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# THE USE OF SYSTEMATIC VALUE STRATEGIES IN SEPARATING THE WINNERS FROM THE LOSERS: EVIDENCE FROM THE FINNISH MARKETS

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## ABSTRACT


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This study examines the Magic Formula and ERP5 value strategies in the Finnish stocks markets. Magic Formula ranks stocks based on EV/EBIT and ROA and ERP5 based on EV/EBIT, ROA, P/B and five-year trailing ROA. The purpose of the study is to examine whether the value strategies can be used to generate excess returns over the market index.

The data has been collected from the Datastream database for the sample period from May 1997 to May 2010 and consists of the companies listed on the main list of Helsinki Stock Exchange. This study confirms the findings of previous research that value premium exists in the Finnish stock markets and that systematic value strategies can be used to form portfolios that outperform the market index with lower volatility.

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Tutkielma käsittelee Magic Formula ja ERP5 -arvostrategioita Suomen osakemarkkinoilla. Magic Formula perustana olevat tunnusluvut ovat EV/EBIT ja ROA sekä ERP5:n EV/EBIT, ROA, P/B ja viiden vuoden rullaava ROA. Tutkielman tarkoituksena on selvittää, voidaanko näitä arvosijoitusstrategioita käyttämällä saavuttaa ylituottoja yleisindeksiin verrattuna.

Aineisto on kerätty Datastream-tietokannasta toukokuussa 1997 alkavalle ja toukokuussa 2010 päättyvälle tutkimusajanjaksolle ja se sisältää Helsingin pörssin päälistalla noteeratut yhtiöt. Tutkielma vahvistaa aiempien tutkimusten näytön arvopreemion olemassaolosta Suomen osakemarkkinoilla ja siitä, että systemaattisia arvostrategioita voidaan käyttää muodostamaan salkkuja, jotka tuottavat yleisindeksiä paremmin alhaisemmalla volatiliteetilla.

## FOREWORD

Being a value investor is not always easy. It takes a big heart and a lot of patience as it may take a long time for the returns to realize. I suppose the same goes for writing a thesis. It has, indeed, taken a very long time for this thesis to realize. Working full-time, I have written most of the thesis during the small hours or weekends and given a whole new meaning to the concept of after work.

I am thankful to the people who have assisted me during my writing process and studies. Firstly, I would like to thank my professor Eero Pätäri not only for the guidance concerning this thesis, but also for his inspiring lections. I must also thank the whole staff at Lappeenranta University of Technology, especially at the School of Business, for they have been most helpful throughout my studies.

There are also a few people who may not be experts on finance but whose contribution for this thesis has been critical. I thank my girlfriend, Marika, for her support and patience in letting me allocate the necessary hours into the thesis. Last and foremost, I would like to express my deepest gratitude to my parents for all of their support over the years of my schooling.

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Topias Kukkasniemi

**TABLE OF CONTENTS**

## DEFINITIONS AND ABBREVIATIONS

| | |
|---|---|
| ERP5 | Value investing strategy. The initials stand for the ratios used to rank stocks: earnings yield, ROA, P/B and 5-year trailing ROA. |
| Earnings yield | Although the term is commonly used when referring to earnings-to-price ratio, in this study, earnings yield is calculated as follows: Earnings before interest and taxes / Enterprise value (EBIT/EV). |
| Enterprise value | Market capitalization + net debt |
| Holding period | In this thesis, the term holding period refers to the time period that begins when the stocks are bought and ends when the stocks are sold after a year of holding. The analysis period consists of 13 holding periods. |
| Magic Formula | Value investing strategy that ranks stocks based on earnings yield and ROA. |
| Price-to-book (P/B) | Market capitalization / Book value of equity |
| Return on assets (ROA) | Earnings before taxes and interest / Total assets |
| Value portfolio | In this thesis, the term value portfolio is used when referring to a portfolio that consists of stocks ranked high by Magic Formula or ERP5 criteria. |

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| Value premium | Value premium refers to the greater risk-adjusted return of value stocks over the market index or in comparison to growth or glamour stocks. |
| Value stock/company | Although no commonly used, precise definition exists, the terms value stock or value company usually refer to stocks or companies that seem undervalued based on fundamentals or certain financial ratios. In this thesis, the terms are used when referring to stocks or companies that are ranked high by Magic Formula or ERP5 criteria. |
| WSEW | Whole Sample Equally Weighted portfolio. WSEW portfolio is an equally weighted portfolio that consists of all the companies in the sample of the thesis and is used as an additional benchmark besides the OMXH Cap index. Financials and utilities are excluded, since they are excluded from the value portfolios as well. |

# 1 INTRODUCTION

Value investing and value strategies have a long tradition in finance and can be traced back at least to Graham and Dodd (1934), when the two gentlemen laid the foundation of value investing by proposing that a disciplined investor can evaluate a rough value for a company from its financial statements, buy when the market inevitably undervalues some stocks at some point and earn a decent profit. In addition, they represented the genesis of financial and fundamental analysis and introduced some of the most basic techniques that can be used to selecting stocks.

However, soon after the efficient market hypothesis by Fama (1970) was published, Graham (1976) stopped advocating the use of such techniques in selecting individual stocks as the costs of preparing fundamental analysis often exceed the benefits of earning a value premium and suggested that an investor should rather form a diversified portfolio based on a few simple criteria focusing on the results of the group instead of individual stocks.

This brings us to the question that has puzzled researchers and investors ever since Fama (1970): How efficient are the markets and if they are inefficient, how should one invest in order to take advantage of the value premium? The question has then been answered numerous times but as concluded by Lo (2007), there is no consensus. The efficient market hypothesis has been challenged by researchers such as Basu (1975) and investors such as Buffett (1984), and they have been answered by researchers such as Fama and French (1992) and Sharpe (Lowenstein 1995, 312).

From previous research, it seems evident that the value premium exists (e.g. Abarbenell and Bushee, 1998 or Piotroski, 2000). The more difficult question is how the value premium can be exploited. This paper tests the

approach suggested by Graham (1976) and examines whether the market index can be beaten by forming portfolios using value strategies based on a few simple accounting ratios.

The value strategies tested in this paper are called Magic Formula and ERP5. Introduced by Joel Greenblatt (2006), the Magic Formula is a strategy that aims to pick high quality companies at bargain prices by ranking stocks based on their earnings yield and ROA. Greenblatt tested Magic Formula on the US market and concluded that the strategy is able to generate higher returns than the market on average.

Introduced by Vastraceele & Allaeys (2010a), ERP5 can be considered as an extension to the Magic Formula as it applies P/B and 5-year trailing ROA in addition to the earnings yield and ROA of the Magic Formula. Vastraceele & Allaeys (2010a and 2010b) tested the Magic Formula and ERP5 in the Eurozone markets and found that while ERP5 performed better, both strategies were able to provide returns that exceeded that of the market.

However, being relatively newly introduced strategies, the evidence on behalf of Magic Formula and ERP5 is not yet exhaustive and the strategies have been tested primarily on major markets. As pointed out by Griffin (2002) and Fama and French (2012), the factors that explain equity returns differ locally and local factors work better for regional portfolios compared to global factors. Consequently, what works in the US or in the Eurozone markets may not work on smaller markets. For this reason, this thesis is limited to the Finnish stock markets.

In addition, Graham (1976) and Piotroski (2000) have stated that instead of picking individual stocks, an investor should focus on purchasing a diversified portfolio in order to take advantage of the value premium. To go deeper, this thesis also examines the important question of what could be the optimal portfolio size.

## 1.1 Research Objectives

The main research objective of the thesis is to examine whether it is possible to achieve excess returns over the market index in the Finnish stock markets by applying systematic value strategies that are based on accounting ratios. The value strategies under examination are Magic Formula and ERP5.

In addition, the thesis has the following additional objectives:

1) To examine whether ERP5 is able to beat Magic Formula during the sample period.
2) To examine whether the riskiness of the value portfolios differ from that of the market portfolio.
3) To determine the optimal portfolios size.

## 1.2 Scope of the Study

This thesis is limited to the companies listed in the Helsinki Stock Exchange. To rule out some of the most illiquid stocks, only stocks quoted in the main list are included. This is done to avoid the bias of a bid-ask bounce which refers to the situation in which the spread between the buying bid and asking price is considerably wide. As suggested by Greenblatt (2006, 136) utility stocks are excluded, as well as financials because their financial statements have a slightly different structure and the ratios are not comparable to companies operating in other sectors, such as manufacturing. If a company has more than one series of shares listed, only the more liquid series is included in the sample.

The time span of the thesis is from 1997 to 2010 which corresponds roughly to the length of one business cycle. Testing over the business cycle allows us to evaluate how the value strategies perform in a bull market as well as in a bear market. The time period also includes major

market events such as the tech bubble and the 2007-09 financial crisis which gives us insight on how the strategies work in an unusual market environment.

### 1.3 Structure of the Thesis

The thesis is divided into five main sections. Section 1 introduces the tested value strategies, the research objectives and the structure of the thesis. Section 2 presents previous studies and findings on the value strategies along with earlier literature. Section 3 introduces the used data and the research methods. Section 4 presents and analyzes the results of the study. Finally, Section 5 concludes the thesis and discusses the practical implications, limitations of both the value strategies and the results of the thesis with suggestions for further research.

# 2 THEORETICAL BACKGROUND

Section 2 presents the theoretical background of the thesis. The section is divided into two parts, of which the first introduces earlier literature and starts by introducing the efficient market hypothesis as well as the critic on the hypothesis. This is followed by earlier research on value investing, different ratios and the use of accounting data in predicting future equity returns. As this thesis tests the selected value strategies on the Finnish stock markets, previous literature published on the Finnish markets is also introduced. After more general research on ratios and value investing has been introduced, we review the earlier results published on the Magic Formula and ERP5 value strategies. Finally, the latter part introduces the ratios used in the Magic Formula and ERP5 value strategies, as well as the economic rationale behind the use of these variables.

## 2.1 Review of Previous Literature

One of the most profound assumptions in finance is the assumption of efficient markets introduced by Fama (1970), who stated that “the evidence in support of the efficient markets model is extensive and (somewhat uniquely in economics) contradictory evidence is sparse.”

The efficient market hypothesis (EMH) can be divided into three different categories based on the type of information subset of interest:

1) The weak form asserts that stock prices already reflect all information that can be derived from market trading data. These include historical prices, trading volume and short interest.
2) The semi-strong form states that all publicly available information is reflected in the prices. In addition to market trading data, this information includes fundamental data on the firm’s product line, quality of management, balance sheet composition, patents held, earnings forecasts and accounting practices.

3) The strong form is more extreme and states that stock prices reflect all information relative to the firm, including information only available to company insiders. (Bodie et al. 2005, 373)

Consequently, if the semi-strong form of market efficiency holds, such accounting based value investing strategies as Magic Formula or ERP5 cannot be used to outperform the market in the long-term.

In addition to the efficient market hypothesis, another important concept in the context of this thesis is the trade-off between risk and return. Although the risk-return trade-off is a logical outcome of market efficiency, the basic idea of relationship between risk and reward dates back to earlier days. For example, Sharpe (1964) presented the connection between risk and return by placing risk (measured by volatility) on the horizontal axis and expected return on the vertical axis as he first introduced the capital market line.

The risk-return trade-off suggests that since price movements are unpredictable, an investor cannot consistently outperform the market when adjusted for risk, and consequently, in order to achieve higher returns, an investor must be willing to take more risk. This stance is advocated beautifully by Malkiel (1973) in his world-famous book *A Random Walk down Wall Street*. Malkiel (1973) suggests that instead of trying to beat the market, one should simply buy and hold index funds that offer the average return of the market.

After the groundbreaking study by Fama was published in 1970, it was soon challenged by numerous researches and investors both on and off the academic field. The earliest academic critics included Basu (1975 and 1977), Ball (1978), Banz (1981) and many more.

In 1984, Warren Buffet, one of the most celebrated value investors, gave a speech at the Columbia University in which he challenged Malkiel’s view

and the efficient market hypothesis. Buffett stated that if a substantial share of long-time winners belonged to a group of value investing adherents and operated independently of each other, their success is a result of the right investment strategy rather than just a lottery win. Buffett then went on presenting nine successful investment funds, including his own, and took special care in explaining that the funds had very little in common except for value investing. The portfolio managers were, indeed, independent of each other. Buffett later wrote an article based on the speech that has been published in books on his life and investment strategy (e.g. Miles 2004). As of 2013, Malkiel has not yet responded to Buffett's argument and other advocates for the EMH, too, seem to widely ignore both the existence and arguments of successful value investors such as Buffett. There are, however, some influential exceptions: for example, the Nobel Laureate William Sharpe called him "a three-sigma event" (Lowenstein 1995, 312) implying his success is mostly due to pure luck.

More recently, Borges (2010) studied weak-form market efficiency on the European markets between 1993 and 2003. The study provided some mixed evidence on the EMH as periphery markets such as Greece and Portugal showed signs of becoming more efficient during the analysis period. However, more develop markets such as the UK and France seemed to go to the opposite direction as mean reversion increased in these markets during the sample period.

