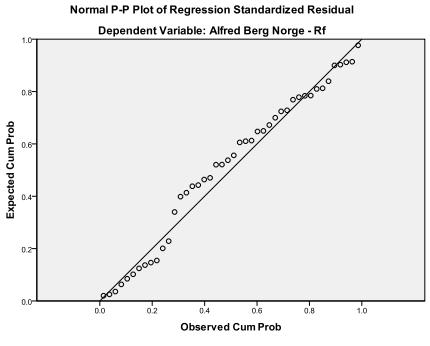
8.1.5 Unbalanced Treynor-Mazuy

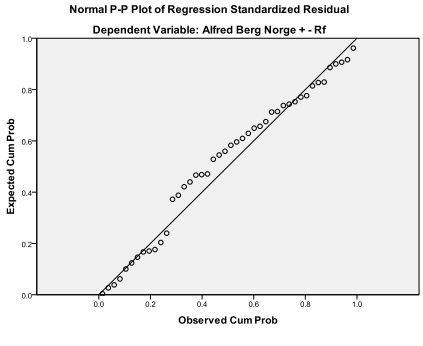


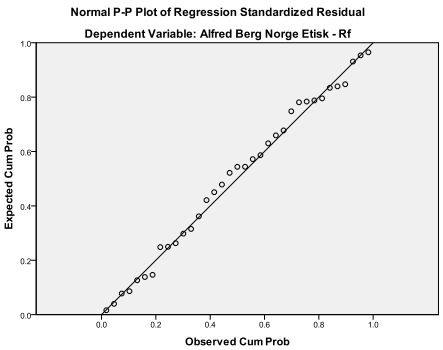


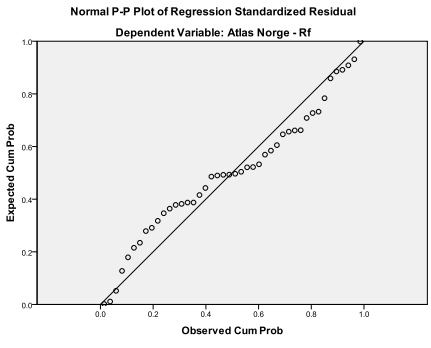


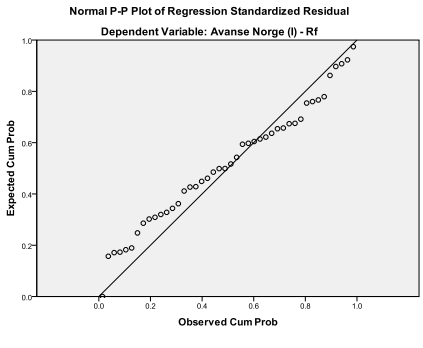


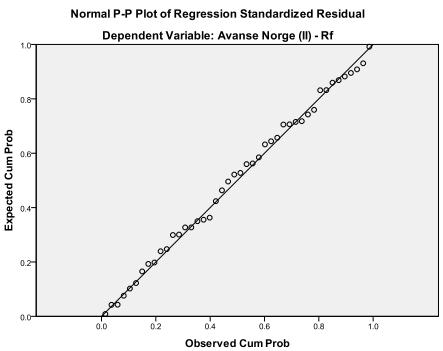


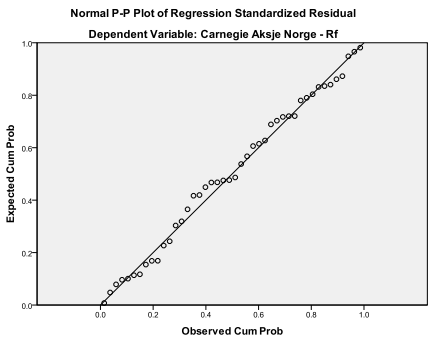


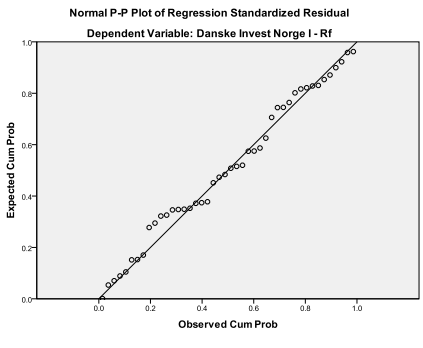


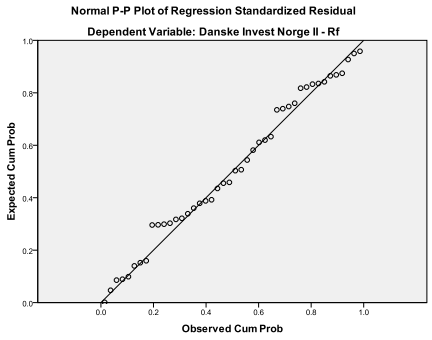


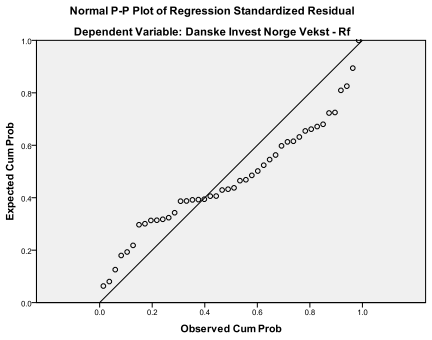


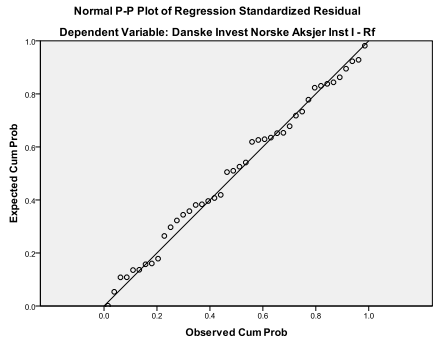


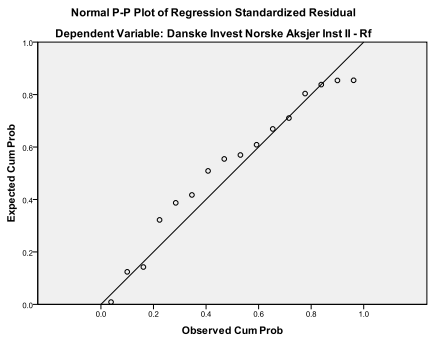


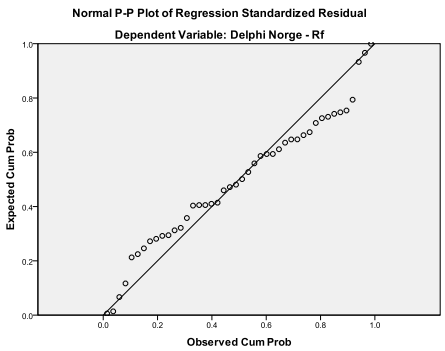


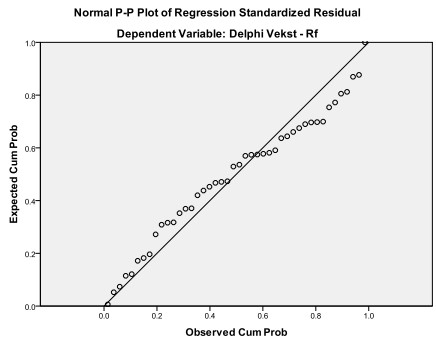

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge II - Rf
Expected Cum Prob
Observed Cum Prob

