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Back testing "The Magic Formula" in the Nordic region

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ABSTRACT

We will in this thesis back test Joel Greenblatt's m*agic formula* on stocks in the Nordic Region between January 1st 1998 and January 1st 2008. We will compare the return with benchmarks such as MSCI Nordic and S&P 500 as well as the return predicted by the Capital Assets Pricing Model (CAPM) and Fama French's three factor model. The portfolio based on the formula had during the ten year period a compounded annual growth rate (CAGR) of 14.68 percent compared to 9.28 percent for the MSCI Nordic and 4.23 percent for the S&P 500. However, the intercept was not significant neither when testing against the CAPM or Fama French's three factor model on the 5 percent level. Adding transaction cost lowers the CAGR to 11.98 percent. With transaction costs, the intercepts were not significant neither when testing against the CAPM or Fama French's three factor model on the 5 percent level. The Sharpe ratio for the portfolio was above MSCI Nordic and S&P 500 both with and without transaction costs. We also find that the return of the portfolios improve when including intangible assets in the magic formula.

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1 Introduction

Can you beat the market? Or rather, can you systematically beat the stock market taking advantage of market inefficiency? This is a frequently debated question within academic circles as well as among practitioners in the investment community. Supporters of the *Efficient market hypothesis* (EMH) claim that you cannot, while others argue that you can. Investors systematically outperforming the market have been present during many decades, including; John Templeton, Warren Buffet and Peter Lynch. We will in this thesis examine a trading strategy from the perspective of EMH. The trading strategy that we have chosen is the strategy presented by hedge fund manager and adjunct professor Joel Greenblatt in his bestselling book *The little book that beats the market.*

Since the efficient market hypothesis became widely accepted in the academic world in the 1970s (Schiller (2003)), many attempts have been done to show its flaws. We will highlight some of the anomalies that have been found, and to large extent disappeared, during the years. Some of the anomalies are more interesting in the understanding of our study, explaining the reason for us to penetrate deeper into those[1]. We will summarize these anomalies and give our current view on their implications on investment strategies in general and Greenblatt's strategy in particular.

Can you beat the market with approximately 10 percent per year for decades without additional risk? Well, Joel Greenblatt claims this is in his book *The little book that beats the market.* Greenblatt's book has gained attention within the investment community and his strategy has been successfully back-tested and published by e.g. Lancetti and Montier for *Dresdner Kleinwort Wasserstein (DrKW)*, and by Robert Haugen, professor in finance at UCLA at Irvine.

Greenblatt belongs to the investment philosophy called Value *investing.* Value investing has a long history, dating back to the work by Benjamin Graham and David Dodd in their book *Security Analysis* from 1934, and further developed by Graham in the book *The intelligent Investor* from 1949. The value investing community, including Greenblatt, has a different view of risk compared to supporters of EMH. Greenblatt and most other value investors disagree on volatility being the proper measure for risk, arguing that the fact that volatility "punishes" upside volatility with increased risk is wrong (Dremen (1998), Greenblatt (2006), Greenwald et al. (2001)). They believe risk to be the probability of losing

[1] Some of the anomalies are included for illustrative purposes.

money and protect themselves against that via thorough analysis and margin of safety[2]. Since the value investing community has a different view of risk, we believe it would be interesting to examine Greenblatt's strategy through a more traditional and academic view of risk via asset pricing models.

The contribution of this thesis is aimed to be fivefold. Firstly, we will try to put Greenblatt's method in a perspective using previous research regarding EMH. Secondly, we will test Greenblatt's formula on Nordic stocks. To our knowledge this has not been done before. Thirdly, we will test Greenblatt's method against two asset-pricing models – the CAPM and Fama & French's three-factor model - to see if the method produces abnormal return. That is also something that to our knowledge has not been done before. Fourthly, we will also test a portfolio including intangible assets and see if that affect the performance of the formula. Finally, we will try to conclude whether the magic formula is a good investment strategy or not.

2 Previous Research

2.1 Efficient Market Hypothesis

According to Fama (1970), a market in which prices always fully reflect available information is a *efficient market*. Jensen (1978) later developed a definition of *efficient market* as a market where it is impossible to make economic profits[3] by trading on a certain set of information.

Fama (1970) developed three forms of the efficient market hypothesis (EMH): *weak form*, *semi-strong form* and *strong form*. In the weak form, current prices reflect all information obtainable by examining historical prices, meaning that technical analysis will not lead to abnormal returns, while fundamental analysis may. The semi-strong form maintains that prices reflect all public available information, e.g. earnings announcements and annual reports. According to this, neither technical- nor fundamental analysis will lead to abnormal returns. Finally, in strong form, prices fully reflect both public and private information and thus, not even investors with monopolistic access to information, e.g. insiders, will be able to earn abnormal return. Fama (1970) conclude that empirical research supports both the weak- and semi-strong form.

There has been a lot of support for EMH since Fama's defintion. Until the mid-1980s empirical research and theoretical reasoning vastly supported the EMH. Jensen (1978) even went so far as saying that there

[2] Value Investors do typically not invest in what they believe to be fair value. They want a margin of safety as well to give them downside protection.
[3] By economic profit, Jensen means risk-adjusted return net all costs.

is no other proposition in economics that has a more solid empirical support than the EMH. Implications of the EMH dominance in the field of investment were seen, as index-funds and buy-and-hold strategies became increasingly popular (Szyszka (2007)).

2.2 Findings contradicting the EMH

Empirical studies that find patterns contradicting the EMH are numerous, though most of them have disappeared. Some of these *anomalies*, as they are called by EMH supporters, have been tried to be explained by what is called *behavioral finance* – finance from a psychological and social perspective (Schiller (2003)). Contrasting the classical paradigm of EMH, behavioral finance assumes that investors are not always rational in their reactions to market information (Szyszka (2007)). Since there have been extensive research performed regarding EMH, we will in this thesis only give a brief introduction to the effects and anomalies that caused the emergence of the field of behavioral finance in the mid 1980s and 1990s.

2.2.1 Size effect

Banz (1981) studied the relationship between return and the market value of common stocks. Banz found that, for the period between 1936 and 1975, the stocks of small size firms had on average higher risk-adjusted return[4] than the stocks of large firms. This finding would be known as the *size effect*. Chan and Chen (1991) found that size had reliable explanatory power on the distribution of returns among the size portfolios. However, when adding additional risk factors, determined by the stock's sensitivity to a value-weighted index, a leverage index and a dividend-decrease index, size lost its explanatory power. This suggests that there is a risk proxy captured by size and that is not captured by CAPM. More recent studies suggest that the small-size effect has disappeared. For example, Horowitz et al (2000) examine data for the period between 1982 and 1997 and they found no sign of a small-size effect.

2.2.2 January effect

Keim (1983) argues that the studies by Banz (1981) implicitly assume that size-related excess returns are obtained continuously; i.e. evenly throughout time. According to Keim's findings, a significant proportion of the size effect is due to the return premium observed during the month of January each year.[5] The average annual premium of 30.3 percent is reduced to 15.4 percent when the January observations are removed, thus the exclusion of January-observations reduces the overall anomaly by close to 50 percent. This finding would be known as the *January effect*.

[4] Banz used CAPM to determinate the risk-adjusted return.

[5] Test performed for the period (1963-1979).

Possible explanations of the January effect are proposed by e.g. Wachtel (1942) and Branch (1977), explaining the abnormal returns with *tax-loss selling* of shares at the end of the year. Roll (1983) suggests that the annual pattern in small firm returns is strongly associated with tax loss selling, and suggest, in line with Lakonishok and Smidt (1984), that in the case of small firms, small trading volume and large bid-ask spreads neutralize big profit opportunities (Thaler (1987)). Evidence suggests that taxes may not be the only explanation of the January effect. In Great Britain and Australia, January effects where identified by Thaler (1987) even though their tax years begin on other times a year. It should be noted that returns in both countries are high in the beginning of the tax-year, indicating that tax has implications on abnormal returns, but may not be the only explanation.

Another possible explanation is the *information hypothesis*. Keim (1983) states that January is a period of increased uncertainty due to the release of important information. The distribution of this information during January may have a greater impact on the prices of small firms, relative to large firms, since the gathering and processing of information in small firms is a less costly process (Keim (1983)).

2.2.3 Weekend effect

First reported by Cross (1973) and further developed by French (1980), the *Monday effect*, later to be known as the *Weekend effect*, refers to the tendency of stocks to have relatively larger returns on Fridays compared to Mondays. According to Dyl and Marbely (1988), common stocks and other financial assets earn negative average returns on Mondays, because of the amount of unfavourable information during the weekend. Dyl and Marbely (1988) further argue that this does not explain the anomaly, as rational investors keep holding the financial assets during this unfavourable part of the week.

The Monday effect is perhaps the strongest of the calendar anomalies, despite this not large enough to build a trading strategy around it (Rubenstein (2001)). According to Rubenstein (2001), while the U.S. stock market rose with approximately 10 percent per year, the Friday-close to Monday-close return was negative. In accordance with Rubenstein's findings, Keim and Stambaugh (1984) add to the findings of Cross (1973) and French (1980), that the majority of the negative average return on the S & P Composite for the period 1928-1952, occurs during the non-trading period from Monday open to previous Friday close, hereby stressing that the *Monday effect* in fact is a *Weekend* effect. The results are similar to the ones reported by French (1980) for the period 1953-1977 and also supported by Rogalski (1984). The

latter also found empirical evidence of an inexplicable link between the Weekend effect, the January effect and the size effect; small firms have higher return on Mondays in January than large firms.

Schwert (2003) found the estimate of the *weekend effect* not being reliably different from the other days of the week since 1978. Sullivan, Timmerman and White (1999) showed that the effect could easily be the result of data mining or chance. After 1987, the weekend effect has disappeared and more strikingly, during the period 1989–1998 Monday has been the best day of the week, suggesting there is no such thing as a weekend effect (Rubenstein (2001)).

2.2.4 Contrarian

De Bondt and Thaler (1985) used monthly data from 1926 to 1982 to form a winners'- and a losers' portfolios based on the stocks' past long-term performance[6] and then measured the performance of the stocks over the next three years. The result was that the losers earned 24.6 percent more than the winners over the following three-year period, despite that the winners were significantly more risky. According to these findings there is a *contrarian effect,* meaning that losers outperform winners in the subsequent time period. De Bondt and Thaler (1985) explained their result with market overreactions to unexpected news and information.

Chan (1988) argued that De Bondt's and Thaler's (1985) results were due to failure to risk-adjust returns. Chan found that the risk of winners and losers were not constant. When adjusted for this, Chan only found small abnormal returns, which were likely to be economically insignificant.

2.2.5 Momentum

In contrast to the contrarian effect, there is the *momentum effect*. Jegadeesh and Titman (1993) studied data for the period between 1965 and 1989. Their strategy is based on buying stocks that have performed well in the past 3- to 12-month period and sell stocks that have performed poorly in the same period. Jegadeesh and Titman (1993) found that the strategy generated significant positive returns over 3- to 12-month holding periods. They argue that the findings were not due to the strategy's systematic risk, nor to a delay in stock price reactions. Lo and MacKinlay (1988) examined weekly returns of US stocks for the period 1962-1987, and found significant positive serial correlation in weekly and monthly holding-period returns.

[6] Ranging between one to five years

2.2.6 Ratios

2.2.6.1 Price-to-earnings (P/e)

Basu (1977) found empirical evidence of stocks with low P/e-ratios outperforming stocks with high P/e-ratios, during the period April 1957-March 1971. The tests performed by Basu (1977) using; *Jensen's alpha*, *Treynor- and Sharpe* measures, show that low P/e-portfolios on average outperform random portfolios of equivalent risk, while high P/e-portfolios fail to outperform randomly selected portfolios of equivalent risk. All investors with the aim of rebalancing their portfolio annually (and tax-exempt investors) could find abnormal returns. Transactions costs, search costs and tax effects prevented traders[7] from taking advantage of the market inefficiency. Basu's findings implicate that security price behavior is not consistent with the *semi-strong* form of the efficient market hypothesis. Basu suggests there are exaggerated investor expectations on high P/e-stocks, and lags in new information being accurately interpreted by investors. Chan, Hamao, and Lakonishok (1991) have found similar results.

Fama and French (1992) argue that low P/e-stocks are fundamentally riskier. Lakonishok, Shleifer and Vishny (1994) on the other hand show that the reward for bearing fundamental risk does not explain higher average returns on low P/e-stock portfolios.

2.2.6.2 Dividend-to-price (d/p)

As P/e, dividend yield or (d/p) is an initial value parameter that has been used extensively in empirical research, in trying to determine future stock returns. The ratio d/p is simply the dividend divided with the stock price. Fama and French (1988) and Campbell and Shiller (1988) have in found that a significant portion of the variance of future returns for the stock market can be predicted by the initial dividend yield. Furthermore, they show that investors have earned a higher rate of return from the stock market when they purchased a market basket of equities with an initial dividend yield that was relatively high. Fama and French (1988) argue that the stock returns are more predictable when measured over a longer time period.

Fluck, Malkiel and Quandt (1997) found that a higher rate of return on equities with initially high dividend yield is not consistent for individual stock picking. Investors purchasing a portfolio of individual stocks with the highest dividend yields in the market will not earn a particularly high rate of return. Examples of mutual funds pursuing this strategy underperformed the market during the period 1995-1999, according to Malkiel (2003). Malkiel (2003) shows evidence of dividend yields being unable to predict future returns since the mid-1980s. Fama and French (2001) argue that this may be due to a

[7] Rebalancing more frequently.

changing pattern in dividend behavior of companies, using share buyback programs as means of pay out money to shareholders. Thus, dividend yield may not be as meaningful as in the past as a predictor of future equity returns.

3 Greenblatt's Magic Formula

3.1 Introduction

In an attempt to link the vast amount of theory on the field of investments to a more pragmatic view on investments, we have chosen to further investigate the magic formula strategy presented by Joel Greenblatt in his book *The little book that beats the market*.

Joel Greenblatt is a value investing hedge fund manager at Gotham Capital and adjunct professor at Columbia University. Greenblatt summarizes his investment philosophy into a simple selection process based on *return on capital* and *earnings yield*, both defined in his own way. Companies are ranked according to these two selection criteria and investments are done in the companies with the best combined rankings. This process makes up the magic formula, which will be treated in the next sections.

3.2 The Magic formula

When valuing a company, Greenblatt stresses the fact that predictions and estimates are guesses of the future outcomes, and those predictions are therefore flawed. The magic formula takes into account factors that are known, making no predictions. In performing the ranking and building of an entire portfolio of stocks, the best reasonable proxy publically available is, according to Greenblatt, last year's performance. The magic formula ranks companies based on two factors:

(i) **Return on capital** = EBIT[8]/ Tangible capital employed[9]

(ii) **Earnings Yield** = EBIT/ Enterprise Value[10]

Greenblatt's way of defining *Return on capital* is by measuring the ratio of the 12 month trailing pre-tax operating profits to tangible capital employed (Net Working Capital + Net Fixed Assets). He presents several reasons for why he uses this ratio instead of the more common ROA (earnings/total assets) or ROE (earnings/equity).

[8] Earnings before Interest and Tax
[9] Net Working Capital + Net Fixed Assets
[10] Market value of equity (including preferred equity) + net interest bearing debt + minority interest

EBIT is used instead of earnings to compare companies on operating level without the distortion of different debt- and tax levels. Greenblatt assumes that depreciation and amortization expenses were roughly equal to maintenance capital spending requirements, meaning earnings were not charged with any cash expenses. Greenblatt thereby assumes: EBITDA- Maintenance capital expenditures = EBIT.

Tangible capital employed is used instead of total assets (ROA) and equity (ROE), to find out the capital needed to conduct business. Greenblatt argues that a company has to fund its inventory and receivables but not its payables, which are an interest free loan.

Intangible assets, specifically goodwill, as well as excess cash (not needed to conduct business), are not part of the tangible capital employed. Goodwill is a historical cost created at a transaction. These assets are not in need of replacement for the company to earn its profits going forward. Consequently Greenblatt argues that tangible capital employed better reflects the return on capital.

Greenblatt's definition of *earnings yield* results in measuring the pre-tax earnings yield on the full purchase price of the company, by taking the ratio of EBIT to enterprise value. The measure is used instead of the more common P/e because distortions of debt level are mitigated, as the price of debt is included. This means taking into account the price paid for the entire business including debt, allowing comparing companies with different levels of tax-rates and debt proportions. In this way Greenblatt takes a private equity view of the companies (Lancetti and Montier (2006)).

3.2.1 Ranking

The formula starts with identifying the largest 3.500[11] stocks on the U.S. stock exchanges, excluding utilities- and financial stocks. The companies are ranked in descending order in each of the two categories, return on capital and earnings yields as defined by Greenblatt. The rankings are then combined, looking for companies with a combination of high return on capital and high earnings yield. A company that is ranked 4th and 6th respectively will get a combined ranking of 10 (4+6 = 10).

Earnings-related figures were based on the latest 12-month period, balance sheet items were based on the most recent figures, and market prices on the most recent closing price. Stocks with limited liquidity were eliminated. The above procedure is also performed, using the 2500[12] and 1000[13] largest stocks.

[11] Market cap > USD 50 million
[12] Market cap > USD 200 million
[13] Market cap > USD 1 billion

The portfolio consists of, on average, the 30 highest ranked companies at every rebalancing of the portfolio. Initially, five to seven stocks are picked during the first few months until 30 stocks are reached. Each time the group of stocks reach one year in the portfolio, rebalancing is done and the highest ranked stocks replace the previous held stocks.