Borges (2010) is not the only one to test the EMH with modern research methods and techniques. However, after reviewing different theoretical and empirical evidence both for and against the EMH, Lo (2007) concludes that there still is no consensus among economists and researchers whether the markets are efficient, even though the statistical analysis has improved and more advanced models have been developed since Fama (1970). Lo (2007) suggests that one of the reasons for this is that the EMH is not well-defined and that more detailed specifications on

information structure and investor preferences need to be made in order to form the most of the hypothesis. Lo also mentions that one frequently repeated explanation for market inefficiency is that market participants are not reacting as they should to new information when it is published.

### 2.1.1 Small Cap Effect

One of the most common arguments against efficient market hypothesis is the small cap effect that refers to the tendency of small capitalization stocks to outperform large market capitalization stocks. Banz (1981) studied the relationship between return and market capitalization for common stocks and found that smaller firms have higher risk-adjusted returns than large market capitalization companies. Moreover, Banz found that the strongest size effect occurs for very small companies while the difference in the return between average-sized and large cap companies is little. According to Banz, it is unknown whether firm size per se is responsible for the effect or whether it is due to unknown factors correlated with size.

Since then, it has been suggested that the reason why small cap companies offer better returns might be weaker information efficiency that surround smaller companies. Hong and Stein (1999) found that the markets give less attention to small companies and that the news concerning smaller companies spreads more slowly than those concerning large companies. Consequently, smaller companies offer a value premium that is of practical significance (Dhatt et al. 1999) which could be due to the weaker information efficiency and the fact that smaller companies are followed by fewer analysts.

Lakonishok and Shapiro (1986) studied the relationship between stock market return, risk and size and found that neither systematic risk (beta) nor alternative risk measures (variance or residual standard deviation) can explain the cross-sectional variance in returns while only size explains the

returns. They suggested that the small cap effect is partly due to transaction costs and other barriers to trade which limit diversification. It has also been suggested that the higher returns generated by small cap companies are due to investor psychology. For example, Lakonishok et al. (1994) suggest that institutional investors prefer large glamour companies to smaller and relatively unknown companies because investing in them is easier to justify. Although there is ample evidence on the small cap effect, there are also studies that do not find evidence in support of the small cap effect. For example, Pätäri and Leivo (2009) found that size did not explain returns on the Finnish stock markets.

### 2.1.2 Different Ratios and Value Strategies

Apart from more general studies on value investing and the efficient market hypothesis, the relationship between various ratios and future returns has been a subject of continuous research. Indeed, the previous research on different ratios and accounting based investment strategies is ample. This research shows that in addition to being useful in evaluating the past performance of a company, ratios can be useful in predicting future earnings and equity returns.

In a classic study, Ou and Penman (1989) found that ratios generated from accounting data were useful in forecasting future earnings and stock returns. Ou and Penman examined as much as 68 different accounting metrics and found that these variables could be reduced to a shorter list and combined in a statistical model that was particularly useful for selecting investments. The variables in the statistical model included return on assets (ROA), operating ROA and pretax margin.

Lev and Thiagarajan (1993) examined the predictive power of fundamental financial variables used by analysts to assess whether they are useful in security valuation. They found that fundamental variables add about 70 percent to the explanatory power of earnings alone in predicting excess

returns. The fundamental variables they found useful included percentage change in inventories and receivables relative to sales, gross margin, sales per employee and the change in bad debt relative to change in accounts receivable, among others. Abarbanell and Bushee (1997) found some of the same variables useful in predicting future accounting earnings and stock returns. Later, Abarbenell and Bushee (1998) devised an investment strategy using these variables and found that they can generate excess returns under this strategy.

Out of single ratios, the relationship between P/B ratio and future returns is probably one of the most researched topics. Stattman (1980) and Rosenberg et al. (1985) found that average returns on the US markets are positively correlated with low price-to-book (P/B) ratios. Chao et al. (1991) examined and reported the same relationship to be strong in the Japanese markets. Capaul et al. (1993) extended the analysis to international markets and reported and found that companies with low P/B earned excess return in every market included in the study between the 1981-1992 period. During the test period, the added return to low P/B value portfolios was between 1.0% and 3.4% per annum in different markets being the lowest in the US and the highest in Japan.

Fama and French (1992), also, found positive relationship between low P/B ratios and futures returns, and stated that the relationship is even stronger than the small cap effect in explaining returns. However, they also pointed out that low P/B ratio may work as a proxy for risk as companies trading with market price well below book value are more likely to be in trouble and go bankrupt. Consequently, Fama and French suggested that investors need to decide whether the higher returns generated by such companies are worth the risk involved. Nevertheless, it has also been suggested that value portfolios are in fact less risky than the market on average (Bird and Casavecchia, 2007).

Another ratio that has raised researchers' interest is earnings yield or its reciprocal price-to-earnings (P/E) ratio. The first study to report on the P/E effect was by Nicholson (1960), who stated that the low P/E ratios represented greater productivity and that investors could seek higher returns by buying companies with low rather than high P/E ratios. Nicholson's findings were confirmed by Basu (1975).

Furthermore, Basu (1977) studied the performance of stocks relative to their price-to-earnings (P/E) ratios and found that when stocks are sorted based on the P/E ratio, future returns are higher for low P/E stocks than predicted by the capital asset pricing model (CAPM), and interpreted it as evidence of market inefficiency. Later, Basu (1983) studied the relationship between high earnings yield (low P/E ratio), firm size and future returns and showed that companies with high earnings yield generate, on average, higher risk-adjusted returns than companies with low earnings yield even when firm size is controlled.

Ball (1978) considered several possible explanations for the P/E effect, such as systematic experimental error, the existence of transaction and processing costs and a failure of Sharpe's CAP model. Fuller et al. (1993) re-examined Ball's (1978) argument by using a comprehensive multi-factor model that allowed for systematic risk, industrial classification factors and other explanatory factors for risk. These included earnings variability and leverage among others. They found higher returns for low P/E stocks but the factors included in the model did not account for the returns generated by low P/E stocks.

There are also studies that question the existence of the P/E effect. Reinganum (1981) studied the P/E and small cap effect and found that after controlling for any P/E effect, a strong small cap effect still remained. However, when controlling for any market value effect, there was no P/E effect found. Banz and Breen (1986) criticized the earlier studies on the effect of firm size and low P/E ratio on future earnings and claimed that

these studies suffered from two major biases: survivorship bias and look ahead bias. They eliminated these biases by gathering their own database for the years 1974-81 that accurately reflected the companies that existed at the time and the data available to investors at the time. They found that although the small cap effect persisted, the P/E effect was not significant and concluded that the earlier findings of P/E effect were a result of the two biases rather than actual anomaly.

Fama and French (1993) managed to explain stock returns with a three-factor model that can be considered an extension of the CAP model. Fama and French took notice that small cap companies and high Book-to-Market (low P/B) companies tend to outperform the market. They then added the two factors to the CAP model and found that the three-factor model explains over 90% of diversified stock returns compared with the 70% of the CAP model.

Griffin (2002) examined the Fama-French three-factor model and found that the factors are country specific and concluded that local factors work better than the global factors. Fama and French (2012) recently analyzed models with local and global risk factors and confirmed that local factors work better than the global factors for regional portfolios. Another weakness of the Fama-French model is that it lacks economic reasoning why these three factors should be included and not some others. Other factors have been, indeed, proposed. For example, in a recent paper, Foye et al. (2013) propose an alternative three-factor model for emerging EU countries in which the market value factor is replaced by a factor that acts as a proxy for accounting manipulation.

Based on the research on the small cap effect as well as the relationship between individual ratios and future returns, several successful value investing strategies have been introduced. In one of the most famous studies on value investing, Piotroski (2000) used value financial ratios to supplement a value investing strategy for high book-to-market (BM)

companies and found that he can generate significant excess returns using this strategy. Variables used by Piotroski include net income, operating cash flow, change in ROA, earnings quality measured by operating cash flow in relation to net income, change in leverage, change in liquidity, change in gross margin and change in asset turnover. The paper also states that the benefits of financial statement analysis are concentrated in small and medium-sized companies, companies with low share turnover and companies with no analyst coverage. This notion is partly in contradiction with Banz's (1981) findings that the effect is the greatest for very small companies and that there is not that much difference between medium and large cap firms.

### 2.1.3 Holding Period

While the earlier evidence on the existence of value premium is extensive, optimal holding period has not been paid as much attention. Earlier research shows that even though a holding period of 12 months may not be optimal as returns can be increased by extending the holding period, 12 months should be sufficient for the value premium to realize. Leivo and Pätäri (2009) found that an investor employing value strategies can extend the holding period up to 5 years without a decrease in returns.

Bird and Whitaker (2003) examined different holding periods from one to 48 months and found that portfolios were adding value for three years when the portfolios were formed based on four ratios (P/B, dividend yield, earnings yield and P/S). Using P/E ratio as the ranking criteria, Rousseau and van Rensburg (2003) found that both returns and the reliability of the returns increased when holding period was extended beyond 12 months. They also noticed that the portfolios should be formed based on 12-month old rankings rather than the most recent ones, implying it takes time from the value stocks to build price momentum.

### 2.1.4 Earlier Research on the Finnish Markets

Earlier research on the Finnish markets suggests that the value premium exists and is even stronger than on larger markets. Pätäri and Leivo (2009) studied different value strategies based on six ratios (P/E, EV/EBITDA, P/CF, P/D, P/B and P/S) and eight composition value measures that are formed by combining the individual ratios. They found that while most value portfolios outperformed the market portfolio, as well as glamour portfolios, there was difference in the returns between value portfolios formed using different ratios during the analysis period of 1993-2008. The return was highest in the portfolio formed by the P/B, P/D and EV/EBITDA ratios. According to Pätäri and Leivo, the higher returns could not be explained by higher risk or the small cap effect. Later, Leivo and Pätäri (2011) found that by adding a momentum factor into the value portfolio even higher returns could be achieved.

Similarly, Leivo (2012) examined different value and momentum based strategies in the Finnish stock markets and found that more traditional value strategies based on ratios, such as P/E, EV/EBITDA, P/B, P/S, P/CF and P/D), could be enhanced by momentum factors to achieve higher results. In addition, Leivo found a long-short strategy, in which the top-ranked stocks are bought while bottom-ranked stocks are sold short at the same time, to be useful.

In addition, Pätäri and Leivo (2009) and Leivo (2012) found that value portfolios lost less of their value during bear markets in the Finnish stock markets compared to the market portfolio or glamour stock, while Xu and Fisher (2006) found that during the tech bubble many growth stocks performed extremely well while value stocks struggled.

### 2.1.5 Earlier Research on Magic Formula and ERP5

Popularized by Greenblatt (2006), there is a lack of academic research on the Magic Formula value strategy. Greenblatt (2006) back-tested the strategy in the US market between the years 1988 and 2004 and found that the Magic Formula is able to substantially outperform the market represented by both a market capitalization weighted index (S&P 500) and an equally weighted index consisting of approximately 3,500 stocks. During the sample period, a portfolio consisting of the 30 top-ranked stocks generated returns of 30.8% p.a. while the market represented by the S&P 500 index and the equally weighted index gained 12.4% and 12.3% p.a., respectively. When only 1000 largest companies were included in the sample, Magic Formula was still able to outperform the market but by a narrower margin providing 22.9% p.a., suggesting there is a small cap effect found by Banz (1981). However, the back-test only concentrates on the returns and does not report any risk figures. In addition, the methodology of the back-testing is not sufficiently disclosed by Greenblatt (2006) which is why the results are difficult to interpret or evaluate.

The ERP5 value strategy, introduced recently by Vanstraceele and Allaeys (2010a), has been empirically tested only once. Vanstraceele and Allaeys back-tested the Magic Formula and ERP5 strategies on the Eurozone markets over a 10-year time period from 1999 to 2009. They found that Magic Formula and ERP5 were able to generate returns of 12.7% and 16.2% p.a., respectively, while the DJ EuroSTOXX index consisting of roughly 310 companies yielded approximately -3.1% p.a. For both strategies, the return was highest when 20 stocks were included in the value portfolio, although increasing the portfolio size did not affect the return severely as the Magic Formula and ERP5 portfolios consisting of 50 stocks gained 9.1% and 14.9% p.a., respectively. Other portfolio sizes were not tested. They also noticed that as smaller companies were excluded from the sample, excess returns generated by the value

strategies decreased (Vantraceele and Allaeys 2010a), implying the small cap effect found by Banz (1981) had something to do with the excess returns.

There are, however, major issues that need to be considered when interpreting the findings of Vanstraceele and Allaeys (2010a). Firstly, as later pointed out by Vanstraceele and Allaeys (2010b), the DJ EuroSTOXX index may not be an appropriate benchmark index for the value portfolios as the proportion of financial sector stocks in the index is considerable. As it was the financials that were hit particularly hard during the 2007-09 financial crisis, the crisis period might have worked in favor of the value portfolios which did not include financials or insurance companies at all. Secondly, Vanstraceele and Allaeys (2010a) only examined the returns and ignored the risk taken by the value strategies although some earlier studies suggest that higher returns are a result of taking more risk (e.g. Fama & French 1992). Finally, Vanstraceele and Allaeys (2010a) did not disclose the used methods sufficiently to allow for a replication.