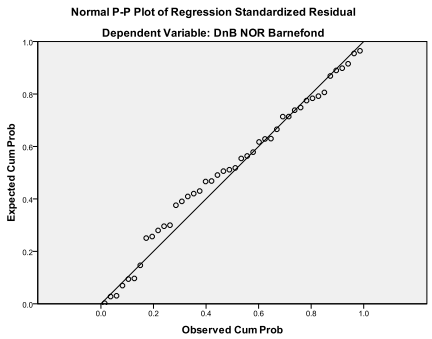

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge Vekst - Rf
Expected Cum Prob
Observed Cum Prob

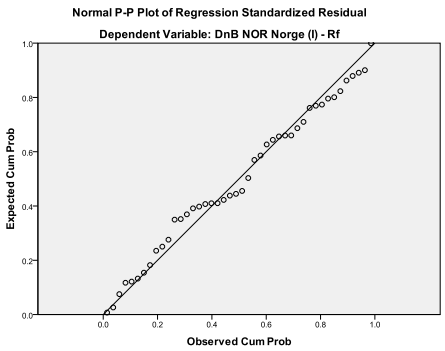

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norske Aksjer Inst I - Rf
Expected Cum Prob
Observed Cum Prob

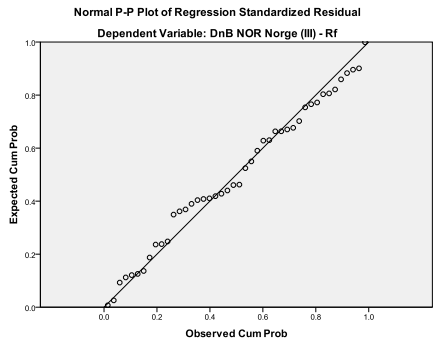

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norske Aksjer Inst II - Rf
Expected Cum Prob
Observed Cum Prob

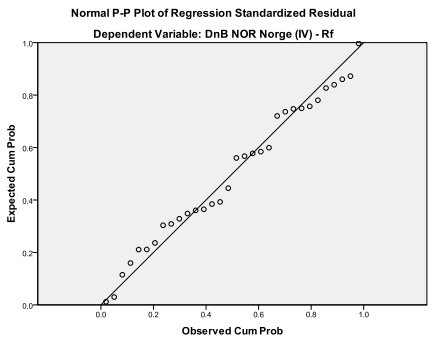

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Norge - Rf
Expected Cum Prob
Observed Cum Prob

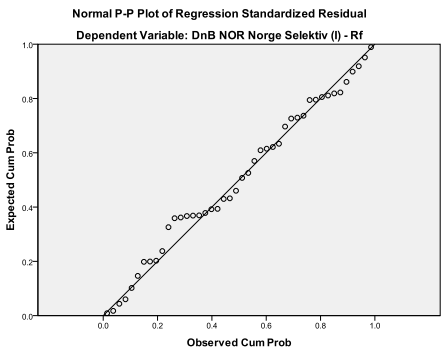

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Vekst - Rf
Expected Cum Prob
Observed Cum Prob

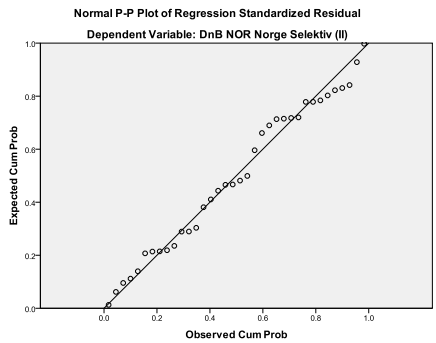

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Barnefond
Expected Cum Prob
Observed Cum Prob

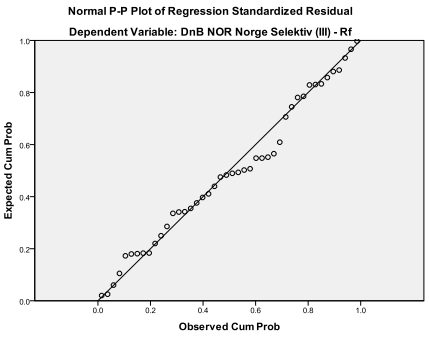

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (I) - Rf
Expected Cum Prob
Observed Cum Prob

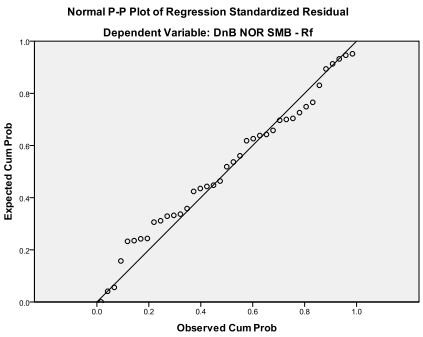

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (III) - Rf
Expected Cum Prob
Observed Cum Prob

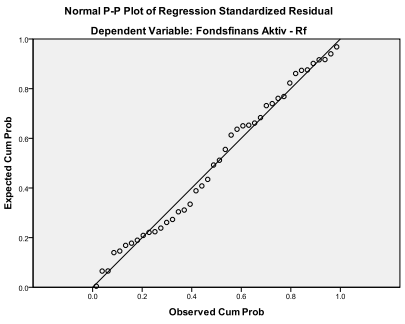

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (IV) - Rf
Expected Cum Prob
Observed Cum Prob

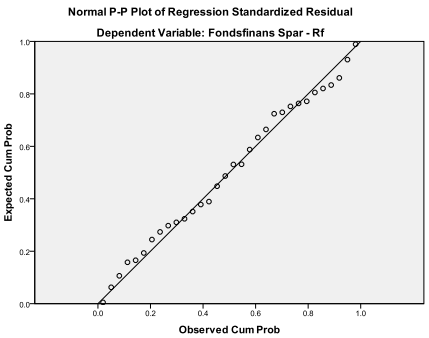

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (I) - Rf
Expected Cum Prob
Observed Cum Prob

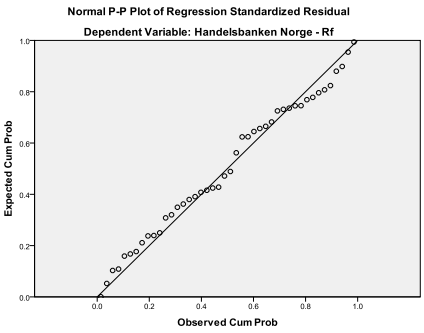

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (II)
Expected Cum Prob
Observed Cum Prob

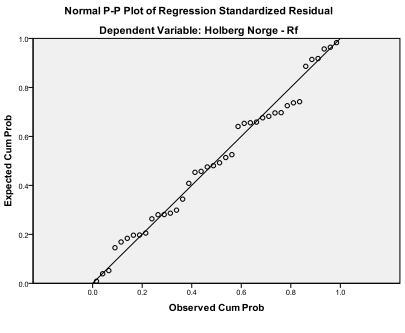

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (III) - Rf
Expected Cum Prob
Observed Cum Prob

