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PRICING ANOMALIES IN THE FINNISH STOCK MARKET

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ABSTRACT

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The aim of this thesis is to examine whether the pricing anomalies exists in the Finnish stock markets by comparing the performance of quantile portfolios that are formed on the basis of either individual valuation ratios, composite value measures or combined value and momentum indicators. All the research papers included in the thesis show evidence of value anomalies in the Finnish stock markets. In the first paper, the sample of stocks over the 1991-2006 period is divided into quintile portfolios based on four individual valuation ratios (i.e., E/P, EBITDA/EV, B/P, and S/P) and three hybrids of them (i.e. composite value measures). The results show the superiority of composite value measures as selection criterion for value stocks, particularly when EBITDA/EV is employed as earnings multiple. The main focus of the second paper is on the impact of the holding period length on performance of value strategies. As an extension to the first paper, two more individual ratios (i.e. CF/P and D/P) are included in the comparative analysis. The sample of stocks over 1993-2008 period is divided into tercile portfolios based on six individual valuation ratios and three hybrids of them. The use of either dividend yield criterion or one of three composite value measures being examined results in best value portfolio performance according to all performance metrics used. Parallel to the findings of many international studies, our results from performance comparisons indicate that for the sample data employed, the yearly reformation of portfolios is not necessarily optimal in order to maximally gain from the value premium. Instead, the value investor may extend his holding period up to 5 years without any decrease in long-term portfolio performance. The same holds also for the results of the third paper that examines the applicability

of data envelopment analysis (DEA) method in discriminating the undervalued stocks from overvalued ones.

The fourth paper examines the added value of combining price momentum with various value strategies. Taking account of the price momentum improves the performance of value portfolios in most cases. The performance improvement is greatest for value portfolios that are formed on the basis of the 3-composite value measure which consists of D/P, B/P and EBITDA/EV ratios. The risk-adjusted performance can be enhanced further by following 130/30 long-short strategy in which the long position of value winner stocks is leveraged by 30 percentages while simultaneously selling short glamour loser stocks by the same amount. Average return of the long-short position proved to be more than double stock market average coupled with the volatility decrease.

The fifth paper offers a new approach to combine value and momentum indicators into a single portfolio-formation criterion using different variants of DEA models. The results throughout the 1994-2010 sample period shows that the top-tercile portfolios outperform both the market portfolio and the corresponding bottom-tercile portfolios. In addition, the middle-tercile portfolios also outperform the comparable bottom-tercile portfolios when DEA models are used as a basis for stock classification criteria. To my knowledge, such strong performance differences have not been reported in earlier peer-reviewed studies that have employed the comparable quantile approach of dividing stocks into portfolios. Consistently with the previous literature, the division of the full sample period into bullish and bearish periods reveals that the top-quantile DEA portfolios lose far less of their value during the bearish conditions than do the corresponding bottom portfolios.

The sixth paper extends the sample period employed in the fourth paper by one year (i.e. 1993-2009) covering also the first years of the recent financial crisis. It contributes to the fourth paper by examining the impact of the stock market conditions on the main results. Consistently with the fifth paper, value portfolios lose much less of their value during bearish conditions than do stocks on average. The inclusion of a momentum criterion somewhat adds value to an investor during bullish conditions, but this added value turns to negative during bearish conditions. During bear market periods some of the value loser portfolios perform even better than their value winner counterparts. Furthermore, the results show that the recent financial crisis has reduced the added value of using combinations of momentum and value indicators as portfolio formation criteria. However, since the stock markets have historically been bullish more often than bearish, the combination of the value

and momentum criteria has paid off to the investor despite the fact that its added value during bearish periods is negative, on an average.

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1. Leivo, T.H., Pätäri, E.J. and Kilpiä, I.J.J. (2009) Value Enhancement Using Composite Measures: The Finnish Evidence, *International Research Journal of Finance and Economics,* No. 33, pp. 7-30.

2. Leivo, T.H. and Pätäri, E.J. (2009) The Impact of Holding Period Length on Value Portfolio Performance in the Finnish Stock Markets, *Journal of Money, Investment and Banking*, No. 8, pp. 71-86.

3. Pätäri, E.J., Leivo, T.H. and Honkapuro, J.V.S. (2010) Enhancement of Value Portfolio Performance using Data Envelopment Analysis, *Studies in Economics and Finance*, Vol. 27, No. 3, pp. 223-246.

4. Leivo, T.H. and Pätäri, E.J. (2010) Enhancement of Value Portfolio Performance Using Momentum and the Long-Short Strategy; the Finnish Evidence, *Journal of Asset Management*, Vol. 11, No. 6, pp. 401-416.

5. Pätäri, E.J., Leivo, T.H. and Honkapuro, J.V.S. (2012) Enhancement of Equity Portfolio Performance using Data Envelopment Analysis, *European Journal of Operational Research*, Vol. 220, No. 3, pp. 786-797.

6. Leivo, T.H. (2012) The Benefits of Combining Value and Momentum Indicators in Varying Stock Market Conditions: the Finnish Evidence, *Review of Accounting and Finance*, Vol. 11, No. 4, pp. 400-447.

Timo Leivo's contribution in the publications:

1. Main author. The contribution is distributed equally with the co-authors (1/3 of the paper's contribution).

2. Main author. The contribution is distributed equally with the co-author (half of the paper's contribution).

3. Second author. The contribution is distributed equally with the co-authors (1/3 of the paper's contribution).

4. Main author. The contribution is distributed equally with the co-author (half of the paper's contribution).

5. Second author. The contribution is distributed equally with the co-authors (1/3 of the paper's contribution).

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PART A: OVERVIEW OF THE THESIS

1 INTRODUCTION

1.1 Background and motivation of the study

Already in the 1930's when the Great Depression had crashed down the stock market, the academics started to develop theories of a correct par value of the stocks. These pricing theories motivated investors to chase abnormal returns by using trading strategies which were based on the mispricing of the stocks. Soon after the introduction of the Capital Asset Pricing Model (henceforth CAPM), the first contrarian results according to which risk and return will not always move hand-in-hand were published: Already Lintner (1965), who is acknowledged as one of inventors of the CAPM, documented that the security market line was too flat in comparison with the predictions. The follow-up anomaly studies began the new era of the stock market research - the era which still goes on. During the recent decades, several investment strategies have been proven to generate abnormal returns. Almost in every case such results have been understated by the apologists of the CAPM by invoking either data mining, methodological flaws or even misinterpretation of the results. However, new evidence against stock market efficiency is published continuously. For example, numerous studies have identified the existence of price momentum on stock returns (e.g., see Jegadeesh and Titman, 1993, 2001; Chan *et al.*, 1996; Rouwenhorst, 1998; Chan *et al.*, 2000; Grundy and Martin, 2001; Lewellen, 2002; Korajczyk and Sadka, 2004; Patro and Wu, 2004; Gutierrez and Kelly, 2008; Galariotis, 2010; Chui *et al.*, 2010), which refers to the tendency of recent winner stocks to generate abnormal returns also in the near future. On the other hand, there is plenty of international evidence of a value premium in stock returns (e.g., see Dimson *et al.*, 2003; Chan and Lakonishok, 2004; Brown *et al.,* 2008; Barbee *et al.*, 2008; Fama and French, 2006, 2012) which refers to the tendency of value stocks to outperform glamour stocks. Recently, new evidence of added-value of combining value and momentum strategies has also been documented (e.g., see Bird and Casavecchia, 2007a; Bettman *et al.*, 2009; Asness *et al.*, 2010; Leivo and Pätäri, 2011; Guerard, Jr. *et al*., 2012).

Stock market anomalies have also examined with the Finnish data (for examples of earlier studies on earnings-to-price (henceforth E/P) anomaly, see e.g., Martikainen, 1992; Booth *et al.*, 1994, and on cash flow-to-price (henceforth CF/P) anomaly, Kauppi and Martikainen, 1994; Kallunki, 2000). However, all these studies have employed data from 1970s and 1980s, when the Finnish stock

market was relatively regulated and prone to low liquidity effects (e.g. the limitations of foreign ownership were removed in 1993). On the other hand, many anomalies documented in international markets have not examined at all with the Finnish data in peer-reviewed journal articles.[1] For these reasons, we have collected a comprehensive data of Finnish exchange-traded companies throughout the 1991-2010 period to find out whether the results from our national markets are consistent with the international evidence of various anomalies. The recent Finnish stock market data provides an interesting basis for this type of analysis since the Finnish stock market are prone to an intermittent "periphery syndrome" caused by the behaviour of international institutional investors who cash their equity positions first from the farthest stock markets during turbulent times. This withdrawal process, coupled with the relatively low liquidity of the Finnish stock market, results in drops in stock prices that are steeper than simultaneous drops in larger and more liquid stock markets. On the other hand, during bullish sentiment stock prices tend to rise in Finland more than they do in the major stock markets due to the comeback of international investors. The recent era of financial crises has provided new evidence of this recurrent phenomenon. It is therefore likely that pricing errors causing various kinds of anomalies are also larger in the Finnish market, implying that the opportunities to earn abnormal profits by means of investment strategies based on pricing anomalies could also be somewhat better.

1.2   Objective of the thesis

The thesis examines whether abnormal returns have been available for the investor following systematic trading strategies in the Finnish stock market over the 1991-2010 period. The first paper examines the performance of various value strategies in the Finnish stock market during the 1991-2006 period. The sample of stocks is divided into quintile portfolios based on four individual valuation ratios; i.e., E/P, EBITDA/EV (*Enterprise Value to Earnings Before Interest, Taxes, Depreciations and Amortizations*), B/P (*Book-to-Price*), and S/P (*Sales-to-Price*) and three hybrids of them. The full sample period is further divided into five year sub-periods and in addition, into distinct bull and bear market periods.

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[1] Recently, some international studies have included Finnish companies as a part of the larger international data but the results based on the Finnish data have not reported separately in these studies (e.g., see Bird and Casavecchia, 2007a; Fama and French, 2012). On the other hand, the Finnish subsample included in these papers has not been very comprehensive, because there are many missing companies in public databases that also include Finnish exchange-traded companies.

The second research paper examines the impact of the holding period length on performance of various value strategies in the Finnish stock market during the 1993-2008 period. The sample of stocks is divided into 3-quantile portfolios based on six individual valuation ratios and three hybrids of them. As an extension to the first paper two individual valuation ratios; i.e. CF/P and D/P (*dividend yield*) are included in the analysis and in addition, D/P ratio is included in composite value measures.

The third research paper examines the applicability of data envelopment analysis (DEA) as a basis of value portfolio selection criterion. The portfolios are based on the DEA scale efficiency scores of sample stocks. The impact of holding period length on the results is also examined in this paper by varying the portfolio reformation frequency from 1 to 5 years at annual frequency. The proposed DEA methodology provides an interesting alternative to detect undervalued stocks by capturing several dimensions of relative value simultaneously. To my best knowledge, this is the first time in financial literature when the DEA methodology is applied as a basis of composite value measure.

The fourth research paper examines the added value of combining price momentum with various value strategies in the Finnish stock market during the same sample period employed in two preceding papers. In addition, the performance of the long-short strategy is analysed. Moreover, the proportions of stocks that have exceeded the return of stock market average are calculated for each quintile portfolio formed on the basis of the different classification criterion. This analysis increases the understanding on the issue how the value premium is actually attributed.

The fifth paper examines the efficiency of DEA as a formation criterion for equity portfolios in a case in which input and output factors are derived from indicators of relative valuation of stocks and from the price momentum indicator. Thus applied, the DEA approach can be considered as an alternative for constructing a combined investment strategy that aims to integrate the benefits of both value investing and momentum investing. As far as I know, this is the first time when the DEA approach is employed for combining value and momentum indicators.

The sixth research paper examines the added value of combining a momentum indicator with a value indicator in varying stock market conditions during the 1993-2009 period. The performance differences between quintile portfolios and the market portfolio are analyzed over several economic cycles to find out whether their existence and degree are dependent on stock market sentiment. In

addition to the bull and bear market analysis, the performance of quintile portfolios are analyzed during the recent financial crisis that provides an interesting basis for sub-period analysis. Since the latest financial crisis has had dramatic consequences on stock markets, an additional robustness test is performed in which the era of financial crisis is excluded from the sample period to see its impact on the main findings.