3.2.2 Results

Table 3.1: Magic Formula results in % for the period 1988 to 2004 (Largest 3500 stocks, market cap > USD 50 million)

Year	Magic Formula	Market Average	S&P 500	Year	Magic Formula	Market Average	S&P 500
1988	27.1	24.8	16.6	1997	40.4	16.8	33.4
1989	44.6	18.0	31.7	1998	25.5	(2.0)	28.6
1990	1.7	(16.1)	(3.1)	1999	53.0	36.1	21.0
1991	70.6	45.6	30.5	2000	7.9	(16.8)	(9.1)
1992	32.4	11.4	7.6	2001	69.6	11.5	(11.9)
1993	17.2	15.9	10.1	2002	(4.0)	(24.2)	(22.1)
1994	22.0	(4.5)	1.3	2003	79.9	68.8	28.7
1995	34.0	29.1	37.6	2004	19.3	17.8	10.9
1996	17.3	14.9	23.0	**Average annual**			
				Return	**30.8**	**12.3**	**12.4**

Table 3.2: Magic Formula results in % for the period 1988 to 2004 (Largest 1000 stocks, market cap > USD 1billion million)

Year	Magic Formula	Market Average	S&P 500	Year	Magic Formula	Market Average	S&P 500
1988	29.4	19.6	16.6	1997	41.0	19.6	33.4
1989	30.0	27.6	31.7	1998	32.6	9.9	28.6
1990	(6.0)	(7.1)	(3.1)	1999	14.4	35.1	21.0
1991	51.5	34.4	30.5	2000	12.8	(14.5)	(9.1)
1992	16.4	10.3	7.6	2001	38.2	(9.2)	(11.9)
1993	0.5	14.4	10.1	2002	(25.3)	(22.7)	(22.1)
1994	15.3	0.5	1.3	2003	50.5	41.4	28.7
1995	55.9	31.4	37.6	2004	27.6	17.3	10.9
1996	37.4	16.2	23.0	**Average annual**			
				Return	**22.9**	**11.7**	**12.4**

Table 3.3: Magic Formula performance based on market cap.

Size of stock universe	Annual return	Market Average
3500 (mark.cap>USD 50 million)	30.8	12.3
2500 (mark.cap>USD 200 million)	23.7	12.4
1000 (mark.cap>USD 1 billion)	22.9	11.7

Tables 3.1-3.3 show the result of the magic formula. The returns are impressive, well above the market average and the S&P 500. The difference when using the 1000 largest or the 2500 largest stocks is rather small, 22.9 percent compared to 23.7 percent. However, when you expand the universe of stocks to the 3500 largest stocks, the return increases 7.1 percent compared to the return of the 2500 largest stocks. This suggests that there could be a size effect, i.e. the formula performs better on smaller stocks.

Greenblatt also examines the results of his magic formulas using 193 separate rolling one-year periods[14], and 169 separate rolling three-year periods.[15] Using the largest 1000 companies, the magic formula underperformed the market average three years in a row but outperformed the market in 75 percent of the 193 one-year periods. Over the three-year periods, Greenblatt's portfolio outperforms the market in 95 percent of the periods (160 out of 169) and the portfolio has positive return in all 169 periods. These results illustrate what Greenblatt's emphasizes as one of the key aspects of the magic formula; that you need a long-term investment horizon. The lowest return in the 169 three-year periods was a gain of 11 percent, while the worst return for the market average was a loss of 46 percent.

Performing the test on the universe of the largest 3500 companies, the results improve. In the 169 three-year periods tested, Greenblatt's magic formula beats the market averages in every period. Selecting stocks from this larger universe of stocks, the lowest return for the magic formula was a gain of 35 percent, while the lowest return for the market average was a loss of 45 percent.

3.2.3 Risk and investment time horizon

Greenblatt argues that when measuring risk (and results) of alternative investment strategies like his magic formula, a time horizon of minimum three years should be used.

When measuring risk, Greenblatt compares the magic formula to the market average on the long-term, in this case three years[16]. Greenblatt believes that risk in a long-term perspective boils down to; what the risk of losing money is, and what the risk of underperforming other strategies is. His findings are that the magic formula had larger returns and beat the market average in most three-year periods. According to Greenblatt, this suggests superior earnings at a lower risk.

[14] 193 Rolling one-year periods; January 1988 to January 1989, February 1988 to February 1989 and so on, ending December 31, 2004.
[15] Same procedure as for one-year rolling periods but the last three-year period tested starts in January 2002 and ends December 31, 2004. Therefore there are 169 rolling three-year periods.
[16] Greenblatt prefers even longer time horizons; 5, 10 or even 20 years.

Greenblatt's view of risk is different from the traditional. He emphasizes the risk of losing money and use rolling long-term performance as a proxy for that. He does not like the traditional view of volatility as a measure of risk. This is why we think it is interesting to examine his returns using traditional views of risk.

The investment time horizon is an issue that Greenblatt's highlights as important when understanding how investors make their decisions. Many investment professionals follow the herd of investors avoiding the risk of poor performance in comparison to peer investors. Professional investors losing money during an extended time period may be subject to sanctions; losing their job, clients, or capital needed. This is a potential reason why long-term investment strategies e.g. the magic formula are disregarded, and also why they perform well (a strategy followed by the entire universe of investors will obviously not beat the market average).

3.3 Greenblatt versus Efficient market hypothesis

The efficient market hypothesis suggests that investors price stocks at a fair value at all times. The EMH is the main framework used in criticizing trading strategies, among them Greenblatt's magic formula. Some of the main critiques brought forward, and dismissed, by Greenblatt are; *data mining*, *look-ahead bias*, *survivorship bias, mispricing of risk* and *size effect.*

As for data mining, Greenblatt assures that the two factors in his model were used by him when investing, prior to the construction of the magic formula. Greenblatt also assures that these were the two first factors that he back tested.

In his tests, Greenblatt used *Compustat,* which is *a point-in-time* database. This means that the database contains the exact information available to Compustat users on each date in the test, ensuring no *look-ahead bias*. Compustat furthermore corrects information that might otherwise produce false positive results in a back test. It restores companies taken out of the database because of insolvency or a merger, which avoids the *survivorship bias* (Alpert).

As mentioned in section 3.2.3, Greenblatt argues that his portfolio is subject to lower risk than the market average in the long-term horizon, which would mean no mispricing of risk. Furthermore, the small-size effect does not seem to be the reason for the high returns, since Greenblatt's formula

performs well even for companies with market cap above USD 1 billion, the largest 1000 U.S Stocks.[17]

3.4 Previous Back Testing of the Greenblatt's work

Back tests of Greenblatt's results have been done by ClariFI[18], finding similar results. The results are an average return of 28 percent (compared to Greenblatt's 30.8 percent) using the largest 3500 U.S stocks, and 17.5 percent (22.9 percent) using the largest 1000 U.S. stocks. These results give credibility to Greenblatt's findings since the results are (almost) replicable. Greenblatt's unrevealed definition of excess cash could be one of the explanations to why the results differ in the ClariFI back test.

There is no indication that Greenblatt intentionally engaged in data mining. In any case, it is interesting to see how his strategy performs on a different set of data, i.e. an out-of-sample test. Tests performed, ranging from finance professor Robert Haugen to Dresdner Kleinwort Wasserstein Securities[19] (DRKW), applying Greenblatt's strategy to the markets of Europe, Japan and the U.S. The research done by DRKW finds results showing that Greenblatt's formula achieves high return in other countries than the U.S. DRKW compares their results only to the market average, not any alternative strategies. Haugen on the other hand makes comparisons between different strategies, including his own and Greenblatt's, on U.S. stocks.

Before presenting Haugen's findings, we will present Greenblatt's comparisons with Haugen's multi-factor model. Greenblatt compares his results to Haugen- and Baker's *71-factor model*, on the Compustat data. The 71-factor model was tested and compared to Greenblatt's magic formula using highest and lowest deciles performance[20], over the period February 1994 through November 2004, on the 1000 largest stocks (market cap over $ 1 billion). The two tables show the results when rebalancing each month and once a year, respectively.

[17] Even though it performs even better using smaller stocks as well.
[18] Develops and sells financial-modeling software that quantitative investors use to test strategies on data like Compustat's.
[19] DRKW through Montier and Lancetti.
[20] Haugen does not suggest investment in the highest decile, nor holding stocks for one year.

Table 3.5 and 3.6: Highest vs. lowest ranked deciles February 1994 through November 2004.

Rebalancing each month	Highest-ranked decile	Lowest-ranked decile
Haugen's 71-factor model	22.98	(6.91)
Greenblatt's magic formula	24.25	(7.91)
Market average	9.38	9.38

Rebalancing each year	Highest-ranked decile	Lowest-ranked decile
Haugen's 71-factor model	12.55	6.92
Greenblatt's magic formula	18.43	1.49
Market average	9.38	9.38

Interesting in the two tables above, is the spread of the highest and lowest ranked portfolios and how the results change in favour of the magic formula as the investment horizon increases. This suggests that, even compared to highly sophisticated models like Haugen's multi-factor model, the magic formula performs well.

Robert Haugen compared the performance of Greenblatt's strategy to that of his 65-factor model[21] in a study presented on his web page[22]. Haugen's tests are performed using point-in-time data from Bloomberg, but processed by himself.[23]

Using Greenblatt's strategy, Haugen tested the magic formula on the largest 1000 U.S. stocks for the period 1996 to 2002. Over this period, Greenblatt reported average returns of 16.4 percent in his book. However, on Haugen's data, the Magic formula returned only 10 percent on average. Haugen's model would have returned 17 percent during the same period. Performance numbers between Haugen´s findings and the results from Greenblatt's book are not directly comparable. Differences arise from differences in databases, the number of stocks held, ranking procedures, and rebalancing strategy. The results from Haugen's back testing and comparison with alternative investment strategies is shown below.

[21] Haugen's multi factor model contain a different number of factors from the 71-factor model used by Greenblatt, in his comparison to Haugen's multi-factor model.
[22] http://www.quantitativeinvestment.com/GreenblattStudy.aspx
[23] This is Haugen's proprietary database. Compustat is used by many investors.

Table 3.7: Results from tests performed by Robert Haugen

	Rosetta test (Greenblatt) EBIT/Net Oper. Assets plus EBIT/EV	Greenblatt Return on Assets & Earnings Yield All Sectors	Earnings Yield plus Profit Margin	Return on Equity plus book to price	Return on Assets plus Book to Price	Return on assets plus Cash Flow Yield
1997	14,70%	11,13%	26,50%	25,57%	15,41%	13,43%
1998	5,82%	8,91%	4,38%	1,46%	8,67%	8,60%
1999	-4,19%	12,35%	12,92%	6,16%	8,59%	12,94%
2000	26,94%	17,28%	25,60%	24,93%	17,67%	19,06%
2001	9,59%	7,61%	6,81%	9,34%	8,10%	8,86%
2002	9,44%	6,50%	10,42%	9,66%	11,36%	7,15%
Average Linked Annual Ret.	9,99%	10,57%	14,12%	12,49%	11,57%	11,60%
Average Annual Return	10,39%	10,63%	14,44%	12,85%	11,63%	11,67%
Longitudinal Std. Deviation	10,27%	3,91%	9,46%	10,05%	4,03%	4,41%
T-stat	2,26	6,07	3,41	2,86	6,45	5,92
Probablility Total Ret < 0	16,42%	7,59%	6,72%	10,99%	9,07%	6,98%

	Earnings Yield plus Sales over Assets	Earnings Yield plus Return on Equity	Return on Assets plus Sales to Price	Greenblatt Returns (from the book)	Haugen Model	S&P 500 Index
1997	15,75%	20,17%	15,03%	41,00%	38,83%	33,36%
1998	-1,11%	5,32%	1,71%	32,60%	29,61%	28,58%
1999	2,55%	4,78%	2,79%	14,40%	42,17%	21,04%
2000	24,26%	21,69%	20,85%	12,80%	-3,53%	-9,11%
2001	13,71%	5,25%	14,99%	38,20%	1,06%	-11,89%
2002	4,51%	3,67%	3,97%	-25,30%	3,78%	-22,10%
Average Linked Annual Ret.	9,60%	9,89%	9,65%	16,43%	17,17%	4,40%
Average Annual Return	9,94%	10,15%	9,89%	18,95%	18,65%	6,65%
Longitudinal Std. Deviation	9,58%	8,39%	8,06%	24,74%	20,51%	23,75%
T-stat	2,32	2,71	2,74	1,71	2,03	0,63
Probablility Total Ret < 0	15,84%	12,31%	11,98%	22,31%	18,74%	37,72%

Haugen was unable to exactly replicate Greenblatt's strategy, since some of the numbers are not included in Haugen's database. Haugen argues that this may explain the poorer performance of Greenblatt's method. Even when using the exact same fields as used by Greenblatt (called the Rosetta test), the magic formula does not perform as well as in Greenblatt's tests. According to Haugen, this strongly suggests that the differences in the returns reported by Haugen and Greenblatt, are due to differences in the databases.

Setting the reported results aside, Haugen has some fundamental critique of the intuition and economical reasoning behind Greenblatt's magic formula. Instead of using normal earnings yield[24], Greenblatt uses the ratio of income available for distribution to both debt- and shareholders (EBIT) to

[24] The ratio of latest reported 12-month trailing earnings per share to the market price of the common stock at the beginning of the month

the market value of equity plus the face value of debt. Haugen argues that this measure the "cheapness" of a combined investment in the firm's debt and equity. Haugen claims that this do not make sense when only investing in equity, as Greenblatt's strategy suggests.

Haugen argues that Greenblatt's version of earnings yield can actually be seen as a blend of two ratios. He decomposes it as follows; *E* is income available for distribution to stockholders, *I* is interest paid on debt, *P* is the market value of the stock, and *D* is the face value of the debt. Greenblatt's version of earnings yield is therefore *(E+I)/(P+D)*. The ratio is *E/P*, is generally known as earnings yield and well known in the investment community. The ratio, *I/D*, is the ratio of interest expense to face value of debt. Haugen further explains that the size of this ratio is determined by: the credit worthiness of the company, the term of the debt, and the interest rates when issuing debt. Haugen argues that the ratio employed by Greenblatt as an earnings yield version has no explanatory effect or economic sense. Furthermore, the results are not better than when using the classical earnings yield, or any other version of this measurement, according to tests presented above.

3.5 The possibility to use anomalies as trading strategies

The predictive power of the anomalies on stock returns are of interest when evaluating Greenblatt's trading strategy. We will in this section assess the possibility to use the anomalies when designing investment strategies.

The anomalies presented represent a significant amount of evidence against the EMH. There are however strong arguments made that these anomalies have common problems, suggesting that the market is efficient. We will present some of these problems below.

Firstly, one problem argued by e.g. Schwert (2003) is data mining. Researchers use data samples to find anomalies that contradict the EMH. Schwert argues that researchers perform their tests trying to mount evidence against the current accepted knowledge, in this case the EMH. This would suggest that the anomalies cannot be used as a trading strategy, as it is a pure statistical construction.

Secondly, a problem common to the anomalies is that even if they are statistically significant during some research periods they show now economic significance, i.e. you cannot take advantage of those anomalies to earn abnormal profits (Malkiel (2003)).

Thirdly, another important critique of the anomalies is that they fail to be consistent over time. One example is the shifting performance of the momentum strategy, which leads to abnormal positive returns during the late 1990s but highly negative returns during 2000 (Malkiel (2003)).

Fourthly, another problem facing some of the anomalies is the self-destructing effect the finding and publishing of the anomalies have. The possibility to use the anomaly as a trading strategy may disappear because investors are handed a free lunch and make use of it until no profits can be made with that particular trading strategy.

3.6 The anomalies and Greenblatt

It is interesting to see the connection between Greenblatt's formula and the anomalies presented. For example, a high earnings yield[25], which Greenblatt uses, is closely associated with low P/e. Both measures premiere companies that has low ratio between earnings and price. Basu (1977) found that stocks with low P/e outperformed, which could be an indicator that a high earnings yield is a good measure to identify winners.

The contrarian strategy is also interesting when it comes to Greenblatt's measures, since it is possible that companies that have a high earnings yield due to a low price, has been a *loser* over the last couple of years. Hence, the earnings yield could possibly identify contrarian stocks.

Greenblatt's findings have a connection to the size effect, since his formula performs substantially better when using a market cap of USD 50 million as cut-off point for which stocks to include compared to using USD 200 million or USD 1 billion.

4 Method and Data

4.1 Method

We will try to imitate Greenblatt's procedures to as a large extent as possible. However, some comments on our procedures are necessary.

We will perform rankings every month for the period starting January 1998 and ending December 2007. The start date of the accumulation of the stocks to our portfolio is January 1st 1998 and the final date of

[25] Greenblatt uses EBIT/EV as earnings yield. It is common to use earnings/profit as earnings yield.

the portfolio will be January 1st 2008. The stock market is typically not open on those dates, but there are values for those dates in the Datastream database and it is those values that we will use[26]. The same procedure will be used for other dates when the stock market is closed.

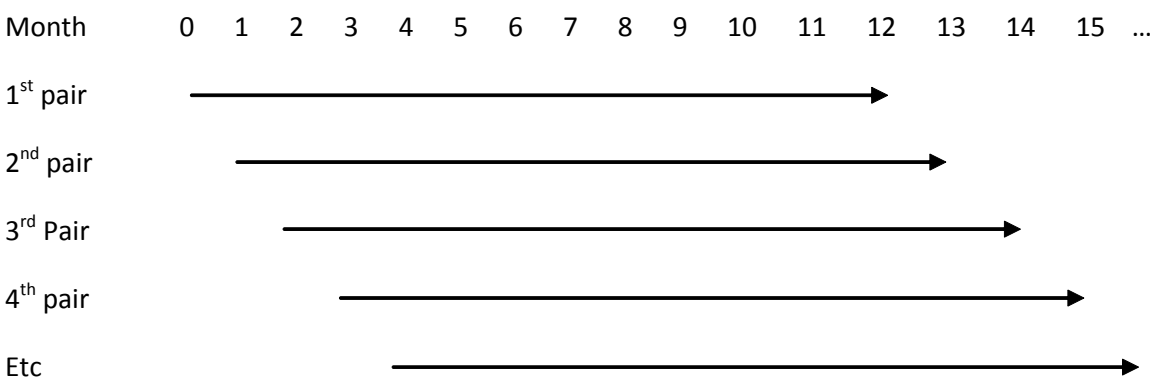
The data from the companies is sorted into different periods. One period represents a month, so in total we will have 120 periods. We perform the rankings on the first day in each month and the stocks will be added to the portfolio the same day.

Exactly what items Greenblatt uses in his rankings is somewhat unclear. We will therefore create two portfolios that we will test. The portfolio that we believe to be most in line with Greenblatt's will use *EBIT/ (Net Working Capital + Net Fixed Assets[27])* as return on capital. This portfolio will be called *Portfolio I.* The other portfolio will use *EBIT / Capital Employed*[28] as return on capital. This portfolio will be called *Portfolio II*. We believe that the latter portfolio could be a better indicator of the performance of the company since it also includes intangible assets such as goodwill, patents and licences etcetera. We argue that these assets should be included because companies use these asset types to get their earnings and should therefore be a part of the measure. Otherwise it could create a bias towards companies that have little fixed assets and large intangible assets. Both portfolios will use *EBIT/EV* as earnings yield.

