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BETA ENHANCED VALUE STRATEGIES: EVIDENCE FROM THE GERMAN EQUITY MARKET

Bachelor's Thesis

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1 INTRODUCTION

1.1 Background

The academic literature in the favour of existing value premium is ample. A distinctive difference between the returns to value portfolios and growth portfolios has been identified over various time periods and in several equity markets around the world. In fact, the relative efficiency of different valuation measures appears to be at least somewhat dependent on the sample period and the equity market studied. The results of Chan et al. (1993) suggest that classifying shares by price-to-book (P/B) and price-to-cash flow (P/CF) leads to the greatest value premium in Japan during 1971-1988. In the very same market, during 1983-1996, Suzuki (1998) again found deviating evidence that ranking stocks by price-to-sales (P/S) produces the largest performance difference between value and glamour portfolios.

Fama and French (1998) examined the differences both in the magnitude of the value premium and the sorting basis (i.e. P/B, P/CF, P/E, and D/P) on which the largest premium was obtained for 13 well-established equity markets. In 6 of the 13 markets (i.e. the US, Japan, the UK, Switzerland, Belgium and Singapore) using P/B as a screening criterion resulted in the greatest value premium. Simultaneously, employing P/CF as a classification criterion lead to the largest difference in returns to value and glamour portfolios in 4 of the 13 countries (i.e. Germany, Italy, Hong Kong, and Australia) observed. Only markets where resorting to the P/E criterion generated the greatest premium, were Sweden and the Netherlands. Divergently, France was the only country where following high D/P yielded the greatest difference for the benefit of value portfolio.

The results of whether the composite valuation measures add to value investing are diverse. Dhatt et al. (2004) found support for added value of combining individual valuation multiples in the US during 1980-1999. They show that sorting shares on the basis of an average of P/E and P/S provide the largest excess returns. In any case, Bird and Casavecchia did not find evidence of added value of combining P/B and P/S for dividing the stocks in 15 European countries (including Germany) during 1989-

2004. More recently, Pätäri and Leivo (2009) studied extensively the relative performance of portfolios based both on the individual valuation ratios and the composite valuation measures in the Finnish equity market during 1993-2008. They found evidence that combining B/P, D/P and EV/EBITDA generates the largest premium being statistically highly significant.

The empirical evidence of the relationship between market beta and stock returns is diverse. The results seem to vary according to test procedures employed, and across time period, average market risk premium during the period, and stock market examined. Fama and French (1992) found very little evidence that a higher market risk goes rewarded by the US stock market during 1941-1990. They found that the relation between beta and average return disappears during the pre-1969 period. Instead, Elsas et al. (2003) show a significant interdependence between beta and experienced returns in the German stock exchange during 1965-1995 simultaneously with the disappearing of that in the US. The authors postulate that earlier studies have failed to discover the connection because the traditional tests neglect the time-varying nature of the relation between beta and returns and ignored the fact that the average market risk premium in the sample period has been very close to zero.

1.2 Scope and Objectives

The main objective of this study is to analyse the differences in relative performance of value and growth portfolios based on both individual and composite valuation criteria, also further enhanced with the market beta. The effect of size premium is omitted for further examination. Market beta is included in the examination to provide a more portfolio managerial aspect on screening stocks according to the expected market sentiment.

This study contributes to existing academic literature in several ways. First, EV/EBITDA as an equity selection criterion is observed to take the net debt of a firm into account. Second, the relative performance of tertile portfolios formed on the basis of composite value measures is examined. To my knowledge, the composite valuation measures are now first time enhanced with market betas in the academic research. Third, skewness- and kurtosis-adjusted deviation (i.e. SKAD), introduced by Pätäri (2009), is used as a basis for measuring the total-risk to avoid the biasness of the traditional Sharpe Ratio stemming from its characteristic assumption of normal return distributions. Fourth, the effect of the average market risk premium to the relative efficiency of earnings multiples as a ranking criterion is observed.