1.3   Structure of the thesis

This thesis consists of two parts. The first part presents an overview of the thesis. It is divided in five sections, the first one being an introduction that identifies the background, the motivation, and the objective of the thesis. The second and third sections describe theoretical and empirical background the dissertation will contribute, and synthesizes the existing literature. A brief review of value anomalies is presented in Section 2 and the interaction of value and momentum anomalies is described in Section 3. The main results of the publications, as well as the limitations of thesis are presented in Section 4. Finally, the fifth section summarizes the first part by discussing the main conclusions, contributions, implications and suggestions for future research. The second part of the dissertation comprises six complementary research papers that address the research objectives of thesis described above.

2 REVIEW OF VALUE ANOMALIES

Relative valuation is widely used and there are several reasons why. A valuation based on valuation ratio can be completed more quickly and with far fewer explicit assumptions than a discounted cash flow valuation, where objective is to find the value of assets, given their cash flow, growth, and risk characteristics. In relative valuation, the objective is to value assets based on how similar assets are currently priced in the market. A relative valuation is simpler to understand and easier to present than discounted cash flow valuation, since in relative valuation the aim is more or less to frame an asset as cheap or expensive using a multiple. Relative valuation gives relative measure and not intrinsic value, and is much more likely to reflect the current mood of the market. Multiples are easy to use but they are also easy to misuse. Usually the potential pitfall is to ignore the key variables such as risk, growth, or cash flow when using a relative valuation ratio (Damodaran, 2002). Next, we will review the literature on the use of valuation measures as a basis for investment strategies by starting from individual valuation ratios and proceeding to composite value measures.

2.1 Earnings yield (E/P) anomaly

Although the principles of value investing can be traced back to the 1930s (e.g., see Graham and Dodd, 1934), the first scientific evidence of E/P anomaly was documented by Nicholson (1960) who examined two samples of common U.S. stocks. The first sample consisted of 100 common stocks, predominantly industrial companies. Nicholson formed the portfolios based on E/P ranking of each stock every fifth year from 1939 to 1959 and examined their return performance during the holding periods ranging from 3 years (minimum) to 20 years (maximum). According to the results, the highest E/P quintile portfolio clearly outperformed the lowest E/P quintile portfolio in all 11 holding periods examined. The main results also held for the other sample of 29 chemical common stocks for the 1937-1954 sample period (For this particular sample, Nicholson formed E/P portfolios each year and compared their subsequent returns from 3-, 5- and 10-year holding periods). However, Nicholson did not report any risk measure or risk-adjusted performance measure

for portfolios being compared. In the second half of the 1960s, similar types of studies were also released by Breen (1968), McWilliams (1966), and Nicholson (1968), for example.

To my best knowledge, Basu (1977) was the first who documented the outperformance of high E/P portfolios also on risk-adjusted basis. For the large sample of U.S. industrial firms, he reported monotonically declining performance of quintile portfolios as one moves from the high E/P to low E/P portfolios. Throughout the sample period from April 1957 to March 1971, Basu reformed the portfolios in the beginning of April each year. Basu's seminal work was challenged by Banz (1981) and Reinganum (1981) who both concluded that E/P anomaly is explained by the small-cap anomaly, and furthermore, that the latter subsumes the former. However, in his further research, Basu (1983) showed that E/P anomaly still exists after exercising experimental control over differences in firm size. He proved further that the size effect virtually disappears when returns are controlled for differences in risk and E/P ratios. The parallel results about the insignificance of size factor and the significance of E/P factor are also reported by Artmann *et al.* (2012) for the large sample of German stocks over the 1963-2006 period. In contrast, Cook and Rozeff (1984) attached approximately equal significance to both E/P and size factors. On the other hand, Banz and Breen (1986) reported a size effect but no independent E/P effect across all months, consistently with Reinganum (1981) whose results were criticized by Basu (1983). Earnings yield anomaly was neither found by Chan *et al.* (1993) in the Japanese stock markets, while the authors documented significant CF/P and B/P anomalies for the same sample period from 1971 to 1988. The seemingly paradoxical results can be for the most part explained by differences in sample periods and methodologies employed.

After correcting several methodological flaws made in previous studies, Jaffe *et al.* (1989) found significant E/P and size effects when estimated across all months during the 1951-1986 period, consistently with Cook and Rozeff (1984). Moreover, Jaffe *et al.* (1989) reported further that E/P effect was significant in all months, while the size effect was significant only in January. Interestingly, the authors found evidence of consistently high returns for firms of all size with negative earnings.

Fama and French (1992) found that differential returns to E/P strategies are captured by a combination of size and book-to-price ratios and therefore, ended up to exclude earnings yield from

their famous 3-factor model[2]. In contrast, when comparing the performance of the three portfolio-formation criteria (i.e., size, B/P and beta) in the U.S. stock market over the 1985-1994 period, Roll (1995) found that high E/P portfolio produced the highest risk-adjusted returns on the basis of both CAPM and APT risk-adjustment procedures. According to his results, high B/P was also a profitable portfolio-formation criterion, while low size was not. In their later study, Fama and French (1998) also reported that in two out of 13 major regional markets (i.e. in Sweden and Netherlands) the use of E/P ratios as value portfolio formation criteria would have resulted in the highest value premium when comparing four different portfolio formation criteria during the 1975-1995 sample period (In addition to E/P criterion, the three other criteria being compared were based on B/P, CF/P, D/P ratios).

Chen and Zhang (2007) also found evidence that beside the Fama-French factors, E/P ratios may still be useful in explaining stock price movements (see also Penman and Reggiani, 2012). Recently, parallel results were also reported by Artmann *et al.* (2012) in the German stock markets during the 1963-2006 period. The authors found that the explanatory power of the standard Fama-French 3-factor model on cross-section of average stock returns in Germany has not been strong. Using one-dimensional sorts and multivariate Fama-MacBeth (1973) regressions the authors documented a significant positive relation between average returns and three firm characteristics which were B/P, E/P, and momentum. An alternative 3-factor model in which the size factor was replaced with earnings yield factor explained returns better, and the explanatory power was further increased by adding momentum factor. Thus, it seems that explanatory power of different portfolio-formation criteria on subsequent stock returns vary across both the stock markets and the sample periods. The recent evidence of E/P anomaly in Canadian and U.S. stock market were documented by Athanassakos (2009 and 2011b) for the 1985-2005 and the 1986-2006 periods, respectively.

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[2] The formula for the Fama-French three-factor model is as follows:

$$r_{it} - r_{ft} = \alpha_i + b_i(r_{mt} - r_{ft}) + s_i SMB_t + h_i HML_t + \varepsilon_{it}$$

where
r_{it} = the return of a portfolio
r_{ft} = the risk-free rate of return
α_i = the three-factor alpha (the abnormal return over and above to what might be expected based on the three-factor model employed)
r_{mt} = the stock market return
SMB_t = the return of size factor (i.e., the return difference between small- and large-cap portfolios)
HML_t = the return of book-to-market (B/P) factor (i.e., the return difference between high and low B/P portfolios)
b_i, s_i, and h_i are factor sensitivities to stock market, SMB, and HML factors, respectively.
ε_i = the residual term.

Some scholars have also examined E/P anomaly in the Finnish stock markets in earlier years. Martikainen (1992) found evidence of E/P anomaly in the long run but the anomaly was very sensitive to the estimation period. Moreover, a considerable part of the cross-sectional variation of the Finnish E/P ratios was found to be devoted to differences in securities' systematic risk estimated by instrumental accounting variables, such as accounting betas, financial leverage, operating leverage and growth, as well as market betas. Martikainen (1992) also discovered that when the E/P ratios were first controlled for the effects of these risk variables, the E/P ratios loosed their explanatory power on abnormal returns in the Finnish stock market. This finding suggested that the generally observed E/P anomaly may be largely due to the serious empirical problems in risk estimation. Significant E/P anomaly in the Finnish stock markets at individual stock level was also documented by Booth *et al.* (1994) who also noted that its major part can be appointed to the unproportional relation between earnings and stock prices. Kauppi and Martikainen (1994) provided also evidence of existence of stock market anomalies in Finland. According the authors, statistical regularities due to earnings, cash flows and firm size were observable on the Finnish stock market and simple trading strategies yielded significant profits over and above transaction costs during the 1975-1990 period. However, in those days, the Finnish stock markets were very small and only 20 firms had their ordinary shares continuously listed and included in this research.

Leivo *et al.* (2009) documented the significant E/P anomaly in the Finnish stock markets during the 1991-2006 period based on the performance of quintile portfolios reformed at 3-year frequency. Instead, Pätäri and Leivo (2009) divided the sample of Finnish stocks into tercile portfolios reformed at 1-year frequency and report the best performance among E/P portfolios for the middle portfolio during the 1993-2008 period. However, the performance difference between value and glamour E/P tercile portfolios was also significant even after controlling for size effect. Using the same sample data, Leivo and Pätäri (2011) showed that the results hold also for quintile portfolios. Leivo (2012) extended the sample period by one year (from May 2008 to April 2009) and found no difference in the main findings. However, his results show that the inferior performance of two lowest E/P quintile portfolios were for the most part explained by their significant underperformance against three other quintile portfolios during the bear market periods. In this sense, the results were consistent with Pätäri and Leivo (2009) who documented the inferior performance of E/P glamour tercile portfolio compared to the corresponding middle and value portfolios during the bearish conditions.

2.2 Cash flow-to-price (CF/P) anomaly

Some investors are suspicious of earnings per share figures because of differences between companies in how they calculate depreciations and amortizations, and in addition, differences over time in how a particular company will calculate these figures. Many scholars have also shown that accounting losses, i.e. negative earnings can be regarded as temporary by nature and therefore, they are not reflected in cash flow expectations (e.g., see Hayn, 1995; Martikainen, 1997; Kallunki et al., 1998). The shortcomings of accounting earnings have motivated a number of scholars to explore the relationship between cash flow yields and stock returns (for the first attempts, see e.g., Wilson, 1986; Bernard and Stober, 1989). Cash flow is the movement of money into or out of a business, and thus it gives a more reliable measure of company's true ability to create wealth.

To my best knowledge, the use of CF/P as a basis of value investment strategy were first adopted by Chan *et al.* (1991) who compared the efficiency of CF/P criterion with E/P, B/P, and size criterion in the Japanese stock market during the 1971-1988 period. Their results showed that of the four variables considered, the B/P and CF/P ratios had the most significant positive impact on expected returns. Parallel results from the U.S. stock markets for the 1963-1990 period were documented by Lakonishok *et al.* (1994) with the exception that CF/P criterion was somewhat more efficient for their sample data than B/P criterion, while reverse held for the Japanese sample of Chan *et al.* (1991). Both of these cornerstone studies concluded that the observed value premium were not explained by higher risk (measured by volatility) of value stocks. Fama and French (1998) documented the superiority of CF/P criterion in 4 stock markets (i.e., in Germany, Italy, Hong Kong, and Australia) when they compared the national value premiums in 13 major regional markets based on four different portfolio formation criteria during the 1975-1995 sample period (In addition to CF/P criterion, the three other criteria included in their study were B/P, E/P, D/P ratios).

The strong performance of CF/P-based strategies relative to E/P-based strategies is also consistent with the recent evidence. E.g., for the large sample of tradable NYSE and NASDAQ stocks, Dhatt *et al.* (2004) found that among 16 different portfolio formation criteria, which included size criterion, B/P, CF/P, E/P, and S/P criteria, and 11 combination criteria formed on the basis of the four last-mentioned ratios, the use of CF/P criterion resulted in lowest risk and the best risk-return trade-off during the 1980-1998 period. Desai *et al.* (2004), whose main objective was to differentiate the accruals anomaly from the value anomaly phenomenon, noted that, one year after portfolio formation, simple E/P-based strategies yield 10.2% p.a. compared to 15.3% p.a. for CF/P-

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based strategies. Dissanaike and Lim (2010) compared the performance of value strategies based on relatively simple measures, like B/P, CF/P, E/P and past return, and some more sophisticated measures, such as those based on the Ohlson (1995) model and residual income model (suggested by Dechow *et al.*, 1999). For the comprehensive sample of U.K. stocks, the authors found that simple cash flow-to-price measures appeared to do almost as well as, and in some cases even better, than the more sophisticated alternatives during the 1987-2001 period.