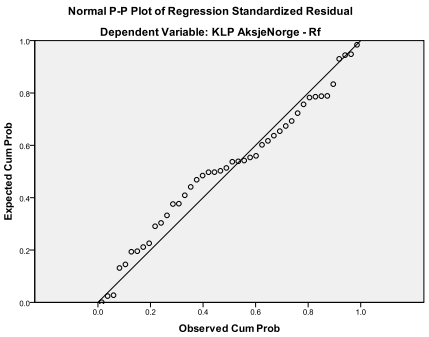

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR SMB - Rf
Expected Cum Prob
Observed Cum Prob

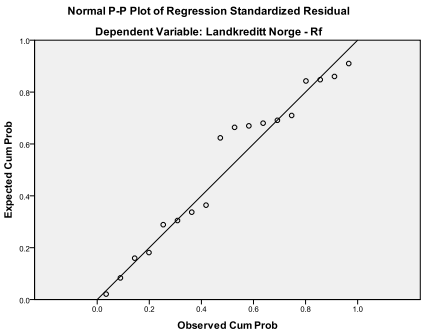

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

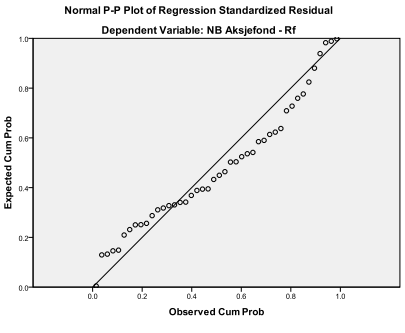

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Spar - Rf
Expected Cum Prob
Observed Cum Prob

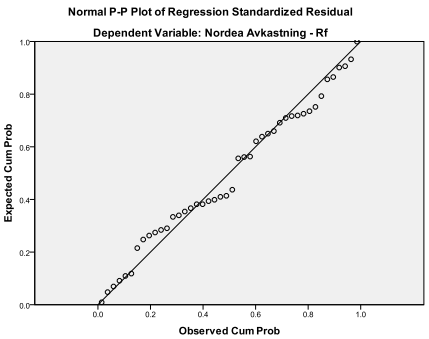

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Handelsbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

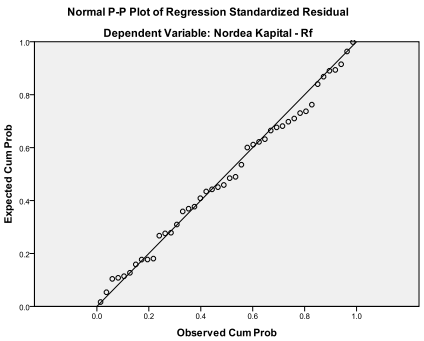

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Holberg Norge - Rf
Expected Cum Prob
Observed Cum Prob

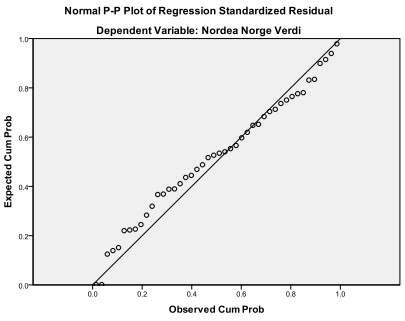

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: KLP AksjeNorge - Rf
Expected Cum Prob
Observed Cum Prob

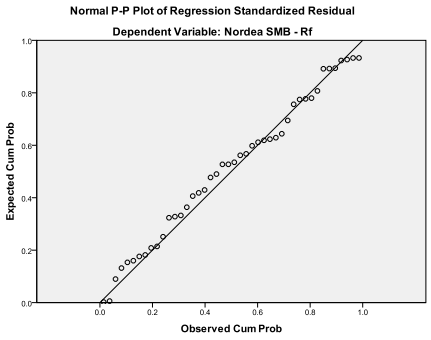

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Landkreditt Norge - Rf
Expected Cum Prob
Observed Cum Prob

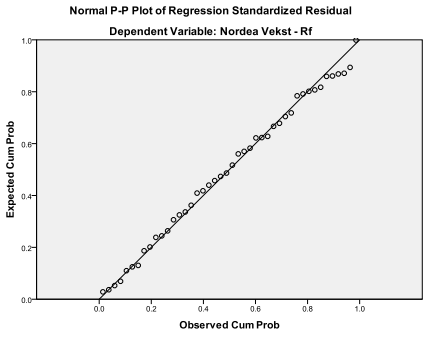

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: NB Aksjefond - Rf
Expected Cum Prob
Observed Cum Prob

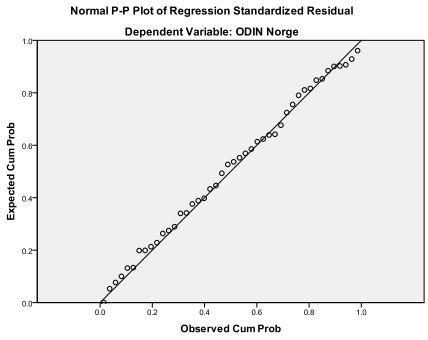

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Avkastning - Rf
Expected Cum Prob
Observed Cum Prob

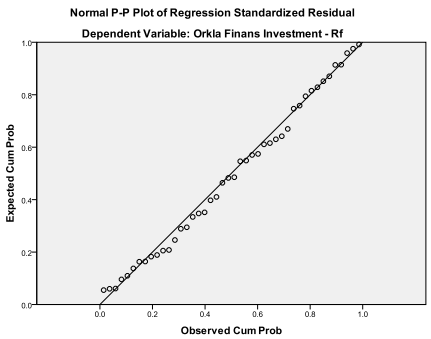

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Kapital - Rf
Expected Cum Prob
Observed Cum Prob

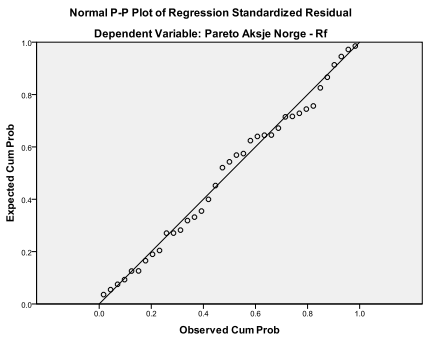

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Norge Verdi
Expected Cum Prob
Observed Cum Prob

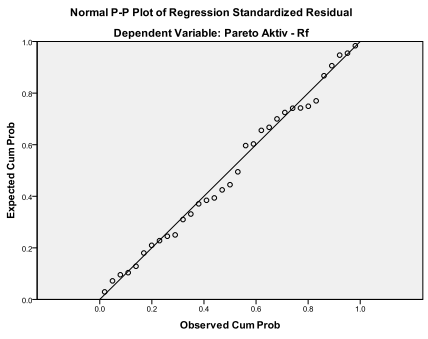

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea SMB - Rf
Expected Cum Prob
Observed Cum Prob

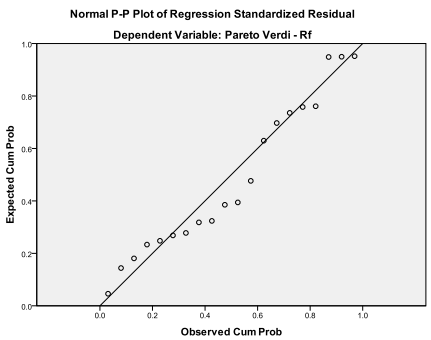

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Vekst - Rf
Expected Cum Prob
Observed Cum Prob