We will accumulate the stocks gradually during the first year by adding the two stocks that rank the highest in each month. Hence, it will take until the twelfth ranking until the portfolio is full. The full portfolio consists of 24 stocks. The two stocks selected by the rankings will be a part of the portfolio for twelve months. After that the two stocks will be sold off and two new stocks selected by the rankings will be added to the portfolio. Stocks that are being sold off in a period can, if selected by the rankings, be picked up in the same period and will then be held for another twelve month period. If the rankings select a stock that already is a part of the portfolio, the next stock that is not part of the portfolio will be added.

[26] Datastream uses the previous day's closing price in those cases.
[27] We uses Datastream's "Total Fixed Assets – Net" as Net Fixed Assets.
[28] As defined in the Datastream data base.

Figure 4.1: Holding of the stocks



We will in the study also see what happens if we add transaction costs. The transaction costs will be calculated as a monthly percentage of the portfolio value. We arrived to the monthly percentage of 0.2 percent (20 basis points). The reasoning behind that number is as follow. The commission on each trade is assumed to be 15 basis points per transaction[29]. In each month the portfolio sells two stocks and buy stocks; that is four transactions. 15 basis points times four equals 60 basis points. However, the transactions each month only represent 1/12 of portfolio value, which brings us down to five (60/12) basis points of portfolio value. But we wanted a larger number than that to reflect potential market impact and possible rebalancing that has to be made to keep the portfolio equally weighted. And that is why we use 0.2 percent. This is not an exact measure of the transaction cost, but it gives a more realistic picture of the performance than without using transaction costs.

One problem with the kind of rankings that we perform is the problem of *look-ahead bias*. Look-ahead bias is that you at a historic point in time use information that was not available for the people who lived then. For example, if you use company X's EBIT for the full year 2006 at January 1st 2007, you are subject to look-ahead bias since company X's annual accounts for 2006 is typically not available at January 1st 2007. The database that we have used, Datastream, does not take this into account. In order to reduce the effects of look-ahead bias, we use a two month lag, e.g. the numbers for 2006 for a company that uses a normal calendar year will not be in the rankings until March 1st 2007. We use a two-month lag since most companies tend to report their full year earnings in the end of January or early February. We did not want to use just a one-month lag, since there are companies that have not report by then and it is better for the reliability of our model to have a disadvantage compared to an advantage. We realize

[29] This number tend to be what the major brokerage firms in the Nordic region charge their institutional clients.

that this is not a perfect solution, since some companies report within a month after their financial year expires and some does not report within two months after expiration of the financial years, but we believe this is a good approximation that makes the rankings more in line what the rankings would have looked.

The monthly return of the portfolios will be tested against the CAPM and Fama-French's three factor model. CAPM is (Cochrane(1999)):

(i) $r_{it} = r_{ft} + \beta_{it}(r_{mt} - r_{ft})$

or as testable in a regression:

(ii) $r_{it} - r_{ft} = \alpha_i + \beta_{it}(r_{mt} - r_{ft})$

where

r_{it} = return of asset *I* at time *t*,

r_{ft} = return of the risk free rate at time *t*,

r_{mt} = return of the market portfolio at time *t*.

When testing against CAPM, we decided to use two different proxies for the *market portfolio*. Since we did the study on a Nordic basic, we used the benchmark *MSCI Nordic* as one proxy[30]. However, since the argument can be made that the Nordic region is not diversified enough to represent the *market portfolio*, we also used the *market portfolio* from database on Kenneth French's homepage[31]. As seen later, which proxy we use does not affect the results.

The Fama-French's three factor model is (Fama (1998)):

(iii) $r_{it} = r_{ft} + \beta_{it}(r_{mt} - r_{ft}) + s_{it}(SMB_t) + h_{it}(HML_t)$

or

(iv) $r_{it} - r_{ft} = \alpha_i + \beta_{it}(r_{mt} - r_{ft}) + s_{it}(SMB_t) + h_{it}(HML_t)$

[30] With 12 month Stockholm Interbank Offered Rate (STIBOR) as the risk free rate.
[31] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

where

r_{it} = return of asset *I* at time *t*,

r_{ft} = return of the risk free rate at time *t*,

r_{mt} = return of the market portfolio at time *t*,

SMB_t = return of the Small minus Big portfolio at time *t*,

HML_t = return of the High minus Low portfolio at time *t*.

We will also calculate the Sharpe ratio for the portfolios and benchmark. The Sharpe ratio is (Sharpe (1994)):

(v) $$S_i = \frac{\bar{r}_i - \bar{r}_f}{\sigma_i}$$

where

$\bar{r}_i$ = the mean return of asset *I,*

$\bar{r}_f$ = the mean return of the risk free rate,

σ_i = the standard deviation of asset *i.*

4.2 Bad model problem and the Joint Hypothesis Problem

In order for a strategy to violate EMH it is not sufficient for the strategy to just have higher returns than the market. Remember, a strategy that leads to large returns can be explained by that the strategy takes on a large amount of risk. The strategy has to earn abnormal return, i.e. the return has to be above what the risk specifies. In order to test for this, you need to have an asset-pricing model that specifies what return you should earn given the risk. An observant reader will here discover a problem. The test that you will perform will be dependent on the asset-pricing model that you use. It becomes a joint hypothesis problem since you will test both the asset-pricing model and EMH (in form of if the return is abnormal). If the asset-pricing model is miss-specified, the test may lead to the wrong conclusion since

the test can fail for two reasons. Either because one of the two hypotheses is false or because both parts of the joint hypothesis are false. And you cannot determine which one it is. (Fama (1991), Jensen (1978))

4.3 Data

The stocks included in our study are all the stocks listed on five stock exchanges in the Nordic region: Copenhagen, Helsinki, Oslo, Reykjavik and Stockholm. We use data from the Datastream database between 1996 and 2008. Most of the data is the form of company account data on annual basis. However, prices on the stocks are on a monthly basis. The prices of the MSCI Nordic and S&P 500 index are also from Datastream. For the Nordic risk free rate we used 12 month STIBOR from the Swedish Riksbank's homepage. The three Fama-French factors – *Market return minus risk free rate*, *High-Minus-Low* and *Small-Minus-Big* - are downloaded from Kenneth French's beautiful homepage[32].

The original number of stocks was 1184. Just as Greenblatt did, we excluded the stocks of financial[33] and utility companies. We also made sure that there only was one type of share representing each company. Unfortunately, for some companies there was not sufficient data in the database and we therefore had to exclude them. It is obviously a problem that companies that should have been a part of the sample had to be excluded. However, since it is most likely completely random which companies did not have sufficient data, this is not likely to interfere with our results. After these procedures, 744 stocks are remaining for our study[34].

5 Hypothesis

Is Greenblatt's finding for real or is it just pure luck? Since the two measures that he used was the first that he tested for, the case of data mining is not applicable, but it could be luck. In a large set of historic stock data, a large number of patterns will appear. And stocks that produce above market returns will share some common patterns. But unless the factors that constitute the patterns are things that cause the above market returns, then the patterns are of no use. For example, Jason Zwieg (1999) from Money Magazine found by using 10 500 stocks between 1980 and 1999, you could have beaten the market with 1.3 percents by just buying stocks that have no repeat letters in its name. By all this we are trying to say that just because Greenblatt managed to get above market return in his sample, it is not certain that we will receive the same when using the formula in the Nordics.

[32] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
[33] Banks, asset managers, clearing houses, brokerage firms and insurance companies.
[34] For a complete list of the companies in the study, see appendix.

However, there is an economic intuition behind Greenblatt's formula that is reasonable (buy companies that create good return on their assets cheap), although Haugen disagrees. Furthermore, the study performed by Dresdner Kleinwort showed that the magic formula outperformed in other regions as well.

With all this in mind we get our first hypothesis, which is that the absolute return of the tested portfolios will be above the return of the market.

Hypothesis 1a. Portfolio I achieves higher return than the Fama-French's market portfolio and broad market indices. The market indices that we use are S&P 500 Composite and MSCI Nordic.

Hypothesis 1b. Portfolio II achieves higher return than the Fama-French's market portfolio and broad market indices.

As we mentioned in section 4.1, we believe that by using *Capital Employed* instead of *Net Working Capital + Net Fixed Assets* we better reflect the state of the companies. We therefore believe that this strategy will achieve a higher return than Greenblatt's original formula. This will be our second hypothesis.

Hypothesis 2. Our strategy achieves higher return than Greenblatt's, i.e. Portfolio II will achieve a higher return than Portfolio I.

According to Finance theory a high return could be explained by high risk. Greenblatt does not talk extensively about risk and he does not risk adjust the return of his portfolios. If Greenblatt's formula produce abnormal returns, then his findings are really interesting. By this we arrive to our third hypothesis, which is if the Magic formula does not outperform the market when risk adjusted.

As discussed before about bad model we cannot have the EMH as a hypothesis. We therefore have to break down EMH to testable hypothesis. We decided to use arguably the two most famous and used asset pricing models; Capital Asset Pricing Model (CAPM) and Fama-French's three-factor model.

Hypothesis 3a. Portfolio I's return is explained by CAPM, i.e. the alpha is not significant.

Hypothesis 3b. Portfolio II's return is explained by CAPM, i.e. the alpha is not significant.

Hypothesis 4a. Portfolio I's return is explained by Fama-French's three factor model, i.e. the alpha is not significant.

Hypothesis 4b. Portfolio II's return is explained by Fama-French's three factor model, i.e. the alpha is not significant.

6 Results

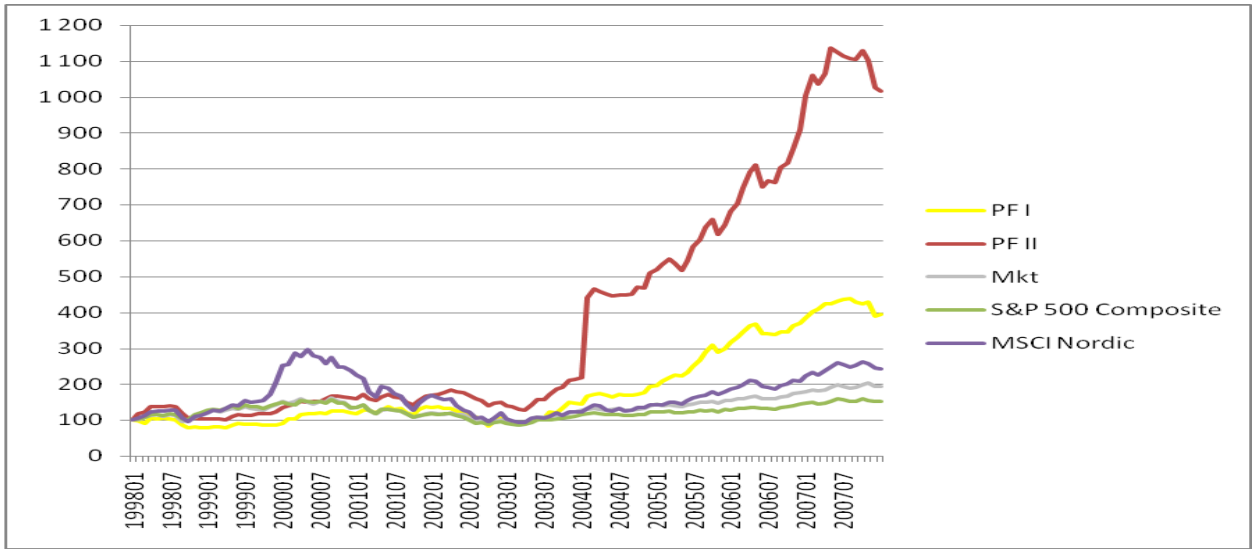
6.1 Hypothesis 1

Table 6.1: Monthly descriptives (except CAGR which is on an annual basis) of the market portfolio, S&P 500 Composite, MSCI Nordic, Portfolio I and Portfolio II for the whole sample period.

Portfolio I		*Portfolio II*		*Mkt*	
Mean	0,0132	Mean	0,0233	Mean	0,0065
Median	0,0080	Median	0,0168	Median	0,0123
Standard Deviation	0,0592	Standard Deviation	0,1040	Standard Deviation	0,0447
Minimum	-0,1750	Minimum	-0,1482	Minimum	-0,1577
Maximum	0,1555	Maximum	1,0114	Maximum	0,0839
CAGR	0,1468	CAGR	0,2609	CAGR	0,0677
Sharpe	0,1739	Sharpe	0,1957	Sharpe	0,0800
S&P 500 Composite		*MSCI Nordic*			
Mean	0,0043	Mean	0,0102		
Median	0,0056	Median	0,0104		
Standard Deviation	0,0414	Standard Deviation	0,0744		
Minimum	-0,1062	Minimum	-0,1794		
Maximum	0,1269	Maximum	0,2389		
CAGR	0,0423	CAGR	0,0928		
Sharpe	0,0338	Sharpe	0,0973		

Both Portfolio I and Portfolio II achieve a higher return than the Market portfolio, S&P 500 and MSCI Nordic, which is what we expected. Both our portfolios achieve impressive compounded annual growth rates (CAGR), 14.68 percent for Portfolio I and 26.09 percent for Portfolio II. The standard deviation of the Market portfolio and S&P 500 is lower than our portfolios, which is also expected. However, the standard deviation of MSCI Nordic is higher than the standard deviations of Portfolio I; but Portfolio II has a higher standard deviation. The Sharpe ratio is higher for both Portfolio I and Portfolio II compared to the benchmarks.

Figure 6.1: The aggregated returns of Portfolio I, Portfolio II, Market portfolio (Mkt), S&P 500 Composite and MSCI Nordic. (Start value for all portfolios is 100)



In figure 6.1 we can see the aggregated returns of the different portfolios and indices. As seen, Portfolio II is a clear-cut winner with Portfolio I as a clear runner-up. If you had invested SEK 100 in Portfolio at the start of 1998, you would have SEK 1015 at January 1st 2008, which represents a return of 915 percent. A SEK 100 investment in Portfolio I in 1998 would have led to SEK 393 at the end of the period.

We can conclude that Portfolio I and Portfolio II achieve higher return (and a higher Sharpe ratio) than the market portfolio and the market indices that we used. We therefore accept hypothesis 1a and 1b.

6.2 Hypothesis 2

Table 6.2: Monthly descriptives (except CAGR which is on an annual basis) of Portfolio I and Portfolio II for the whole sample period.

Portfolio I		*Portfolio II*	
Mean	0,0132	Mean	0,0233
Median	0,0080	Median	0,0168
Standard Deviation	0,0592	Standard Deviation	0,1040
Minimum	-0,1750	Minimum	-0,1482
Maximum	0,1555	Maximum	1,0114
CAGR	0,1468	CAGR	0,2609
Sharpe	0,1739	Sharpe	0,1957

As seen in table 6.2 the both portfolios have a positive mean, Portfolio I 1.32 percent and Portfolio II 2.33 percent. Portfolio II also has a higher median than Portfolio I. An explanation for that Portfolio II has a higher return is that it takes on more risk; Portfolio II has a standard deviation of 10.4 percent compared to 5.92 percent for Portfolio I. However, Portfolio I has the lowest minimum value indicating that Portfolio I has the lowest single month drop in the portfolio value. Portfolio II also has a higher Sharpe ratio than Portfolio I

We can therefore conclude that Portfolio II achieves a higher return than Portfolio I. We therefore accept hypothesis 2.

6.3 Hypothesis 3

We now move on to the hypothesis regarding EMH, which is the heart and soul of this thesis.

Table 6.3: Regression table using the return of Portfolio I as dependable variable and Mkt-RF as explanatory variable.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0078	0,0046	1,6817	0,0953
Mkt-RF	0,7024	0,1034	6,7950	0,0000000

Table 6.4: Regression table using the return of Portfolio I as dependable variable and MSCI – 12 month STIBOR as explanatory variable.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0070	0,0045	1,5432	0,1254
MSCI Nordic - 12M	0,4521	0,0604	7,4794	1,45E-11

The intercept (alpha) is positive when using *Mkt-RF* as explanatory variable. However, the P-value is quite high. The coefficient for *Mkt-RF* is positive and significant on all reasonable significant levels. The same analysis can be made when *MSCI – 12M* is the explanatory variable. Hence, we cannot reject hypothesis 3a that the return of Portfolio I is explained by CAPM.

Table 6.5: Regression table using the return of Portfolio II as dependable variable and Mkt-RF as explanatory variable.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0175	0,0090	1,9447	0,0542
Mkt-RF	0,7880	0,2015	3,9113	0,0002

Table 6.6: Regression table using the return of Portfolio II as dependable variable and MSCI–12 month STIBOR as explanatory variable.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0160	0,0087	1,8454	0,0676
MSCI Nordic -12M	0,5824	0,1169	4,9817	2,18E-06

For Portfolio II the intercepts are still positive and the p-values are lower, but still quite high. The coefficients for *Mkt-RF* respectively *MSCI Nordic - 12M* are still positive and significant. Hence, we cannot reject hypothesis 3b that the return of Portfolio II is explained by CAPM.

One thing that we find interesting and quite puzzling is that the coefficients of Mkt-RF of below one despite that all the portfolios clearly outgain the Market portfolio.

6.4 Hypothesis 4

Table 6.7: Regression table using the return of Portfolio I as dependable variable and the Fama-French factors as explanatory variables.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0051	0,0046	1,1057	0,2711
Mkt-RF	0,8479	0,1183	7,1692	0,0000
SMB	0,1895	0,1231	1,5386	0,1266
HML	0,4260	0,1517	2,8089	0,0058

As seen in table 6.8 the intercept for Portfolio I is positive, however the P-value for the intercept is very high. This means that we cannot reject hypothesis 4a that the return of Portfolio I is explained by Fama-French's three factor model.

Table 6.8: Regression table using the return of Portfolio II as dependable variable and the Fama-French factors as explanatory variables.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0135	0,0091	1,4788	0,1419
Mkt-RF	0,9546	0,2333	4,0906	0,0001
SMB	0,4235	0,2430	1,7432	0,0839
HML	0,6008	0,2992	2,0078	0,0470

We can see in table 6.9 that the intercept for Portfolio II is positive, but once again the P-value for the intercept is high. We can therefore not reject hypothesis 4b that the return of Portfolio II is explained by Fama-French's three factor model.