To correct some of the flaws of their first paper, Vanstraceele and Allaeys (2010b) published a new paper in which they back tested the Magic Formula and ERP5, among other value strategies, in the Eurozone markets during the years 1999-2010. In this paper, they observed the risk taken by the value strategies and formed their own benchmark index consisting of 250 stocks with the highest trading volume (excluding financials and insurance companies). The new paper confirmed the findings of the earlier paper, with Magic Formula and ERP5 providing 8.6% and 19.1% p.a., respectively, while the benchmark index only gained 1.0% p.a. The returns came with lower risk than that of the market portfolio, as volatilities for the Magic Formula and ERP5 were 13.0% and 19.9%, respectively, compared to 22.3% for the benchmark index. The portfolio size of the best-performing portfolios was 30 stocks and increasing the portfolio size to 50 decreased the returns. Although other portfolio sizes were not examined, Vanstraceele and Allaeys (2010b) state they believe

that a portfolio of roughly 30 companies performs well in the European markets. There are, however, flaws to the second paper by Vanstraceele and Allaeys, as well. Most importantly, Vanstraceele and Allaeys (2010b) do not disclose the used methods sufficiently to allow for a replication.

## 2.2 Magic Formula Value Strategy

The Magic Formula "seeks to find good companies at bargain prices" (Greenblatt 2006, 57). Hence, the formula consists of two components, the first of which considers the relative price and the second the quality of the company:

1) Earnings yield
2) Return on assets.

Earnings yield is the factor used to separate bargain buys from the rest. It is calculated as follows:

$$Earnings\ yield = \frac{Earnings\ Before\ Interest\ and\ Taxes\ (EBIT)}{Enterprise\ Value\ (EV)} \quad \text{(Eq. 1)}$$

While most of the previous study (i.e. Nicholson 1960, Basu 1975) calculates earnings yield as the relationship between net earnings and market value of equity, EBIT is used instead of net earnings since companies operate with different levels of debt and differing tax rates. Instead of simply using market value of equity, EV is used since it is less sensitive to changes in debt (Greenblatt 2004, 141-143). In addition, the findings of Pätäri and Leivo (2009) imply that using EV/EBITDA (a close relative to EV/EBIT) instead of the more commonly used P/E resulted in higher returns on the Finnish markets. Later, the superiority of EV/EBITDA was verified by Leivo (2012).

While earnings yield presents the price of the company in relation to its earnings, it does not take a stance on the quality of the company. In other words, a company may be cheap because it is in trouble or of poor quality.

For this purpose, another ratio of return on assets is employed and it is calculated as follows:

$$Return\ on\ Assets\ (ROA) = \frac{Earnings\ Before\ Interest\ and\ Taxes\ (EBIT)}{Total\ Assets} \quad \text{(Eq. 2)}$$

The return on assets of a firm measures its operating efficiency in generating profits from its assets prior to the effects of financing (Damodaran 2002). In this sense, the figure can be understood as a measure of quality.

While Greenblatt (2004, 138-141) advises to use return on invested capital (ROIC) instead of the more commonly used return on assets (ROA), this study applies ROA for two reasons. Firstly, the previous research on the relationship between ROA and future returns is extensive (e.g. see Ou and Penman, 1989 and Piotroski, 2000). Secondly, ROA figures for different companies are more easily accessible by small investors than ROIC. Consequently, the results of the study can be used more widely in practice by small investors if ROA is used instead of ROIC.

Both factors are calculated separately for each company, after which companies are ranked within both factors by giving the best company 1 point and the second best 2 points and so forth. Finally, the points are summed and the companies ranked by placing the company with least points on top and the company with most points at the bottom (Vanstraceele & Allaeys 2010b, 13).

### 2.3 ERP5 Value Strategy

ERP5 ranks companies based on the following factors:

1) Earnings yield (calculated as in the Magic Formula)
2) Return on assets (calculated as in the Magic Formula)
3) Price-to-book ratio
4) 5-year trailing ROA

Basically, ERP5 is the Magic Formula with the extension of two factors: P/B and 5-year trailing ROA. The logic behind adding P/B is to capture the effect that low P/B companies generate excess return reported by Stattman (1980), Rosenberg et al. (1985) and Chao et al. (1991) and many more.

Price-to-book ratio is calculated as the relation between the market capitalization and the book value of equity:

$$Price\ to\ Book\ = \frac{Market\ Capitalization}{Book\ Value\ of\ Equity} \quad \text{(Eq. 3)}$$

It can be said that the fourth factor – trailing ROA – is added in order to keep the factors in balance. By adding P/B, we have created a strategy based on three factors: earnings yield, ROA and P/B, two of which compare the market value of the company to either earnings or book value. However, Greenblatt's idea of finding good companies at bargain prices requires that the components considering the price and the component considering the quality of the company are kept in balance. This means that another measure of quality is needed in addition to ROA. As value investors usually are in it for the long run and are trying to find quality companies that are undervalued, why not add a factor that measures the long-term efficiency of the company?

The 5-year trailing ROA is calculated as follows:

$$5\ Year\ Trailing\ ROA\ = \frac{ROA_T + ROA_{T-1} + ROA_{T-2} + ROA_{T-3} + ROA_{T-4}}{5} \quad \text{(Eq. 4)}$$

Where T is the financial year on which the latest annual report is published.

As in the Magic Formula, the factors are calculated separately for each company, after which companies are ranked within each factor by giving

the best company 1 point and the second best 2 points and so forth. Finally, the points are summed and the companies ranked by placing the company with least points on top and the company with most points at the bottom (Vanstraceele & Allaeys 2010a, 11).

# 3 DATA AND METHODOLOGY

The data and methodology section goes through in detail what kind of data is used in this thesis, how it is processed and how portfolios are formed using the data. In addition, the section introduces the possible biases that might affect the results and explains how these biases are taken into account in the research design.

## 3.1 Data Description

The data used in the thesis is downloaded from the Thomson Reuters Datastream database. For some rare occasions, if a specific ratio or price history is missing, the missing data is collected from company sources such as annual reports or company websites. For returns, total return data which includes dividends is used for both individual stocks and the benchmark index.

The number of companies in the dataset ranges from 61 to 120 depending on the test period. If a company has more than one series of shares listed, only the more liquid series is included in the study. As suggested by Greenblatt (2006, 136) utilities are excluded, as well as financials because their financial statements have a slightly different structure and the ratios are not comparable to companies operating in other sectors.

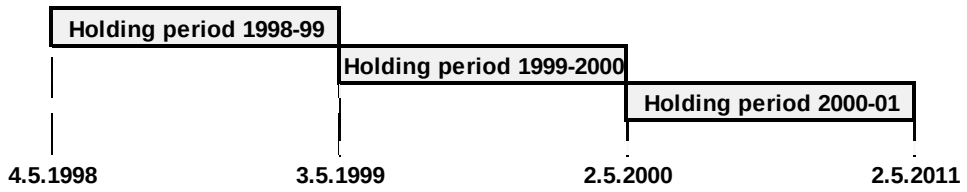
### 3.1.1 Data Periods

The time period examined in the study is 13 years starting on May 2, 1997 and ending on May 2, 2010. The time period includes several bearish and bullish periods, as well as major events such as the tech bubble and the 2007-09 financial crisis.

The portfolios are formed once a year, on the first trading day of May. Forming the portfolios as late as in May should minimize the risk of look

ahead bias, as it takes a couple of months from the companies to publish their annual reports. After the portfolios have been formed, all the stocks in the portfolio are hold until the first trading of May of the next year. Figure 1 presents an example of how holding periods are formed. The portfolios for holding period 1998-99 are formed based on the annual reports for the year 1997, the portfolios for holding period 1999-2000 are based on the annual reports of year 1998 and so forth.

**Figure 1. An example of holding periods.**




Holding period refers to the time period that begins when the stocks are bought and ends when the stocks are sold after a year of holding, whereas sample period refers to the time period which begins when the first test portfolios are bought in 1997 and ends when the last test portfolios are sold in 2010. Consequently, the 13-year sample period consists of 13 holding periods of one year. According to earlier research (e.g. Bird and Whitaker, 2003), a holding period of one year should be long enough for the value premium to realize. In addition, purchasing the portfolios as late as in May should not be a problem as according to Rousseau and van Rensburg (2003), it might even be beneficial to form the portfolios based on one year old rankings instead of the most recent ones.

### 3.1.2 Data Adjustment

Most of the data downloaded from the database is applicable as it is. However, if EV/EBIT or P/B is negative, the need for data adjustment arises, since both negative EV/EBIT and P/B represent undesirable situations which must be taken into account when ranking the companies.

Magic Formula and ERP5 rank the companies in order based on the selected ratios. As a result, if no adjustments are made, the rankings system gives companies with negative EV/EBIT or P/B a very high ranking because a negative figure is smaller than a positive one.

Table 1 gives an example of how negative EV/EBIT and P/B are modified in the study. To better illustrate the logic, a fictitious example with only five companies is presented. Companies with either negative EV/EBIT or P/B are simply moved to the back of the pack in reverse order. Consequently, Company A is listed after Company B in Table 1 since -1.2 < -0.4.

**Table 1. An example of company ranking before and after adjustment of negative figures.**

| | P/B | Rank (P/B) | | Mod. P/B | Rank (P/B) |
|---|---|---|---|---|---|
| Company A | -1.2 | 1 | Company C | 0.7 | 1 |
| Company B | -0.4 | 2 | Company D | 1.2 | 2 |
| Company C | 0.7 | 3 | Company E | 2.5 | 3 |
| Company D | 1.2 | 4 | Company B | Neg 1 | 4 |
| Company E | 2.5 | 5 | Company A | Neg 2 | 5 |

## 3.2 Construction of Test Portfolios

The companies are divided into four categories based on the rankings. The number of companies varies between 61 and 120 as can be seen in Table 2. As a result, the number of companies in the formed portfolios varies between 15 and 30 depending on the holding period. This is relatively close to the portfolio size of 20 tested by Vastraceele & Allaeys (2010a).

**Table 2. The number of companies included in the sample and the number of companies in each of the formed portfolios.**

| | Total Number of Companies in the Sample | Number of Companies in Top 25 % | Number of Companies in Upper Mid 25 % | Number of Companies in Lower Mid 25 % | Number of Companies in Bottom 25 % |
|---|---|---|---|---|---|
| 1997-98 | 61 | 15 | 15 | 15 | 16 |
| 1998-99 | 64 | 16 | 16 | 16 | 16 |
| 1999-2000 | 66 | 16 | 17 | 16 | 17 |
| 2000-01 | 90 | 22 | 23 | 22 | 23 |
| 2001-02 | 94 | 23 | 24 | 23 | 24 |
| 2002-03 | 100 | 25 | 25 | 25 | 25 |
| 2003-04 | 95 | 23 | 24 | 24 | 24 |
| 2004-05 | 86 | 21 | 22 | 21 | 22 |
| 2005-06 | 87 | 21 | 22 | 22 | 22 |
| 2006-07 | 98 | 24 | 25 | 24 | 25 |
| 2007-08 | 101 | 25 | 25 | 25 | 26 |
| 2008-09 | 120 | 30 | 30 | 30 | 30 |
| 2009-10 | 114 | 28 | 29 | 28 | 29 |

The companies are divided into four portfolios according to the Magic Formula and ERP5 ranking so that each portfolio consists of approximately same number of companies. This means that for each period, eight portfolios are constructed: Top 25% according to Magic Formula, Top 25% according to ERP5, Upper Mid 25% according to Magic Formula, Upper Mid 25% according to ERP5 and so forth.

In addition to the eight portfolios, five extra portfolios are formed that consist of top 5, top 10, top 15, top 20 and top 25 companies according to the ERP5 ranking. The purpose of this is to examine what could be the optimal portfolio size. The extra portfolios are not constructed for the Magic Formula strategy since the Magic Formula Upper Mid 25% portfolio seems to be performing better than the Top 25% portfolio, indicating that the best performing stocks can be found in the second quarter when the stocks are ranked in order according to the Magic Formula criteria.

### 3.2.1 Ranking the Stocks

The Magic Formula portfolios are formed based on the following ratios: EV/EBIT and ROA. For ERP5 portfolios, two additional ratios are used: P/B and 5-year trailing ROA. The ratios and the ranking logic are summarized in Table 3. Before ranking the stocks, data adjustments presented in Subsection 3.1.2 are made in order to prevent companies with negative EV/EBIT or negative P/B from getting an unjustifiably high ranking.