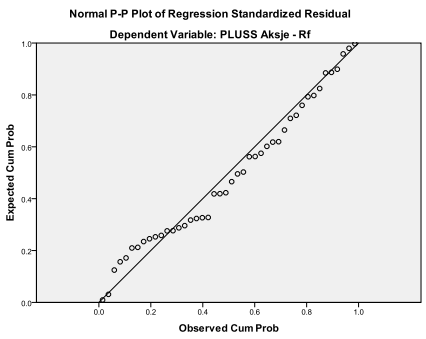

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: ODIN Norge
Expected Cum Prob
Observed Cum Prob

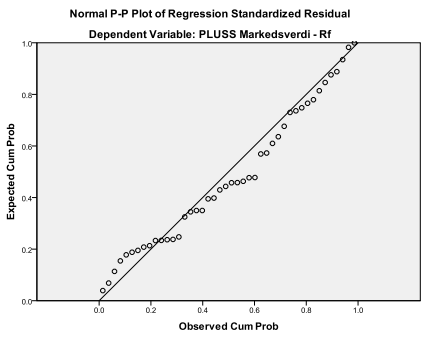

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Orkla Finans Investment - Rf
Expected Cum Prob
Observed Cum Prob

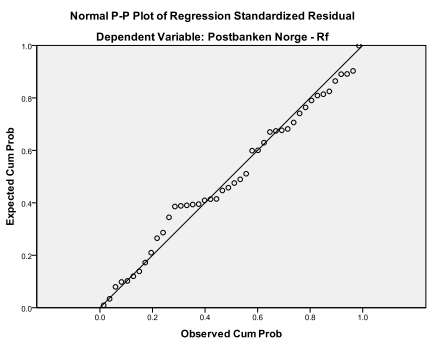

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aksje Norge - Rf
Expected Cum Prob
Observed Cum Prob

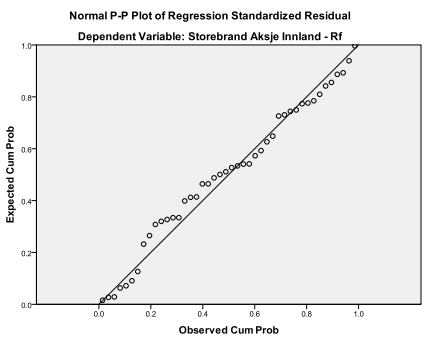

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

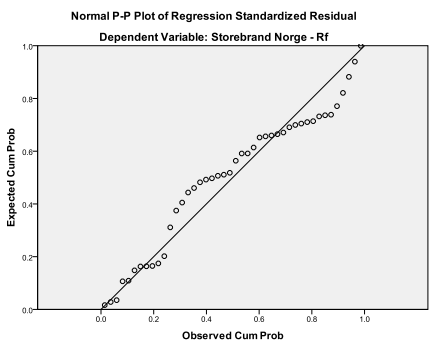

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Verdi - Rf
Expected Cum Prob
Observed Cum Prob

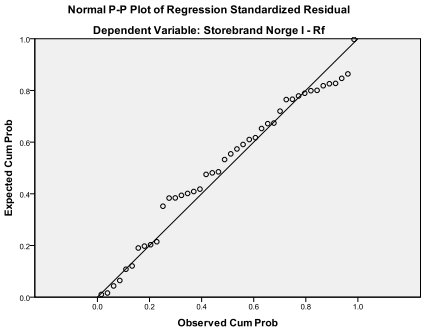

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Aksje - Rf
Expected Cum Prob
Observed Cum Prob

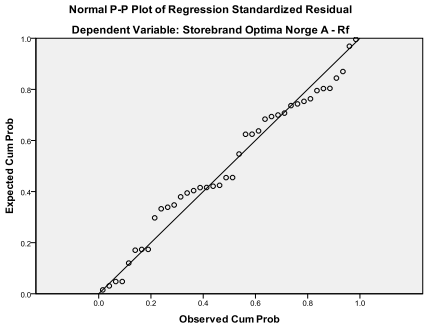

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Markedsverdi - Rf
Expected Cum Prob
Observed Cum Prob

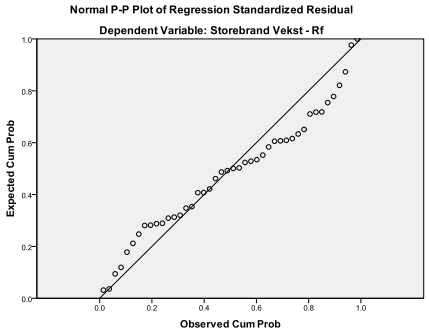

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Postbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

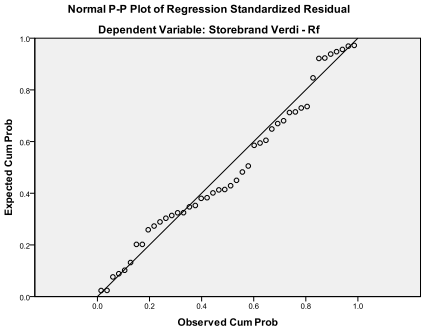

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Aksje Innland - Rf
Expected Cum Prob
Observed Cum Prob

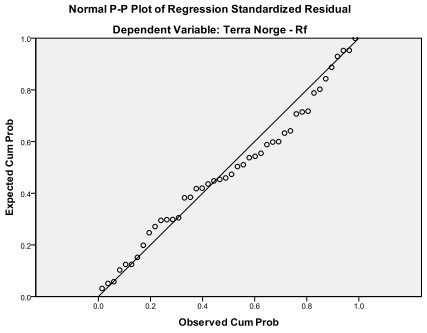

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge - Rf
Expected Cum Prob
Observed Cum Prob

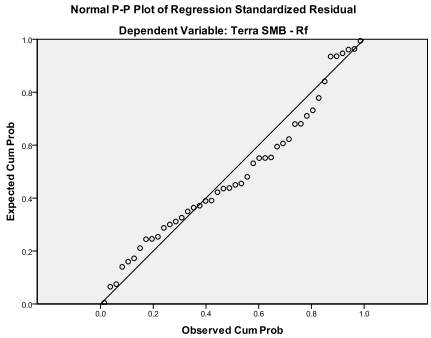

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge I - Rf
Expected Cum Prob
Observed Cum Prob

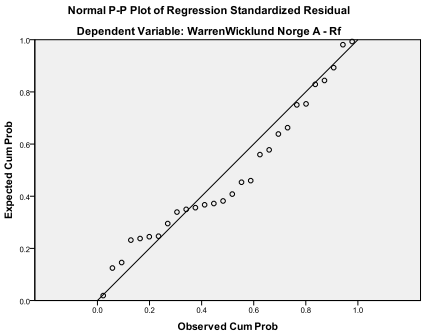

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Optima Norge A - Rf
Expected Cum Prob
Observed Cum Prob


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Vekst - Rf
Expected Cum Prob
Observed Cum Prob

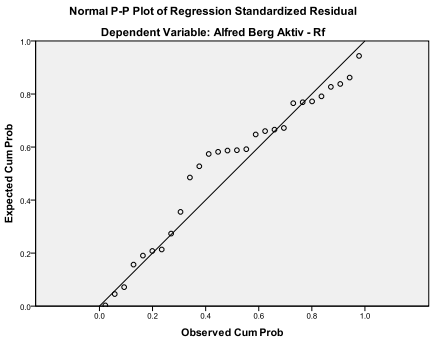

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Verdi - Rf
Expected Cum Prob
Observed Cum Prob