6.5 Adding transaction costs

Since we are testing a trading strategy it would be interesting to see how the strategy performs when adding transactions cost. As mentioned before we use 0.2 percent of the portfolio value on a monthly basis as transaction cost.

Figure 6.2: The aggregated returns of Portfolio I, Portfolio II, S&P 500 Composite and MSCI Nordic when adding transaction costs (TC) to Portfolio I and Portfolio II. (Start value for all portfolios is 100)

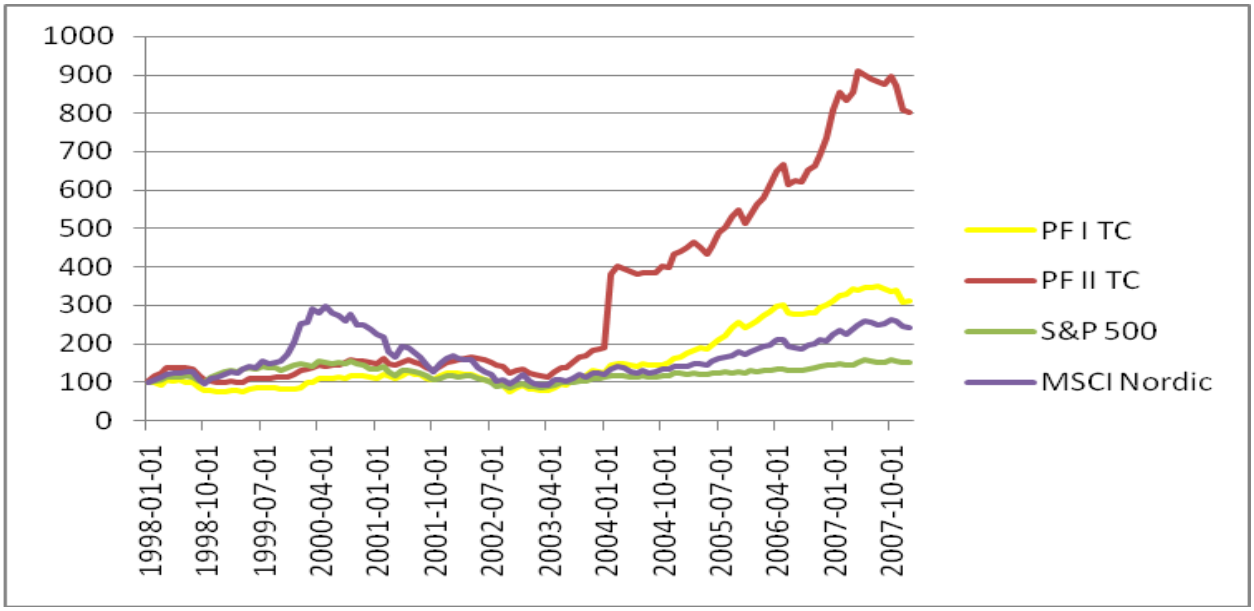


Table 6.9: Monthly descriptives (except CAGR which is on an annual basis) of Portfolio I and Portfolio II for the whole sample period when adding transaction costs.

Portfolio I		*Portfolio II*	
Mean	0,0112	Mean	0,0213
Median	0,0060	Median	0,0148
Standard Deviation	0,0592	Standard Deviation	0,1040
Minimum	-0,1770	Minimum	-0,1502
Maximum	0,1535	Maximum	1,0094
CAGR	0,1198	CAGR	0,2314
Sharpe	0,1381	Sharpe	0,1754

As seen in the figure and table above, Portfolio I and Portfolio II still outperforms the broad market indices. The CAGR is still on an impressive level, 11.98 percent and 23.14 percent respectively. The Sharpe ratios are still above the market portfolio and the benchmarks. Adding transaction costs did not affect the conclusion from hypothesis 1 and 2.

Table 6.10: Regression table using the return of Portfolio I as dependable variable and Mkt-RF as explanatory variable with transaction costs.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,00578	0,00463	1,24947	0,21397
Mkt – RF	0,70244	0,10338	6,79497	0,00000

Table 6.11: Regression table using the return of Portfolio I as dependable variable and MSCI Nordic–12 Month STIBOR as explanatory variable with transaction costs.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,00496	0,00451	1,09957	0,27376
MSCI Nordic -12M	0,45209	0,06044	7,47943	0,00000

Both intercepts are still positive, but a bit smaller. However, what is interesting here is that p-value of intercepts have increased significantly compared to when there was no transaction costs (see tables 6.3 and 6.4). Hence, we have no reason to change the conclusion from section 6.3.

Table 6.12: Regression table using the return of Portfolio II as dependable variable and Mkt-RF as explanatory variable with transaction costs.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0155	0,0090	1,7229	0,0875
Mkt – RF	0,7880	0,2015	3,9113	0,0002

Table 6.13: Regression table using the return of Portfolio II as dependable variable and MSCI Nordic–12 Month STIBOR as explanatory variable with transaction costs.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0141	0,0087	1,6160	0,1088
MSCI Nordic -12M	0,5824	0,1169	4,9817	0,0000

The intercept decreased somewhat here as well. The p-values of the intercepts increased somewhat, but not to the same degree as for Portfolio I. The results by adding transaction costs do not make us change previous conclusions.

Table 6.14: Regression table using the return of Portfolio I as dependable variable and the Fama-French factors as explanatory variables.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0030	0,0046	0,6484	0,5180
Mkt-RF	0,8490	0,1185	7,1637	0,0000
SMB	0,1851	0,1234	1,5003	0,1363
HML	0,4251	0,1520	2,7978	0,0060

Table 6.15: Regression table using the return of Portfolio II as dependable variable and the Fama-French factors as explanatory variables.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0114	0,0091	1,2485	0,2144
Mkt-RF	0,9557	0,2332	4,0977	0,0001
SMB	0,4192	0,2428	1,7264	0,0869
HML	0,6000	0,2990	2,0064	0,0471

By studying tables 6.14 and 6.15 we can conclude that nothing changed when adding transaction costs. The intercepts are still insignificant, which mean that we cannot reject the hypothesis that the returns are explained by Fama-French's three factor model.

6.6 Rolling 12 Month Performances

The average rolling 12-month return is 21.5 percent for Portfolio I and 36.0 percent for Portfolio II. However, there is a risk of losing money since both portfolios had quite many negative rolling 12-month periods. Portfolio I lost money in 25 of the 109 periods (22.9 percent), while Portfolio II lost money in 22 periods (20.2 percent). The probability of losing money could therefore been seen as quite high in our case. See appendix for complete list of the rolling 12-month performance.

7 Discussions and Conclusions

As we have pointed earlier in this thesis, you can with a large set of data by pure luck find patterns among stocks that perform better than the market. Was this the case with Joel Greenblatt? Probably not, since others and we managed to get healthy returns above the market by back testing his strategy.

The implications of our results are dependent on how you look at risk and what you believe risk to be. Our two portfolios had an absolute return above the market. It did however lose money in more than 20 percent of the rolling 12-month periods, which suggest that there is a rather big chance of losing money.

When we risk adjust our portfolios with CAPM and Fama-French's three factor model, they do not beat the market. From an EMH perspective this suggests that there is something more risky with this strategy. That earnings yield could be a proxy for risk is not hard to see, the price of the stock could be low due to financial distress. That a high return on capital could be a proxy for risk is harder, but not impossible, to see. It could be that the market expects the company to continue achieving high returns and therefore pushes up the price. And if the expectations are not met, that would lead to volatility. However, that combining the two should be a proxy for risk is intuitively hard to understand.

We found that using transaction cost lowered the return (no surprise there) but the intercepts in our regressions remained insignificant. We also found that using a measure that includes intangible assets was a better measure to use. That is not surprising to us since we believe such measure better reflect the state of the company.

Greenblatt stresses, in line with other value investors, that the traditional risk measures have flaws and are not adequate in the interpretation of risk for an investing strategy. Bearing in mind the development of risk measures since the CAPM was introduced, we see the point with this criticism. However, we want to stress the fact that neither Greenblatt, nor any other value investors that we have come across, have any compelling alternative measure that are quantifiable. This leads us to another interesting question,

does it make sense to use statistical measures such as the significances of the intercepts to judge whether or not an investment strategy is good or bad? We raise this question since it is hard to get significance intercepts with a limited number of time periods, which often is the case when evaluating trading strategies. Maybe the best measure of an investment strategy's performance is the track-record of an investor putting his money where his mouth is.

The high returns of the magic formula are definitely intriguing. However, we would be caution to use this strictly as a trading strategy, since the results are not definitive. We are not convinced that the strategy will achieve high returns going forward. We do believe that the formula could be valuable as a part of a screening process for which stocks to invest in, since it has in the past shown an ability to pick good stocks.

8 Further research

We think that the most interesting thing to further research is to use the strategy over a longer period, say 20 or 30 years. That would give a better picture of the risk of the strategy.

It would be interesting to further examine if the formula performs better if updating the corporate accounts data quarterly and use rolling four quarters. To use more recent data would most likely lead to a better performance. In our thesis we have used last year's EBIT when performing the rankings. A better way to identify future winners could be to use average EBIT for the last couple of years, since this would better reflect a typical year for the companies. Other things one can try are changing the holding period and the number of stocks that you buy to see if this affects the performance.

Another interesting thing to examine is to see how the formula performed during the fall of 2008 when the market dropped significantly. Since our result indicates that the strategy increases the risk it is not unreasonable to believe that this would come in effect during an event like that. However, by buying stocks that are cheap, the fall height would probably not be as high. It would also be interesting to see if the formula could pick future winners by identifying cases where the stock market has overreacted, which De Bondt and Thaler (1985) showed that it sometimes does.

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9.4 Databases

Thomson Datastream

Kenneth French's Data Library
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

The Swedish Riksbank's database of Market rates,
http://www.riksbank.se/templates/stat.aspx?id=16738

10 Appendix

10.1 More of Greenblatt's results

The table below shows that *the magic formula* not only performs well on the 30 stocks in the portfolio, it performs well in ascending order as well as the return of the stocks in the group descends as the groups contain stocks with lower combined rankings. Rankings are performed every month and stock the stocks in each group are held for one year and then rebalanced according to the new combined rankings.

Table 10.1: 10 groups of 250 stocks each, with the highest ranked in group 1, based on a universe of 2500 stocks (market cap> USD 200 million), annualized returns 1988-2004.

Group	Annual return in %, 1988-2004.
1	17.9
2	15.6
3	14.8
4	14.2
5	14.1
6	12.7
7	11.3
8	10.1
9	5.2
10	2.5

10.2 Rolling 12 Month Performance

12 Month Period Ending	Portf. I	Portf. II	12 Month Period Ending	Portf. I	Portf. II	12 Month Period Ending	Portf. I	Portf. II
1999-01-01	-21,60%	2,10%	2002-04-01	11,40%	19,00%	2005-07-01	46,80%	29,80%
1999-02-01	-17,60%	-11,70%	2002-05-01	-2,20%	8,30%	2005-08-01	58,40%	34,60%
1999-03-01	-12,80%	-16,60%	2002-06-01	-12,40%	2,50%	2005-09-01	72,60%	41,00%
1999-04-01	-25,10%	-26,10%	2002-07-01	-12,60%	2,50%	2005-10-01	79,80%	40,10%
1999-05-01	-16,80%	-18,40%	2002-08-01	-18,70%	-1,50%	2005-11-01	63,70%	32,10%
1999-06-01	-15,50%	-16,80%	2002-09-01	-15,80%	3,20%	2005-12-01	55,00%	26,50%
1999-07-01	-14,10%	-18,50%	2002-10-01	-27,50%	-2,40%	2006-01-01	60,30%	31,00%
1999-08-01	-11,80%	-17,30%	2002-11-01	-25,50%	-5,70%	2006-02-01	60,20%	31,60%
1999-09-01	2,10%	-0,10%	2002-12-01	-23,00%	-9,60%	2006-03-01	57,70%	36,10%
1999-10-01	7,20%	9,60%	2003-01-01	-32,50%	-17,50%	2006-04-01	61,30%	47,50%
1999-11-01	5,70%	11,90%	2003-02-01	-32,20%	-21,10%	2006-05-01	64,90%	57,00%
1999-12-01	7,80%	20,90%	2003-03-01	-32,90%	-26,90%	2006-06-01	46,30%	38,30%
2000-01-01	15,40%	32,60%	2003-04-01	-33,60%	-30,40%	2006-07-01	35,30%	31,30%
2000-02-01	26,30%	34,90%	2003-05-01	-21,60%	-20,30%	2006-08-01	26,80%	26,30%
2000-03-01	29,10%	41,00%	2003-06-01	-10,30%	-11,50%	2006-09-01	18,90%	26,10%
2000-04-01	45,80%	48,90%	2003-07-01	-7,10%	-8,00%	2006-10-01	12,00%	24,00%
2000-05-01	37,80%	33,50%	2003-08-01	13,80%	6,90%	2006-11-01	25,50%	38,60%
2000-06-01	31,20%	32,30%	2003-09-01	17,50%	20,60%	2006-12-01	23,70%	41,30%
2000-07-01	35,50%	34,30%	2003-10-01	57,60%	37,90%	2007-01-01	22,30%	47,50%
2000-08-01	33,50%	40,60%	2003-11-01	56,50%	43,40%	2007-02-01	21,30%	50,70%
2000-09-01	41,10%	43,10%	2003-12-01	38,90%	42,80%	2007-03-01	18,90%	38,60%
2000-10-01	46,00%	42,20%	2004-01-01	56,60%	58,10%	2007-04-01	17,20%	34,60%
2000-11-01	43,60%	41,60%	2004-02-01	78,80%	223,70%	2007-05-01	15,50%	40,10%
2000-12-01	43,10%	30,80%	2004-03-01	93,00%	260,50%	2007-06-01	27,10%	49,80%
2001-01-01	29,80%	17,00%	2004-04-01	95,90%	260,70%	2007-07-01	28,10%	45,70%
2001-02-01	24,60%	22,60%	2004-05-01	72,40%	216,30%	2007-08-01	29,90%	45,60%
2001-03-01	23,10%	11,10%	2004-06-01	54,10%	185,90%	2007-09-01	24,20%	37,60%
2001-04-01	3,70%	1,90%	2004-07-01	60,60%	189,00%	2007-10-01	23,00%	38,40%
2001-05-01	8,80%	11,30%	2004-08-01	37,80%	162,50%	2007-11-01	18,10%	29,10%
2001-06-01	16,10%	14,00%	2004-09-01	40,30%	142,10%	2007-12-01	5,60%	12,90%
2001-07-01	10,10%	8,10%	2004-10-01	29,30%	145,90%	2008-01-01	2,10%	1,30%
2001-08-01	11,20%	2,10%	2004-11-01	17,70%	122,70%	Average	21,50%	36,00%
2001-09-01	-2,90%	-9,80%	2004-12-01	31,50%	138,50%	**Negative**	**25**	**22**
2001-10-01	-6,40%	-14,20%	2005-01-01	36,70%	137,20%	Periods	109	109
2001-11-01	4,20%	-5,90%	2005-02-01	24,70%	21,30%	Negative		
2001-12-01	13,30%	2,60%	2005-03-01	27,20%	17,80%	periods (%)	22,90%	20,20%
2002-01-01	15,60%	5,90%	2005-04-01	29,70%	17,20%			
2002-02-01	6,80%	0,60%	2005-05-01	31,70%	14,90%			
2002-03-01	4,20%	11,00%	2005-06-01	40,70%	22,10%			

10.3 The Case of Raysearch Laboratories

When studying the descriptive of Portfolio II (see section 6.1), one thing that stands out is the extreme high maximum value for Portfolio II of 101.14 percent. That return is due to that the stock of the company Raysearch Laboratories (Raysearch) increased from SEK 0.42 to SEK 9.47 between 2004-01-01 and 2004-02-01[35]. Suspecting that the return of Raysearch during that month interferes with the results, we tested to exclude that return. Portfolio II without Raysearch's return between 2004-01-01 and 2004-02-01 will be called Portfolio II*. You could argue that Raysearch suffered a great deal of risk at that point in time in and could as easily have gone the other way and become worthless. We therefore tested to set Raysearch's return for that month -100 percent, which is the ultimate risk. Portfolio II with Raysearch's return between 2004-01-01 and 2004-02-01 set to -100 percent will be called Portfolio II**.

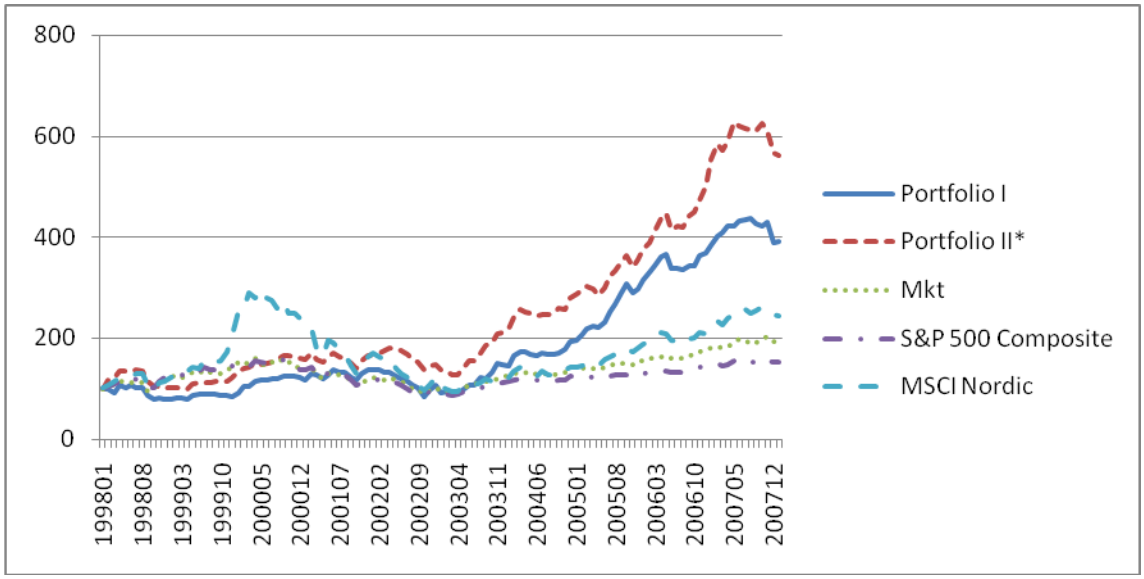
Table 10.2: Monthly performance of Portfolio II and of Portfolio II** for the whole sample period.*

*Portfolio II**		*Portfolio II***	
Mean	0,0158	Mean	0,0154
Median	0,0168	Median	0,0168
Standard Deviation	0,0513	Standard Deviation	0,0507
Minimum	-0,1482	Minimum	-0,1482
Maximum	0,1720	Maximum	0,1720
CAGR	0,1885	CAGR	0,1840
Sharpe	0,2511	Sharpe	0,2469

The means drop from 2.33 percent to 1.58 percent and 1.54 percent respectively, which is still higher than the return of Portfolio I. The CAGRs are still impressive, above 18 percent in both cases. The most interesting thing here is that the standard deviations of the portfolios drop to 5.13 percent and 5.07[36] percent respectively, which is below the standard deviation than Portfolio I. Hence, Portfolio II* and Portfolio II** achieve higher returns than Portfolio I with less volatility. It is also interesting that Portfolio II* and Portfolio II** achieve the highest Sharpe ratio of all the included benchmarks and portfolios.