**Table 3. Summary of used ratios and ranking logic with Magic Formula and ERP5.**

| Ratio | Ranking logic | Magic Formula | ERP5 |
|---|---|---|---|
| EV/EBIT | The lower the ratio, the higher the ranking | Yes | Yes |
| P/B | The lower the ratio, the higher the ranking | No | Yes |
| ROA | The higher the ratio, the higher the ranking | Yes | Yes |
| 5Y ROA | The higher the ratio, the higher the ranking | No | Yes |

After companies are ranked according to their ratios, the rankings are summed up as presented in Table 4 to get the MF points and ERP5 points for each company. Finally, the companies with the lowest points are purchased to the top portfolios and the companies with the highest points purchased to the bottom portfolios.

**Table 4. Example of calculating ranking points for Magic Formula (MF) and ERP5.**

| | Rank EV/EBIT | Rank P/B | Rank ROA | Rank 5Y ROA | Points MF | Points ERP5 |
|---|---|---|---|---|---|---|
| Martela | 5 | 25 | 16 | 25 | 21 | 71 |
| Rautaruukki | 13 | 47 | 13 | 10 | 26 | 83 |
| Nordic Aluminium | 15 | 65 | 11 | 7 | 26 | 98 |
| Scanfil | 3 | 34 | 29 | 39 | 32 | 105 |
| Raute | 7 | 26 | 33 | 41 | 40 | 107 |
| PKC Group | 17 | 28 | 67 | 23 | 84 | 135 |
| Yleiselektroniikka | 10 | 37 | 45 | 49 | 55 | 141 |
| Panostaja | 9 | 52 | 25 | 56 | 34 | 142 |
| Tamfelt | 1 | 82 | 38 | 21 | 39 | 142 |
| TeliaSonera | 24 | 60 | 34 | 24 | 58 | 142 |

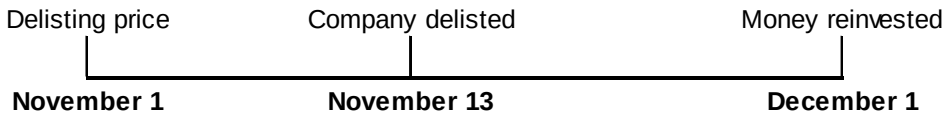
### 3.2.2 Calculating Portfolio Returns

All of the tested portfolios in the thesis are equally weighted. For example, if the tested portfolio consists of 25 stocks, each stock has a weight of 4% in the portfolio at the time the portfolio is purchased. Portfolio returns are calculated using total return times series, which means that dividends are reinvested in the same stock that paid the dividend. Portfolios are not rebalanced during the holding periods.

The portfolios are only modified during a holding period if companies within the portfolio are delisted for a reason or another. In the case of delisting, the reason of delisting affects how the portfolio is modified. There are two reasons why a company might get delisted: 1) the company is acquired by another company listed in the Helsinki Stock Exchange 2) the company is acquired by a foreign company or an unlisted company. If a company A that is included in a portfolio is acquired by another company B listed in the Helsinki Stock Exchange, the acquiring B company becomes part of the portfolio. If the acquiring company is foreign or the acquired company has no successor in the Helsinki Stock Exchange, the money received as a result of the delisting is reallocated equally among all the companies within the same portfolio.

In the study, monthly returns are used. For this reason, if a merger or buyout takes place in the middle of the month, the price at the time of delisting is unknown and cannot be taken into account, which may affect the results. Figure 2 gives an example of how delisted companies are treated in the calculations. The example company is delisted on the 13$^{th}$ of November. In this case, the presumed delisting price is based on the market price on November 1. The money is hold in cash for the month of delisting, after which the money is either invested in the acquiring company or reallocated among the remaining companies in the portfolio.

**Figure 2. An example of the reallocation of money in a case of delisting.**




The method presented in Figure 2 may affect results. However, usually the transaction price in the case of a merger or buyout is public before the actual delisting takes places. Consequently, the market price at the beginning of the delisting month should reflect the public information and the market price at the beginning of the delisting month should be relatively close to the actual delisting price. As a result, the presented method should minimize the bias caused by the delisting in the portfolio return calculations.

### 3.3 Portfolio Performance Evaluation

The results are represented separately for Magic Formula and ERP5. For all value portfolios being examined, a statistical hypothesis test was conducted to observe the differences between the means in the monthly returns of the OMXH Cap index and the portfolio.

The null hypothesis of the one tailed t test is that the index return is higher than or equal to the portfolio return ($R_{index} \geq R_{portfolio}$) and the alternative hypothesis is that the index return is lower than the portfolio return ($R_{index} < R_{portfolio}$). The tests were conducted at 15%, 10% and 5% significance level. Rejecting the null hypothesis suggests that the index return will only very rarely exceed the portfolio return. An example print of the t test can be found in Appendix 1.

## 3.4 Robustness Checks

There are aspects that need to be considered in determining the trustworthiness and reliability of the study. Taxes or transaction costs are not taken into account, which naturally affects the return of the tested portfolios.

In addition, the tested portfolios are reformed once a year using the closing price of one single trading day. In reality, the trades could not be executed at the closing price and reforming the portfolios even within a single trading day might prove difficult, especially if the invested amount of money is large or the stocks are illiquid.

From 2006 onwards the minimum trading lot in the Helsinki Stock Exchange has been one share. However, before 2006 the minimum trading lot was considerably larger for some companies, which would have made it difficult to form equally weighted portfolios in reality, especially if the invested amount of money is small. In the thesis, the minimum trading lot is ignored when forming equally weighted portfolios.

Because monthly returns are used to calculate portfolio returns, the actual price of delisting cannot be taken into account when calculating portfolio returns if a merger or buyout takes place. The effect of this bias is minimized as presented in Subsection 3.2.2.

There are also several biases that might affect the results of back testing and which should be taken into account. What these biases are and how they are taken into account in the thesis, is explained below.

### 3.4.1 Survival Bias

Survival bias refers to a situation where companies which have gone bankrupt or which have been acquired have been removed from the data

or database. Since companies that go bankrupt or get acquired are usually low quality companies, excluding them from the data can improve the average quality of the companies in the data. This can lead to better back-testing performance compared to a market portfolio, in which all companies are represented. For this reason, the data should include all companies even if they have gone bankrupt or been acquired during the sample period.

The dataset used in the study consists of those companies listed in the Helsinki Stock Exchange during the years 1997-2010. Companies that have gone bankrupt or that have been delisted for another reason are included in the dataset.

### 3.4.2 Look Ahead Bias

In back testing, look ahead bias refers to a situation in which investment decision is made based on information, which was not yet available at the time of the decision. For example, if a company had published its annual report on March 1, 2000, no back testing investment decision should be made based on this information prior to that date.

Portfolios are formed based on the annual figures reported by the companies. Annual figures are usually reported per the end of year. However, since it takes time to prepare the publications, the data is not available at the start of the year. To minimize the risk of look ahead bias in the study, portfolios are formed on the first trading day of May. This should make sure that the data used to form the portfolios was, indeed, public and available in reality at that time.

### 3.4.3 Bid-Ask Bounce

Bid-ask bounce refers to a situation in which the spread between the bid and ask prices is considerably high. Because of the spread, an investor is

unable to buy or sell a large number of shares in a company without affecting the market price. This usually happens when trying to buy shares of a very small company or if the stock of a middle cap or large cap company is very illiquid. In back testing, it is impossible to approximate the effect on bid-ask bounce on the market price.

To minimize the effect of the bid-ask bounce, the smallest companies should be excluded from the data. For this reason, only companies listed on the Helsinki Stock Exchange main list are included in the data. Since the Finnish stock market is rather small and consists relatively small number of companies, the sample is not limited based on the market capitalization of companies as it would shrink the sample size. This allows testing with a meaningful number of companies.

### 3.4.4 Small Cap Effect

Earlier research suggests that small market capitalization companies tend to outperform large market capitalization companies (e.g. Banz 1981). In this thesis, each constructed portfolio is an equally weighted portfolio, whereas the benchmark index OMXH Cap is a market capitalization weighted index, which means OMXH Cap puts more emphasis on the large cap companies than the portfolios formed using Magic Formula or ERP5.

As a result, if small cap stocks outperform large cap stocks during the sample period, the reason why the value strategies outperform the benchmark index might be the fact that the relative proportion of small cap stocks in Magic Formula and ERP5 portfolios is higher compared to the benchmark index. However, the objective of this study is not to examine whether the small cap effect exists but instead, to examine whether Magic Formula or ERP5 value strategies possess stock picking power that make it possible to achieve excess returns. For this reason, a Whole Sample

Equally Weighted portfolio (WSEW) is constructed and the performance of Magic Formula and ERP5 portfolios is compared to the WSEW.

The Whole Sample Equally Weighted portfolio is an equally weighted portfolio that consists of all the stocks included in the study. As financials and utilities are excluded from the data, WSEW portfolio does not include them either. Using the WSEW as a benchmark, in addition to OMXH Cap, it can ruled out that the value strategies being examined outperform the OMXH Cap only because 1) financials and utility stocks have been excluded from the sample 2) Magic Formula and ERP5 put more emphasis on small cap stocks than the benchmark index. Consequently, the use of WSEW allows gaining understanding on what the stock picking power of the strategies is based.

# 4 RESULTS

This section presents and analyzes the results of the study. The section is divided into three subsections. The first subsection represents the performance results for the tested value portfolios, after which the second subsection discusses the relationship of return and risk. Finally, the third subsection represents the results on what could be the optimal portfolio size.

## 4.1 Performance of Test Portfolios

When looking at the results, one has to be aware and interpret the results in light of two important facts. Firstly, during the tech bubble in the years 1998-2000, a relatively large proportion of the OMXH Cap index consisted of technology and IT stocks. It was the tech stocks that first skyrocketed, and crashed down soon after, while other sectors were not as volatile. Because the value strategies are used to form equally weighted portfolios, the effect of the tech bubble is not as great on the value portfolios as it is on the OMXH Cap index. This was also noted by Xu and Fisher (2006), who found that growth stocks performed well and value stocks struggled during the period of tech bubble. For this reason, the returns are calculated for the test period 1997-2010 and to a period after the tech bubble (2001-2010). The latter period is chosen to begin in May 2001 because at this point of time the outperformance of the OMXH Cap index compared to the portfolio consisting of the whole sample (WSEW portfolio) has been compensated by an underperformance of equal size. This allows the examination of how the value strategies perform in a more usual market environment in comparison to the era of technology hype.

Secondly, previous research suggests that small cap companies generally tend to outperform large cap companies (e.g. Banz 1981). For this reason, it is possible that the equally weighted value portfolios outperform the OMXH Cap index only because they put more weight on small cap

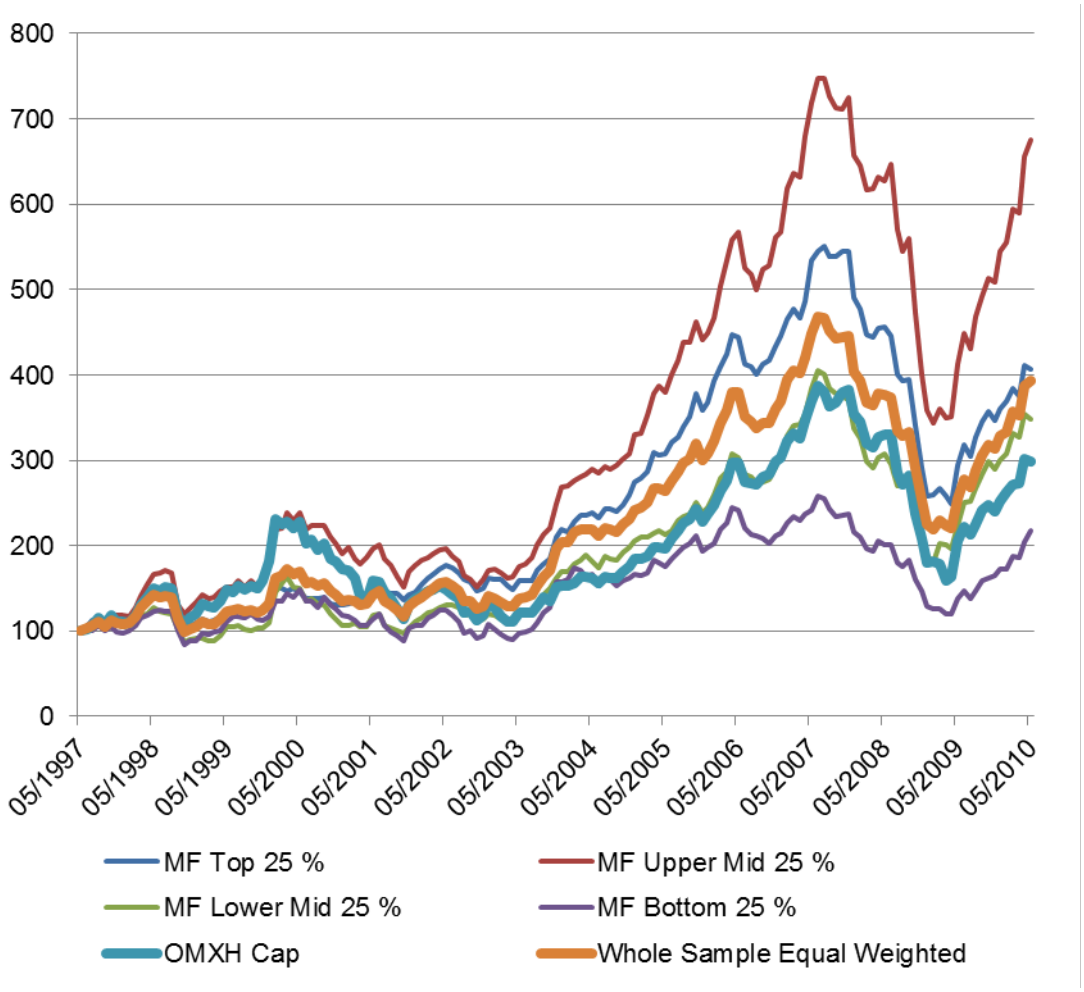
companies than the benchmark index. For this reason, the value portfolios are compared not only against the OMXH Cap index, but also against a portfolio that is equally weighted and consists of all the stocks included in the sample (abbreviated WSEW). This should help to understand whether the returns exceeding the benchmark returns are due to stock picking power of the value strategies or simply a result of overweighting the small caps against the benchmark index.