Hou *et al.* (2011) examined a large number of firm-level characteristics that might explain the cross-sectional and time-series variation in global stock returns. Their analysis included size, D/P, E/P, CF/P, B/P, leverage, and momentum factors using monthly returns for over 27,000 individual stocks from 49 countries from 1981 to 2003. Using cross-sectional Fama and MacBeth (1973) tests of individual stock returns and time-series regression-based tests of multifactor models, the authors confirmed the strong and reliable explanatory power of a value-based factor in global stock returns. In contrast to almost all preceding comparable studies, this factor was surprisingly based on CF/P, and not on B/P, E/P, or D/P.[3] In addition, the incremental explanatory power of a B/P factor-mimicking portfolio, over and above that based on CF/P, turned out to be negligible.

Kallunki (2000) investigated with the Finnish sample data whether the predictability of risk-adjusted stock returns using the ratio of earnings to stock price and the ratio of cash flow earnings to stock price disappears, when accounting-based risk measures, such as ratio of debt to sales and absolute value of the percentage change in sales, were used for risk-adjusting purposes. The empirical results of cross-sectional regressions for the 1975-1990 period indicated that E/P ratios lost their ability to predict stock returns when a firm's financial and business risks were used to measure the risk of its stock. The results also indicated that these accounting-based risk measures can weaken but not totally negate the ability of the cash-flow earnings-to-price ratio to predict risk-adjusted stock returns. Earlier, Kauppi and Martikainen (1994) found evidence that cash flows were observable on the Finnish stock market and simple trading strategies yielded significant profits over and above transaction costs during 1975-1990 period.

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[3] The CF/P characteristic was proved to be statistically reliable and economically important in the Fama-MacBeth cross-sectional regressions. Moreover, in time-series tests, a global long/short CF/P factor-mimicking portfolio (long in high CF/P stocks and short in low CF/P stocks) explained much of the return differences for country and industry test portfolios, and also, for a wide variety of characteristic-based global test portfolios (see the original article for details) which was not the case for the E/P, D/P, and B/P characteristics and their respective factor-mimicking portfolios.

The recent evidence of CF/P anomaly in the Finnish stock markets is somewhat ambiguous. While value premiums based on CF/P portfolios seemed to be significant for all holding period lengths from one year up to five years during the 1993-2008 period, the performance of middle CF/P portfolio was better than that of high CF/P portfolio on the basis of both tercile and quintile division (see Leivo and Pätäri, 2009 and 2011). Thus, it seemed that CF/P criterion is capable to identify the underperforming stocks of the future, but the highest CF/P stocks did not perform any better than average CF/P stocks, but rather vice versa. The same conclusion was also drawn by Leivo (2012) for the 1993-2009 period. In fact, the middle CF/P portfolios outperformed significantly stock market average over the 1993-2008 period when the tercile portfolio approach was employed in the classification of stocks and portfolios were updated either annually or at 5-year frequency (Leivo and Pätäri, 2009). The same held also for corresponding quintile portfolios reformed annually (Leivo and Pätäri, 2011), and for the 1993-2009 period (Leivo, 2012). Altogether, the results based on CF/P criterion were pretty much in line with the corresponding results of E/P criterion for the recent Finnish sample data. Thus, the recent evidence from the Finnish stock market is somewhat in contrast to the majority of international studies that have found CF/P criterion better than E/P criterion (e.g., see Chan *et al.*, 1993; Lakonishok *et al.*, 1994; Dhatt *et al.*, 2004; Desai *et al.*, 2004; Dissanaike and Lim, 2010).

2.3 Earnings Before Interest, Taxes, Depreciations and Amortizations to Enterprise Value (EBITDA/EV) anomaly

Among all the valuation ratios discussed in this thesis, EBITDA/EV is clearly the least examined in the context of academic investment research. Kim and Ritter (1999) noted in their study on initial public offering (IPO) valuation that while all valuation metrics had significant shortcomings, EBITDA/EV generally performed as well as earnings yield, and substantially better when valuing older firms. Damodaran (2006) summarized the benefits of EBITDA/EV in an unpublished study of 550 equity research reports, noting that EBITDA/EV, along with E/P and S/P, were the most common relative valuation multiples used. The reasons for the increasing popularity of EBITDA/EV are in that it can be compared more easily across firms with differing leverage. Including debt is important, as firm debt levels may have an immense impact on the tabulation of EV, particularly for highly-leveraged firms. Another reason for using EBITDA/EV is in its use of operating income before depreciation as the profitability measure. Differences in depreciation

methods across different companies can cause differences in net income but do not affect EBITDA. Of course, the limitations of EBITDA as a measure of profitability should also be borne in mind. However, the recent empirical evidence showed that use of EBITDA/EV for portfolio selection purposes is justified: Controlling for firm size, Loughran and Wellman (2011) found for the sample of U.S. stocks over the 1963-2009 period that top-decile EBITDA/EV portfolio outperformed bottom-decile EBITDA/EV portfolio by more than 5 % per year. When the authors used to create a factor designed to mimic the return differences of high versus low high EBITDA/EV portfolios, it generated a value premium of 5.28 % per year which was significant at the 1 % level. Motivated by the *q*-theory of investment from Tobin (1969) and extended by Cochrane (1991) and Liu *et al.* (2009), Loughran and Wellman (2011) interpreted EBITDA/EV as a proxy for the unlevered investment return, which is in turn positively related to the firm's cost of equity. According to the authors, companies with low EBITDA/EV ratios (signalling high valuation) appear to have lower discount rates and lower subsequent realized stock returns than firms with high EBITDA/EV ratios.

To my best knowledge, the first published journal article that examines the performance of EBITDA/EV-ranked quantile portfolios and compares it to performance of portfolios formed on the basis of more commonly used valuation ratios is Leivo *et al.* (2009). Among 20 quintile portfolios formed on the basis of four individual valuation ratios (i.e. EBITDA/EV, E/P, B/P and S/P), the best performer in the Finnish stock markets during the 1991-2006 period was the top-quintile EBITDA/EV portfolio. Quite recently, parallel results were also reported in the U.S. stock markets: Gray and Vogel (2012) found that top-quintile EBITDA/EV portfolio has been the best-performing one among 25 quintile portfolios formed on the basis of five individual valuation ratios (i.e. B/P, EBITDA/EV, free cash flow/EV, E/P, B/P and S/P). However, the more recent evidence on the performance of EBITDA/EV-based value strategy in the Finnish stock markets is somewhat mixed. In the studies which also included D/P as one potential valuation ratio, the D/P appeared to be the most efficient portfolio formation criterion (see Leivo and Pätäri, 2009, 2011; Pätäri and Leivo, 2009). For the 1993-2008 sample period and based on the tercile portfolio approach, EBITDA/EV value maintained its position as the best earnings multiple (compared to E/P and CF/P) for holding period lengths from one to three years in risk-adjusted performance comparisons, but lost this status for four- and five-year holding period lengths to CF/P and E/P, respectively (Leivo and Pätäri, 2009). However, the division of terciles into two distinct portfolios (i.e. sextile portfolios) revealed that at least for the one-year holding period length, the top-sextile EBITDA/EV portfolio was outperformed by the second-highest sextile portfolio (Leivo and Pätäri, 2011). The proportion of stocks generated higher returns than stock market average was also distinctly higher for the second-

highest EBITDA/EV sextile portfolio than for the corresponding top-sextile portfolio. These findings indicate that among top-sextile EBITDA/EV stocks there are cases in which the underpricing seems to be spurious or persistent, just like it is among the highest E/P stocks. The main results held also for the one-year longer sample period from 1993 to 2009 (Leivo, 2012). The results of Pätäri and Leivo (2010) showed further that relative valuation differences between value and glamour portfolios were somewhat stable based on EBITDA/EV portfolio formation criterion than based on E/P criterion.

2.4   Book-to-Price (B/P) anomaly

The book value provides a relatively stable, intuitive measure of value that can be compared to the market value of the equity that reflects the market's expectations of the firm's earning power and cash flows. In case that an instinctively mistrust discounted cash flow estimates of value, the book value is a much simpler benchmark for comparison. Value-to-price ratios can be compared across firms for signs of under- or overvaluation. Stocks selling for well below the book value of equity are deemed undervalued and the stocks selling more than book value are considered as overvalued. The relationship between book value and price is however much more complex than that. A firm's price to book value can be determined by a combination of its expected payout ratio, expected growth rate in earnings, riskiness, and return on equity. Higher returns lead to higher price to book value ratio and vice versa. Investors have used the book-to-price relationship for investment strategies in several ways. Some have used high book-to-price ratios as a screen to pick undervalued stocks. Some have combined book-to-price ratios with other fundamentals (e.g., see Piotroski, 2000; Penman and Reggiani, 2012). Book-to-price ratio is sometimes considered even as a proxy for equity risk due to sheer persistence of higher returns earned by high book-to-price stocks (Damodaran, 2002).

To my knowledge, Rosenberg *et al.* (1985) were the first who report significant B/P anomaly in the U.S. stock market over the 1973-1984 period. Chan *et al.* (1991) compared four portfolio formation criterion (i.e., CF/P, E/P, B/P, and size criterion) in the Japanese stock market during the 1971-1988 period and concluded that B/P ratio had the best discriminatory power on value and glamour stocks. In addition, the highest return on both absolute and risk-adjusted basis was also reported for B/P

value quartile portfolios. Parallel results from the U.S. markets were documented by Fama and French (1992) who also found B/P ratio to have the best explanatory power on expected returns in the U.S. markets over the 1963-1990 period. The authors demonstrated further that together with market value of equity (i.e. firm size) these two variables captured the explanatory power of E/P ratio. The dramatic dependence of returns on B/P ratio is independent of beta, suggesting either that high B/P ratio firms are relatively underpriced, or that the B/P ratio is serving as a proxy for a risk factor that effects equilibrium expected returns. After controlling for the size and B/P effects, beta seemed to have no power to explain average security returns indicating that systematic risk seems not to matter, while B/P ratio seems to be capable of predicting future returns. Brennan *et al.* (1998) found that investments based on book-to-market and size resulted in reward-to-risk ratios which were about three times as high as those obtained by investing in the market.

Fama and French (1993) provided evidence that a three-factor model based on factors formed on the size and book-market and beta characteristics explains average returns, and argued that the characteristics compensate for distress risk. Consistently with the results of Fama and French (1992, 1993), Davis (1994) and Chan *et al.* (1995) provided further evidence that B/P has significant explanatory power on expected stock returns and furthermore, that the performance difference between value and growth stocks cannot be explained by data-selection biases, like suggested by Black (1993) and Kothari *et al.* (1995), for example. Moreover, Capaul *et al.* (1993) concluded that value stocks earned excess returns also in other international markets. The returns obtained from portfolios of stocks with low B/P ratios and those obtained from portfolios of stocks with high B/P ratios were compared over the period from January 1981 through June 1992 in six countries; France, Germany, Switzerland, the United Kingdom, Japan and the United States. The results showed the existence of a significant "value-growth factor" in each country. The returns on portfolios formed according to the value-growth factor differed far more from month to month than would be expected if the securities had been selected randomly. Value stocks outperformed growth stocks on average in each country during the period studied, both an absolute and risk adjustment basis. Cross-country correlations of monthly value-growth spreads were small suggesting that any decision to "tilt" a portfolio toward value stocks would have been more effective if done globally. Parallel results were also reported in Fama and French (1998) who compared the value premiums obtained from using four different portfolio-formation criteria (i.e., B/P, CF/P, E/P and D/P) in 13 major stock markets. According to the results, the B/P criterion resulted in the greatest value premium in 6 out of 13 regional stock markets (in the USA, the UK, Belgium, Switzerland, Singapore, and Japan) during the 1975-1995 period. In comparison of the same four valuation

ratios, Bauman et al. (1998) also found the greatest value premium on the basis of B/P ratio for a large pooled sample of international stocks from 21 countries during the 1986-1996 period. However, the total risk-adjusted performance of value quartile portfolios formed on the basis of E/P and D/P ratios were slightly better than that of B/P value portfolio. The superiority of B/P criterion was also documented for the large pan-European data over the 1990-2002 period by Bird and Whitaker (2003) who compared the performance of quintile portfolios formed on the basis of B/P, S/P, E/P and D/P criterion.