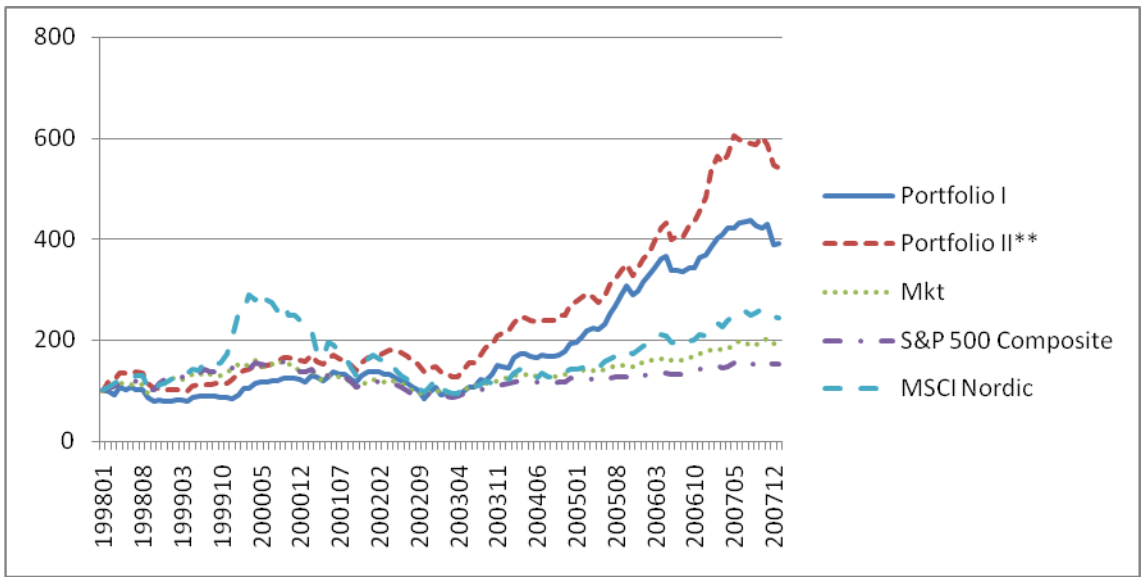
[35] That is a return of 2 155 percent in one month!
[36] It is interesting noticing that the risk decreases the most when the share of Raysearch becomes worthless.

Figure 10.1: The aggregated returns of Portfolio I, Portfolio II, Market portfolio (Mkt), S&P 500 Composite and MSCI Nordic. (Start value for all portfolios is 100)*



In figure 10.1 Portfolio II is exchanged for Portfolio II*. Portfolio II* achieves the highest return; an invested SEK 100 would have led to SEK 562 ten years later. What also is worth noticing is how closely Portfolio I and Portfolio II* follows each other during the second half of the period.

*Figure 10.2: The aggregated returns of Portfolio I, Portfolio II**, Market portfolio (Mkt), S&P 500 Composite and MSCI Nordic. (Start value for all portfolios is 100)*



In figure 10.2 Portfolio II is exchanged for Portfolio II** respectively. The analysis is in line with the one made regarding figure 10.1.

We here test Portfolio II with the elimination of Raysearch in January 2004 and the simulation of bankruptcy of Raysearch in January 2004 against CAPM.

Table 10.3: Regression table using the return of Portfolio II as dependable variable and Mkt-RF as explanatory variable.*

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0103082	0,0036819	2,7996709	0,0059781
Mkt-RF	0,7172410	0,0822546	8,7197673	0,0000000

*Table 10.4: Regression table using the return of Portfolio II** as dependable variable and Mkt-RF as explanatory variable.*

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0099728	0,0036286	2,7483797	0,0069306
Mkt-RF	0,7139585	0,0810628	8,8074755	0,0000000

For both Portfolio II* and Portfolio II** the intercept positive and is significant on the 1 percent level. The coefficient for Mkt-RF is still significant. This indicates that the return of those portfolios cannot fully be explained by CAPM.

As we have done before we decided to see how the elimination of Raysearch in January 2004 and the simulation of bankruptcy of Raysearch in January 2004 affect the results, this time for the Fama-French three factor model.

Table 10.5: Regression table using the return of Portfolio II as dependable variable and Fama-French factor as explanatory variables.*

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0078319	0,0036182	2,1645831	0,0324687
Mkt-RF	0,8187483	0,0927761	8,8249877	0,0000000
SMB	0,2564389	0,0965881	2,6549739	0,0090460
HML	0,3651024	0,1189581	3,0691686	0,0026731

*Table 10.6: Regression table using the return of Portfolio II** as dependable variable and Fama-French factor as explanatory variables.*

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,0075708	0,0035714	2,1198456	0,0361506
Mkt-RF	0,8124421	0,0915753	8,8718484	0,0000000
SMB	0,2486842	0,0953379	2,6084503	0,0102920
HML	0,3541635	0,1174183	3,0162538	0,0031453

The intercepts for Portfolio II* and Portfolio II** are positive and with P-values of 3.25 percent and 3.62 percent respectively. At the 5 percent level we would have rejected the hypothesis that the returns of the portfolios are explained by Fama-French's three factor model.

It is kind of contra-intuitive that by dropping our most successful stock and replacing it by a -100 percent return, the risk adjusted return increases.

10.4 Original List of Stock

Stock that is marked with an “I” is excluded due to lack of information. Stock that is marked with a “D” is excluded because there are doublets. Stock that is marked with an “F” is excluded due to being a financial company. Stock that is marked with an “U” excluded due to being a utility company. Stock that is unmarked, 744 in total, is a part of the study.

Name of Stock	Excluded	Name of Stock	Excluded
AALBORG BOLDSPILKLUB		CBRAIN	I
AARHUS LOKALBANK	F	CHEMOMETEC	I
ALM BRAND	F	#ERROR	I
ALM BRAND PANTEBREVE	F	COLUMBUS IT PARTNER	
ALMANIJ BRAND FORMUE 'B'	F	#ERROR	I
ALK-ABELLO		COLOPLAST 'B'	
AMAGERBANKEN	F	#ERROR	I
AMBU		CURALOGIC	
ANDERSEN & MARTINI		DANSKE BANK	F
A & O JOHANSEN PR.		DANTRUCK	
ARKIL HOLDING		DANIONICS	
ASGAARD GROUP		DANISCO	
ATLANTIC PETROLEUM		DANTAX 'B'	
AURIGA INDUSTRIES 'B'		DAN EJENDOMME HLDG.	
BAVARIAN NORDIC		DFDS	
BG INVEST HEALTH CARE	I	DIBA BANK	F
BG INVEST EUROPA	I	DJURSLANDS BANK	F
IC COMPANYS (EX. UDBYTTE 06/07)	I	DLH 'B'	
OSTJYDSK BANK NYE	F	#ERROR	I
BG INVEST VERDEN	I	D/S NORDEN	
BRONDBY IF 'B'		DANTHERM	
#ERROR	I	D/S ORION	
BAVARIAN NORDIC NYE	I	A P MOLLER - MAERSK 'A'	D
BANG & OLUFSEN 'B'		A P MOLLER - MAERSK 'B'	
BIOPORTO		DSV 'B'	
BOCONCEPT HOLDING 'B'		D/S TORM	
BONUSBANKEN	F	#ERROR	I
BRD KLEE 'B'		EUROINVESTOR COM NYE	I
BRODRENE HARTMANN 'B'		EDB GRUPPEN	
CARLSBERG 'B'		EGETAEPPER 'B'	
CAPINORDIC NYE	I	EBH BANK A/S	F
CAPINORDIC	F	EUROINVESTOR COM	I
CARLSBERG 'A'	D	EIK BANKI	F
CARNEGIE WORLDWIDE	I	ARHUS ELITE 'B'	

#ERROR	I	INVESTEA STOCKHOLM RET.	I
NORDJYSKE BANK	F	JEUDAN	
ERRIA	I	JENSEN & MOL.INVEST	
EXIQON NYE	I	JYSKE BANK	F
EXPEDIT 'B'		KAPITALPLEJE	F
EXIQON		KOBENHAVNS LUFTHAVNE	
FE BORDING 'B'		KREDITBANKEN	F
FIRSTFARMS	I	LAN & SPAR BANK	F
FIONIA BANK	F	LASTAS 'B'	
FLSMIDTH & COMPANY 'B'		LIFECYCLE PHARMA NYE	I
FLUGGER 'B'		LIFECYCLE PHARMA	
FORSTAEDERNES BANK	F	FORMUEPLEJE LIMITTELLUS	I
FOROYA BANKI	I	LAND & LEISURE 'A'	D
FORMUEPLEJE EPIKUR	I	LAND & LEISURE 'B'	
FORMUEPLEJE MERKUR	I	LOKALBANKEN I NORD	F
FORMUEPLEJE PENTA	I	LOLLANDS BANK	F
FORMUEPLEJE SAFE	I	LUNDBECK	
#ERROR	I	LUXOR 'B'	
GABRIEL HOLDING		MACONOMY	
GENMAB		MIGATRONIC 'B'	
GREENTECH ENERGY SYS.		MIDTINVEST	I
GLUNZ & JENSEN		MONDO	I
GPV INDUSTRI 'B'		MONS BANK	F
GPV INDUSTRI 'A'	D	#ERROR	I
GRIFFIN III BERLIN 'B'	I	MOLS-LINIEN	
GRIFFIN IV BERLIN 'B'	I	MONBERG & THORSEN 'B'	
GRONLANDSBANKEN	F	MORSO BANK	F
GUDME RAASCHOU VISION	I	NEUROSEARCH	
GN STORE NORD		NKT	
GREEN WIND ENERGY		NORDICOM	
GYLDENDAL 'B'		NORDFYNS BANK	F
GYLDENDAL 'A'	D	NORDIC TANKERS	
HARBOES BRYGGERI 'B'		NOVO NORDISK 'B'	
HEDEGAARD		NORRESUNDBY BANK	F
H&H INTERNATIONAL 'B'		NORDIC TANKERS NYE	I
HOJGAARD HLDG.'B'		NETOP SOLUTIONS	
HOJGAARD HOLDING 'A'	D	NTR HOLDING	
MAX BANK	F	NUNAMINERALS	I
SPAREKASSEN HVETBO	I	NOVOZYMES	
HVIDBJERG BANK	F	OLICOM	
IC COMPANYS		OSTASIATISKE KOM	
INTERMAIL 'B'		OSTJYDSK BANK	F
INVESTEA GERMAN HIGH ST II	I	PER AARSLEFF	

PHARMEXA	
PRIME OFFICE	I
PARKEN SPORT & ENTM.	
ROYAL UNIBREW	
RELLA HOLDING	
RENEWAGY	
RIAS 'B'	
RINGKJOBING LNDOBK	F
RINGKJOBING BANK	F
ROCKWOOL 'A'	D
ROBLON 'B'	
ROCKWOOL 'B'	
ROSKILDE BANK	F
ROVSING	I
RTX TELECOM	
#ERROR	I
SALLING BANK	F
SANISTAL 'B'	
SATAIR	
SCANDINAVIAN BRAKE SYS.	
SCHOUW & CO	
SCF TECHNOLOGIES	I
SCHAUMANN PROPERTIES	I
DICENTIA	
SIF FODBOLD 'B'	
SIMCORP	
SJAELSOE GRUPPEN	
SKJERN BANK NYE	I
SKAELSKOR BANK	F
SKAKO INDUSTRIES	
SKJERN BANK	F
SPAR NORD BANK	F
SONDAGSAVISEN	
SOLAR 'B'	
SPAENCOM 'A'	D
SPAENCOM 'B'	
SPAREKASSEN FAABORG	F
SP GROUP	
SPAREKASSEN HIMLD.	I
SPAREKASSEN LOLLAND	I
SPARBANK	F
#ERROR	I
SVENDBORG SPAREKASSE	F
SYDBANK	F
TDC	
THRANE & THRANE	
TIVOLI 'B'	
TK DEVELOPMENT	
TONDER BANK	F
TOPDANMARK	F
TOTALBANKEN	F
TOWER GROUP	
TOPOTARGET	
#ERROR	I
#ERROR	I
DK TRENDS INVEST	I
TRIFORK	I
TRYGVESTA	F
TOPSIL SEMICON.MATS.	
UTD.INTL.ENTS.	
UNITED PLTNS.AFRICA	
UP	I
VESTFYNS BANK	F
VESTAS WINDSYSTEMS	
VIBORG HANDBOLD KLUB 'B'	
VICTOR INTERNATIONAL	
VINDERUP BANK	F
VICTORIA PROPERTIES	
VESTJYSK BANK	F
VORDINGBORG BANK	F
WALLS	
WILLIAM DEMANT HLDG.	
AFFECTO	
AHLSTROM	
ALANDSBANKEN 'A'	F
ALANDSBANKEN 'B'	F
ALDATA SOLUTIONS OYJ	
ALMA MEDIA	
AMER SPORTS 'A'	
UPONOR	
ASPOCOMP GROUP	
ASPO	
ATRIA 'A'	
BASWARE	
WULFF-GROUP	
BIOHIT 'B'	

BIOTIE THERAPIES	
CAPMAN 'B'	I
CARGOTEC 'B'	
CITYCON	
CENCORP	
CRAMO	
COMPONENTA	
COMPTEL	
DONE SOLUTIONS	
STORA ENSO 'A'	D
STORA ENSO 'R'	
ELISA	
ELCOTEQ SE	
ETTEPLAN	
EVIA	
EXEL	
EFORE	
FINNLINES	
FISKARS 'A'	D
FISKARS 'K'	
FINNAIR	
FORTUM	U
F-SECURE	
GEOSENTRIC	
GLASTON	
HEX 25	I
HKSCAN 'A'	
HONKARAKENNE 'B'	
HUHTAMAKI	
ILKKA 1	D
ILKKA YHTYMA	
INCAP	
INTERAVANTI	
ELEKTROBIT	
JULIUS TALLBERG	
SUOMINEN	
KONECRANES	
KEMIRA	
KESKISUOMALAINEN	
KESKO 'A'	D
KESKO 'B'	
KESLA 'A'	
KONE 'B'	
LANNEN TEHTAAT	
LAROX 'B'	
LEMMINKAINEN	
LASSILA & TIKANOJA	
MARTELA 'A'	
MARIMEKKO	
METSO	
M-REAL 'A'	D
M-REAL 'B'	
NORDEA BANK FDR	F
NESTE OIL	
NURMINEN LOGISTICS	
#ERROR	I
NOKIA	
NOKIAN RENKAAT	
NORDIC ALUMINIUM	
ORIOLA-KD 'A'	D
ORIOLA-KD 'B'	
OKMETIC	
ORAL HAMMASLAAKARIT	
ORION 'A'	D
ORION 'B'	
OUTOTEC	
OUTOKUMPU 'A'	
OLVI 'A'	
PANOSTAJA 'B'	D
PANOSTAJA 'A'	
PERLOS	
PROHA	
PKC GROUP	
POHJOLA BANK	F
POHJOISKARJALAN	
PONSSE	
POYRY	
QPR SOFTWARE	
RAMIRENT	
RAPALA VMC	
#ERROR	I
RAUTE 'A'	
RUUKKI GROUP	
ROCLA	
RAUTARUUKKI 'K'	
RAISIO 'K'	

RAISIO YHTYMA 'V'	D	AQUA BIO TECHNOLOGY	I
SALCOMP		ACTA HOLDING	F
SAMPO 'A'	F	ACERGY	
SOPRANO	I	ABILITY DRILLING	I
SOLTEQ		AF GRUPPEN 'A'	
SPONDA		ARENDALS FOSSEKOMPANI	U
SRV GROUP		ARTUMAS GROUP	I
SSH COMMS.SCTY.		AGR GROUP	
STOCKMANN 'A'	I	AKTIV KAPITAL	F
STOCKMANN 'B'		AKER BIOMARINE	
STROMSDAL 'B'		AKER	
STONESOFT		AKER FLOATING PRODUCTION	
SSK SUOMEN SAASTAJIEN		AKER PHILADELPHIA SHPYD.	I
SUOMEN TERVEYSTALO		AKER SEAFOODS	
DIGIA		AKER SOLUTIONS	
TAKOMA		AKVA GROUP	I
TAMFELT KANTA	D	AKER EXPLORATION	
TAMFELT ETU		AKER YARDS	
TALENTUM		ALGETA	
TECHNOPOLIS		AMERICAN SHIPPING CO.	
TEKLA		APPTIX	
TELESTE		ABG SUNDAL CLI.HLDG.	F
TECNOMEN		AURSKOG SPAREBANK	F
TIETOENATOR		AUSTEVOLL SEAFOOD	
TIIMARI		AWILCO OFFSHORE	
WESTEND ICT		BELSHIPS	
TRAINERS' HOUSE		BERGEN GROUP	I
TULIKIVI 'A'		BIOTEC PHARMACON	
ELECSTER 'A'		BIRDSTEP TECHNOLOGY	
TURKISTUOTTAJAT 'C'		BJORGE	
UPM-KYMMENE		BLOM	
VAAHTO GROUP 'A'	D	BLUEWATER INSURANCE	F
VAAHTO GROUP 'K'		BYGGMA	
VACON		BONHEUR	
VAISALA 'A'		BORGESTAD 'A'	
VIKING LINE		BOUVET	I
SCANFIL		BWG HOMES	
WARTSILA		BW GAS	I
#ERROR	I	BW OFFSHORE	
IXONOS		BADGER EXPLORER	
YLEISELEKTRONIIKKA OYJ		CECON	I
YIT		CAMILLO EITZEN & CO	
ADRESSEAVISEN		CERMAQ	