### 4.1.1 Magic Formula Portfolios

By looking at Figure 3, we can separate three very different time periods. As the tech bubble develops, the OMXH Cap index rises quickly led by the rocketing IT stocks. During this period, the index outperforms the value portfolios, except for one, and the WSEW portfolio. This is in line with the findings of Xu and Fisher (2006) that growth stocks did extremely well while value stocks suffered during the tech bubble. The second period starts as the tech bubble breaks in 2000. Until the summer of 2001, the index declines sharply, again led by the crashing IT stocks. During these periods, the performance is greatly affected by the IT and other technology stocks and it is fair to assume that the outperformance during the years 1999-2000 and the underperformance during the decline of 2000-01 are due to the IT stocks which at the time, formed a large proportion of the index.

The third period begins in 2001 after the outperformance of the index during the tech bubble has been compensated by the sharp decline. From 2001 onwards, the performance of the OMXH Cap index is more modest compared to the Magic Formula portfolios and the WSEW portfolio. As the WSEW portfolio outperforms the index, we can assume that during this period, the small cap effect works in favor of the Magic Formula portfolios.

**Figure 3. Performance of tested Magic Formula portfolios compared to OMXH Cap and whole sample equally weighted portfolio (WSEW) 1997-2010.**




The results for the Magic Formula portfolios are in contradiction with the assumption based on theory. The portfolio consisting of stocks ranked in the second quartile (MF Upper Mid 25%) outperforms the portfolio consisting of the top quartile stocks, which should not be the case. The MF Upper Mid portfolio does not only outperform against the OMXH Cap index during the full sample period, but does it consistently during every holding period except for 2000-01 and 2001-02 (see Table 5). Moreover, the MF Upper Mid portfolio is the only portfolio that generates returns that differ significantly from the benchmark returns according to the statistical test. There is no evident explanation for this. A possible explanation for this could be that the stocks ranked in the top quartile are cheap for a reason and have only recently taken a turn to the worse so that the accounting

ratios still look attractive although the business environment has changed. For some reason, Magic Formula seems to put the biggest gainers in the second quarter. It is also possible that this is just a coincidence, however, the fact that the results are statistically significant at the 5% significance level, give reason to assume the opposite.

**Table 5. Performance of the tested Magic Formula portfolios compared to OMXH Cap index and whole sample equally weighted portfolio (WSEW) and the summary of the statistical significance tests.**

| | Top 25 % Magic Formula | Upper Mid 25 % Magic Formula | Lower Mid 25 % Magic Formula | Bottom 25 % Magic Formula | OMXH Cap | WSEW |
|---|---|---|---|---|---|---|
| 1997-98 | 52,1 % | 66,6 % | 26,9 % | 23,2 % | 49,3 % | 41,9 % |
| 1998-99 | -17,8 % | -9,0 % | -17,7 % | -10,4 % | -0,9 % | -13,7 % |
| 1999-2000 | 16,2 % | 56,9 % | 43,1 % | 34,6 % | 54,3 % | 38,0 % |
| 2000-01 | 0,9 % | -17,3 % | -21,3 % | -23,7 % | -30,3 % | -15,5 % |
| 2001-02 | 20,6 % | -0,3 % | 11,3 % | 9,7 % | -7,0 % | 10,2 % |
| 2002-03 | -10,4 % | -10,3 % | -6,4 % | -21,6 % | -18,0 % | -12,2 % |
| 2003-04 | 50,4 % | 64,3 % | 48,5 % | 70,2 % | 33,0 % | 58,5 % |
| 2004-05 | 28,9 % | 31,4 % | 17,1 % | 5,4 % | 21,6 % | 20,5 % |
| 2005-06 | 44,9 % | 49,3 % | 42,2 % | 37,9 % | 51,3 % | 43,6 % |
| 2006-07 | 20,2 % | 26,7 % | 26,9 % | 0,3 % | 24,3 % | 18,5 % |
| 2007-08 | -14,7 % | -12,7 % | -20,0 % | -17,3 % | -10,6 % | -16,1 % |
| 2008-09 | -35,4 % | -34,3 % | -27,6 % | -31,0 % | -37,6 % | -32,1 % |
| 2009-10 | 38,1 % | 63,9 % | 56,1 % | 57,4 % | 45,1 % | 54,2 % |
| 1997-2010 Cumulative | 306,7 % | 575,8 % | 247,8 % | 117,4 % | 198,6 % | 293,7 % |
| 1997-2010 (p.a.) | 11,4 % | 15,8 % | 10,1 % | 6,2 % | 8,8 % | 11,1 % |
| Statistical significance | No | ** | No | No | Not tested | No |
| 2001-2010 Cumulative | 177,5 % | 243,6 % | 195,6 % | 91,9 % | 87,8 % | 175,9 % |
| 2001-2010 (p.a.) | 12,0 % | 14,7 % | 12,8 % | 7,5 % | 7,3 % | 11,9 % |
| Statistical significance | No | * | No | No | Not tested | No |

*) Significant at 10 % significance level, **) Significant at 5 % significance level

The top Magic Formula portfolios generate returns that exceed the benchmark return. However, this seems to be partly because Magic Formula puts more weight on small cap companies, although the WSEW portfolio does not consist purely of small cap stocks – it just puts more weight on them compared to the OMXH Cap index. This conclusion is also backed by the fact that during the holding periods 2001-10, all Magic Formula portfolios outperform the benchmark index. This can either be because of the small cap effect or the fact that the sample (nor the Magic Formula portfolios neither WSEW portfolio) does not include financials and utilities. The performance of financial stocks during the same time period gives reason to assume the former.

When looking at the performance of the MF Bottom 25% portfolio, one can see that the portfolio does not perform as well as the other portfolios. Not only does the MF Bottom portfolio underperform the other Magic Formula portfolios, it also underperforms the benchmark index. This implies that Magic Formula could be used to separate the losers from the rest. However, the result for the MF Bottom portfolio is not statistically significant.

All in all, the results for the Magic Formula portfolios are somewhat confusing and contradictory. Although the results for the MF Upper Mid 25% portfolio are statistically significant, they cannot be considered meaningful as they go against the theory and economic rationale. One explanation for this could be that the companies ranked in the top quartile high low earnings yield for a valid reason, for example, if they have only recently become distressed or there has been a major change in their business environment. Such a recent change would impact accounting figures with a lag which could explain attractive ratios, but less impressive returns for the top quartile portfolio. All the same, one should not expect the MF Upper Mid portfolio to outperform the other portfolios during other time periods or using different data. Although the top portfolios seem to generate better returns compared to the bottom portfolios which is in line with the theoretical assumptions, the fact that the MF Upper Mid portfolio produces higher returns compared to MF Top portfolio cannot be explained. In addition, the results for the other portfolios are not statistically significant.

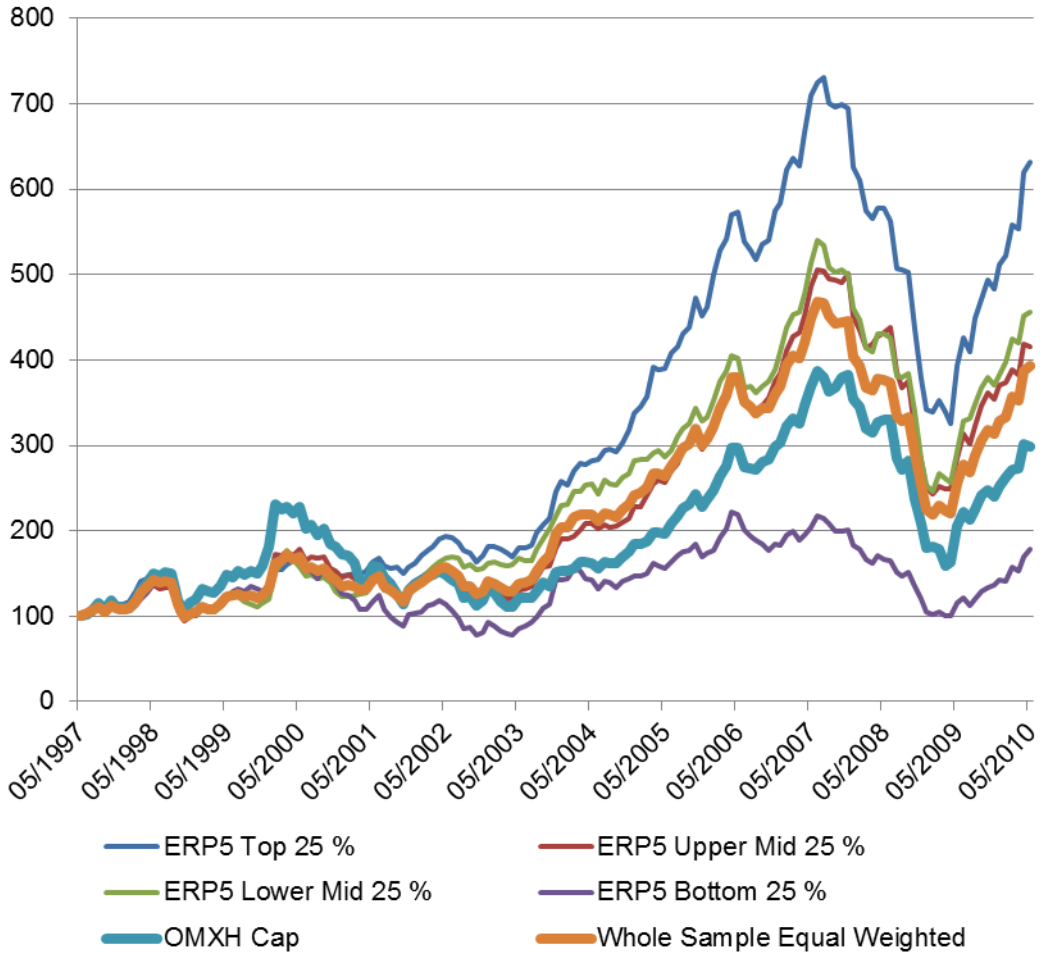
### 4.1.2 ERP5 Portfolios

Looking at Figure 4, the same three time periods can be recognized as with the Magic Formula portfolios. As the tech bubble develops, the ERP5 portfolios underperform the OMXH Cap index, as does the WSEW portfolio. During the sharp decline after the peak in 2000, the index declines more than the quartile portfolios and the WSEW portfolio. Once

the new upswing begins, the OMXH Cap still underperforms the best performing ERP5 portfolios and the WSEW portfolio. The probable reasons for this are explained in Subsection 4.1.1.

However, the performance of the ERP5 portfolios tells quite a different story than that of the Magic Formula portfolios. As is evident from Figure 4, both the returns of the best-ranked stocks (ERP5 Top 25% portfolio) and the worst-ranked stocks (ERP5 Bottom 25% portfolio) differ greatly from the return of the benchmark index. During the sample period, the ERP5 Top 25% portfolio generated returns of 15.2% per annum while the ERP5 Bottom 25% was left behind at only 4.6% p.a. During the same period, the benchmark index gained 8.8% p.a. This implies that the ERP5 value strategy, indeed, possesses stock picking power that can be used to construct portfolios that generate excess returns in the long-term. The results are similar to those reported by Vanstraceele and Allaeys (2010a), who tested the ERP5 strategy in the Eurozone stock markets.

**Figure 4. Performance of tested ERP5 portfolios compared to OMXH Cap and whole sample equally weighted portfolio (WSEW) 1997-2010.**




The more detailed results are presented in Table 6, which shows that the ERP5 strategy is able to steadily generate results exceeding the return of the index. However, the strategy is not very good at avoiding declines. Although the ERP5 Top 25% portfolio managed to decrease the losses during the years 2000-03 compared to the benchmark index, the outperformance during 2000-01 can be explained by the breaking tech bubble. During the financial crisis, the negative returns posted by the value strategy are roughly the same size as those posted by the benchmark. However, as the sample period includes only two downturns and three upswings, one should be cautious in making conclusions on how the strategy performs during a downturn or an upswing.