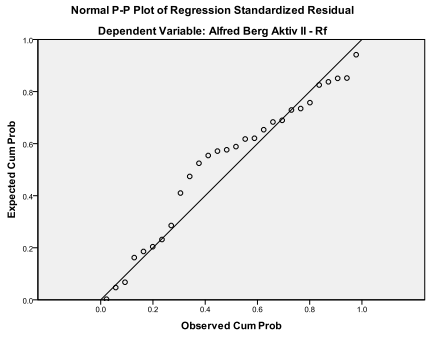

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra Norge - Rf
Expected Cum Prob
Observed Cum Prob

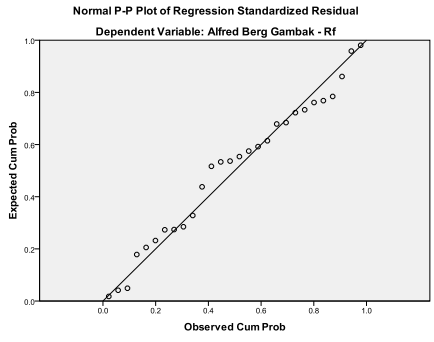

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra SMB - Rf
Expected Cum Prob
Observed Cum Prob

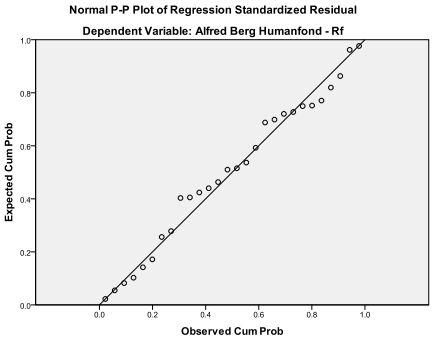

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: WarrenWicklund Norge A - Rf
Expected Cum Prob
Observed Cum Prob