CLAVIS PHARMA	I	GOODTECH	
CODFARMERS	I	GOLDEN OCEAN GROUP	
COMROD COMMUNICATION	I	GOLAR LNG	
CONFIRMIT	I	GREGOIRE	I
COPEINCA		GANGER ROLF	
CONTEXTVISION		GREEN REEFERS	
CAMPOSOL HOLDING	I	GRIEG SEAFOOD	I
DATA RESPONS		GYLDENDAL	
DEEP SEA SUPPLY		HAVILA ARIEL	I
DET NORS.OLJESELSKAP		HAVILA SHIPPING	
DIAGENIC		HELGELAND SPAREBANK	I
DNB NOR	F	HEXAGON COMPOSITES	
DNO INTERNATIONAL		HAFSLUND INFRATEK	I
DOCKWISE		HJELLEGJERDE	
DOF		HAFSLUND 'A'	U
DOF SUBSEA		HAFSLUND 'B'	U
DOLPHIN INTCONN.SLN.	I	HOL SPAREBANK	F
DOMSTEIN		HURTIGRUTEN	
EITZEN CHEMICAL		HOLAND SPAREBANK	I
EDB BUSINESS PARTNER		INTERNATIONAL GOLD EXP.	
EIDSIVA REDERI		IGE NORDIC	I
EIDESVIK OFFSHORE		IGNIS	
EKORNES		IMAREX	F
ELTEK		IM SKAUGEN	
EMENTOR		INMETA	
ELECTROMAGNETIC GEOSVS.		INVIVOSENSE	I
EITZEN MARITIME SERVICES		INTEROIL EXP.& PRDN.	I
EOC		INDRE SOGN SPAREBANK	F
ETMAN INTERNATIONAL	I	INTELECOM GROUP	
EXENSE		ITERA CONSULTING GROUP	
EXENSE CONSULTING DEAD - 24/09/08	I	INTEX RESOURCES	
FAIRSTAR HEAVY TRAN.		PETROJACK	
FAKTOR EIENDOM	I	JINHUI SHIP.& TRSP.	
FARSTAD SHIPPING		KONGSBERG AUTV.HOLDING	
FARA ASA		KITRON	
FRED OLSEN ENERGY		KLEPP SPAREBANK	I
FRED OLSEN PRDN.		KONGSBERG GRUPPEN	
FOSEN		KOMPLETT	
FRONTLINE		KVERNELAND	
FUNCOM		LIGHTHOUSE CALEDONIA	
GRENLAND GROUP ASA		LONDON MINING	I
GLOBAL GEO SERVICES		LEROY SEAFOOD GROUP	
GLOBAL IP SLTN.HOLDING	I	LUXO	

MARINE FARMS	I
MAMUT	
MEDICULT	
MEDI-STIM	
MELHUS SPAREBANK	F
MARINE HARVEST	
SPAREBANK 1 SMN	F
MARITIM INDUSTRIAL SVS.	
SPAREBANKEN MORE	F
NAMSOS TRAFIKKSELSKAP	
NORWEGIAN AIR SHUTTLE	
NATTOPHARMA	I
NAVAMEDIC	I
NEAS	I
NORSE ENERGY CORP.	
NES PRESTEGJELDS SPB.	F
NEXUS FLOATING PRDN.	I
NORSK HYDRO	
NIO SECURITY	I
NORTHERN LOGISTIC PR.	
NORDIC SEMICONDUCTOR	
NORWEGIAN ENERGY CO.	
NORDIC MINING	I
SPAREBANK 1 NORD-NORGE	F
NORWEGIAN PROPERTY	
NORMAN	
NORDIAG ASA	
NORWAY PELAGIC	I
NORSKE SKOG	
SPAREBANK 1 NOTTEROY	I
NUTRIPHARMA	
ODFJELL 'A'	D
ODFJELL 'B'	
ODIM	
OCEAN HEAVY LIFT	
ODFJELL INVEST	
OLAV THON	
OPERA SOFTWARE	
OCEANTEAM	I
ORKLA	
OTRUM	
PCI BIOTECH HOLDING	I
PETROLIA DRILLING	
PETROLEUM GEO SERVICES	
PHOTOCURE	
SPAREBANKEN PLUSS	F
PETROMENA	
POWEL	
PETROPROD	I
PROSAFE PRODUCTION PUB.	I
PRONOVA BIOPHARMA	
PROTECTOR FORSIKRING	I
PROSAFE	
PSI GROUP	
Q-FREE	
RENEWABLE ENERGY	
REM OFFSHORE	
REPANT	I
REVUS ENERGY	
ROCKSOURCE	
RIEBER & SON	
RINGERIKE SPAREBANK	F
GC RIEBER SHIPPING	
REMEDIAL (CYPRUS)	I
SPAREBANK 1 SR BANK	F
ROMREAL	I
ROXAR	
RYGGE-VAALER SPB	I
RESERVOIR EXP.TECH.'B'	
SANDNES SPAREBANK	F
SALMAR	
SANDSVAER SPAREBANK	F
SEABIRD EXPLORATION	
SCANARC	
SCAN GEOPHYSICAL	
SCHIBSTED	
SCANA INDUSTRIER	
SCANDINAVIAN CLIN.NUT.	I
SCORPION OFFSHORE	
SEADRILL	
SEAJACKS INTERNATIONAL	
SEVAN MARINE	
SYNNOVE FINDEN	
SIMTRONICS	I
SIEM OFFSHORE	
SIMRAD OPTRONICS	

SKIENS AKTIEMOLLE		2ENTERTAIN	
STOLT NIELSEN		360 HOLDING	I
SOLSTAD OFFSHORE		3L SYSTEM	
SOFTWARE INNOVATION		AARHUSKARLSHAMN	
SOLVANG		ACAP INVEST 'A'	I
SONGA OFFSHORE		ACADEMEDIA 'B'	
SCANDINAVIAN PR.DEV.		ACANDO 'B'	
SPAREBANKEN OST	F	ACAP INVEST	I
SPECTRUM	I	ATLAS COPCO 'B'	
STAR REEFERS		ACCELERATOR NORDIC 'B'	
STAVANGER AFTENBLAD		ACSC DEAD - 31/12/07	
STOREBRAND	F	ACTIVE BIOTECH	
STATOILHYDRO		ADDVISE	
STEPSTONE		ADDTECH 'B'	
SUBSEA 7		AEROCRINE 'B'	
SUPEROFFICE		AF 'B'	
SPAREBANKEN VEST	F	AFFARSSTRATEGERNA 'B'	
TANDBERG		AGELLIS GROUP	I
TANDBERG DATA		AIK FOTBOLL 'B'	
TELECOMPUTING		ALFA LAVAL	
TECO MARITIME		AUTOLIV SDB	I
TELENOR		BEIJER ALMA 'B'	
TELIO HOLDING	I	ALLOKTON 'B'	I
24SEVENOFFICE		ALPHAHELIX MOLEDIAG.	
TGS-NOPEC GEOPHS.		AMAGO CAPITAL	I
THIN FILM ELECTRONICS	I	AMHULT 2 'B'	
THULE DRILLING	I	ANCORA ENERGISPAR	I
TIDE		ANNEHEM FASTIGHETER	I
TOMRA		ADDNODE 'B'	
TOTENS SPAREBANK	F	ANOTO GROUP	
TANDBERG STORAGE		AROS QUALITY GROUP	
TTS MARINE		AQERI HOLDING	I
VEIDEKKE		ARCAM 'B'	
VMETRO		ARENA PERSONAL	I
SPAREBANKEN VESTFOLD	F	ARK TRAVEL	
VOSS VEKSEL-OG LMDBK.	F	ARTIMPLANT	
WAVEFIELD INSEIS		ASPIRO	
WEGA MINING		ASSA ABLOY 'B'	
WILSON		ALLTELE ALLM.SVEN.TELAB	I
WILHS.WILHELMSEN 'A'	D	AQUA TERRENA	
WILHS.WILHELMSEN 'B'		AUDIODEV 'B'	
YARA INTERNATIONAL		AU HOLDING	
ZONCOLAN	I	AVALON ENTERPRISE 'B'	

AVEGA	I	CATERING PLEASE	I
AVENSIA INNOVATION		CAPILON	I
AVONOVA SVERIGE		D CARNEGIE & CO	F
AXFOOD		CARDO	
AXIS		CARL LAMM	I
AXLON GROUP	I	CASTELLUM	
AVANZA BANK HOLDING	F	CATENA	
BAHNHOF 'B'	I	CATECH 'B'	I
FASTIGHETS BALDER 'B'		CYBAERO	I
BALLINGSLOV INTL.		COMMUNITY ENTM.	I
B&B TOOLS 'B'		CELLAVISION	I
BE GROUP		CHEMEL	I
BEIJER ELECTRONICS		CHERRYFORETAGEN 'B'	I
BEOWULF MINING SDB	I	CLAS OHLSON 'B'	
BETSSON 'B'		CARL LAMM HOLDING	I
BETTING PROM.SWEDEN		CONCORDIA MARITIME 'B'	
BONG LJUNGDAHL		CISION	
BIOSENSOR APPS.SWEDEN 'A'		CONNECTA	
BIOGAIA 'B'		CONPHARM 'A'	D
BILIA 'A'		CONPHARM 'B'	
BILLERUD		SVENSKA CAPITAL OIL	I
BIOINVENT INTL.		A-COM	
BIOMETRON 'B'		CONSILIUM 'B'	
BIOPHAUSIA 'A'		CONFIDENCE INTL.'B'	
BIOTAGE		COOLGUARD 'B'	
BJORN BORG		COREM PROPERTY GROUP	I
ELEKTRONIKGRUPPEN BK 'B'		COUNTERMINE 'B'	I
BLACK EARTH FARMING SDB		CELLPOINT CONNECT	
BENCHMARK OIL & GAS		C-RAD 'B'	I
BOLIDEN		CLOETTA FAZER 'B'	
BOREVIND		CTT SYSTEMS	
BRIO 'B'		CYBERCOM GROUP EUROPE	
BERGS TIMBER 'B'		CRYPTZONE	I
BRINOVA FASTIGHETER		DACKE GROUP NORDIC	I
BROSTROM		DAGON	
BRIO 'B' SPECIAL RIGHTS	I	DEVICOM	I
BTS GROUP		DGC ONE	I
BURE EQUITY		DIADROM HOLDING	I
BIOVITRUM		DIAMYD MEDICAL 'B'	
BRINGWELL INTERNATIONAL		DTG SWEDEN	I
C2SAT 'B'	I	DIBS PAYMENT SER.	I
CENTRAL ASIA GOLD	I	DIN BOSTAD SVERIGE	
NCS NDC.CAMPING & SPS.		DIOS FASTIGHETER	I

DANNEMORA MINERAL	I	FINGERPRINT CARDS	
DO NETWORKS SVERIGE	I	FIREFLY	
#ERROR	I	FENIX OUTDOOR	
DONE MAN.& SYS.	I	FORSSTROM HIGH FREQ.	
DORO		FOLLOWIT HOLDING	
DRILLCON	I	FORSHEM GROUP	I
DUROC 'B'		FORMPIPE SOFTWARE	I
DUNI		FRAGUS GROUP 'B'	
DIGITAL VISION		FUNDIOR	I
ELECTROLUX 'A'		GEVEKO 'B'	
EAST CAPITAL EXPLORER	F	GENERIC SWEDEN	I
EIRIKUVA DIGITAL IMAGE	I	GENLINE HOLDING	
EDI COMPANY 'B'	I	GENOVIS 'B'	
EFFNET HOLDING		GLOBALFUN	I
HEXAGON 'B'		GLOBAL GAMING FACTORY X	
ELECTRA GRUPPEN	I	GIFTTODAY SWEDEN	
ELEKTA 'B'		GETUPDATED INET.MKTG.	
ELLEN	I	GETINGE	
ELANDERS 'B'		GUIDELINE OIL DRL.TECH.	I
ELOS 'B'		LAPPLAND GOLDMINERS	
ELVERKET VALLENTUNA	U	GLYCOREX TRANSPL 'B'	
EMPIRE 'B'		GULD INVEST NORDEN	I
EMITOR HOLDING	I	GUNNEBO INDUSTRIER	
ENACO		GUNNEBO	
ENEA		GEXCO	I
ENDOMINES		H1 COMMUNICATION 'B'	I
#ERROR	I	HAKON INVEST	
ENLIGHT INTERNATIONAL		HALDEX	
ENJOY GROUP 'B'	I	HAMMAR INVEST 'B'	
ENIRO		HUFVUDSTADEN 'C'	
ENTRACTION HOLDING 'B'		HEBA 'B'	
ENERGYO SLTN.RUSSIA	I	HEBI HEALTH CARE	I
ERICSSON 'A'		HEDSON TECHS.INTL.	
EUROCINE VACCINES		HEMTEX	
EUROCON CONSULTING	I	HIQ INTERNATIONAL	
EUROPEAN INST.OF SCI.'B'		HL DISPLAY 'B'	
EUROVIP GROUP 'A'	I	PEAB 'B'	
EUROVIP GROUP 'B'	I	HENNES & MAURITZ 'B'	
FABEGE		HANSA MEDICAL	I
FAGERHULT		HMS NETWORKS	I
FAST PARTNER		HEART OF BRANDS 'B'	I
FASTTV NET		HOGANAS 'B'	
FEELGOOD SVENSKA		HOMEMAID	

HOME PROPERTIES	
HEXPOL 'B'	I
HQ	F
HUFVUDSTADEN 'A'	I
HUMAN CARE H C	
HUSQVARNA 'A'	D
HUSQVARNA 'B'	
IBS 'B'	
ICT SWEDEN HOLDING	I
ICM KUNGSHOLMS	
INTELLECTA 'B'	
IDL BIOTECH 'B'	
INDL.& FINL.SYS.'A'	D
INDL.& FINL.SYS.'B'	
#ERROR	I
IMPACT COATINGS	I
INDUTRADE	
INTRUM JUSTITIA	
INNATE PHARMS.'A'	
INTOI	
INTIUS	
INVESTOR 'A'	D
INSPLANET	I
INVESTOR 'B'	
ITAB SHOP CONCEPT 'B'	
INDUSTRIVARDEN 'A'	D
INDUSTRIVARDEN 'C'	
INVISIO HEADSETS	I
RORVIK TIMBER	
JAMES CONCEPTS	I
JEEVES INFO.SYSTEMS	
JELLO	
JLT MOBILE COMPUTERS	
JM	
KARO BIO	
KAPPAHL HOLDINGS	
KABE HUSVAGNAR 'B'	
KONTAKT EAST HOLDING	I
KINNEVIK 'A'	D
KINNEVIK 'B'	
KLOVERN	
KUNGSLEDEN	
KLICK DATA 'B'	
#ERROR	I
KOPPARBERG MINERAL 'B'	I
KNOW IT	
KINDWALLS 'B'	
LABS2GROUP	
LAGERCRANTZ 'B'	
LAMMHULTS DESIGN GROUP	
LBI INTERNATIONAL	
LINDAB INTERNATIONAL	
LIFEASSAYS 'B'	I
LINEAR 'B'	
#ERROR	I
ATRIUM LJUNGBERG 'B'	
LINKMED	I
LUNDBERGFORETAGEN 'B'	
LOVISAGRUVAN	I
LATOUR INVESTMENT 'A'	D
LATOUR INVESTMENT 'B'	
LUCENT OIL	
LUNDIN MINING SDB	I
LUNDIN PETROLEUM	
MAHLER INTERNATIONAL AB	
MALKA OIL	I
MEDCAP	I
MICRO HOLDING	
MEDIVIR 'B'	
MIDWAY HOLDINGS 'A'	D
MALMBERGS ELEKTRISKA	
MEDA 'A'	
BIOLIN	
MEGACON	
MEKONOMEN	
MELKER SCHORLING	
MEDIAPROVIDER SCAN.	I
MICRONIC LASER SYS.	
MILLICOM INTL.CELU.SDB	I
MIDWAY HOLDINGS 'B'	
MIRIS HOLDING	
MUNTERS	
#ERROR	I
MOBISPINE	I
MOBYSON	
HOLMEN 'A'	

MODUL 1 DATA	
MORPHIC TECHNOLOGIES 'B'	
MODERN TIMES GP.MTG 'A'	D
MODERN TIMES GP.MTG 'B'	
MEDICPEN	
MEDIROX 'A'	I
MICRO SYSTEMATION 'B'	I
MSC KONSULT 'B'	
MIDELFART SONESSON 'B'	
MIDELFART SONESSON 'A'	D
METRO INTL.SDB 'B'	
METRO INTL.SDB 'A'	D
MULTIQ INTERNATIONAL	
MYSCOOP INTERNATIONAL	I
NOLATO 'B'	
NORDIC ACS.BUYOUT FUND	I
NOVACAST TECHS.'B'	
NORDEA BANK	F
NEONET	
NET ENTERTAINMENT NE 'B'	
NET INSIGHT 'B'	
NETREVELATION	
NEW WAVE GROUP 'B'	
TECHNOLOGY NEXUS	
NGM HOLDING	I
NGS NEXT GENERATION SYS. SWEDEN	I
NIBE INDUSTRIER 'B'	
NILORNGRUPPEN 'B'	
NISCAYAH GROUP 'B'	
NEDERMAN HOLDING	
NEW NORDIC HEALTHBRANDS	I
NOBIA	
NORDIC MINES	I
NETONNET	
NOTE	
NOVOTEK 'B'	
NOVUS GROUP INTL.	
NORDNET SECURITIES BANK	F
NORDIC SER.PTNS.HDG.'B'	I
NCC 'A'	D
NCC 'B'	
OASMIA PHARMACEUTICAL	I
OBDUCAT 'B'	
ODD MOLLY INTL.	I
ODEN CONTROL 'B'	
OEM INTERNATIONAL 'B'	
ONSKEFOTO	I
OPCON	
OPUS PRODOX	I
ORC SOFTWARE	
ORIFLAME COSMETICS SDB	
ORTIVUS 'A'	D
ORTIVUS 'B'	
OREXO	
ORASOLV	I
PANALARM	I
PA RESOURCES 'B'	
PARTNERTECH	
PANAXIA SECURITY	I
PAYNOVA	I
PRECOMP SOLUTIONS 'B'	I
PARADOX ENTERTAINMENT	I
PHONERA	
PILUM 'B'	I
PEAB INDUSTRI 'B'	
POLYPLANK	I
POOLIA 'B'	
PROBI	
PRECIO SYSTEMUTVECKLING	
PROACT IT GROUP	
PREVAS 'B'	
PRECISE BIOMETRICS	
PRICER 'B'	
PROFFICE 'B'	
PROFILGRUPPEN 'B'	
PUSH DEVELOPMENT	I
PV ENTERPRISE SWEDEN	
PEARL EXP.& PRDN.SDB.	I
Q-MED	
RATOS 'A'	D
REDERI AB TNSAT.'B'	
RAILCARE GROUP	I
RASTA GROUP	
RELATION AND BRAND 'B'	
REDBET HOLDING	I
RAYCLINIC	I