**Table 6. Performance of the tested ERP5 portfolios compared to OMXH Cap index and whole sample equally weighted portfolio (WSEW) and the summary of the statistical significance tests.**

| | Top 25 % ERP5 | Upper Mid 25 % ERP5 | Lower Mid 25 % ERP5 | Bottom 25 % ERP5 | OMXH Cap | WSEW |
|---|---|---|---|---|---|---|
| 1997-98 | 50,8 % | 36,8 % | 42,9 % | 37,4 % | 49,3 % | 41,9 % |
| 1998-99 | -18,5 % | -9,5 % | -15,3 % | -11,8 % | -0,9 % | -13,7 % |
| 1999-2000 | 34,8 % | 44,1 % | 30,4 % | 41,8 % | 54,3 % | 38,0 % |
| 2000-01 | -1,5 % | -15,8 % | -11,5 % | -32,2 % | -30,3 % | -15,5 % |
| 2001-02 | 18,5 % | 5,1 % | 20,5 % | -2,4 % | -7,0 % | 10,2 % |
| 2002-03 | -6,7 % | -17,4 % | 0,0 % | -24,7 % | -18,0 % | -12,2 % |
| 2003-04 | 56,8 % | 60,3 % | 50,9 % | 66,1 % | 33,0 % | 58,5 % |
| 2004-05 | 37,8 % | 22,6 % | 12,9 % | 9,1 % | 21,6 % | 20,5 % |
| 2005-06 | 47,2 % | 46,3 % | 40,1 % | 40,8 % | 51,3 % | 43,6 % |
| 2006-07 | 23,8 % | 29,6 % | 27,7 % | -6,6 % | 24,3 % | 18,5 % |
| 2007-08 | -18,7 % | -11,1 % | -16,2 % | -18,4 % | -10,6 % | -16,1 % |
| 2008-09 | -32,0 % | -34,0 % | -32,1 % | -30,5 % | -37,6 % | -32,1 % |
| 2009-10 | 60,7 % | 45,7 % | 56,2 % | 54,3 % | 45,1 % | 54,2 % |
| 1997-2010 Cumulative | 531,0 % | 315,4 % | 356,0 % | 78,6 % | 198,6 % | 293,7 % |
| 1997-2010 (p.a.) | 15,2 % | 11,6 % | 12,4 % | 4,6 % | 8,8 % | 11,1 % |
| Statistical significance | No | No | No | No | Not tested | No |
| 2001-2010 Cumulative | 286,9 % | 176,6 % | 226,2 % | 53,2 % | 87,8 % | 175,9 % |
| 2001-2010 (p.a.) | 16,2 % | 12,0 % | 14,0 % | 4,9 % | 7,3 % | 11,9 % |
| Statistical significance | ** | No | * | No | Not tested | No |

*) Significant at 10 % significance level, **) Significant at 5 % significance level

The higher returns generated by the ERP5 strategy seem to be partly explained by the small cap effect. However, when we compare the performance of ERP5 Top 25% portfolio to that of the portfolio consisting of all sample companies (WSEW), it is clear that the higher returns are not only due to the small cap effect. The most probable explanation for this is that the ERP5 strategy possesses stock picking power and is able to separate better performing stocks from the rest.

One must notice that the results of the statistical tests are affected by the unusual time period during the tech bubble, as is evident from Table 6. The difference in the returns of the ERP5 Top 25% portfolio and the benchmark index becomes significant at 5% level if the era of the tech bubble is excluded and the test is conducted for the time period 2001-2010. Whether events such as the tech bubble should be considered normal is a matter of opinion. However, in the historical perspective, events such as the tech bubble are rare and if they happen in sample period of only 13 years, the results may become biased as the unusual

event gets exaggerated importance. In this sense, it can be argued that the t test results for the time period 2001-10 are more trustworthy.

All in all, it appears that using ERP5 to screen stocks can indeed result in higher returns. And what is more, ERP5 can be used to separate not only the winners but the losers as well. ERP5 also provides better returns compared to Magic Formula. The results are in line with the results reported by Vanstraceele and Allaeys (2010a and 2010b).

The higher returns appear to be partly explained by the small cap effect. However, the small cap effect does not explain why the Top 25% portfolio also outperforms the WSEW portfolio. The explanation for the outperformance over the WSEW portfolio could, instead, be that the ERP5 strategy is able to separate future winners from future losers. This statement is also backed by the fact that the bottom-quartile stocks (Bottom 25% portfolio) underperform against both the benchmark index and the WSEW portfolio.

Based on this thesis, it remains unclear whether short-selling the worst ranking stocks is profitable. At least with the portfolio size being examined, short selling would not be profitable in the long-term as the ERP5 Bottom 25% portfolio generates positive, albeit lower returns than the benchmark index. Whether short selling a smaller number of worst ranked stocks would be profitable cannot be said based on this thesis.

### 4.2 Return and Risk

To examine whether the value strategies include more risk than the general market portfolio, the volatilities of the quartile portfolios are compared to those of the benchmark index and the equal weighted portfolio consisting of all the sample companies (WSEW).

The returns and volatilities for the Magic Formula portfolios are presented in Figure 5 and the returns and volatilities for the ERP5 portfolios in Figure 6. The figures reveal that the value portfolios do not include more risk in terms of volatility. On the contrary, the volatility of the value portfolios is somewhat lower than that of the OMXH Cap index, which is in line with the earlier research (e.g. Pätäri and Leivo, 2009). However, the higher volatility of the OMXH Cap index seems to be partly due to the tech bubble. If the volatilities are calculated for the 2001-10 period, the volatility of the index is slightly lower (21.6%) while the volatilities of the quartile portfolios remain roughly the same. Nevertheless, the volatility of the top value portfolios is lower during this period as well.

It is also notable that the top portfolios based on both Magic Formula and ERP5 have the lowest volatility while the bottom portfolios have the highest volatility. This implies that both strategies could be used to separate the most risky stocks from the stocks that have lower risk in terms of volatility.

**Figure 5. Annualized returns and volatilities for Magic Formula portfolios compared to OMXH Cap index and the whole sample equally weighted portfolio (WSEW) 1997-2010.**

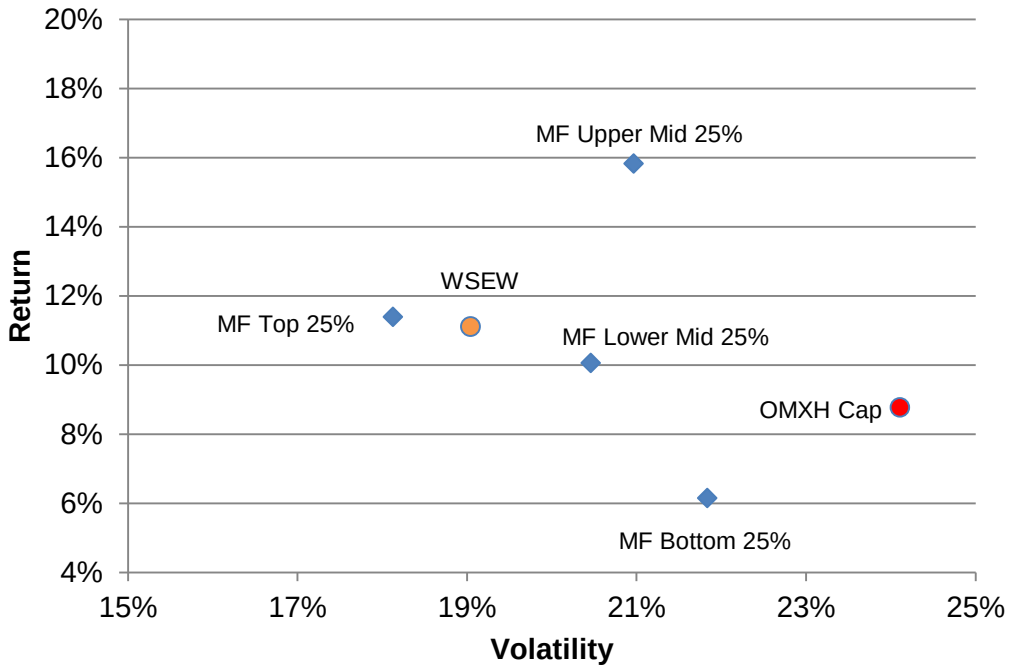
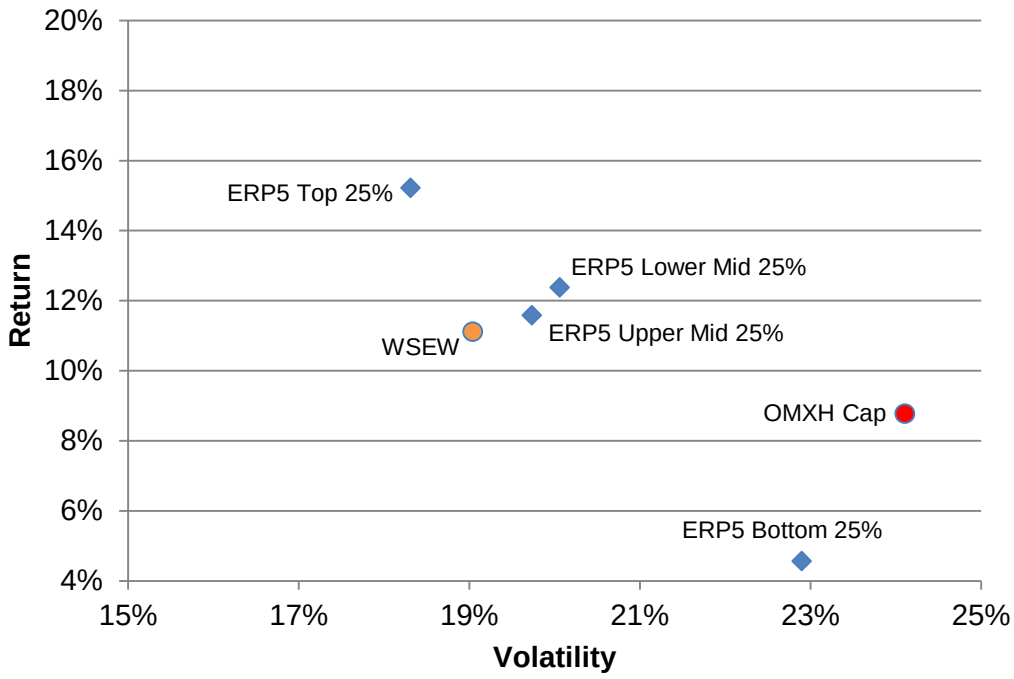



**Figure 6. Annualized returns and volatilities for ERP5 portfolios compared to OMXH Cap index and the whole sample equally weighted portfolio (WSEW) 1997-2010.**



When interpreting the volatility figures, one must keep in mind that the volatilities for the value portfolios might be artificially low because the portfolios include small companies that may not been traded often. If a stock is traded, for example, only once a month the volatility of the stock does not reflect the riskiness of the stock and can be considered artificially low compared to a stock that is traded daily. To even out this effect, the volatilities are calculated using monthly observations. In addition, the companies not listed on the main list are excluded from the sample. Despite these operations, the volatility of the OMXH Cap seems to be slightly higher than that of the WSEW portfolio and one cannot exclude to possibility that the volatilities do not entirely represent the riskiness of the quartile portfolios.

Additional measures and ratios of risk and return are presented in Tables 7 and 8. All additional measures favor the top Magic Formula portfolios over the market index. However, the comparison to the WSEW portfolio is more mixed. Compared to the WSEW portfolio, the MF Top 25% portfolio is not outstanding when looking at return-to-volatility, Sharpe ratio, Treynor ratio or Jensen's alpha, for example. Return-to-volatility ratio calculated as the relationship between the annual return and annual volatility.