Fama and French (1995) sought explanations to the P/B anomaly. They concluded that low B/P firms typically have high average returns on capital, and moreover, that high B/P companies are relatively financially distressed. Their evidence showed that low B/P companies do in fact remained more profitable for at least five years after portfolio formation, but that the growth rates of high B/P firms became more similar to low B/P firms after portfolio formation. They also found evidence that the market does not understand this convergence of earnings growth and that the market merely seems to extrapolate the strong earnings growth of low B/P firms and the weaker growth of high B/P firms. Similar findings were also reported by Chan *et al.* (2003). The market estimates the growth of high B/P stocks too low leading to a mispricing of stocks due to over-pessimistic extrapolation of previous growth. The main conclusion made by Fama and French (1995) and supported by Chen and Zhang (1998), for example, is that high B/P companies are at least some level financially distressed. The interpretation is also consistent with the conclusion on Penman (1996), who used the residual income valuation framework to illustrate expectations embedded in the price of a high book-to-price company.

Piotroski (2000) also supported the argument made by Fama and French (1995) and suggested that as a result, the valuation of these firms should focus on accounting fundamentals such as leverage, liquidity, profitability trends and cash flow adequacy. This finding also suggested that these fundamentals could also be used in discriminating companies within the high B/P set of firms by using financial analysis fundamentals. Previous literature has also shown that an average high B/P firm is in many cases neglected by market and is followed by fewer investors (see e.g., Griffin and Lemon, 2002; Jegadeesh *et al*., 2004; Doukas *et al.*, 2005). This would also support the effectiveness of fundamental statement analysis on high B/P firms since the market is more likely to misprice companies that are not actively followed by investors. Even as the success of the B/P value strategy has been found to prevail time and time again, there still remains critique towards the strategy. Perhaps the most compelling argument against the B/P strategy is that its success depends

on the outstanding performance of a handful of companies while tolerating the very poor performance of many others (Piotroski, 2000).

Trecartin, Jr. (2001) studied whether B/P systematically explains the cross section of stock returns. The portfolios were formed of stocks included in NYSE, AMEX and NASDAQ during the 1963-1997 sample period. The results indicated that high B/P ratio was positively and significantly related to return in only 43% of the monthly regressions. The author also argued that B/P value portfolio doesn't outperform B/P growth portfolio in a short investment period. However, there was a significant positive correlation between high B/P and stock returns in investment periods of 10 years. The results also implied that while B/P ratio doesn't consistently correlate with expected returns, high B/P might not defend its place as a risk proxy. Ali *et al.* (2003) showed that the book-to-market effect is greater for stocks with higher idiosyncratic return volatility, higher transaction costs, and lower investor sophistication, consistent with the market-mispricing explanation for the anomaly.

The evidence of Penman *et al.* (2007) suggested that the B/P ratio could be decomposed into an enterprise B/P ratio and a leverage component reflecting financial risk. They also showed that as the high B/P ratio is associated with high returns, the leverage component is negatively associated with the returns. This suggests that the B/P value premium could be further enhanced if the leverage related factors could be taken into account in the portfolio formation. However, this result is contrary to the belief that higher amount of leverage and risk should yield higher excess return as a reward for the leverage risk, when in fact the effect is the opposite (for the recent evidence of this, see e.g. Campbell *et al*., 2008). Penman *et al.* (2007) suggested that this result could be due to one or more of the following explanations; measurement error in leverage, or omitted operating risk factors that are negatively correlated with leverage, or mispricing of leverage by the market. Although the reason for the leverage effect was not explained, it does at least on some level support the conclusion that market mispricing could happen within high B/P companies and that this effect may be exploited.

Fama and French (2007a) traced three sources of value premium; firstly, it is contributed by the value stocks that improve in type because their companies are acquired by other companies or because they earn high returns and migrate to a neutral or growth portfolio. Secondly, the value premium is attributed by poor performance of some growth stocks earning low returns and thus moving to a neutral or value portfolio. The third reason for the value premium is the slightly higher

returns of value stocks that do not migrate compared with the returns of corresponding growth stocks. In another related study, Fama and French (2007b) found the convergence in book-to-price ratios of value and growth portfolios which is caused by mean reversion in profitability and expected returns; B/P of value portfolios tend to rise as some value companies become more profitable, while B/P of growth portfolio falls as growth companies cannot reach the profitability level that is expected from them.[4]

Evidence of B/P anomaly in the Finnish stock markets is relatively weak. Leivo *et al.* (2009) documented somewhat significant B/P anomaly based on the performance of quintile portfolios reformed at 3-year frequency for the 1991-2006 period. In contrast, Pätäri and Leivo (2009) and Leivo and Pätäri (2011) found no evidence of B/P anomaly for either tercile or quintile portfolios reformed at 1-year frequency for the 1993-2008 period. The same conclusion was also drawn by Leivo (2012) for the 1993-2009 period. The results of Leivo and Pätäri (2009) showed that the main findings of B/P effect in Finland were neither dependent on the portfolio formation frequency within range from one year up to five years. For most of the holding period lengths, the best performance were documented for the middle tercile B/P portfolios and the performance difference between value and glamour B/P portfolios were not significant for any of the reformation frequencies.

2.5 Dividend yield (D/P) anomaly

The hypothesis that D/P predicts returns has been the subject of considerable theoretical and empirical research (e.g., see Dow, 1920; Ball, 1978). Actually, there are two central competing hypotheses: the tax effect hypothesis and the dividend-neutrality hypothesis. The tax-effect hypothesis proposed by Brennan (1970) states that investors receive higher before-tax, risk-adjusted returns on stocks with higher anticipated dividend yields to compensate for the historically higher taxation of dividend income relative to capital gain income. In contrast, the dividend-neutrality

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[4] In the Finnish stock markets, Pätäri and Leivo (2010) provided a new insight into the value premium literature by examining the convergence of valuation differences between portfolios of value and glamour stocks over time. Their analysis somewhat reminded that made by Fama and French (2007b) on B/P ratios but authors examined the convergence of many other valuation ratios such as E/P, EV/EBITDA, CF/P, and S/P besides B/P ratios. In addition, the authors applied the migration approach of Fama and French (2007a) by examining the degree of stock shifts between fraction portfolios.

hypothesis proposed by Black and Scholes (1974) states that if investors required higher returns for holding higher yield stocks, firms would adjust their dividend policy to restrict the quantity of dividends paid, lower their cost of capital, and thus, increase their share price. Correspondingly, if investors required a lower return on high-yield stocks, value maximizing firms would increase their dividend pay-outs to increase their share price. In equilibrium, value maximizing behaviour would result in an aggregate supply of dividends to equal the aggregate demand for dividend income from investors that prefer dividends at least as much as capital gains. As a consequence, predictable relationship between anticipated dividend yields and risk-adjusted stock returns should exist.

Research on differences in returns among stocks with high and low anticipated long-run dividend yields has been mixed. In their seminal study, Black and Scholes (1974) found no statistically reliable link between a portfolio's monthly return and its long-run dividend yield. In contrast, Litzenberger and Ramaswamy (1982) reported positive but non-linear association between U.S. stock returns and dividend yields during the 1940-1980 period. Rozeff (1984) and Fama and French (1988) also argued for the feasibility of dividend yields in predicting stock returns. Blume (1980) and Keim (1985) documented an U-shaped relationship between risk-adjusted returns and dividend yields, with zero-yield stocks realizing larger returns than dividend-paying stocks and higher yield stocks realizing larger risk-adjusted returns than lower yield stocks. Christie (1990) showed that the anomalous zero-yield result is largely due to the performance of stocks with a value of less than two dollars during the 1930s. By comparing the returns of zero-yield stocks during the 1945-1986 period to the performance of dividend-paying stocks of equal market capitalization, Christie found the returns of zero-yield stocks significantly lower than those of dividend-paying stocks. Though his evidence indicated a positive relationship between dividend yields and returns, Christie argued that the magnitude of the effect is too large to be explained by a tax effect and might be better explained by the market overestimating the prospects of non-dividend-paying stocks.

Many authors have also documented the relationship between value premium and dividends. E.g. Chen *et al.* (2008) reported the expected HML return of 6.1 % per annum in the U.S. markets, consisting of an expected-dividend-growth component of 4.4 % and an expected-dividend-to-price component of 1.7 % during the 1941-2005 period. A major seminal US study by Black and Scholes (1974) found no effect that higher dividend yields would have generated higher returns, but their study has been criticized later on statistical grounds. For example, Litzenberger and Ramaswamy (1979) strongly challenged their results and criticized their methods suggesting that high yields and high returns go together as well as Elton *et al.* (1983) who demonstrated that dividend yield had a

large and statistically significant impact on return above and beyond that explained by the zero-beta form of the CAPM. Their study covered the period 1937-76, but also looked at 5-year subperiods during which only two of them, the overall finding did not hold. Keim (1985, 1986) found a significant relationship between dividend yield and abnormal returns in the U.S. market.

In UK, Levis (1989) examined the relationship between yields and return during the 1961-85 period and found that high yield and high return were monotonically positively related. Generally, the yield effect was the strongest in relative to size, E/P and share price. Morgan and Thomas (1998) found that in the UK over the 1975-93 period, high yield and high returns, over the following five years, go together. Chan and Chui (1996) found for the period 1973-90 that high yields were related to higher returns, while Miles and Timmermann (1996) for the 1979-91 period found no relationship.

Naranjo *et al.* (1998) found that actual and risk-adjusted returns for NYSE stocks increased with increasing dividend yield during the period 1963-94. Zero-dividend stocks had higher actual returns than low-yield stocks, but using a Fama-French risk adjustment they earned the lowest returns. According the authors, tax effects could not account for their findings. Fama and French (1998) compared the value premiums obtained from using four different portfolio-formation criteria (i.e., B/P, CF/P, E/P and D/P) in 13 major stock markets. According to the results, the D/P criterion resulted in the greatest value premium in only one out of 13 regional stock markets (i.e. in France) during the 1975-1995 period. Moreover, the value premium based on D/P criterion was statistically significant in only two regional markets (i.e. in Japan and in France). Instead, a comparison of the same four valuation ratios by Bauman *et al.* (1998) documented the greatest value premium based on the D/P ratio for a large pooled sample of international stocks whose fiscal year end was in March. However, the total risk-adjusted performance of value quartile portfolios formed on the basis of CF/P and B/P ratios were slightly better than that of D/P value portfolio for this subsample. Instead, when the subsample consisted of the stocks whose fiscal year ended in December the best total risk-adjusted performance was shared with E/P and D/P value quartile portfolios. Thus, it seems that the relative performance of value portfolios based on different valuation ratios is also dependent on the timepoint of fiscal year end of sample companies (Most of the studies have been conducted based on the sample that includes only the companies whose fiscal year equals the calendar year). The superiority of D/P criterion over the other individual valuation criteria has also

been documented in the Greek stock market during the 1995-2002 period (Kyriazis and Diacogiannis, 2007).[5]

There are many arguments why high-dividend yield stocks might produce abnormal returns. The total return on a stock will be its initial dividend yield plus its growth rate. In efficient market, if all stocks with the same risk offer the same total return, the low-growth stocks will have to offer higher initial yields. However, if investors are incapable at assessing growth prospects correctly, it is possible that the growth rate assumed for high-growth-rate stocks will be too high, and that for low-growth-rate stocks will be too low. This in turn, implies that high-yield stocks might be expected to offer a higher total return. Investors might also simply just understate the importance of initial yield and focus too much on growth. Different taxation on dividends and capital gains might also have impact on phenomenon. U.S. tax law has treated capital gains more favorably than dividends, and therefore taxable investors may have demanded a higher pretax return on higher-yielding stocks to compensate for the increased tax liability. However in Finland, the tax laws have been different, and *avoir fiscal* system made dividends practically tax-free for the Finnish investors during the 1990-2004 period. In year 2005 tax treatments changed and for the individual investors, 30 % of dividends are tax free and 70 % of dividends are taxed based on fixed capital income tax rate (that has varied between 28 % - 29 %).