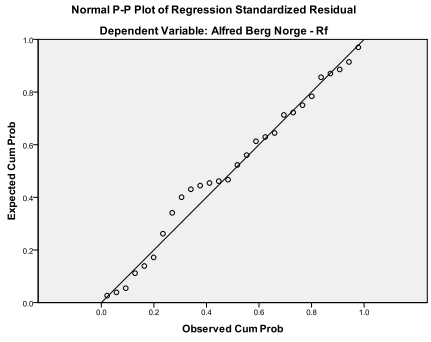
8.1.6 Balanced Treynor-Mazuy

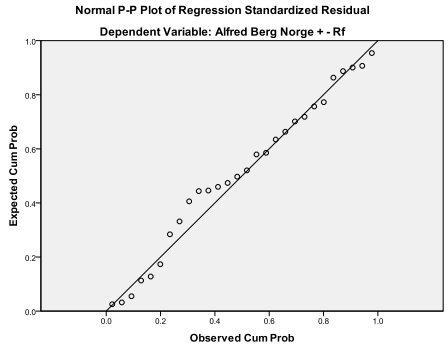


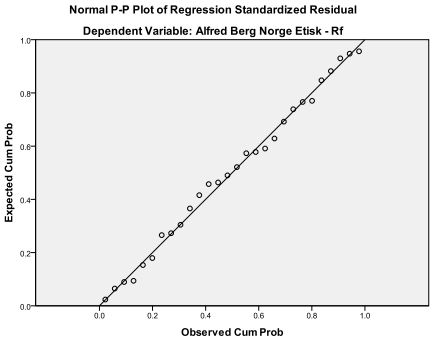


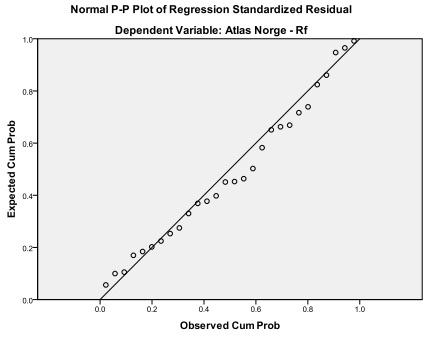


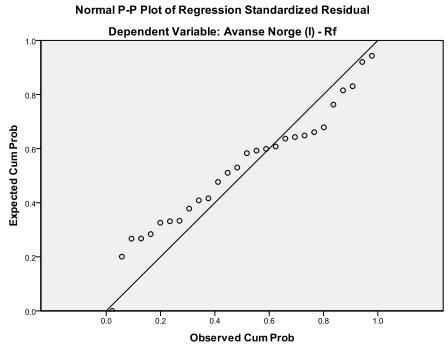


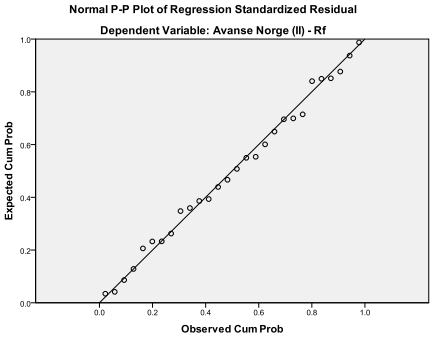


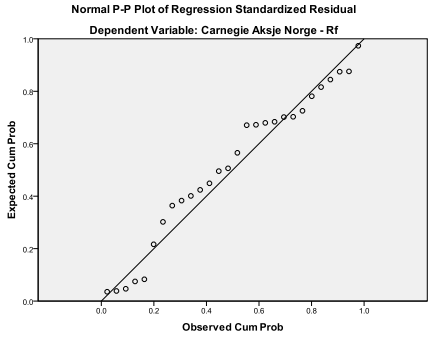


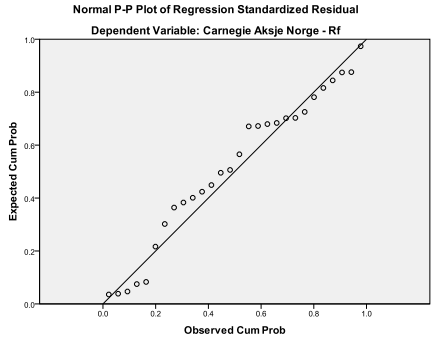


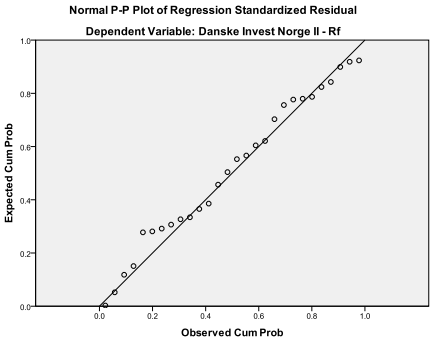


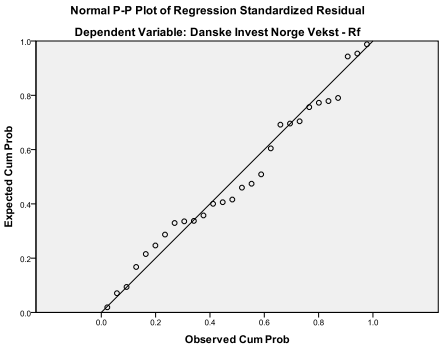


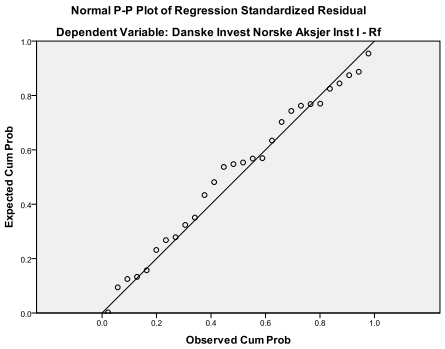


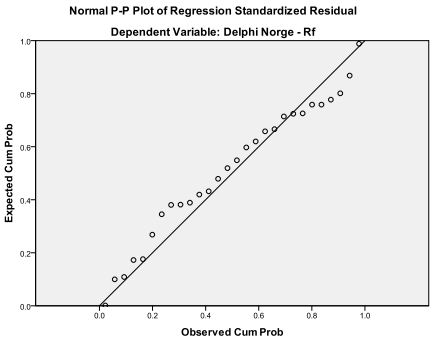


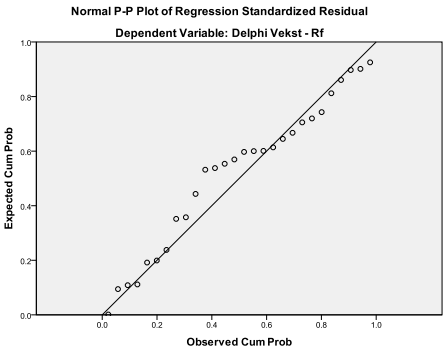


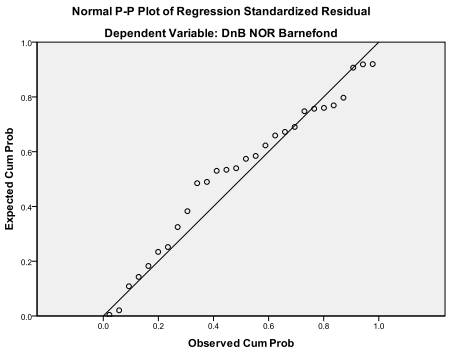

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge II - Rf
Expected Cum Prob
Observed Cum Prob

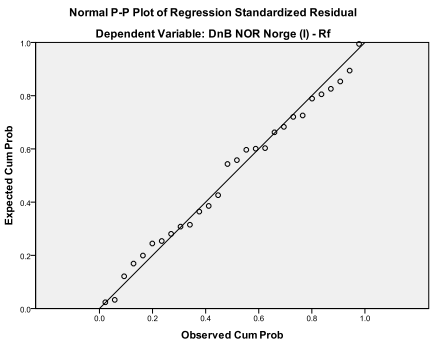

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norge Vekst - Rf
Expected Cum Prob
Observed Cum Prob

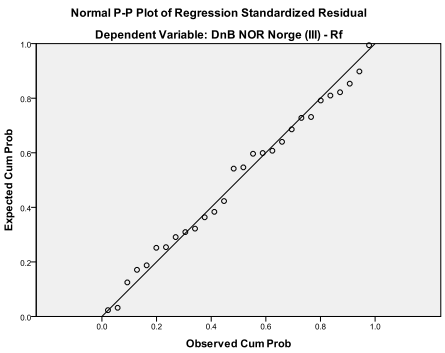

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Danske Invest Norske Aksjer Inst I - Rf
Expected Cum Prob
Observed Cum Prob

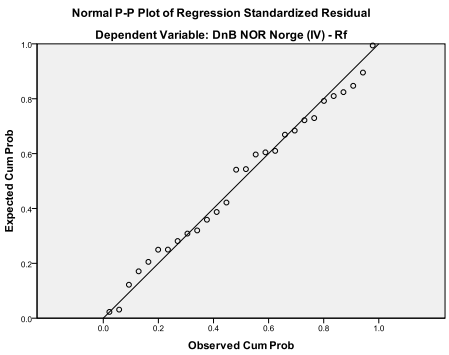

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Norge - Rf
Expected Cum Prob
Observed Cum Prob

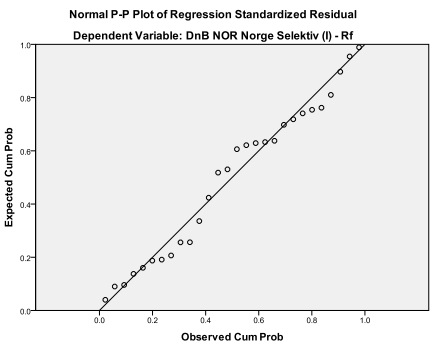

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Delphi Vekst - Rf
Expected Cum Prob
Observed Cum Prob

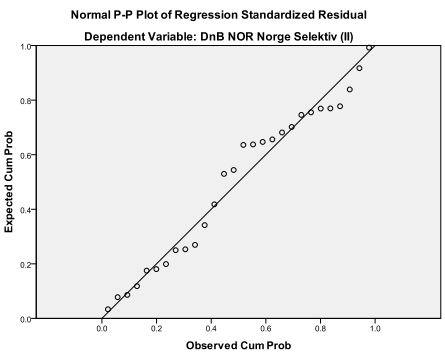

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Barnefond
Expected Cum Prob
Observed Cum Prob

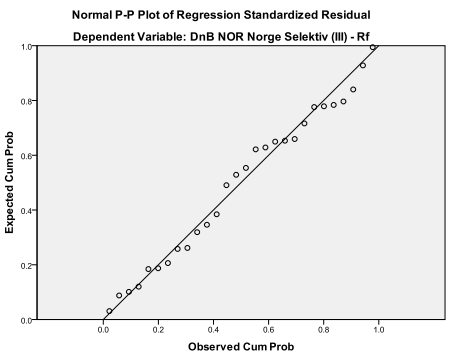

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (I) - Rf
Expected Cum Prob
Observed Cum Prob

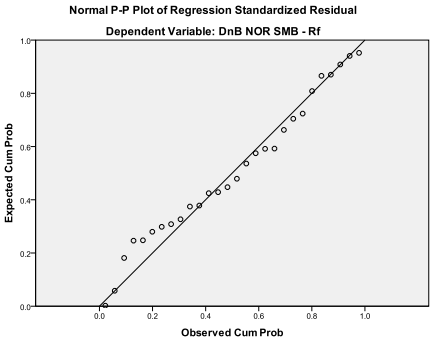

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (III) - Rf
Expected Cum Prob
Observed Cum Prob

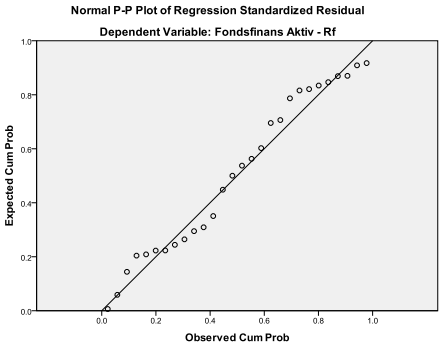

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge (IV) - Rf
Expected Cum Prob
Observed Cum Prob

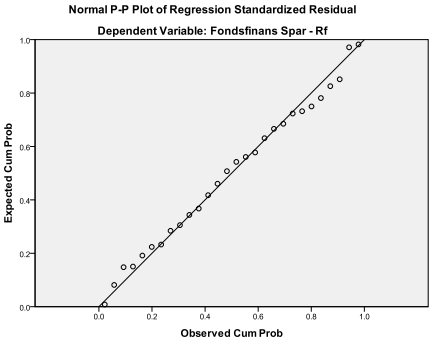

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (I) - Rf
Expected Cum Prob
Observed Cum Prob