**Table 7. Additional ratios for the tested Magic Formula portfolios compared to OMXH Cap index and the whole sample equally weighted portfolio (WSEW). For Sharpe ratio and Jensen's Alpha, the return of the 1-year German Bund is used as the risk-free rate as it is a commonly used benchmark for risk-free rate. For beta and Treynor ratio, OMXH Cap is used as the benchmark index.**

| | Top 25 % Magic Formula | Upper Mid 25 % Magic Formula | Lower Mid 25 % Magic Formula | Bottom 25 % Magic Formula | OMXH Cap | WSEW |
|---|---|---|---|---|---|---|
| Return (p.a.) | 11,4 % | 15,8 % | 10,1 % | 6,2 % | 8,8 % | 11,1 % |
| Volatility | 18,1 % | 21,0 % | 20,5 % | 21,8 % | 24,1 % | 19,0 % |
| Return-to-Volatility Ratio | 0,63 | 0,75 | 0,49 | 0,28 | 0,36 | 0,58 |
| Beta | 0,64 | 0,78 | 0,71 | 0,77 | 1,00 | 0,72 |
| Sharpe | 0,46 | 0,61 | 0,34 | 0,14 | 0,23 | 0,42 |
| Treynor | 0,13 | 0,16 | 0,10 | 0,04 | 0,06 | 0,11 |
| Jensen's Alpha | 4,6 % | 8,3 % | 2,9 % | -1,3 % | 0,0 % | 3,9 % |
| Periods with Negative Return | 4 | 6 | 5 | 5 | 6 | 5 |
| Periods with Below OMXH Cap Return | 6 | 3 | 6 | 8 | - | 7 |

**Table 8. Additional ratios for the tested ERP5 portfolios compared to OMXH Cap index and the whole sample equally weighted portfolio (WSEW). For Sharpe ratio and Jensen's Alpha, the return of the 1-year German Bund is used as the risk-free rate as it is a commonly used benchmark for risk-free rate. For beta and Treynor ratio, OMXH Cap is used as the benchmark index.**

| | Top 25 % ERP5 | Upper Mid 25 % ERP5 | Lower Mid 25 % ERP5 | Bottom 25 % ERP5 | OMXH Cap | WSEW |
|---|---|---|---|---|---|---|
| Return (p.a.) | 15,2 % | 11,6 % | 12,4 % | 4,6 % | 8,8 % | 11,1 % |
| Volatility | 18,3 % | 19,7 % | 20,1 % | 22,9 % | 24,1 % | 19,0 % |
| Return-to-Volatility Ratio | 0,83 | 0,59 | 0,62 | 0,20 | 0,36 | 0,58 |
| Beta | 0,64 | 0,75 | 0,69 | 0,82 | 1,00 | 0,72 |
| Sharpe | 0,66 | 0,43 | 0,46 | 0,06 | 0,23 | 0,42 |
| Treynor | 0,19 | 0,11 | 0,13 | 0,02 | 0,06 | 0,11 |
| Jensen's Alpha | 8,4 % | 4,2 % | 5,3 % | -3,2 % | 0,0 % | 3,9 % |
| Periods with Negative Return | 5 | 5 | 4 | 7 | 6 | 5 |
| Periods with Below Benchmark Return | 5 | 5 | 6 | 9 | - | 7 |

When interpreting the additional ratios, one has to keep in mind that they are all based on volatility. Consequently, if volatility is artificially low, the ratios are biased. That being said, it must be stated that when comparing the ERP5 Top 25% portfolio to the WSEW portfolio – which suffers from the same possible bias concerning the volatility – the ERP5 portfolio generates better return-risk ratio. Likewise, the ERP5 Bottom 25% portfolio is the worst portfolio using any of the additional ratios. As a result, it is fair to conclude that the higher returns generated by the ERP5 strategy are not due to higher risk. This is also in line with the findings of Vanstraceele and Allaeys (2010b).

### 4.3 Optimal Portfolio Size

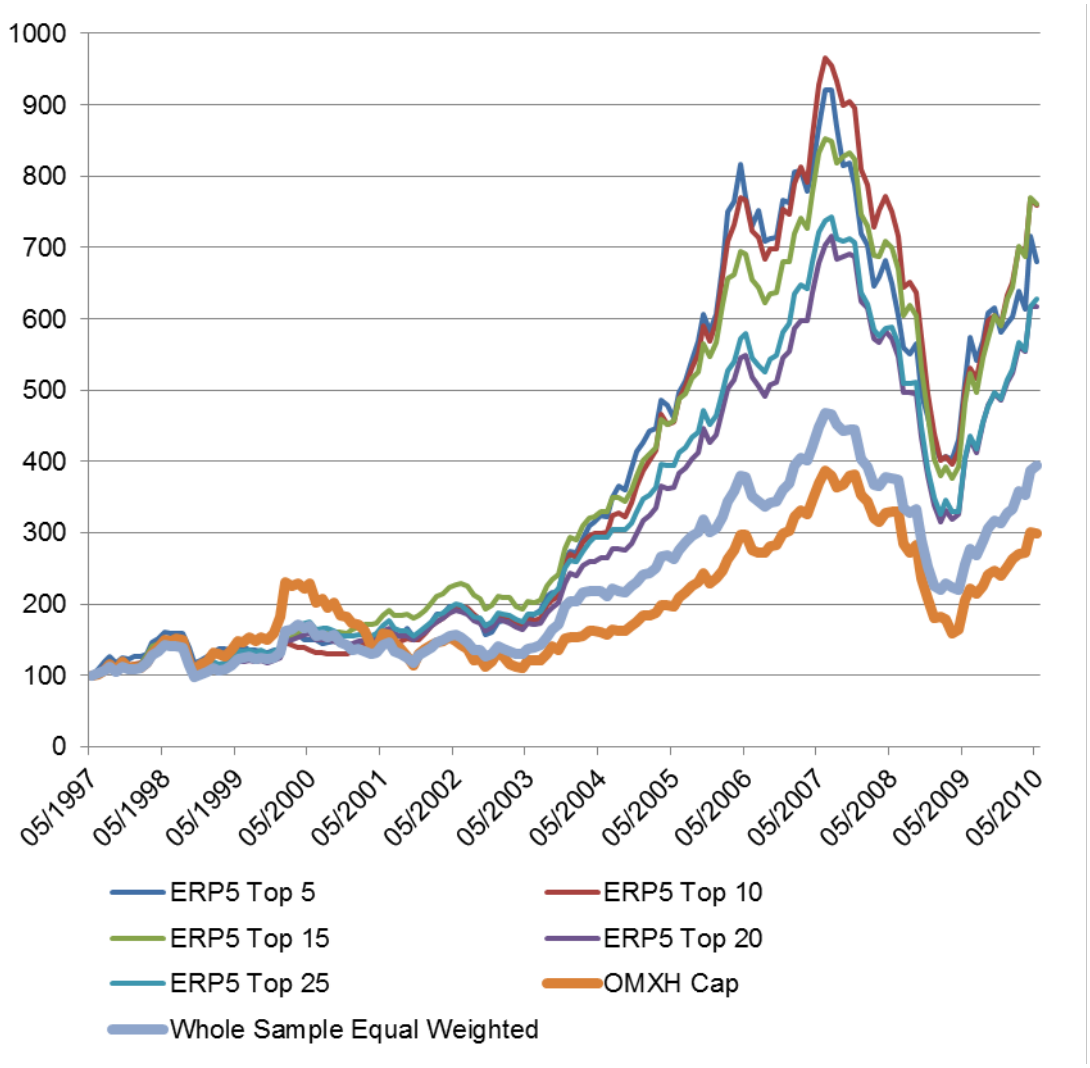
If one chooses to apply a value strategy in forming a portfolio, the question of how many stocks should be included in the portfolio is probably the first that one considers. Value investing advocates, such as Graham (1976), suggest the instead of picking individual stocks, one should form a portfolio of stocks. However, the optimal number of stocks is not as clear. In this section, the problem is examined by forming five portfolios using the ERP5 ranking criteria. The portfolios consist of top 5, top 10, top 15, top 20

and top 25 companies ranked by the ERP5. The best performing portfolio presented in Subsection 4.1.2, the ERP5 Top 25% portfolio, consists of 22 stocks on average, and the number of stocks in the portfolio ranges from 15 to 30 depending on the year. This gives us reason to assume that the optimal number of companies could be somewhere between 5 and 25.

Different portfolio sizes are not tested for the Magic Formula strategy as the top companies ranked using the Magic Formula criteria do not seem to generate excess returns that are statistically significant compared to the benchmark index.

All the tested extra portfolios outperform the marker index and the WSEW portfolio considerably, as shown in Figure 7. However, during the tech bubble the portfolios are not able to beat the market index which outlines the unusual nature of this time period. Figure 7 shows that the relative performance of the test portfolios differs during different holding periods. For example, the ERP5 Top 15 portfolio seems to generate the best return during 2000-02 but the portfolios consisting of the Top 5 and Top 10 stocks do far better during the years 2003-07. After sharp decline during the financial crisis, the Top 15 portfolio seems to regain its position as the best portfolio. The fact that the relative performance of the portfolios vary over time suggests that it is difficult to determine the optimal portfolio size. However, portfolios of 10-15 stocks seem to perform best in the long-term.

**Figure 7. Performance of tested ERP5 portfolios with different number of stocks compared to OMXH Cap and whole sample equally weighted portfolio (WSEW) 1997-2010.**




As can be observed in Table 9, the era of the tech bubble seems to affect the results of the statistical test. When the tests are conducted for the time period 1997-2010, the results are significant at 10% significance level. However, when the tech bubble is excluded and the test is conducted for the time period 2001-10, the results for all portfolios are significant at 5% significance level. It seems that part of the excess returns generated by the value portfolios are attributable to the small cap effect as the WSEW portfolio does better than the OMXH Cap index. Nevertheless, the test portfolios outperform even the WSEW portfolio quite clearly which implies that the superior performance of the value portfolios is not solely due to

the small cap effect. This gives us reason to assume that the outperformance is partly due to the stock picking power of the strategy. From the performance perspective, it is not clear which could be the optimal portfolio size. There are no major differences in the returns between portfolios Top 10 and Top 15 which seem to generate slightly better returns compared to the other portfolios.

**Table 9. Performance of the tested ERP5 portfolios with different number of stocks compared to OMXH Cap index and whole sample equally weighted portfolio (WSEW) and the results of the statistical significance test.**

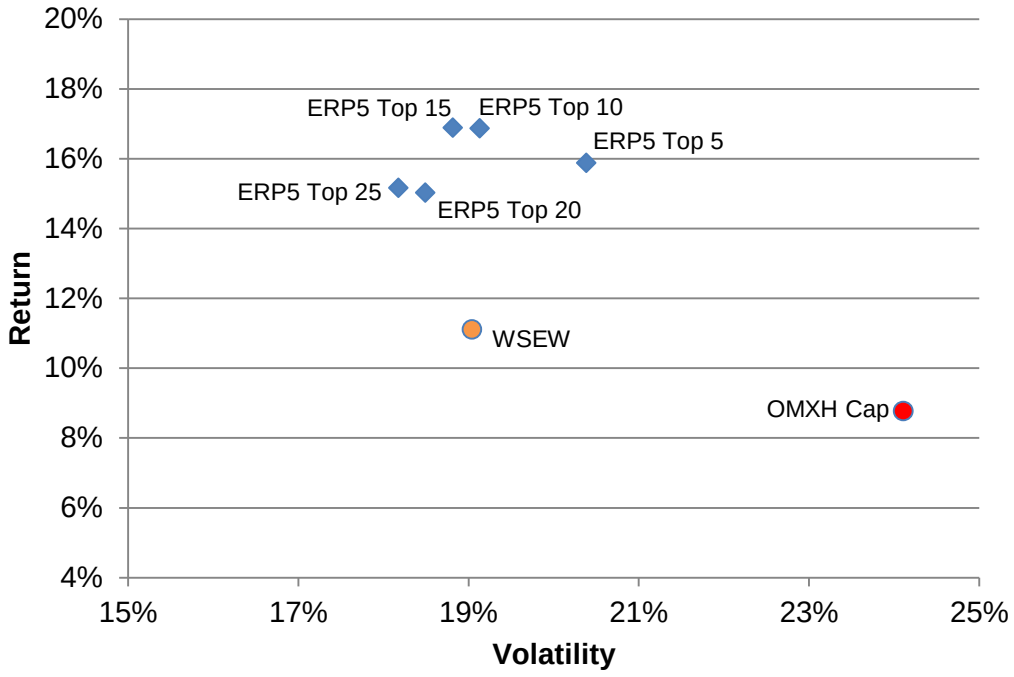
| | Top 5 Stocks ERP5 | Top 10 Stocks | Top 15 Stocks | Top 20 Stocks | Top 25 Stocks | OMXH Cap | WSEW |
|---|---|---|---|---|---|---|---|
| 1997-98 | 60,5 % | 51,6 % | 50,8 % | 47,9 % | 48,6 % | 49,3 % | 41,9 % |
| 1998-99 | -13,6 % | -15,9 % | -18,6 % | -18,2 % | -10,6 % | -0,9 % | -13,7 % |
| 1999-2000 | 7,5 % | 6,1 % | 35,8 % | 31,0 % | 31,3 % | 54,3 % | 38,0 % |
| 2000-01 | 4,8 % | 10,4 % | 10,6 % | 1,9 % | -2,4 % | -30,3 % | -15,5 % |
| 2001-02 | 24,1 % | 29,0 % | 23,3 % | 17,8 % | 17,2 % | -7,0 % | 10,2 % |
| 2002-03 | -9,3 % | -7,5 % | -10,5 % | -9,5 % | -6,7 % | -18,0 % | -12,2 % |
| 2003-04 | 83,9 % | 68,1 % | 61,7 % | 53,8 % | 58,1 % | 33,0 % | 58,5 % |
| 2004-05 | 42,2 % | 52,0 % | 38,8 % | 37,3 % | 33,7 % | 21,6 % | 20,5 % |
| 2005-06 | 67,3 % | 68,4 % | 51,3 % | 50,8 % | 47,3 % | 51,3 % | 43,6 % |
| 2006-07 | 12,9 % | 21,2 % | 20,7 % | 23,6 % | 24,6 % | 24,3 % | 18,5 % |
| 2007-08 | -25,2 % | -19,2 % | -16,0 % | -15,6 % | -18,7 % | -10,6 % | -16,1 % |
| 2008-09 | -21,3 % | -33,4 % | -31,1 % | -29,7 % | -31,0 % | -37,6 % | -32,1 % |
| 2009-10 | 32,9 % | 51,9 % | 57,6 % | 53,4 % | 54,8 % | 45,1 % | 54,2 % |
| 1997-2010 Cumulative | 579,7 % | 659,1 % | 660,6 % | 517,6 % | 527,2 % | 198,6 % | 293,7 % |
| 1997-2010 (p.a.) | 15,9 % | 16,9 % | 16,9 % | 15,0 % | 15,2 % | 8,8 % | 11,1 % |
| Statistical significance | No | * | * | No | * | Not tested | No |
| 2001-2010 Cumulative | 334,9 % | 408,7 % | 312,3 % | 282,1 % | 268,5 % | 87,8 % | 175,9 % |
| 2001-2010 (p.a.) | 17,7 % | 19,8 % | 17,0 % | 16,1 % | 15,6 % | 7,3 % | 11,9 % |
| Statistical significance | ** | ** | ** | ** | ** | Not tested | No |