The very strong D/P anomaly has been documented in the Finnish markets during the past two decades. Pätäri and Leivo (2009), Leivo and Pätäri (2009, 2011) and Leivo (2012) have all compared value premiums between quantile portfolios formed on the basis of six individual valuation ratios (i.e. E/P, etc.). In all of these the greatest value premium was generated on the basis of D/P criterion. Moreover, the best risk-adjusted performance among all quantile portfolios were documented for top D/P portfolios in all comparisons. Furthermore, Leivo and Pätäri (2011) showed that selecting value stocks based on the D/P criterion has resulted in the greatest proportion of stocks that have provided higher total return during the subsequent 1-year holding period than the stock market average. In fact, the proportion has been exceptionally high (i.e. 54.3 % during the 1993-2008 period), since the previous international evidence has typically shown proportions lower than 50 % for value-only strategies (e.g., see Piotroski, 2000; Rousseau and van Rensburg, 2004).

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[5] In addition to studies on D/P anomaly, many papers have evidenced the outperformance of the so-called "Dogs of the Dow" –strategies or their variants in different regional markets (e.g., see McQueen *et al*., 1997 for U.S. evidence, Visscher and Filbeck, 2003, for Canadian evidence, and Rinne and Vähämaa, 2011, for Finnish evidence). Furthermore, e.g., Martikainen *et al*. (1993) documented that a simple long/short trading strategy in which stocks with increased dividends were bought and stocks with dividend cuts were sold resulted in abnormal returns in the Finnish stock market during the 1974-1987 period.

2.6 Sales-to-Price (S/P) anomaly

During the recent years, analysts have increasingly turned to use alternative multiples to value companies besides widely used and intuitively appealing earnings and book value multiples. Firms that have negative earnings and that are young, sales multiples offer a tool to value such companies. Sales are very difficult to manipulate through accounting. In addition, sales multiples are not as volatile as earnings multiples, and hence are less likely to affected by year-to-year swings in a firm's fortunes. Moreover, earnings are much more sensitive to economic changes than sales. As with other ratios, other things remaining equal, companies that trade at low sales multiples are considered as cheap relative to companies that trade at high multiples of revenues. The biggest disadvantage of using sales multiples is that if a firm generates high sales growth while losing simultaneously significant amounts of money, the use of sales can lull the investor assigning high values to such firms. Beside high sales, a firm has to generate earnings and cash flows for it to have value. The failure to control for company-specific characteristics in costs and profit margins can lead to misleading valuations (Damodaran, 2002).

To my knowledge, Fisher (1984) was the first to discuss the role of the S/P ratio in stock selection. A bit later, Senchack and Martin (1987) examined the relative performance of high S/P ratio and high E/P ratio strategies for the period 1975-1984 and results suggested that high S/P ratio stocks produced abnormal risk-adjusted returns compared both on low S/P ratio stocks and market return. However, high E/P ratio stocks dominated high S/P ratio stocks on both absolute and risk-adjusted return basis. The relative performance of the high E/P ratio stocks was more consistent than that of the high S/P ratio stocks. Instead, Barbee *et al.* (1996) found that S/P ratios explains U.S. stock returns better than corresponding B/P ratios or firm size during the 1979-91 period. The authors also examined the debt-equity ratio but found that sales-to-price was the only variable with a consistently significant role in explaining returns. They stated further that S/P captures the role of the debt-equity ratio in explaining the returns. Instead, Mukherji *et al.* (1997) who found evidence of S/P and B/P anomaly in the Korean stock markets during the 1982-1993 period showed that the positive relationship of the debt-equity ratio persisted in portfolios formed on the basis of B/P and S/P. Suzuki (1998) studied the S/P ratio as a simple investment factor in portfolio formation in the Tokyo Stock exchange during the 1983-1996 period and showed its superiority as a valuation multiple. Before Suzuki, many papers had pointed out the existence of a B/P of equity anomaly in Japan. Suzuki found that by using the S/P ratio in portfolio formation over a 14-year period not only could generate abnormal returns, but also could beat the E/P and the B/P strategy in 6 years within

the 14-year period. He also showed that the S/P ratio was especially meaningful during periods of economic recovery. In contrast to the results of Suzuki (1998), Guerard, Jr. *et al.* (2006) reported that S/P ratio has lost its formerly-documented prediction power in the Japanese stock markets during the 1993-2001 period.

Dhatt *et al.* (1999) found that for small-cap U.S. stocks, S/P is a better indicator of value than B/P, which in turn is superior to E/P. However, value portfolios formed on the basis of all three ratios provided the best risk-return characteristics. Bird and Casavecchia (2007a, 2007b) documented the superiority of S/P ratios in the European markets during the 1989-2004 period. Barbee *et al.* (2008) found that in the U.S. stock markets S/P has the most consistently significant positive relation and highest explanatory power with subsequent annual returns. According the authors, the results suggested that S/P is an undervalued value measure, since investors may tend to focus more on E/P and B/P than on CF/P or S/P, resulting the information contained in the first two multiples being more efficiently incorporated into stock returns than the information in the last two multiples.

Though S/P anomaly is well documented in international studies, the Finnish evidence of S/P anomaly is somewhat mixed: Leivo *et al.* (2009) documented somewhat significant S/P anomaly based on the performance of quintile portfolios reformed at 3-year frequency for the 1991-2006 period. In contrast, Pätäri and Leivo (2009) and Leivo and Pätäri (2011) found no evidence of S/P anomaly for either tercile or quintile portfolios reformed at 1-year frequency for the 1993-2008 period, respectively. According the results of these two studies, the best performing S/P portfolios have been the middle portfolio among tercile portfolios and the second lowest S/P portfolio among quintile portfolios.[6] For the same sample, the results of Leivo and Pätäri (2009) revealed that the middle S/P portfolio remained the best tercile S/P portfolio for the holding period lengths from one up to five years. In the light of the above-cited results it seems that the significance of S/P anomaly in the Finnish stock markets, if it exists at all, seems to depend heavily on the sample period employed.

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[6] The S/P quintile portfolio results of Leivo (2012) are also parallel to Leivo and Pätäri (2011) for one year longer sample period (i.e. from 1993 to 2009).

2.7 Composite value measures

The idea of combining value indicators to enhance the value portfolio performance and/or value premium is not new (e.g., see Graham, 1973). The combination may add value if the indicators are not highly correlated. However, the current literature on the empirical tests of the use of composite value measures is relatively scarce. To my best knowledge, Dhatt *et al.* (1999) were the first who reported the results of performance comparisons between value portfolios based on both individual valuation ratios and a composite value measure. The authors formed tercile portfolios of stocks included in The Russell 2000 Index, which is the commonly used U.S. small-cap benchmark, on the basis E/P, B/P and S/P ratios. The portfolios based on composite value measure were formed by combining stocks with consistently low values by all the three aforementioned valuation ratios into one portfolio, consistently medium positive values into another portfolio, and consistently high positive values into a third portfolio.[7] All the portfolios were rebalanced each year on the basis of end-of-June ratios for the stocks in the reconstituted Russell 2000 over the 1979-1997 sample period. According to the results, the composite value portfolio performed best on the basis of both absolute and risk-adjusted returns among all the portfolios compared. Dhatt *et al.* (1999) showed further that the results were robust to January effect and to the exclusion of low-liquidity stocks.

Chan and Lakonishok (2004) examined the efficiency of combining B/P, CF/P, E/P, and S/P ratios. By employing robust regression methods, they first estimated cross-sectional models that predicted future yearly returns from beginning-year values of each valuation ratio. The estimated slope coefficients determined the weights to be applied to valuation ratio to arrive at the composite value measure. The authors tested the efficiency of the above-described portfolio formation criterion with the three different samples of which the first consisted of six largest-cap deciles of NYSE stocks, the second of the stocks that were in the sixth through nine deciles in the same stock exchange, and the third of largest-cap stocks in the MSCI EAFE Europe (Europe/Australasia/Far East) Index of non-U.S. countries. The sample periods were 1969-2001 for U.S. stocks and 1989-2001 non-U.S. stocks. For all the samples examined, Chan and Lakonishok (2004) concluded that the use of composite value measure boosted the performance of the value strategy. The authors showed further that the outperformance was not explained by greater risk of value portfolios.

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[7] Stocks with negative values for any of the three valuation ratios were excluded from the sample. The average number of companies included in three portfolios formed on the basis of the composite value measure decreased to 536 (in total), indicating that the majority of companies did not have consistently low, medium, or high values of the three ratios used as the basis of the composite value measure.

Unfortunately, Chan and Lakonishok (2004) did not report the results based on individual valuation ratios, which would have been an interesting extension for comparability purposes. In contrast, Dhatt *et al.* (2004) did so for the same valuation ratios employed by Chan and Lakonishok (2004). However, Dhatt *et al.* (2004) used somewhat simpler methodology in constructing the quintile portfolios instead of decile portfolios employed by Chan and Lakonishok (2004). At the first stage, Dhatt *et al.* (2004) standardized each of the valuation ratios of a firm in a particular year by the median value of that ratio for all the firms in their final sample in that year. At the second stage, composite value measures were computed as simple averages of different combinations of these relative valuation ratios. According to their results, the highest return during the 1980-1999 period was reported for the value portfolio that was based on the combination of E/P and S/P ratios. Although the best risk-return trade-off, as well as the lowest risk, was documented for CF/P criterion, Dhatt *et al.* (2004) concluded that using composite value measures can expand the set of efficient portfolios, enabling investors to achieve a wider range of risk-return trade-offs.

The different methodological approach was introduced by Piotroski (2000) who examined whether the performance of B/P-based strategy can be boosted by accounting-based fundamental variables. Piotroski used the F_Score that is a composite score given to a company each year. It is the sum of nine individual binary signals that are used as measures for three areas of the firm's financial condition. The areas are profitability, financial leverage or liquidity, and operating efficiency. The aggregate signal, F_Score, is designed to measure the overall quality, or the strength of the firm's position. Piotroski (2000) tested the F_Score and its ability to separate "winners from losers" within a broad portfolio of high B/P companies. The mean return of the low B/P portfolio could be increased by 7.5 percentage points p.a. to 13.5 %. Also the entire distribution was shifted more to the right. In addition the long/short strategy was tested and it was able to generate a 23 % annual return between the 1976-1996 period. In general, the results were very interesting because the observed patterns of return are inconsistent with common notions of risk.

Bird and Gerlach (2006) also examined the extent to which fundamental accounting information can be used to better identify truly undervalued stocks to enhance profit in a simple value strategy. Gibbs sampling and model averaging were used in a logistic regression setting to enhance a forecast value investment strategy applied to stock markets in the US, the UK and Australia. According to the results, it appears that the stocks in the value portfolio that are most likely to show positive market-corrected returns can be predicted more successfully through the use of fundamental company accounting information.

Chen and Zhang (2007) provided theory and evidence showing how accounting variables explain cross-sectional stock returns by providing accounting based model that holds greater promise in explaining cross-sectional price movements than models developed in the finance literature that are based on common risk factors. According to authors, stock returns, as changes in value, are related to changes in expectations about the firm's scale and profitability in future periods. The authors identified the following four cash-flow-related factors for explaining returns: earnings yield, capital investment, and changes in profitability and growth opportunities. According to the results, the set of cash-flow-related factors, profitability-related information (earnings yield and change in profitability) accounts much more return variation in the pooled sample and is thus empirically more important than are scale-related factors (capital investment and change in growth opportunities). Their theory however shows further that earnings variables alone are not adequate, and that returns should also depend on both balance sheet data (such as invested capital) and the characteristics of the firm's external environment (such as growth opportunities and the interest rate). Leong *et al.* (2009) tested the efficiency of economic value-added-to-market value (EVAM), which can be seen as a hybrid of E/P and B/P ratios, as portfolio selection criterion. Their results showed that the highest EVAM ratio performed the best during 1995-2004 period in the U.S. stock markets.

An unique composite value measure is suggested by Athanassakos (2011a) who employed the multi-stage selection criteria for the sample Canadian stocks. At the first stage, the stocks were divided into quartile portfolios on the basis of E/P ratios. At the second stage, each E/P quartile portfolios were further subdivided into four quartiles based on B/P ratios. This process was repeated for each year of the sample. As a result, 16 quantile portfolios, of which the first (Q1) consists of the highest E/P - highest B/P stocks and the last (Q16) of the lowest E/P - lowest B/P stocks, were generated. At the third stage, to determine the truly undervalued stocks, each stock in Q1 portfolio were individually valued using two valuation criteria that were the net replacement value of each company's assets (called Net Asset Value, NAV), and Free Cash Flow –based valuation (called Earnings Power Value). Based on these two values, the intrinsic value for each Q1 company were calculated using both quantitative and qualitative decisions rules (for details, see the original article). The upper price limit for stocks to be included in the portfolio of truly undervalued stocks was set to 2/3 of the intrinsic value allowing for 1/3 margin of safety. When comparing the performance of the former portfolio to that of the naïve value portfolio (i.e. that based on the

selection criterion of the second stage), Athanassakos documented significant enhancement for the second subperiod from 1999 to 2007.