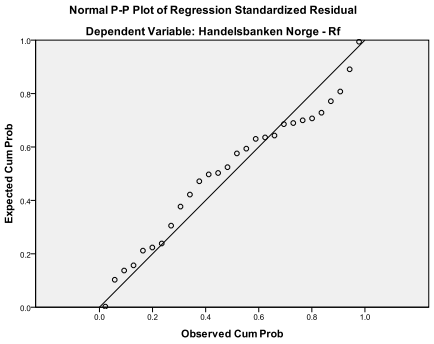

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (II)
Expected Cum Prob
Observed Cum Prob

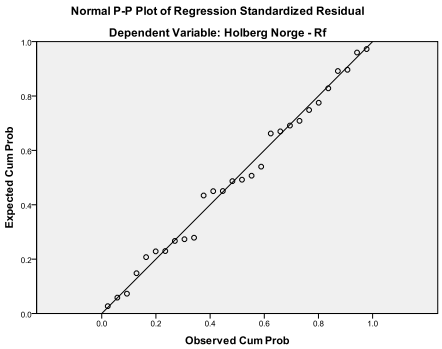

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR Norge Selektiv (III) - Rf
Expected Cum Prob
Observed Cum Prob

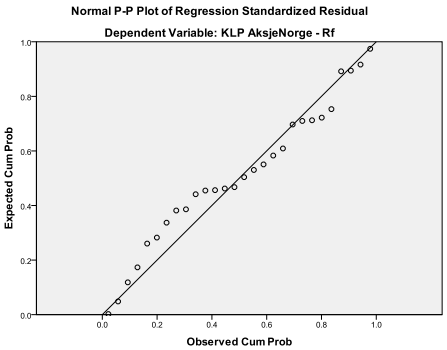

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: DnB NOR SMB - Rf
Expected Cum Prob
Observed Cum Prob

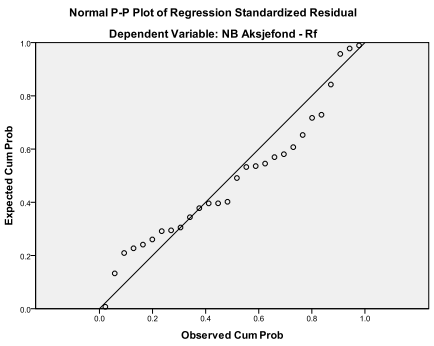

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

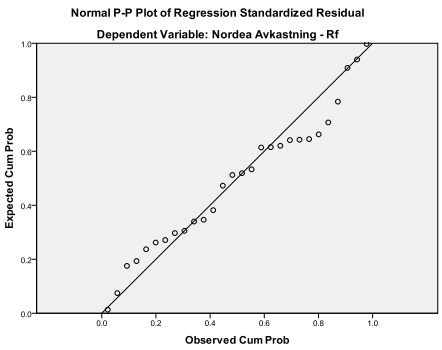

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Fondsfinans Spar - Rf
Expected Cum Prob
Observed Cum Prob

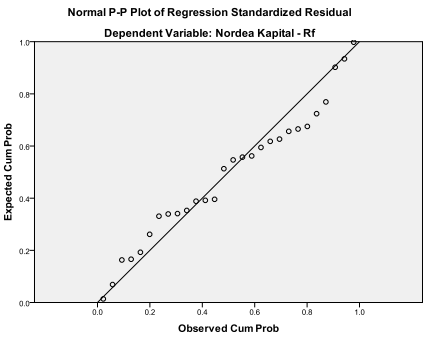

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Handelsbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

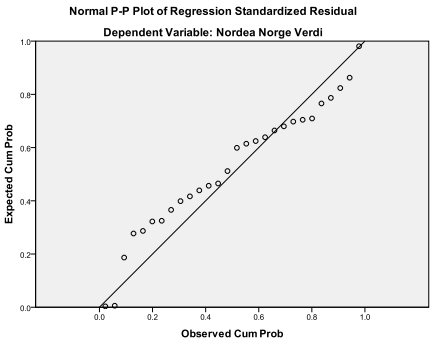

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Holberg Norge - Rf
Expected Cum Prob
Observed Cum Prob

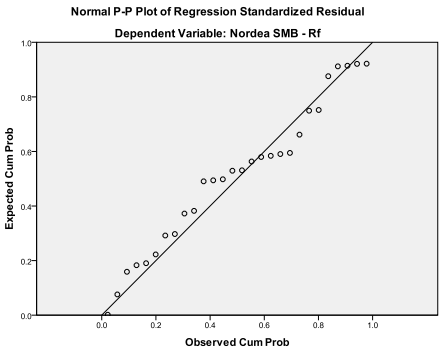

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: KLP AksjeNorge - Rf
Expected Cum Prob
Observed Cum Prob

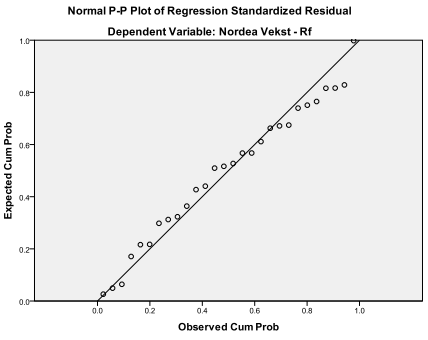

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: NB Aksjefond - Rf
Expected Cum Prob
Observed Cum Prob

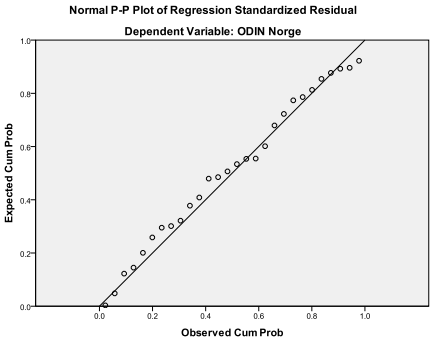

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Avkastning - Rf
Expected Cum Prob
Observed Cum Prob

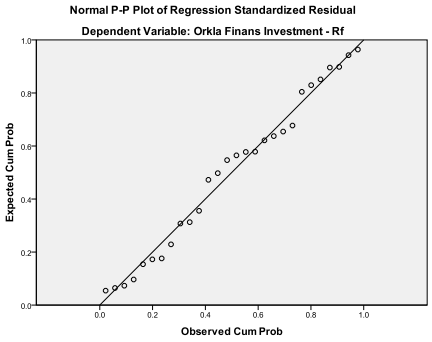

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Kapital - Rf
Expected Cum Prob
Observed Cum Prob

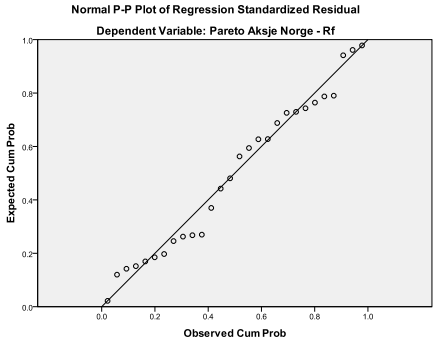

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Norge Verdi
Expected Cum Prob
Observed Cum Prob