REJLERKONCERNEN 'B'	I	SKANE MOLLAN	
RESURS CNC 'B'	I	SKANSKA 'B'	
REZIDOR HOTEL GROUP		SKF 'A'	D
RADIO FREQ.INV.GP.SWEDEN		SKF 'B'	
RAYSEARCH LABORATORIES		SKISTAR 'B'	
ROTTNEROS		G & L BEIJER	
RNB RETAIL AND BRANDS		ERICSSON 'B'	D
READSOFT 'B'		HOLMEN 'B'	D
RATOS 'B'		SMARTEQ 'B'	
RUNAWARE	I	SECO TOOLS 'B'	
RUSSIAN RL.EST.INV.		SOFTRONIC 'B'	
SAAB 'B'		PSI SPELINVEST	I
SAFE AT SEA	I	ATLAS COPCO 'A'	D
SAGAX	I	SRAB SHIPPING 'B'	
SANDVIK		SSAB 'A'	D
SAS		SSAB 'B'	
SVERIGES BOSTADSRATTSCENTRUM		STARBREEZE	
SCA 'A'	D	STAVRULLEN FINANS 'B'	I
SCRIBONA 'A'	D	STORA ENSO 'A' (OME)	I
SCRIBONA 'B'		STORA ENSO 'R' (OME)	I
SCIROCCO 'B'		STILLE	
SWITCHCORE		STRAND INTERCONNECT 'A'	D
#ERROR	I	STRAND INTERCONNECT 'B'	
SCANIA 'A'	D	1618 STRICT B SHARE	I
SCANIA 'B'		STORMFAGELN	
SEAMLESS DISTRIBUTION	I	STAR VAULT	I
ELECTROLUX 'B'	D	SECURITAS 'B'	
SEB 'A'	F	SVEDBERGS 'B'	
SEANET MARITIME COMMS.	I	STUDSVIK	
SEMCON		SVITHOID TANKERS 'B'	I
SEB 'C'	F	SVENSKA HANDBKN.'A'	F
SENSYS TRAFFIC		SCA 'B'	
SWEDE RESOURCES		SWECO 'A'	D
SERVAGE 'B'	I	SWECO 'B'	
SECTRA 'B'		SWEDBANK 'A'	F
SENZIME	I	SWEDISH MATCH	
SKANDITEK INDRI.FRV.		SWEDOL 'B'	
SVENSKA HANDBKN.'B'	F	SY.SEPTN.SWEDEN HLDG.	
SIGMA B		SYSTEMAIR	
SINTERCAST		TRIGON AGRI	
SV.INTERNETREKRYTERING	I	TATURA	I
SIX 'B'		TAURUS ENERGY 'B'	I
SJR IN SCANDINAVIA 'B'	I	TELE2 'B'	

TELE2 'A'	D	WAYFINDER SYSTEMS	I
TELECA 'B'		WALLENSTAM 'B'	
#ERROR	I	WEDINS SKOR & ACESOR.'B'	
TETHYS OIL	I	WESC	I
TAGMASTER	I	#ERROR	I
TELIGENT		WIHLBORGS FASTIGHETER	
THALAMUS NETWORKS 'B'		WIKING MINERAL	
TICKET TRAVEL		WEST INTERNATIONAL	I
TILGIN	I	WISE GROUP	I
TELIASONERA		WATER JET SWEDEN	I
TOWORK SVERIGE	I	WHITE SHARK 'B'	I
TRAVELPARTNER	I	WEST SIBERIAN RES.SDB	
TRIPEP	I	XANO INDUSTRI 'B'	
TRADEDOUBLER		XTRACOM CNSL.GROUP 'B'	I
TRACTECHNOLOGY		XPONCARD	
#ERROR	I	XRF ANALYTICAL 'B'	I
TRIMERA		XTRANET	
TRICORONA	F	ZODIAK TELEVISION 'B'	
TRETTI	I	ATLANTIC AIRWAYS (ICE)	I
SKY COMMUNICATION		HF EIMSKIPAFELAG ISLANDS	
TRELLEBORG 'B'		BAKKAVOR	
TRANSCOM WWD.SDB.A	D	EXISTA	F
TRANSCOM WWD.SDB.B		FL GROUP DEAD - 09/06/08	
TANGANYIKA OIL SDB	I	GRANDI HF	I
UNIFLEX 'B'	I	HAMPIDJAN	I
ULYSS	I	ICELANDAIR GROUP	
UNIBET GROUP SDB		GLITNIR BANKI	F
UNLTD.TRAVEL GROUP	I	ATORKA GROUP	
VARYAG RESOURCES	I	KAUPTHING BANK	F
VOSTOK GAS SDB		LANDSBANKI ISLANDS	F
VBG GROUP		MAREL FOOD SYSTEMS	
VICTORIA PARK	I	NYHERJI	I
VINOVO	I	OSSUR	
VITEC SOFTWARE GROUP 'B'		ALFESCA	
VITROLIFE		SKIPTI HF	I
VARMEKYL GRSSN.SCAN.		SLATURFELAG SUDURLAND	I
VLT 'B'		SPRON	I
VOSTOK NAFTA INV.SDB		STRAUMUR BUROARAS	F
VITA NOVA VENTURES		TEYMI	I
VOLVO 'B'		TRYGGINGAMIDSTODIN HF	F
VOLVO 'A'	D	VINNSLUSTODIN	I
BORAS WAFVERI 'B'			

10.5 The Stocks Selected in Each Period

Date	Portfolio I	
1998-01-01	SPAENCOM	ACTIVE BIOTECH
1998-02-01	OSTASIATISKE KOM	PANOSTAJA
1998-03-01	SOLAR	BURE EQUITY
1998-04-01	TURKISTOUTTAJAT	RAUTE
1998-05-01	G&L BEIJER	BEIJER ALMA 'B'
1998-06-01	GC RIEBER SHIPPING	FLÜGGER
1998-07-01	ARKIL HOLDING	TOWER GROUP
1998-08-01	EVIA	SKANSKA 'B'
1998-09-01	HEXAGON	ORKLA
1998-10-01	VOLVO 'B'	TULIKIVI
1998-11-01	INTELLECTA 'B'	LAROX
1998-12-01	SANISTAL	A&O JOHANSEN
1999-01-01	EXPEDIT	GLUNZ & JENSEN
1999-02-01	GPV INDUSTRI	MARTELA
1999-03-01	BONHEUR	LEMMINKAINEN
1999-04-01	TURKISTOUTTAJAT	OSTASIATISKE KOM
1999-05-01	GANGER ROLF	SKAKO INDUSTRIES
1999-06-01	RENEWAGY	FLÜGGER
1999-07-01	ELECTROLUX 'A'	MONBERG & THORSEN 'B'
1999-08-01	GC RIEBER SHIPPING	TOWER GROUP
1999-09-01	INCAP	GABRIEL HOLDING
1999-10-01	LANNEN TEHAT	BURE EQUITY
1999-11-01	OLICOM	TULIKIVI
1999-12-01	IC COMPANYS	A&O JOHANSEN
2000-01-01	PANOSTAJA	SANISTAL
2000-02-01	MARTELA	SCANA INDUSTRIER
2000-03-01	NKT	SOLAR
2000-04-01	LEMMIKAINEN	GEVEKO
2000-05-01	RAUTE	AURIGA INDUSTRIES
2000-06-01	KESLA	INDUSTRIVARDEN 'C'
2000-07-01	ELECTROLUX 'A'	FLÜGGER
2000-08-01	WARTSILA	CARDO
2000-09-01	SKANSKA 'B'	STOCKMANN
2000-10-01	SKF 'B'	SECO TOOLS 'B'
2000-11-01	HALDEX	HONKARAKENNE
2000-12-01	OLICOM	GABRIEL HOLDING
2001-01-01	PANOSTAJA	A&O JOHANSEN
2001-02-01	MARTELA	TURKISTOUTTAJAT
2001-03-01	ADDNODE	MONBERG & THORSEN 'B'
2001-04-01	SCHOUW & CO	TRAINERS' HOUSE
2001-05-01	AF	VLT 'B'

2001-06-01	RAUTE	SKANE MOLLAN
2001-07-01	ELECTROLUX 'A'	FLÜGGER
2001-08-01	LEMMIKAINEN	ELCOTEQ
2001-09-01	NKT	STEPSTONE
2001-10-01	LBI INTERNATIONAL	LABS2GROUP
2001-11-01	ASPIRO	GLUNZ & JENSEN
2001-12-01	PREVAS 'B'	INTOI
2002-01-01	PANOSTAJA	TOWER GROUP
2002-02-01	TURKISTOUTTAJAT	WARTSILA
2002-03-01	MSC KONSULT 'B'	ILKKA YHTYMA
2002-04-01	ADDNODE	GABRIEL HOLDING
2002-05-01	GEVEKO	NUTRIPHARMA
2002-06-01	RAUTE	LAROX
2002-07-01	FLÜGGER	QPR SOFTWARE
2002-08-01	INCAP	ROTTNEROS
2002-09-01	STEPSTONE	OTRUM
2002-10-01	ITERA CONSULTING GROUP	MODUL 1 DATA
2002-11-01	ASPIRO	MACONOMY
2002-12-01	GLOBAL GEO SERVICES	BIOLIN
2003-01-01	VICTORIA PROPERTIES	D/S TORM
2003-02-01	ARK TRAVEL	TURKISTOUTTAJAT
2003-03-01	EXENSE	INMETA
2003-04-01	PHARMEXA	LEMMINKAINEN
2003-05-01	ORAL HAMMASLAAKARIT	PROACT IT GROUP
2003-06-01	SCHOUW & CO	ACADEMEDIA 'B'
2003-07-01	EGETAEPPER	ILKKA YHTYMA
2003-08-01	GENMAB	VEIDEKKE
2003-09-01	DANTAX	ACSC
2003-10-01	SOLAR	TELIGENT
2003-11-01	STONESOFT	UTD.INTL.ENTS.
2003-12-01	WARTSILA	PANOSTAJA
2004-01-01	KONE	EXPEDIT
2004-02-01	DIN BOSTAD SVERIGE	STATOILHYDRO
2004-03-01	HOJGAARD HOLDING	SIX
2004-04-01	HEDEGAARD	GEVEKO
2004-05-01	NORWEGIAN AIR SHUTTLE	VITROLIFE
2004-06-01	BIOINVENT INTL.	QPR SOFTWARE
2004-07-01	BYGGMA	LEMMINKAINEN
2004-08-01	MSC KONSULT 'B'	VEIDEKKE
2004-09-01	DANTAX	STAVANGER AFTENBLAD
2004-10-01	SOLAR	TECO MARITIME
2004-11-01	TURKISTOUTTAJAT	DNO INTERNATIONAL
2004-12-01	LANNEN TEHAT	ACSC

2005-01-01	PANOSTAJA	ROBLON
2005-02-01	STATOILHYDRO	BILLERUD
2005-03-01	ELECTROLUX 'A'	D/S NORDEN
2005-04-01	YARA INTERNATIONAL	HEDEGAARD
2005-05-01	NORWEGIAN AIR SHUTTLE	D/S ORION
2005-06-01	TIIMARI	RAUTARUUKKI
2005-07-01	NORDIC ALUMINIUM	VITEC SOFTWARE GROUP 'B'
2005-08-01	KINNEVIK 'B'	RAUTE
2005-09-01	BELSHIPS	ELOS
2005-10-01	INMETA	BYGGMA
2005-11-01	MONBERG & THORSEN 'B'	TDC
2005-12-01	LUNDBECK	D/S TORM
2006-01-01	PERLOS	EXEL
2006-02-01	ARKIL HOLDING	AXFOOD
2006-03-01	D/S NORDEN	PEAB
2006-04-01	HEDEGAARD	GLASTON
2006-05-01	D/S ORION	AVALON ENTERPRISE 'B'
2006-06-01	RAUTARUUKKI	ELECTROLUX 'A'
2006-07-01	NORDIC ALUMINIUM	DOMSTEIN
2006-08-01	KINNEVIK 'B'	RAUTE
2006-09-01	BELSHIPS	CERMAQ
2006-10-01	HALDEX	ELECSTER
2006-11-01	VITEC SOFTWARE GROUP 'B'	TIIMARI
2006-12-01	HOJGAARD HOLDING	TIETOENATOR
2007-01-01	GEVEKO	NORMAN
2007-02-01	DANTAX	ELCOTEQ
2007-03-01	EXENSE	AKER
2007-04-01	DAN EJENDOMME HLDG.	ILKKA YHTYMA
2007-05-01	BOLIDEN	OUTOKUMPU
2007-06-01	ICM KUNGSHOLMS	AF GRUPPEN
2007-07-01	ARKIL HOLDING	SCHOUW & CO
2007-08-01	KINNEVIK 'B'	VEIDEKKE
2007-09-01	EKORNES	HEDEGAARD
2007-10-01	KONGSBERG AUTV.HOLDING	ELECSTER
2007-11-01	BEIJER ALMA	NORSK HYDRO
2007-12-01	LEMMIKAINEN	RAUTARUUKKI

Date	**Portfolio II**	
1998-01-01	RATOS	ARHUS ELITE
1998-02-01	MTG	BLOM
1998-03-01	DNO INTERNATIONAL	SKANSKA 'B'
1998-04-01	YLEISELEKTRONIIKKA OYJ	SWEDISH MATCH

1998-05-01	TULIKIVI	YIT
1998-06-01	PANOSTAJA	AF GRUPPEN
1998-07-01	B&B TOOLS 'B'	TURKISTOUTTAJAT
1998-08-01	SJAELSOE GRUPPEN	LAROX
1998-09-01	VEIDEKKE	ETORE
1998-10-01	MUNTERS	RAUTE
1998-11-01	INTELLECTA 'B'	VAISALA
1998-12-01	ACSC	NTR HOLDING
1999-01-01	ELTEK	ARHUS ELITE
1999-02-01	BLOM	ROCLA
1999-03-01	SCRIBONA 'B'	SKAKO INDUSTRIES
1999-04-01	SOLSTAD OFFSHORE	ELEKTRONIKGRUPPEN BK 'B'
1999-05-01	TULIKIVI	FINNLINES
1999-06-01	MSC KONSULT 'B'	RENEWAGY
1999-07-01	GABRIEL HOLDING	LEMMINKAINEN
1999-08-01	AXFOOD	TK DEVELOPMENT
1999-09-01	MALMBERGS ELEKTRISKA	SOLAR
1999-10-01	EKORNES	PONSSE
1999-11-01	GETINGE	ASPO
1999-12-01	IC COMPANYS	MARTELA
2000-01-01	TGS-NOPEC GEOPHS.	SJAELSOE GRUPPEN
2000-02-01	VEIDEKKE	SKANSKA 'B'
2000-03-01	NKT	SWEDISH MATCH
2000-04-01	VOLVO 'B'	LAMMHULTS DESIGN GROUP
2000-05-01	FENIX OUTDOOR	SVEDBERGS 'B'
2000-06-01	SCANFIL	MSC KONSULT 'B'
2000-07-01	ADDVISE	AF GRUPPEN
2000-08-01	EDB GRUPPEN	FINNAIR
2000-09-01	SATAIR	ROCLA
2000-10-01	IXONOS	MALMBERGS ELEKTRISKA
2000-11-01	ACSC	PKC GROUP
2000-12-01	GABRIEL HOLDING	EKORNES
2001-01-01	NOVOTEK 'B'	PANOSTAJA
2001-02-01	VEIDEKKE	SKANSKA 'B'
2001-03-01	SWECO 'B'	ROTTNEROS
2001-04-01	GN STORE NORD	GLASTON
2001-05-01	BLOM	BURE EQUITY
2001-06-01	WULFF-GROUP	AF
2001-07-01	ADDVISE	VLT
2001-08-01	SIX 'B'	SCHOUW & CO
2001-09-01	STATOILHYDRO	METSO
2001-10-01	IXONOS	ADDTECH
2001-11-01	ARK TRAVEL	DFDS

2001-12-01	SJAELSOE GRUPPEN	ELEKTRONIKGRUPPEN BK 'B'
2002-01-01	PANOSTAJA	SKAKO INDUSTRIES
2002-02-01	SKANSKA 'B'	BRD KLEE
2002-03-01	WARTSILA	RAUTE
2002-04-01	D/S TORM	ETTEPLAN
2002-05-01	INCAP	ROBLON
2002-06-01	WULFF-GROUP	TELESTE
2002-07-01	ADDVISE	QPR SOFTWARE
2002-08-01	TIETOENATOR	SWECO 'B'
2002-09-01	STATOILHYDRO	VESTAS WINDSYSTEMS
2002-10-01	VMETRO	GLOBAL GEO SERVICES
2002-11-01	TGS-NOPEC GEOPHS.	SIX
2002-12-01	SJAELSOE GRUPPEN	PA RESOURCES 'B'
2003-01-01	IXONOS	HIQ INTERNATIONAL
2003-02-01	B&B TOOLS 'B'	SKAKO INDUSTRIES
2003-03-01	BIOGAIA 'B'	AVALON ENTERPRISE 'B'
2003-04-01	RAYSEARCH LABORATORIES	EXENSE
2003-05-01	ORC SOFTWARE	ORAL HAMMASLAAKARIT
2003-06-01	KOMPLETT	TANDBERG
2003-07-01	INMETA	ELECSTER
2003-08-01	EGETAEPPER	CARDO
2003-09-01	STATOILHYDRO	DANTAX
2003-10-01	INDUSTRIVARDEN 'C'	VEIDEKKE
2003-11-01	ELECTROLUX 'A'	ACANDO 'B'
2003-12-01	PA RESOURCES 'B'	TGS-NOPEC GEOPHS.
2004-01-01	DNO INTERNATIONAL	BILLERUD
2004-02-01	NORSK HYDRO	ACSC
2004-03-01	HOJGAARD HOLDING	UTD.INTL.ENTS.
2004-04-01	Q-MED	BAVARIAN NORDIC
2004-05-01	DORO	SIX
2004-06-01	NOKIA	KONE
2004-07-01	ADDVISE	KOMPLETT
2004-08-01	D/S TORM	PKC GROUP
2004-09-01	STATOILHYDRO	EXENSE
2004-10-01	POYRY	NOVOTEK 'B'
2004-11-01	ELECTROLUX 'A'	ORC SOFTWARE
2004-12-01	QPR SOFTWARE	DICENTIA
2005-01-01	DNO INTERNATIONAL	BILLERUD
2005-02-01	NORSK HYDRO	WULFF-GROUP
2005-03-01	RAISIO	CONCORDIA MARITIME 'B'
2005-04-01	GEOSENTRIC	BELSHIPS
2005-05-01	ALK-ABELLO	IBS
2005-06-01	D/S NORDEN	ARK TRAVEL