The Finnish evidence on the performance of composite value measures is quite strong. Leivo *et al.* (2009) compared the performance of three composite value portfolios formed by the 2-combination of B/P and EBITDA/EV ratios, the 3-combination of B/P, EBITDA/EV, and S/P ratios and inverse of the Graham ratio (i.e. the product of E/P and B/P). The first two of these appeared to be improve risk-return ratios of value portfolios compared to those generated by the best value portfolios based on individual valuation ratios, but the improvement were mostly statistically insignificant. In addition, the authors noted that abnormal returns of value portfolios formed on the basis of composite value measures were generally less sensitive to changing stock market sentiment than those based on individual valuation ratios. However, when Leivo and Pätäri (2009) included also dividend yield as one individual valuation criterion, the performance differences between such portfolios that were formed on the basis of composite value measures including dividend yield and those based only on dividend yield were marginal for all holding period lengths from one year up to five years. The similar results for the same sample period were also documented in Leivo and Pätäri (2011) for one-year holding period length using quintile portfolio division, while the results of Leivo and Pätäri (2009) were for tercile portfolios. Pätäri et al. (2010) tested the applicability of DEA on value portfolio selection based on input and factors derived from the components of three traditional valuation ratios and later on, Pätäri et al. (2012) examined the added value of using DEA as formation criteria for equity portfolio selection. Their study includes two criteria that are based on composite value-only measures. According to the results for the 1994-2010, these two criteria were very selective in identifying the best-performing stocks of the future to the extent that not only the DEA glamour tercile portfolio but also the DEA middle tercile portfolio was significantly outperformed by the corresponding value portfolio.

2.8 Explanations to value premium

The reasons for the value premium are widely discussed in the financial literature. E.g., Fama and French (1993) suggested that the value premium exists to compensate investors for the risks inherent in value stocks relative to growth stocks, which is not captured by the traditional Capital Asset Pricing Model (henceforth CAPM) of Sharpe (1964), Lintner (1965) and Mossin (1966). Using the neoclassical framework with rational expectations and competitive equilibrium, Zhang (2005) came to a parallel conclusion, but explained the value premium with the difference between value and growth companies in their ability to adjust the level of production to match the demand in varying economic conditions. This, in turn, results in a countercyclical price of risk and cyclical behavior of unconditional market betas of value and growth stocks, which predicts countercyclical variation in the value premium. Petkova and Zhang (2005) also showed that the economic fundamentals of value firms respond negatively to economic shocks while the same does not hold for growth stocks. They interpreted this as evidence that value stocks are riskier than growth stocks, at least in the adverse states of the world. Gulen *et al.* (2011) also agreed that the value premium is explained by less flexibility of value firms in adjusting to worsening economic conditions compared to growth firms. Instead, Fong (2012) found no evidence of macroeconomic risks explaining the value premium.

In contrast, Gerakos and Linnainmaa (2012) stated that the value premium exists because high B/P portfolios have high expected returns simply because they are riskier than low B/P portfolios. They showed that changes in the market value of equity also give book-to-market ratios predictive power over future returns, while the changes in the book of equity do not do that. Therefore, the Fama-French HML factor consists of a priced and unpriced risk component. Because every factor has just one price of risk, the Fama-French 3-factor model gives the appearance of high risk-adjusted returns for strategies that covary negatively with the unpriced component. This finding explains why the three-factor model appears to price anomalies associated with earnings-to-price and cash flow-to-price ratios. When Gerakos and Linnainmaa (2012) adjusted these ratios to not overlap with the unpriced part of the HML factor, these anomalies resurfaced. In contrast, Lettau and Wachter (2007) proposed a dynamic risk-based model which they tested using simulated portfolio sortings and found that growth firms (long-horizon equity) covary more with the discount rate than do value firms (short-horizon equity) which covary more with cash flows. They concluded that value stocks do not appear to be riskier than growth stocks.

Doukas *et al.* (2002) provided evidence that the value premium is not explained by overoptimism in analysts' EPS forecasts[8], thus rejecting their non-risk based explanation of the value premium. In the follow-up paper, the same authors found support for the risk factor explanation as the source of value premium when using the standard deviation of analysts' EPS forecasts as a risk proxy (Doukas *et al.*, 2004). The authors suggested that the abnormal returns of value stocks reflect compensation for higher risk as measured by the dispersion in analysts' EPS forecasts.

Fama and French (1992) reported in their seminal study that size and B/P explain most of the anomalous differences in future stock returns. However, Daniel and Titman (1997) showed that, after controlling for size and B/P, returns are not strongly related to market betas calculated on the basis of the Fama-French 3-factor model (for a contrary view on this inference, see Davis *et al.*, 2000). In contrast, Ang and Chen (2007) argued that when the tests allow for time-varying market betas, no evidence against a CAPM story for the value premium is left. However, Fama and French (2006) showed that the inferences of Ang and Chen (2007) were valid only for the 1926-1963 period, and furthermore that during the 1963-2004 period the value stocks have had lower betas than growth stocks, contrary to CAPM requirements for explaining the value premium. Moreover, contradicting the findings of Loughran (1997), Fama and French (2006) showed that the value premium is not restricted to small-cap stocks by rejecting CAPM pricing formed on size, B/P, and market beta during the 1928-2004 period. Daniel and Titman (2006) argued that the B/P effect is driven by overreaction to the part of the B/P ratio that is not related to accounting fundamentals. The other part of the B/P ratio that is related to the fundamentals does not appear to forecast returns, thus casting doubts on the explanation according to which violations of the CAPM could be captured by controlling for size and B/P effects that have been interpreted to represent proxies for distress risk by the advocates of market efficiency.

An alternative explanation for the value premium is based on the irrational behavior of investors, first proposed in the 1930s by Graham and Dodd (1934). Investors extrapolate past earnings too far out into the future, which drives the prices of the stocks of better-performing firms to too high a level, and the prices of the stocks of poorly performing firms to too low a level. The differentials in predicted returns come as a surprise to investors. According to Jacobs and Levy (1988) anomalies such as residual reversal and trends in analysts' earnings estimates appear to be true evidence of stock market inefficiency. Other effects, such as high E/P and small size, appear nonstationary; they

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[8] The overoptimism in analysts' EPS forecasts has been documented all over the world (e.g., see Ackert and Athanassakos, 1997 for the U.S. evidence, Capstaff *et al*., 2001 for the European evidence).

may be anomalous, or they might represent empirical return regularities only in a broader macroeconomic framework. The idea of Graham and Dodd at the irrational behavior of investors was re-launched within the theory of investments in the form of DeBondt and Thaler's (1985) overreaction hypothesis. The conclusion was supported by the results of Chopra *et al.* (1992), and Lakonishok *et al.* (1994) who applied it in the context of examining the value premium and draw conclusions parallel to the reasoning of the original authors. Moreover, Lakonishok *et al.* found little, if any, support for the view that value strategies are fundamentally riskier than glamour strategies. These results can be seen as a major setback for the efficient markets hypothesis. Later on, Haugen (1995), and Haugen and Baker (1996) came to same conclusion and stated that since the differences in realized returns are too large to be credibly called risk premiums and since the high return value portfolios are not relatively risky, the results also strongly favour the pricing bias hypothesis. Also according to Barberis *et al.* (1998), the naïve extrapolation of past growth causes stock prices to overreact in both directions, resulting in return predictability on the basis of valuation ratios. The results of Brennan *et al.* (1998), which the Sharpe ratio of the B/P factor calculated on the basis of a time-series of return differences between high and low B/P portfolios was more than 50 per cent higher than that of the market, also supports the explanation of pricing irrationalities. Such a great performance difference indicates that the evidence on the predictability of returns from B/P ratios at least partially supports behavioral non-risk-based explanations. According to Daniel *et al.* (2001), investors' overconfidence induces overreaction, and extreme B/P ratios are caused by overreactions to private signals. Phalippou (2008) found neither support for risk-based explanations of the value premium, but showed that the value premium is concentrated in stocks mostly held by individual investors and that, consistent with behavioral explanations, the value premium declines from the lowest to the largest institutional ownership decile.

The recent results of Piotroski and So (2012) also support mispricing explanations. They found that prices of glamour (value) firms reflect systematically optimistic (pessimistic) expectations. Thus, the value/glamour effect should be concentrated (absent) among firms with (without) ex ante identifiable expectation errors. Classifying firms based upon whether expectations implied by current pricing multiples are congruent with the strength of their fundamentals, the authors documented that value/glamour returns and ex post revisions to market expectations are predictably concentrated (absent) among firms with ex ante biased (unbiased) market expectations. In contrast, Arnott and Hsu (2008) argued that both size and value anomalies are driven by pricing noise but the authors did not excluded the possibility that such anomalies could also be partially driven by hidden risk factors or behavioral irrationalities. Athannassakos (2011b) concluded that both risk and

mispricing may have a role in explaining the value premium, although the scale of the evidence seems to be inclined to mispricing hypothesis. As the ongoing academic debate on the reasons for the value premium indicates, the research community is still far from consensus in this respect.

A third group of explanations for the existence of the value premium relies on data snooping bias or other biases related to data (e.g., see Black, 1993; Conrad and Kaul, 1993; Ball *et al.*, 1995; Kothari *et al.*, 1995; Conrad *et al.*, 2003). However, in the light of recent results on the value premium documented all around the world, it seems unlikely that all of the evidence of its existence might be explained by these types of biases (e.g., see Markowitz and Xu, 1994; Guerard, Jr. *et al.*, 2012).

3 INTERACTION OF VALUE AND MOMENTUM ANOMALIES

3.1 Momentum anomalies

Numerous studies have identified the existence of momentum on stock returns (e.g., see Jegadeesh and Titman, 1993; Chan *et al.*, 1996; Chan *et al.*, 2000; Rouwenhorst, 1998; Grundy and Martin, 2001; Jegadeesh and Titman, 2001; Lewellen, 2002; Eakins and Stansell, 2004; Patro and Wu, 2004). There has been debate over whether or not momentum represents mispricing (e.g., see Barberis *et al.*, 1998; Hirshleifer and Subrahmanyam, 1998; Hong and Stein, 1999) or an unobserved risk factor (e.g., see Conrad and Kaul, 1998). A number of possible explanations for momentum effect have been advanced. They include a behavior theory that abnormal returns based on momentum strategies occur because of inherent biases in the way investors interpret information (Barberis *et al.*, 1998; Hirshleifer and Subrahmanyam, 1998; Hong and Stein, 1999). Several researchers have reported success with momentum investing. Moskowitz and Grinblatt (1999) found a strong and prevalent momentum effect in industry components of stock returns and that momentum strategies were profitable even after controlling for size, book-to-market equity, individual stock momentum, and potential microstructure influences. Similarly, according to O'Neal (2000) strategies attempting to exploit industry stock price momentum using sector mutual funds may provide superior risk-adjusted returns. Some researchers suggest that the profitability of momentum strategies may still be consistent with market efficiency in that the returns are simply compensating investors for as yet unidentified risk (Conrad and Kaul, 1998). However, some

scholars have found that momentum does not persist, since mean-reversion effect exists in the stock market from time to time and severely decreases returns on continuous momentum investing. Thus, a momentum investor would perform much better if he managed to avoid investing on momentum during mean-reversion periods. Some evidence has been found that the alternation of momentum and mean-reversion periods would stem from stock market sentiment. Therefore, it is interesting to study whether there is a difference in performance of momentum strategies between different stock market sentiments. This research question is appropriate also because momentum effect has been attributed to the fact that investors underreact to the release of firm-specific information, and earnings announcements carry an associated momentum effect, and on the other hand, because stock market sentiment might have at least some impact on the speed of investors' reaction on earnings announcement.