*) Significant at 10 % significance level, **) Significant at 5 % significance level

While portfolios Top 10 and Top 15 seem to generate slightly higher returns, adding stocks to the portfolio seems to result in lower volatility, as is evident in Figure 8. While the volatility for the Top 5 portfolio is over 20%, the volatility for the Top 25 is the lowest of the ERP5 portfolios being compared, 18.2%. The volatility of all these portfolios is lower than the volatility of the OMXH Cap index. However, the volatilities of the ERP5 portfolios do not differ greatly from that of the WSEW portfolio. It must also be stated that the volatility of the OMXH Cap index is affected by the tech bubble. When the volatilities are calculated for the time period 2001-10,

the differences between the volatilities of the test portfolios and the index are not as great.

**Figure 8. Annualized returns and volatilities for ERP5 portfolios with different number of stocks compared to OMXH Cap index and the whole sample equally weighted portfolio (WSEW) 1997-2010.**




To determine the optimal portfolio size, additional ratios shown in Table 10 are also applied. Looking at these measures, there is no clear winner. The Treynor ratio and Jensen's alpha seem to favor the portfolio consisting of 10 stocks while the Sharpe ratio suggests the portfolio consisting of 15 stocks has done better in relation to the risk. However, there are hardly any differences in the ratios of these two portfolios.

**Table 10. Additional ratios for the tested ERP5 portfolios with different number of stocks compared to OMXH Cap index and the whole sample equally weighted portfolio (WSEW). For Sharpe ratio and Jensen's Alpha, the return of the 1-year German Bund is used as the risk-free rate as it is a commonly used benchmark for risk-free rate. For beta and Treynor ratio, OMXH Cap is used as the benchmark index.**

| | Top 5 Stocks ERP5 | Top 10 Stocks | Top 15 Stocks | Top 20 Stocks | Top 25 Stocks | OMXH Cap | WSEW |
|---|---|---|---|---|---|---|---|
| Return (p.a.) | 15,9 % | 16,9 % | 16,9 % | 15,0 % | 15,2 % | 8,8 % | 11,1 % |
| Volatility | 20,4 % | 19,1 % | 18,8 % | 18,5 % | 18,2 % | 24,1 % | 19,0 % |
| Return-to-Volatility Ratio | 0,78 | 0,88 | 0,90 | 0,81 | 0,83 | 0,36 | 0,58 |
| Beta | 0,61 | 0,61 | 0,63 | 0,65 | 0,65 | 1,00 | 0,72 |
| Sharpe | 0,63 | 0,72 | 0,73 | 0,64 | 0,66 | 0,23 | 0,42 |
| Treynor | 0,21 | 0,23 | 0,22 | 0,18 | 0,18 | 0,06 | 0,11 |
| Jensen's Alpha | 9,3 % | 10,3 % | 10,2 % | 8,2 % | 8,3 % | 0,0 % | 3,9 % |
| Periods with Negative Return | 4 | 4 | 4 | 4 | 5 | 6 | 5 |
| Periods with Below Benchmark Return | 5 | 4 | 5 | 6 | 5 | - | 7 |

The returns of the Top 20 (15.0% p.a.) and Top 25 (15.2% p.a.) portfolios are roughly the same as the return of the ERP5 Top 25% portfolio (15.2% p.a.), which consists of 15 to 30 depending on the year. Based on this it seems that increasing the portfolio size beyond 25 would not be very beneficial.

It can also be said that one should not include less than 10 stocks in the portfolio as it seems to increase volatility and lower the returns. Increasing the portfolio size to more than 15 stocks results in slightly lower volatility. However, it comes with lower returns. As a result, we can conclude that based on this thesis, the portfolio size of 10-15 stocks is the optimum in terms of return and risk.

# 5 CONCLUSIONS

## 5.1 Research Summary

The main research objective of the study was to examine whether it is possible to achieve excess returns over the market index in the Finnish stocks markets by applying systematic value strategies that are based on accounting ratios. The value strategies under examination were Magic Formula and ERP5.

In addition, the following additional objectives were addressed:

1) To examine whether the ERP5 value strategy is able to beat Magic Formula during the analysis period.
2) To examine whether the riskiness of the value portfolios differ from that of the market portfolio.
3) To determine the optimal portfolios size.

The results are in line with the findings from previous research (e.g. Pätäri and Leivo, 2009) that the value premium exists. Using the ERP5 value investing strategy, an investor could have earned excess returns in the Finnish stock markets during the years 1997-2010, if taxes and transactions costs are ignored. The best ERP5 portfolios (portfolios with 10 and 15 stocks) gained 16.9% per annum with relatively low volatility while the OMXH Cap index yielded only 8.8% p.a. Other ERP5 value portfolios, also, outperformed the benchmark index while the bottom-ranked stocks underperformed the market. ERP5 provided better results compared to Magic Formula, which was also the case in the studies by Vanstraceele and Allaeys (2010a and 2010b).

For the Magic Formula value strategy, the results are somewhat incoherent. Out of the four test portfolios each consisting of 25% of the stocks listed in the Helsinki Stock Exchange, the portfolio consisting of the highest ranking stocks yielded less than the portfolio consisting of the

stocks ranked in the second quarter. Although the results for the best performing Magic Formula portfolio are statistically significant, they can hardly be considered meaningful since the results go against the economic rationale that the highest ranking stocks should do better than the stocks in the middle top quartile. A possible explanation for this could be that the stocks ranked in the top quartile are cheap for a reason and have only recently taken a turn to the worse which would explain why the accounting ratios still look attractive although the business environment has changed.

Earlier research suggests that small cap companies tend to outperform large cap companies (e.g. Banz 1981), which could be the reason why value strategies – such as Magic Formula or ERP5 – outperform the market capitalization weighted market index that is dominated by large cap companies. This thesis implies that while there might be small cap effect, the higher returns cannot be explained only by company size.

The efficient market hypothesis suggests that there is a trade-off between return and risk and that higher returns cannot be achieved without taking more risk. The findings of this thesis are in contradiction with this hypothesis. The volatilities of the value portfolios are either slightly smaller or equal to that of the market portfolio. Many other studies have found similar results that volatility is lower for value portfolios than it is for growth stocks or the market index (e.g. Bird and Casavecchia, 2007, and Pätäri and Leivo, 2009).

Based on the results of this thesis, the optimal portfolio size is around 10-15 stocks when using the ERP5 value strategy. The test portfolios of 10 and 15 stocks formed on the basis of ERP5 criteria generated the highest returns while having lower volatility than the market index. Increasing the number of shares in the portfolio from 5 to 25 decreased the volatility of the portfolio, however, when the portfolio size was increased beyond 15 stocks this came with lower returns. The findings underline the notions by

Graham (1976) and Piotroski (2000) that a value investor should focus on forming portfolios of several value stocks instead of picking individual stocks.

To conclude, the ERP5 value strategy seems to be a valid tool for building portfolios that can beat the market. The strategy does not provide excess returns every year or in every market situation, however, in the long-term it seems to outperform the market. For Magic Formula, the results are more incoherent and partly against economic rationale. For this reason, the results of this thesis do not support the earlier results (e.g. Greenblatt 2006, Vanstraceele & Allaeys 2010b) that the Magic Formula is able to provide excess returns, although it certainly does not prove the opposite either.

## 5.2 Practical Implications

The value strategies being examined have certain limitations of which one must be aware before utilizing the strategies in managing investments. Firstly, the strategies do not outperform the market portfolio every year and may in fact underperform the market portfolio for a relatively long period of time. For this reason, the strategies are only suitable for investors with a long investment horizon.

Secondly, the strategies do not recognize turnaround companies and usually give high rankings to companies which have done well in the past and have only recently taken a turn to the worse. Examples of such companies could include Nokia, Rautaruukki or Outokumpu during the recent years. Buying and holding such stocks could prove disastrous especially if the investor wishes to hold a concentrated portfolio with only a few stocks. For this reason, personal judgment must be used in making the final investment decision. Furthermore, the portfolio size must be kept sufficient.

Thirdly, both Magic Formula and ERP5 rank stocks based on their relative cheapness within the selected set of stocks. As a result, if the stock market is expensive as a whole, a highly ranked stock may not be cheap in absolute terms, although it may seem cheap in relative terms. For this reason, both strategies are suitable only for investors who wish to be fully invested at all times (so-called long-only investors) but not for investors who wish to avoid downturns by holding cash or going short when the market seems overvalued.

Moreover, ERP5 and Magic Formula rank stocks on an ordinal scale which might not do justice for companies with exceptionally high ROA. On average, one can expect to find that companies with high ROA have high EV/EBIT and P/B as well. When ranking is done on an ordinal scale, it is probable that companies with exceptionally high ROA, high EV/EBIT and high P/B end up in the middle quartile. However, if the ranking system was based on interval or ratio scale, the companies with exceptionally high ROA could reach the top quartile more easily.

Finally, using Magic Formula or ERP5 requires holding small cap stocks and switching stocks in the portfolio within a relatively short time. This may prove to be difficult if the amount of capital is high. If a large investor starts to buy an illiquid stock, the investor may end up pushing the price up. The reverse happens when the investor decides to sell the stock. In addition, a large investor may not be able to buy the required amount of the shares in a very small company, for example, if the majority of the shares are owned by a single family. For this reason, both strategies are best suited for small investors.

Because of the above-mentioned limitations, it is advisable to utilize Magic Formula and ERP5 in screening potential stocks from a large set of stocks, after which fundamental analysis can be used to identify the most prosperous stocks. The strategies can also be used to exclude the most

distressed companies, after which the portfolio can be formed of the companies that are left.

### 5.3 Limitations of the Study

Since the sample includes small companies the shares of which may not be traded often, the reported volatility figures for the value portfolios ought to be viewed with caution. If a stock is traded, for example, only once a month, the volatility of the stock is artificially low and does not reflect the risk involved in holding the stock. The annualized volatilities in this thesis are calculated based on monthly returns which should mitigate the problem. However, it does not fully rule out the possibility of artificially low volatilities caused by possibly illiquid stocks.

### 5.4 Suggestions for Further Research

There are several possible ways to expand the study. For example, one could examine the optimal holding period for either or both of the value strategies. It appears that part of the excess return generated by the tested value strategies are due to the fact that the strategies put overweight on small cap stocks. For this reason, it would be interesting to see how the strategies perform with a set of only large cap companies, which are followed by more analysts than small cap companies and should therefore be more efficiently priced. However, such a research with large caps would have to be done on a European or US level, since the number of large cap companies in Finland or other small markets is very limited. In addition, the value strategies could be enhanced with a factor that takes into account the size of the company. The simplest way of doing this would be to use market capitalization as an additional ranking criterion alongside earnings yield, ROA and P/B.

The strategies could also be expanded into long-short strategies. The results of this thesis imply that simply selling the worst-ranked stocks short

may not be very beneficial as even the bottom portfolios seem to gain value in the long-term. Therefore, in order to beneficially employ a long-short strategy based on Magic Formula or ERP5, one might need to determine when to go short and when to go long. Macroeconomic factors or data on equity fund inflows and outflows could be tested for this purpose, as well as comparing the level of the company specific ratios to their long-term averages. However, portfolio size also affects the returns, and portfolio size for bottom portfolios was not examined.

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## APPENDIX

**Appendix 1.** T test result for the ERP5 Top 10 portfolio for the period 1997-2010.

| | *ERP5 Top 15* | *OMXH Cap* |
|---|---|---|
| Mean | 0,014543317 | 0,00942062 |
| Variance | 0,002950626 | 0,004842661 |
| Observations | 156 | 156 |
| Pearson Correlation | 0,810491789 | |
| Hypothesized Mean Difference | 0 | |
| t Stat | 1,567620723 | |
| P(T<=t) one-tail | 0,059504467 | |
| t Critical one-tail | 1,654743774 | |