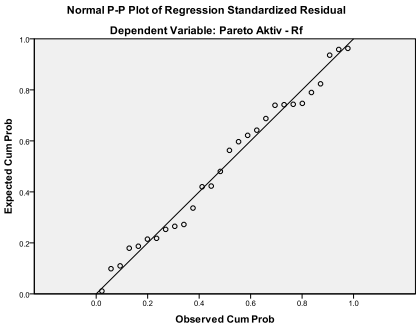

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea SMB - Rf
Expected Cum Prob
Observed Cum Prob

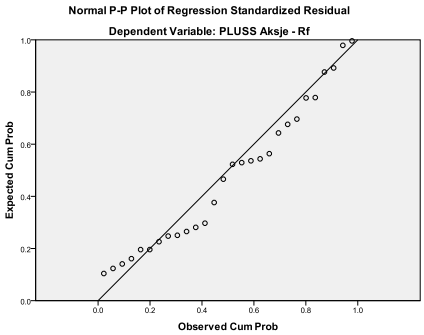

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Nordea Vekst - Rf
Expected Cum Prob
Observed Cum Prob

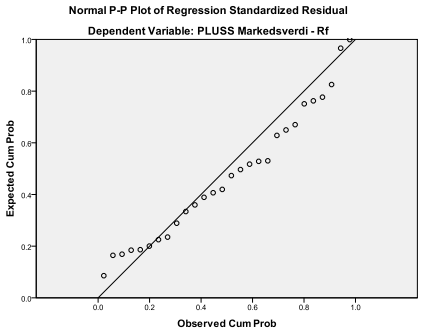

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: ODIN Norge
Expected Cum Prob
Observed Cum Prob

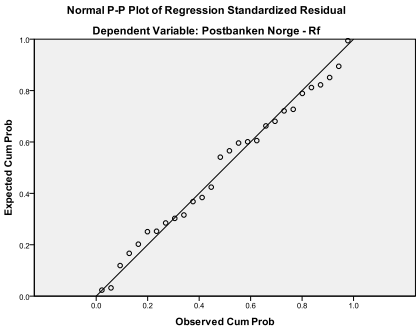

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Orkla Finans Investment - Rf
Expected Cum Prob
Observed Cum Prob

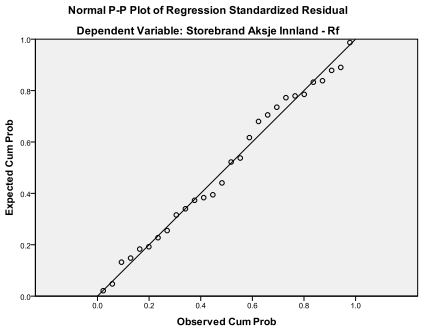

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aksje Norge - Rf
Expected Cum Prob
Observed Cum Prob

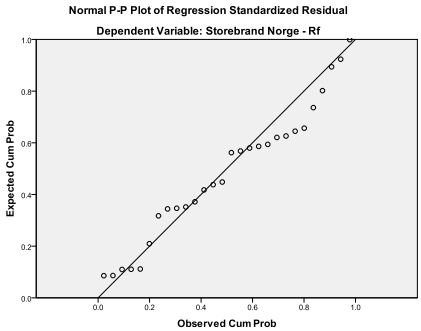

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Pareto Aktiv - Rf
Expected Cum Prob
Observed Cum Prob

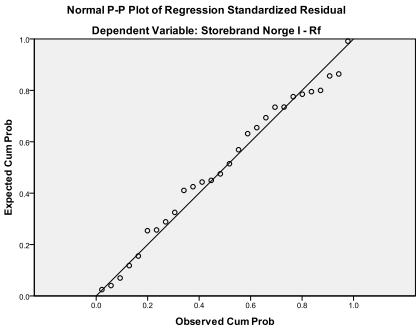

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Aksje - Rf
Expected Cum Prob
Observed Cum Prob

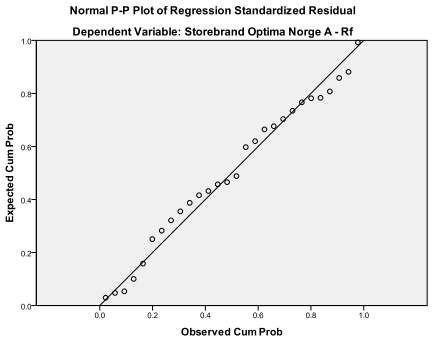

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PLUSS Markedsverdi - Rf
Expected Cum Prob
Observed Cum Prob

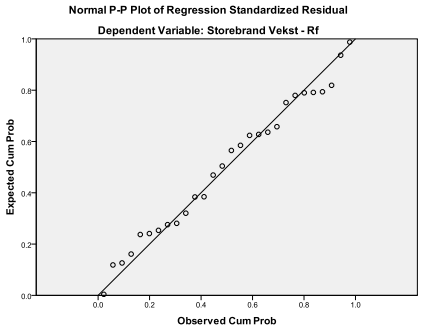

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Postbanken Norge - Rf
Expected Cum Prob
Observed Cum Prob

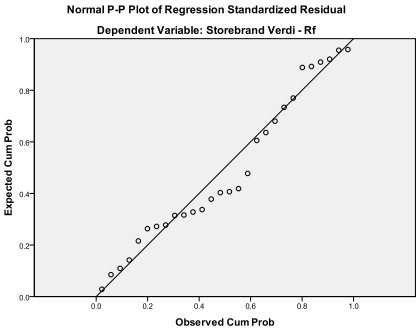

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Aksje Innland - Rf
Expected Cum Prob
Observed Cum Prob

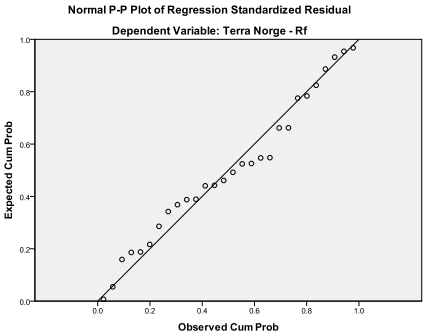

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge - Rf
Expected Cum Prob
Observed Cum Prob

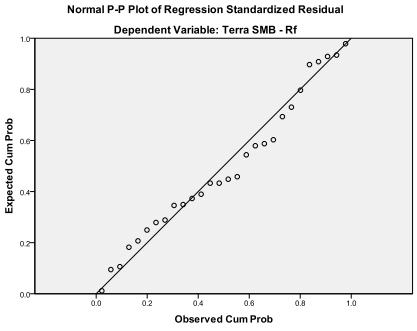

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Norge I - Rf
Expected Cum Prob
Observed Cum Prob

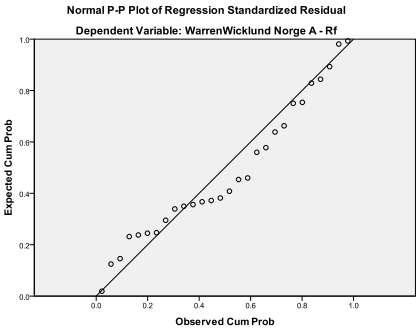

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Optima Norge A - Rf
Expected Cum Prob
Observed Cum Prob


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Vekst - Rf
Expected Cum Prob
Observed Cum Prob


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Storebrand Verdi - Rf
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra Norge - Rf
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Terra SMB - Rf
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: WarrenWicklund Norge A - Rf
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0