3.2 Explanations to momentum anomalies

Analogous to the explanations given for the value premium, also the profitability of momentum strategies has been attempted to explain by many separate lines of research. The first suggests that momentum profits are just a trade-off for higher risk, and can be explained by some control variables, such as market beta (e.g., Conrad and Kaul, 1998), B/P (e.g., Daniel and Titman, 1999), size (e.g., Lesmond *et al.*, 2004), industry effects (e.g., Moskowitz and Grinblatt, 1999), growth options (e.g., Berk *et al.*, 1999; Sagi and Seasholes, 2007), macroeconomic factors (e.g., Chordia and Shivakumar, 2002; Liu and Zhang, 2008), a stochastic discount factor (e.g., see Ahn *et al.*, 2003), or the time-variability of risk (e.g., see Li *et al.*, 2008). The other stream of research relies on behavioral and cognitive biases to explain momentum profits (e.g., see Daniel *et al.* 1998; Barberis *et al.*, 1998; Hong and Stein, 1999; Lewellen and Shanken, 2002; Grinblatt and Han, 2005). Daniel *et al.* (1998) suggested that the investors are overconfident about their private information and overreact to it. On one hand, investors attribute successes to their own skill more than they should, and on the other hand, attribute failures to external noise more than they should. As a consequence, investors' overconfidence increases following the arrival of confirming news. This, in turn, increases the initial overreaction and causes the short-term price momentum. In contrast, a competing behavioral theory of Hong and Stein (1999) is based on initial underreaction to information which is caused by gradual diffusion of private information through the market place.

The underreaction and the subsequent positive autocorrelation in returns attracts the momentum traders who base their investment decisions only in past price data. Their increased trading activity leads to an eventual overreaction to news. The third category of theories explaining the momentum profitability is related to market frictions such as trading costs (e.g., see Lesmond *et al.*, 2004; Korajczyk and Sadka, 2004), whereas the fourth stems from the cross-sectional dispersion in expected returns (e.g., see Bulkley and Nawosah, 2009; Stivers and Sun, 2010). Given the wealth of alternative explanations, the research community clearly disagrees on the reasons for the existence of price momentum, yet agrees unanimously that it does exist.

3.3   Empirical evidence of value-momentum interaction

Over the last 30 years, loads of empirical evidence related to the success of both value and momentum strategies have been documented in the financial literature. Motivated by these findings, some researchers have started to examine combinations of these two approaches as a basis of investment strategy. To my knowledge, the interaction of value and momentum strategies was first discussed by Asness (1997) who concluded that momentum and value are negatively correlated across stocks, yet each is positively related to the cross-section of average stock returns. According the author, pursuing a value strategy entails, to some extent, buying firms with poor momentum. Equivalently, buying firms with good momentum entails, to some extent, pursuing a poor-value strategy. In most cases, holding momentum constant leads to a more effective value strategy. That is, the value strategy works best when not forced to short the effective momentum strategy. Similarly, holding value constant leads to a generally superior momentum strategy. Parallel to the results of Asness (1997), Bird and Whitaker (2004) reported that the best long-only (i.e. no short sales allowed) portfolio performance in the major European stock markets (i.e. France, Germany, Italy, Netherlands, Spain, Switzerland and the UK) during the 1990-2002 period would have been achieved by investing in value-loser stocks if a six-month price momentum had been used as a timing indicator and B/P as a value indicator. The added value of the combination strategy stemmed from the fact that value-loser stocks are late in the negative momentum cycle to the extent that they will soon turn around and start generating positive abnormal returns. Bird and Casavecchia (2006) provided further insights into the momentum life cycle for European stocks by demonstrating that a

pickup in momentum for a value stock provides a good early warning sign of a sustained improvement in the stock's fundamental and market performance.

Instead, Bird and Casavecchia (2007a) reported a significant outperformance of value-winner stocks against both the stock market and value-loser stocks when price momentum was used as a sentiment indicator and S/P as a value indicator in the European stock markets during the 1989-2004 period.[9] The authors also examined the added value of a financial health indicator (2007a) and that of a combined earnings momentum indicator[10] as timing indicators, but find their impact on the value premium to be marginal compared to that provided by price momentum indicators.[11] However, the results of Bird and Casavecchia (2007b) showed that at least for value strategies based on individual valuation ratios, the performance improvement could be increased including not only price momentum but also the acceleration rate of the price momentum[12].

Brown *et al.* (2008) examined the performance of value and momentum strategies and the combined value-momentum strategies in four representative Asian markets (Hong Kong, Korea, Singapore, and Taiwan) during the 1990–2005 sample period. Best value and momentum strategies were combined by a long portfolio of stocks classified as both value stocks and winner stocks, and a short portfolio of stocks classified as both growth and loser stocks. According to their findings, the combination of best value and momentum strategies did not provided a significant improvement over the value or the momentum strategy evaluated separately. In contrast, Bettman *et al.* (2009) found fundamental and technical analysis as complements rather than substitutes in equity valuation models. The authors proposed an equity valuation model integrating both fundamental and momentum indicators. Their results for the U.S. sample data over the 1983-2002 period confirmed the complementary nature of fundamental and technical analysis by showing that, although each performs well in isolation, models integrating both have superior explanatory power. In this sense, their results were consistent with the recent results from the European stock markets (e.g., see Bird and Casavecchia, 2007a and 2007b).

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[9] The original sample consisted of almost 8,000 firms from 15 European countries: France, Italy, The Netherlands, Germany, Spain, United Kingdom, Belgium, Portugal, Ireland, Austria, Greece, Norway, Sweden, Denmark, and Finland.

[10] Each year the authors build a model based on 24 accounting variables to predict the probability that the reported earnings per share for the next financial year will be greater the current year's EPS and then use this probability as the measure of each stock's financial strength.

[11] The results of Chordia and Shivakumar (2006) showed that price momentum is actually related to the systematic component of earnings momentum.

[12] The authors defined the momentum based on previous six month rate of return, and the rate as these returns are chancing is used as an acceleration rate of the price momentum.

Recently, Fama and French (2012) examined size, value and momentum in international stock markets. According the results, value premium existed in all four regions (North America, Europe. Japan and Asia Pacific) and there were strong momentum returns in all regions, except in Japan. Except for Japan, value premiums were larger for small stocks. The winner minus loser spreads in momentum returns also decreased from smaller to bigger stocks. In Japan there was no hint of momentum return in any size group.

Leivo and Pätäri (2011) provided evidence that taking account of price momentum besides the relative valuation of stocks would have added value to an investor in the Finnish stock market during the 1993-2008 sample period. Among the best-performing portfolios, the performance improvement resulting from the inclusion of a momentum indicator was the greatest for value portfolios that were formed on the basis of three-composite value measures.[13] The risk-adjusted performance of the best value winner portfolios could be enhanced further by following the 130/30 long-short strategy to the extent that the best long-short portfolios significantly outperformed even the corresponding long-only value winner portfolios and more than double the average return of the stock market while at the same time, the annual volatility of the former was more than three percentage points lower than the average stock market volatility. Consistently with Bird and Casavecchia (2007a and 2007b), the inclusion of price momentum in portfolio-formation criteria also increased the proportion of stocks with above-average returns in the best-performing portfolios.

Pätäri *et al.* (2012) examined the efficiency of DEA as a formation criterion for equity portfolios in a case in which input and output factors were derived from indicators of relative valuation of stocks and from the price momentum indicator. Their results for the comprehensive sample of the Finnish stocks over the 1994-2010 period clearly showed the capability of the DEA approach to separate the outperforming stocks of the future from the underperforming stocks at tercile portfolio level. Moreover, the discriminating power of the DEA approach was higher than that documented for other methods in the earlier Finnish studies in which portfolio-formation criteria based on either value-only measures or combination of value and momentum indicators have been used. However, due to slight differences in sample periods and methodology, the results of these studies are not directly comparable.

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[13] In contrast, Leivo (2012) reported that for the 1993-2009 period, the inclusion of price momentum benefits most S/P value portfolio.

4   SUMMARY OF PUBLICATIONS

4.1   The main results of the publications

The *first research paper* of the dissertation co-authored with Eero Pätäri and Ilkka Kilpiä examines the performance of various value strategies in the Finnish stock market during the 1991-2006 period. The sample of stocks was divided into quintile portfolios based on four individual valuation ratios (i.e., E/P, EBITDA/EV, B/P, and S/P) and three hybrids of them. The performance of quintile portfolios were evaluated based on several performance metrics that take account of different dimensions of portfolio risk (i.e., the Sharpe ratio, the Sortino ratio, the Jensen alpha, and 2-factor alpha). All the performance tests employed give strong evidence of the value premium that cannot be explained by size effect. During the sample period value portfolios significantly outperformed both the market portfolio and comparable glamour portfolios. The results showed further that the risk-adjusted performance of value portfolios could be somewhat enhanced by basing portfolio selection criteria on such composite measures that employs EBITDA/EV as earnings multiple. To our knowledge, this is actually the first published journal article that examines the performance of EBITDA/EV-ranked quantile portfolios and compares it to performance of portfolios formed on the basis of more commonly used valuation ratios.

Consistently with the results of Dhatt et al. (1999, 2004), our results give some indications that the performance of value strategies based on individual valuation multiples could be somewhat enhanced by using the composite selection criteria. Two best selection criteria in forming the value portfolio in the sample period were those based on C2 and C3 composite value measures, which are a hybrid of EBITDA/EV and B/P, and a hybrid of EBITDA/EV, B/P and S/P. Interestingly, we noted that abnormal returns of value portfolios formed on the basis of composite value measures were generally less sensitive to changing stock market sentiment than those based on individual valuation ratios. During the sample period EBITDA/EV turned out to be the best of those selection criteria that were based on individual valuation multiples and it was also included in both of two above-mentioned best composite value measures. Based on the results, it seems that replacing E/P with EBITDA/EV as earnings multiple would add some value into portfolio performance.

The *second research paper*, co-authored with Eero Pätäri, examines the impact of the holding period length on performance of various value strategies in the Finnish stock market during the 1993-2008 period. The sample of stocks was divided into 3-quantile portfolios based on six individual valuation ratios and three hybrids of them which in this study were D/P and EBITDA/EV, and 3-compositions of D/P, B/P and EBITDA/EV, and D/P, B/P and E/P. Parallel to the findings of many international studies, our results from performance comparisons indicated that for the sample data employed, the yearly reformation of portfolios is not necessarily optimal in order to maximally gain from the value premium (e.g., see Lakonishok *et al.* 1994; Bird and Casavecchia, 2007a, 2007b). Instead, the value investor may extend his holding period up to 5 years without any decrease in long-term portfolio performance. Regardless of the portfolio reformation frequency, the use of either dividend yield criterion or one of three composite value measures employed results in best value portfolio performance according to all performance metrics used. The superiority of these four formation criteria stems particularly from their ability to separate the best performing stocks of the future from the average-performing stocks of the future. In addition, the proportion of stocks that outperform the stock market average during the subsequent holding period can be somewhat increased by forming the value portfolio based on these four criteria. Somewhat surprisingly, those individual portfolio formation criteria that have been proven to be the most efficient in the recent studies employing international sample data (i.e., S/P and B/P), were the least efficient in the Finnish stock market leading to the smallest and sometimes even a negative value premium during the 1993-2008 sample period.

To my knowledge, the *third research paper,* co-authored with Eero Pätäri and Samuli Honkapuro, is the first attempt to form value portfolios using DEA models. The proposed methodology provides an interesting alternative to detect undervalued stocks by capturing several dimensions of relative value simultaneously. Using the Finnish sample data over the 1993-2008 period, tercile portfolios of non-financial stocks were formed on the basis of their DEA scale efficiency scores. The performance of each portfolio was evaluated on the basis of stacked time-series of monthly returns throughout the 15-year period. The results showed that the DEA scale efficiency scores provide a useful basis for value stock portfolio selection.

The *fourth research paper,* co-authored with Eero Pätäri examines the added value of combining price momentum with various value strategies in the Finnish stock market during the 1993-2008 period. The results showed that taking account of the price momentum of value stocks enhances portfolio performance. Among the best-performing portfolios, the performance improvement resulting from the inclusion of a momentum indicator was the greatest for value portfolios that were formed on the basis of three-composite value measures which consists D/P, B/P and EBITDA/EV. The risk-adjusted performance of the best value winner portfolios could be enhanced further by following the 130/30 long-short strategy in which the long position of value winner stocks is leveraged by 30 percentages while simultaneously selling short glamour loser stocks by the same amount. The best long-short portfolios significantly outperformed the corresponding long-only value winner portfolios and yielded more than double the average return of the stock market coupled with the volatility decrease.