2005-07-01	D/S ORION	BJORN BORG
2005-08-01	STAVANGER AFTENBLAD	ADDTECH
2005-09-01	STATOILHYDRO	BRIO
2005-10-01	BYGGMA	D/S TORM
2005-11-01	SSAB	AROS QUALITY GROUP
2005-12-01	JINHUI SHIP.& TRSP.	EKORNES
2006-01-01	SWEDISH MATCH	YARA INTERNATIONAL
2006-02-01	NORSK HYDRO	TANDBERG
2006-03-01	Q-FREE	BETSSON
2006-04-01	DOMSTEIN	TECO MARITIME
2006-05-01	ALK-ABELLO	IBS
2006-06-01	D/S NORDEN	ARK TRAVEL
2006-07-01	D/S ORION	SKANDITEK INDRI.FRV.
2006-08-01	RAUTARUUKKI	2ENTERTAIN
2006-09-01	STATOILHYDRO	ADDTECH
2006-10-01	SUPEROFFICE	ICM KUNGSHOLMS
2006-11-01	SSAB	AROS QUALITY GROUP
2006-12-01	ENTRACTION HOLDING 'B'	JINHUI SHIP.& TRSP.
2007-01-01	VEIDEKKE	NESTE OIL
2007-02-01	NORSK HYDRO	PKC GROUP
2007-03-01	BORGESTAD	AIK FOTBOLL 'B'
2007-04-01	BYGGMA	BOLIDEN
2007-05-01	3L SYSTEM	MIDWAY HOLDINGS 'B'
2007-06-01	SALMAR	TGS-NOPEC GEOPHS.
2007-07-01	D/S ORION	BEIJER ELECTRONICS
2007-08-01	2ENTERTAIN	JM
2007-09-01	STATOILHYDRO	SENSYS TRAFFIC
2007-10-01	EKORNES	TK DEVELOPMENT
2007-11-01	SONDAGSAVISEN	BE GROUP
2007-12-01	ADDTECH	BETTING PROM.SWEDEN

10.6 Result in each Period

Period 1 starts 1998-01-01 and ends 1998-02-01, Period 2 starts 1998-02-01 and ends 1998-03-01 and so forth.

Period	Portfolio I	Portfolio II
1	-0,0110	0,1720
2	-0,0724	0,0390
3	0,1480	0,1225
4	-0,0272	-0,0068
5	0,0338	0,0063
6	-0,0352	0,0186
7	-0,0158	-0,0208
8	-0,1397	-0,1482
9	-0,0850	-0,0858
10	0,0305	-0,0209
11	-0,0383	-0,0210
12	-0,0001	0,0040
13	0,0396	0,0139
14	-0,0185	-0,0188
15	-0,0141	-0,0056
16	0,0799	0,0969
17	0,0508	0,0254
18	-0,0198	-0,0017
19	0,0106	-0,0059
20	-0,0037	0,0286
21	-0,0394	0,0030
22	0,0154	-0,0002
23	-0,0186	0,0576
24	0,0697	0,1007
25	0,1386	0,0316
26	0,0030	0,0256
27	0,1134	0,0501
28	0,0207	-0,0166
29	0,0007	0,0160
30	0,0123	0,0136
31	-0,0048	0,0408
32	0,0531	0,0470
33	-0,0057	-0,0038
34	-0,0013	-0,0045
35	-0,0224	-0,0227
36	-0,0293	-0,0156
37	0,0923	0,0813
38	-0,0088	-0,0706
Period	**Portfolio I**	**Portfolio II**
39	-0,0617	-0,0367
40	0,0703	0,0740
41	0,0678	0,0401
42	-0,0397	-0,0387
43	0,0049	-0,0170
44	-0,0803	-0,0752
45	-0,0420	-0,0523
46	0,1117	0,0918
47	0,0631	0,0656
48	-0,0088	0,0164
49	0,0090	0,0270
50	-0,0335	0,0253
51	0,0032	0,0331
52	-0,0601	-0,0228
53	-0,0438	-0,0152
54	-0,0419	-0,0385
55	-0,0646	-0,0555
56	-0,0480	-0,0310
57	-0,1750	-0,1038
58	0,1422	0,0548
59	0,0990	0,0219
60	-0,1309	-0,0728
61	0,0126	-0,0177
62	-0,0428	-0,0500
63	-0,0075	-0,0170
64	0,1099	0,1198
65	0,0937	0,0934
66	-0,0072	-0,0004
67	0,1458	0,0974
68	-0,0172	0,0923
69	0,1062	0,0250
70	0,1344	0,0975
71	-0,0249	0,0172
72	-0,0195	0,0265

73	0,1555	1,0114
74	0,0335	0,0581
75	0,0076	-0,0166
76	-0,0232	-0,0178
Period	**Portfolio I**	**Portfolio II**
77	-0,0226	-0,0118
78	0,0345	0,0103
79	-0,0166	-0,0033
80	0,0008	0,0077
81	0,0191	0,0411
82	0,0329	-0,0062
83	0,0892	0,0893
84	0,0197	0,0208
85	0,0537	0,0287
86	0,0540	0,0278
87	0,0275	-0,0219
88	-0,0079	-0,0373
89	0,0443	0,0501
90	0,0794	0,0744
91	0,0611	0,0337
92	0,0903	0,0551
93	0,0615	0,0351
94	-0,0594	-0,0634
95	0,0311	0,0436
96	0,0549	0,0572
97	0,0529	0,0334
98	0,0373	0,0627
Period	**Portfolio I**	**Portfolio II**
99	0,0515	0,0599
100	0,0141	0,0247
101	-0,0735	-0,0750
102	-0,0019	0,0199
103	-0,0057	-0,0056
104	0,0225	0,0539
105	0,0001	0,0179
106	0,0537	0,0465
107	0,0159	0,0638
108	0,0434	0,1041
109	0,0441	0,0556
110	0,0167	-0,0227
111	0,0369	0,0295
112	-0,0009	0,0661
113	0,0197	-0,0106
114	0,0057	-0,0085
115	0,0084	-0,0059
116	-0,0226	-0,0042
117	-0,0097	0,0242
118	0,0124	-0,0240
119	-0,0916	-0,0696
120	0,0086	-0,0098

10.7 Summary output of regressions

SUMMARY OUTPUT, Portfolio I - 12M STIBOR

Regression Statistics	
Multiple R	0,56711
R Square	0,32161
Adjusted R Square	0,31586
Standard Error	0,04915
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,13516	0,13516	55,94190	0,00000
Residual	118	0,28510	0,00242		
Total	119	0,42026			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00696	0,00451	1,54325	0,12545	-0,00197	0,01588	-0,00197	0,01588
MSCI Nordic - 12M	0,45209	0,06044	7,47943	0,00000	0,33239	0,57178	0,33239	0,57178

SUMMARY OUTPUT, Portfolio II - 12M STIBOR

Regression Statistics	
Multiple R	0,416858
R Square	0,173771
Adjusted R Square	0,166769
Standard Error	0,095068
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,2242964	0,2242964	24,8174715	0,0000022
Residual	118	1,0664655	0,0090378		
Total	119	1,2907619			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,01609	0,00872	1,84536	0,06749	-0,00118	0,03335	-0,00118	0,03335
MSCI Nordic - 12M	0,58238	0,11690	4,98171	0,00000	0,35088	0,81388	0,35088	0,81388

SUMMARY OUTPUT, Portfolio II* - 12M STIBOR

Regression Statistics	
Multiple R	0,68183
R Square	0,46489
Adjusted R Square	0,46035
Standard Error	0,03777
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,1463	0,1463	102,5147	1,01286E-17
Residual	118	0,1684	0,0014		
Total	119	0,3146			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,0094	0,0035	2,7154	0,0076	0,0025	0,0163	0,0025	0,0163
MSCI Nordic - 12M	0,4703	0,0464	10,1250	0,0000	0,3783	0,5623	0,3783	0,5623

SUMMARY OUTPUT for Portfolio II** - 12M STIBOR

Regression Statistics	
Multiple R	0,68134
R Square	0,46423
Adjusted R Square	0,45969
Standard Error	0,03740
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,14304	0,14304	102,24202	1,09033E-17
Residual	118	0,16509	0,00140		
Total	119	0,30813			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00910	0,00343	2,65173	0,00911	0,00230	0,01589	0,00230	0,01589
MSCI Nordic - 12M	0,46508	0,04600	10,11148	0,00000	0,37400	0,55617	0,37400	0,55617

SUMMARY OUTPUT for Portfolio I - RF

Regression Statistics	
Multiple R	0,53032
R Square	0,28124
Adjusted R Square	0,27515
Standard Error	0,05053
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,11788	0,11788	46,17163	0,00000
Residual	118	0,30127	0,00255		
Total	119	0,41915			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00778	0,00463	1,68168	0,09528	-0,00138	0,01695	-0,00138	0,01695
Mkt-RF	0,70244	0,10338	6,79497	0,00000	0,49773	0,90715	0,49773	0,90715

SUMMARY OUTPUT for Portfolio II - RF

Regression Statistics	
Multiple R	0,3387729
R Square	0,1147671
Adjusted R Square	0,1072651
Standard Error	0,0984705
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,1483387	0,1483387	15,2982492	0,0001538
Residual	118	1,1441808	0,0096964		
Total	119	1,2925194			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,01754	0,00902	1,94467	0,05419	-0,00032	0,03539	-0,00032	0,03539
Mkt-RF	0,78797	0,20146	3,91130	0,00015	0,38903	1,18692	0,38903	1,18692

SUMMARY OUTPUT, Portfolio II* - RF

Regression Statistics	
Multiple R	0,62599
R Square	0,39186
Adjusted R Square	0,38671
Standard Error	0,04020
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,12290	0,12290	76,03434	2,08577E-14
Residual	118	0,19074	0,00162		
Total	119	0,31364			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,01031	0,00368	2,79967	0,00598	0,00302	0,01760	0,00302	0,01760
Mkt-RF	0,71724	0,08225	8,71977	0,00000	0,55435	0,88013	0,55435	0,88013

SUMMARY OUTPUT, Portfolio II** - RF

Regression Statistics	
Multiple R	0,62979
R Square	0,39664
Adjusted R Square	0,39153
Standard Error	0,03962
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,12178	0,12178	77,57163	1,30176E-14
Residual	118	0,18525	0,00157		
Total	119	0,30703			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00997	0,00363	2,74838	0,00693	0,00279	0,01716	0,00279	0,01716
Mkt-RF	0,71396	0,08106	8,80748	0,00000	0,55343	0,87448	0,55343	0,87448

SUMMARY OUTPUT, Fama-French Portfolio I

Regression Statistics	
Multiple R	0,57250
R Square	0,32775
Adjusted R Square	0,31037
Standard Error	0,04929
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0,13738	0,04579	18,85177	4,99824E-10
Residual	116	0,28178	0,00243		
Total	119	0,41915			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00510	0,00461	1,10572	0,27114	-0,00404	0,01424	-0,00404	0,01424
Mkt-RF	0,84793	0,11827	7,16919	0,00000	0,61367	1,08219	0,61367	1,08219
SMB	0,18945	0,12313	1,53859	0,12663	-0,05443	0,43334	-0,05443	0,43334
HML	0,42597	0,15165	2,80887	0,00584	0,12560	0,72634	0,12560	0,72634

SUMMARY OUTPUT, Fama-French Portfolio II

Regression Statistics	
Multiple R	0,38889
R Square	0,15124
Adjusted R Square	0,12928
Standard Error	0,09725
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0,19547	0,06516	6,88973	0,00026
Residual	116	1,09705	0,00946		
Total	119	1,29252			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,01346	0,00910	1,47878	0,14191	-0,00457	0,03149	-0,00457	0,03149
Mkt-RF	0,95463	0,23337	4,09058	0,00008	0,49241	1,41686	0,49241	1,41686
SMB	0,42353	0,24296	1,74321	0,08395	-0,05768	0,90475	-0,05768	0,90475
HML	0,60081	0,29923	2,00783	0,04698	0,00814	1,19348	0,00814	1,19348

SUMMARY OUTPUT, Fama-French Portfolio II*

Regression Statistics	
Multiple R	0,66873
R Square	0,44721
Adjusted R Square	0,43291
Standard Error	0,03866
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0,14026	0,04675	31,28102	0,00000
Residual	116	0,17338	0,00149		
Total	119	0,3136397			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00783	0,00362	2,16458	0,03247	0,00067	0,01500	0,00067	0,01500
Mkt-RF	0,81875	0,09278	8,82499	0,00000	0,63499	1,00250	0,63499	1,00250
SMB	0,25644	0,09659	2,65497	0,00905	0,06513	0,44774	0,06513	0,44774
HML	0,36510	0,11896	3,06917	0,00267	0,12949	0,60071	0,12949	0,60071

SUMMARY OUTPUT, Fama-French Portfolio II**

Regression Statistics	
Multiple R	0,67069
R Square	0,44983
Adjusted R Square	0,43560
Standard Error	0,03816
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0,13811	0,04604	31,61453	5,20931E-15
Residual	116	0,16892	0,00146		
Total	119	0,30703			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00757	0,00357	2,11985	0,03615	0,00050	0,01464	0,00050	0,01464
Mkt-RF	0,81244	0,09158	8,87185	0,00000	0,63107	0,99382	0,63107	0,99382
SMB	0,24868	0,09534	2,60845	0,01029	0,05986	0,43751	0,05986	0,43751
HML	0,35416	0,11742	3,01625	0,00315	0,12160	0,58673	0,12160	0,58673

SUMMARY OUTPUT, Portfolio I - RF with transaction cost

Regression Statistics	
Multiple R	0,53032
R Square	0,28124
Adjusted R Square	0,27515
Standard Error	0,05053
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,11788	0,11788	46,17163	4,6793E-10
Residual	118	0,30127	0,00255		
Total	119	0,41915			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00578	0,00463	1,24947	0,21397	-0,00338	0,01495	-0,00338	0,01495
Mkt - RF	0,70244	0,10338	6,79497	0,00000	0,49773	0,90715	0,49773	0,90715

SUMMARY OUTPUT, Portfolio I - 12M STIBOR with transaction cost

Regression Statistics	
Multiple R	0,56711
R Square	0,32161
Adjusted R Square	0,31586
Standard Error	0,04915
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,13516	0,13516	55,94190	1,44968E-11
Residual	118	0,28510	0,00242		
Total	119	0,42026			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00496	0,00451	1,09957	0,27376	-0,00397	0,01388	-0,00397	0,01388
MSCI Nordic - 12M	0,45209	0,06044	7,47943	0,00000	0,33239	0,57178	0,33239	0,57178

SUMMARY OUTPUT, Portfolio II - RF with transaction cost

Regression Statistics	
Multiple R	0,33877
R Square	0,11477
Adjusted R Square	0,10727
Standard Error	0,09847
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,14834	0,14834	15,29825	0,00015
Residual	118	1,14418	0,00970		
Total	119	1,29252			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,01554	0,00902	1,72289	0,08753	-0,00232	0,03339	-0,00232	0,03339
Mkt - RF	0,78797	0,20146	3,91130	0,00015	0,38903	1,18692	0,38903	1,18692

SUMMARY OUTPUT, Portfolio II - 12M STIBOR with transaction cost

Regression Statistics	
Multiple R	0,41686
R Square	0,17377
Adjusted R Square	0,16677
Standard Error	0,09507
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,22430	0,22430	24,81747	2,17893E-06
Residual	118	1,06647	0,00904		
Total	119	1,29076			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,01409	0,00872	1,61596	0,10877	-0,00318	0,03135	-0,00318	0,03135
MSCI Nordic - 12M	0,58238	0,11690	4,98171	0,00000	0,35088	0,81388	0,35088	0,81388

SUMMARY OUTPUT, Fama-French Portfolio I with transaction cost

Regression Statistics	
Multiple R	0,57170
R Square	0,32684
Adjusted R Square	0,30943
Standard Error	0,04938
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0,13736	0,04579	18,77356	5,4015E-10
Residual	116	0,28290	0,00244		
Total	119	0,42026			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,00300	0,00462	0,64844	0,51798	-0,00616	0,01215	-0,00616	0,01215
Mkt-RF	0,84897	0,11851	7,16366	0,00000	0,61425	1,08370	0,61425	1,08370
SMB	0,18510	0,12338	1,50026	0,13626	-0,05927	0,42947	-0,05927	0,42947
HML	0,42514	0,15196	2,79782	0,00603	0,12418	0,72611	0,12418	0,72611

SUMMARY OUTPUT, Fama-French Portfolio II with transaction cost

Regression Statistics	
Multiple R	0,38884
R Square	0,15120
Adjusted R Square	0,12925
Standard Error	0,09718
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0,19516	0,06505	6,88770	0,00026
Residual	116	1,09560	0,00944		
Total	119	1,29076			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,0114	0,00910	1,24851	0,21436	-0,00666	0,02937	-0,00666	0,02937
Mkt-RF	0,9557	0,23322	4,09774	0,00008	0,49375	1,41760	0,49375	1,41760
SMB	0,4192	0,24280	1,72644	0,08693	-0,06172	0,90008	-0,06172	0,90008
HML	0,6000	0,29904	2,00639	0,04714	0,00771	1,19226	0,00771	1,19226