The *fifth paper* of the thesis co-authored with Eero Pätäri and Samuli Honkapuro examines the applicability of data envelopment analysis (DEA) as a basis of selection criteria for equity portfolios. It is the first DEA application for constructing a combined equity investment strategy that aims to integrate the benefits of both value investing and momentum investing. Because DEA is capable to combine multiple inputs and outputs of an entity into a single efficiency score without any *a priori* definitions of the relationship between the input and output parameters or their pre-assigned weights, the methodology employed in this paper offers a new approach to combine value and momentum indicators.[14] Tercile portfolios were composed of a comprehensive sample of Finnish non-financial stocks based on their DEA efficiency scores that were calculated using three variants of DEA models (the constant returns-to-scale, the super-efficiency, and the cross-efficiency models). The performance of portfolios was evaluated on the basis of the average return and several risk-adjusted performance metrics throughout the 1994-2010 sample period.

Based on the results, DEA seems to provide a highly selective approach to portfolio formation, since most of the criteria employed are capable of classifying stocks in such a way that not only do the top-quantile portfolios outperform both the market portfolio and the corresponding bottom-quantile portfolios, but also the middle-quantile portfolios outperform the comparable bottom-

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[14] To my best knowledge, this cannot be done by means of any of the methods that have been previously used for combining value and momentum indicators into single portfolio-formation criterion.

quantile portfolios. To my knowledge, such strong performance differences have not been reported in earlier peer-reviewed studies that have employed the comparable 3-quantile approach of dividing stocks into portfolios. Consistently with the previous literature, the division of the full sample period into bullish and bearish periods revealed that the top-quantile DEA portfolios had lost far less of their value during the bearish conditions than the corresponding bottom portfolios. The methodology employed offers an interesting alternative for detecting the outperforming stocks of the future by capturing both the price momentum and several dimensions of relative value simultaneously. DEA is particularly useful as a multicriteria methodology in cases in which the number of stocks in the sample is large. It therefore also has useful implications to practical portfolio management.

The *sixth research paper* examines the added value of combining a momentum indicator with a value indicator in varying stock market conditions using the Finnish stock market data during the 1993-2009 period. The results showed that taking account of price momentum beside relative valuation criteria enhances the performance of most of the best value-only portfolios during the full sample period. In this sense, the results were consistent with those of Bird and Casavecchia (2007b) and Leivo and Pätäri (2011). The subperiod analysis revealed that during bullish conditions, the inclusion of a momentum criterion somewhat adds value to an investor, but during bearish conditions this added value is reversed. Interestingly, even though value winner strategies were, on an average, the best strategies during the full sample period and outperformed the stock market portfolio also during bearish conditions, they are not the most optimal strategies during bear market periods. In such conditions, some of the value loser portfolios performed even better, especially among those strategies that were the best during the full sample period. The finding is explained by the fact that during bear market conditions the value loser portfolios lose much less of their value than all the rest of the quantile portfolios. In contrast, among value-only portfolios the losses were lowest for P1 portfolios that consisted of stocks of the lowest relative valuation sextile. Thus, the added value of including momentum beside the valuation criterion during bearish conditions is negative. The additional subperiod results showed further that the recent financial crisis has reduced the added value of using a combination of momentum and value indicators as a portfolio formation criterion. This massive crash provided a very interesting basis for subperiod analysis especially for value strategies which have been proved to outperform markets and glamour portfolios during bearish conditions (e.g., see Lakonishok *et al.*, 1994; Pätäri and Leivo, 2009). Moreover, the previous subperiod analysis revealed that the outperformance of value strategies is almost entirely

attributed to the fact that value portfolios lose much less of their value during bearish conditions than do stocks on average. In this sense, the results were consistent with the recent findings of Athanassakos (2010, 2011b) and Gulen *et al.* (2011) on the time-variability of the value premium[15]. The same phenomenon, though based on different portfolio-formation criteria that included only relative value aspect, were also documented by Lakonishok *et al.* (1994), Bauman et al. (1998) and Bird and Whitaker (2003). Therefore, the recent financial crisis offered an interesting opportunity for comparing whether this phenomenon holds also for the latest stock market downtrend that has been described as exceptional in many ways.

Overall, according to the results, the price momentum criterion adds value to value portfolio performance only during non-bearish periods, while the reverse holds for bearish periods. However, since the stock markets have historically been bullish more often than bearish, the combination of the value and momentum criteria has paid off to the investor despite the fact that its added value during bearish periods is negative, on an average. In this respect, the findings are consistent with recent evidence from the major stock markets, according to which momentum profits are dependent on market states (e.g., see Cooper *et al.*, 2004; Avramov and Chordia, 2006; Antoniou *et al.*, 2007).

4.2 Limitations of the thesis

When considering the robustness of the results of the articles included in this thesis, there are several issues that must be taken into account. Firstly, we have assumed that there are neither transaction costs nor taxes. Thus, the trading strategies being examined could most benefit institutional investors who do not pay taxes and whose transaction costs are relatively low, such as mutual funds, for example. In addition, the net asset value of such an investor should not be very high so that trades could be made without major impact on market prices of stocks purchased or sold. So the most potential gainer for these trading strategies would be small-scale institutional investors. However, our overall results do not show that the main findings would have been explained by firm size effect, which could decrease the limitations set by the liquidity effects. On

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[15] Athanassakos (2011b) reported that the both E/P and B/P value quartile portfolios of AMEX, NASDAQ and NYSE stocks lost less of their value than did the corresponding growth portfolios during the bearish conditions within 1986-2006 period, except for the case of AMEX stocks when the year-end projected (forward-looking) E/P ratios were used as a portfolio formation criterion.

the other hand, while the results do not necessarily violate the market efficiency, they are indisputably in contrast with informational efficiency of the Finnish stock market. In addition, the impact of taxes on the evidence of value premium would be somewhat restricted because the portfolio-reformation frequency is always the same for all quantile portfolios.

Moreover, the sample of stocks is not large in spite of its comprehensiveness from the local stock market aspect. Therefore, it might well be that our results are specific to the Finnish stock markets and for the sample periods employed. On the other hand, numerous corresponding international comparisons have shown that the results are always at least to some extent country-specific (e.g., see Artmann *et al.*, 2012, Fama and French, 1998; 2012) and dependent on sample period (e.g., see Guerard, Jr., 2006). In contrast to the great majority of value investing literature, we chose to include also companies with negative earnings in our sample and classified the stocks of such companies as glamour stocks. We included them for three reasons: Firstly, excluding them would have caused sample-selection bias that, in our opinion, would have been a bigger trade-off than including them, since our aim was to find out whether trading strategies examined would have generated abnormal returns within the whole universe of the Finnish non-financial stocks, and not just within those with positive earnings. Secondly, excluding them would have further narrowed down our sample data or forced us to reduce the sample period which both would have been disadvantageous to the statistical reliability of our results. Thirdly, the scarce previous literature in which stocks with negative earnings have included in comparable analysis does not indicate that this methodological choice would tend to increase the value premium, but rather vice versa: e.g. Jaffe *et al.* (1989) and Bauman *et al.* (1998) reported consistently above-average returns for firms of all size with negative earnings. In addition, the main results based on E/P criterion are pretty much in line with those based on other valuation multiples which gives further justification to the inclusion of all potential stocks in our analyses. Like noted by Leivo *et al.* (2009), the impact of the inclusion of firms with negative earnings on the value premium is bidirectional; if those firms continued making losses in the near future, the inclusion of such companies might tend to increase the value premium. On the other hand, if they succeed in turning their negative earnings to positive, the inclusion of such companies will most probably decrease the value premium since the highest returns are often generated by stocks of such turnaround companies.

5   DISCUSSION AND CONCLUSIONS

The overall results of this thesis showed indisputably that the Finnish stock markets have offered interesting possibilities for the investor who has based his/her investment decisions on systematic trading strategies. In contrast to the majority of international studies, there is strong evidence that the best individual valuation criterion for portfolio formation in the Finnish stock market has been the D/P ratio. On the other hand, the parallel results have also been reported from French stock markets (Fama and French, 1998) and from the Greek stock markets (Kyriazis and Diacogiannis, 2007). Correspondingly the discriminatory power of valuation ratios that have shown their efficiency in international studies, such as B/P and S/P ratio has been relatively low in the Finnish stock market. However, the differences may at least partially be explained by the differences in tax treatments of capital gains and dividend pay-outs between different countries.

The overall results give strong evidence of the value premium that cannot be explained by risk factors. Value portfolios significantly outperformed both the market portfolio and comparable glamour portfolios. The results showed further that the risk-adjusted performance of value portfolios can be somewhat enhanced by basing portfolio selection criteria on composite value measures. The division of the full sample period into bull and bear market periods revealed that outperformance of value strategies were attributed for the most part to their superior performance during bear market conditions. Moreover, abnormal returns of value portfolios based on composite measures were least sensitive to changing stock market sentiment. The inclusion of a momentum criterion somewhat adds value to an investor during bullish conditions, but during bearish conditions this added value is reversed. The recent financial crisis has reduced the added value of using a combination of momentum and value indicators as a portfolio formation criterion. According to the results, the price momentum criterion adds value to value portfolio performance only during non-bearish periods, while the reverse holds for bearish periods. However, since the stock markets have historically been bullish more often than bearish, the combination of the value and momentum criteria has paid off to the investor despite the fact that its added value during bearish periods is negative, on an average.

The yearly reformation of portfolios is not necessarily optimal in order to maximally gain from the value premium. Instead, the value investor may extend his holding period up to 5 years without any decrease in long-term portfolio performance. Regardless of the portfolio reformation frequency, the use of either dividend yield criterion or one of the composite value measures employed results in

best value portfolio performance according to all performance metrics used. In addition, the proportion of stocks that outperform the stock market average during the subsequent holding period can be somewhat increased by forming the value portfolio based on these criteria.

The thesis contributes to the existing literature of value anomalies in several ways: First, we examined whether the excess returns of value portfolios are explained by greater downside risk. To my best knowledge, this was the first time when the downside risk approach is employed in the studies on performance of value strategies.[16] Second, we use EBITDA/EV multiple as a basis of value strategies while comparable studies have for the most part concentrated on E/P and CF/P ratios as representatives of earnings multiples. Leivo *et al.* (2009) was the first published journal article that examined the performance of EBITDA/EV-ranked quantile portfolios and compared it to performance of portfolios formed on the basis of more commonly used valuation ratios. The evidence from the Finnish markets shows that in many cases, it is appropriate to use EBITDA/EV ratio as earnings multiple in portfolio formation. The results showed that the use of EBITDA/EV ratio adds often value to portfolio selection particularly in the context of composite value measures as it often brings two new dimensions in classification criteria, whereas conventional price based earnings multiples (E/P and CF/P) bring only one. The thesis contributes to the existing financial literature also by examining the added value of combining price momentum with composite value measures as a portfolio formation criterion in the articles published in *Journal of Asset Management* and in *Review of Accounting and Finance*.

The results showed also the applicability of data envelopment analysis (DEA) for the purpose of equity portfolio formation. To my best knowledge, the article published in *Studies in Economics and Finance* is the first in the financial literature in which DEA efficiency scores are based solely on the variables that are components of traditional valuation multiples. In the article published in *European Journal of Operational Research*, we also extend the applicability of DEA methods to the combination of value and momentum indicators. At least for the sample data employed, the discriminatory power of DEA in classifying stocks into quantile portfolios seems superior to the conventional portfolio formation methods.

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[16] The topic was indirectly discussed by Rousseau and van Rensburg (2004) who report positive skewness in return distributions of value portfolios that become more pronounced over longer holding periods.

DEA applications provide several potential extensions for further research. The DEA methods employed in this thesis could be applied to larger international sample data to examine to what extent our results hold for the larger sample of stocks. Furthermore, several combinations and permutations of input and output variables could be tested to find the set of variables that leads to the best performance in each stock market.

The implications of the results of this thesis are useful for both academics and equity investors who are interested in enhancing risk-adjusted performance of their investments. Results give useful insights to the Finnish stock market and provide especial useful implications for value portfolio management.

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