I've been motivated to examine the relative performance of beta enhanced composite valuation measures using German data because (i) the German equity market is relatively developed and well-diversified, (ii) the progressive capital gain tax sets Germany to a divergent position when it comes to dividends, and (iii) the continental financial reporting system employed in Germany differs greatly from the US Anglo-Saxon system.

The research questions of the study are as follows:

1. What combination of individual valuation ratios as a screening criterion produces the greatest value premium?
2. What return and/or risk characteristics different valuation multiples add to the value portfolio?
3. Do earnings multiples differ in their relative efficiency during investment periods in which the average market risk premium is positive and correspondingly negative?
4. Does low historical market beta enhance the performance of the value portfolio during an investment period in which the premium is negative and correspondingly high historical beta during a period in which the premium is positive?

1.3 Structure

The research method in this study is a statistical analysis. The applicable theoretical background is gathered from scientific articles and books concerning the topics of value investing and investment strategies. First, the theoretical background of this study is introduced. Second, the employed performance measures and the statistical tests are introduced. Then the valuation multiples, beta and composed portfolio selection criteria are statistically tested and the achieved results analysed. Finally, all the extreme tertile portfolios are compared to each other and the market portfolio in a risk-return framework.

2 THEORETICAL BACKGROUND

2.1 Comparative Valuation Ratios

In this chapter all the valuation ratios selected for this study are introduced. Value investing can be seen as investing in common stocks that are underpriced with some measure of valuation. For valuing stocks earnings multiples, book value multiples, sales multiples, dividend yield and their combinations can be used. In value investment strategy, stocks with a low book value, weak sales or low dividends in relation to market capitalisation or enterprise value are picked. The relatively modest price of a common stock might be subsequent to lowered expected rate of return or a prediction of a weaker future cash flow than the market has anticipated given the firm's history of returns.

2.1.1 Earnings Multiples

The most commonly used earnings based valuation ratio is the price-earnings ratio; *earnings yield* vice versa, the ratio of earnings per share (EPS) to the ratio of price per share (P). Earnings yield is usually relatively low with growth stocks and relatively high with value stocks. It indicates the yield to the stock. The stock price can be divided into two components (Bodie et al. 2005, p. 623); the no-growth value of the firm added with the present value of growth opportunities. Consequently, we can see how growth opportunities are reflected in the earnings yield (trailing 12 months or expected):

$$\frac{EPS}{P_0} = r \times \left(\frac{EPS}{EPS + r \times PVGO} \right) \qquad \text{(Eq. 1)}$$

where

EPS = expected or trailing 12 months Earnings Per Share

r = expected rate of return (return that the investors require on average)

PVGO = discounted Present Value of Growth Opportunities

Equation 1 suggests that the higher the growth opportunities are, the lower the earnings yield is. When there are no growth opportunities (i.e. PVGO = 0), equation points out that P_0 equals EPS_1/r which is the no-growth value of the firm. Earnings yield can also be considered the inverse of stock's payback time (i.e. the duration needed for the stock to cover its today's price through its yearly net incomes when the yearly net incomes are a constant factor).

Low earnings yield might illustrate for instance high growth or dividend expectations. It may also be a sign of relatively low financial risk which conventionally shows relatively low cost of equity (i.e. investors' requirement for earnings). In addition, low earnings yield can sometimes stem from a temporary hiccough in the firm's earnings in an occasion where the stock price doesn't fall in the same extent as the firm's interim EPS. In this case the economic picture of the firm has to be reasonably strong to say the least meaning that investors believe that its earnings relatively fast revert to type. Again, very low earnings yield could identify for overvaluation of the stock.

Another approach for earnings yield originates from the constant-growth dividend discount model (DDM) popularised by Gordon and Myron. In the spirit of a growing perpetuity the earnings yield can be illustrated as follows:

$$\frac{EPS_1}{P_0} = \frac{EPS_1 \times (r\text{-}g)}{D_1} \qquad \text{(Eq. 2)}$$

where

D_1 = expected dividend for the next year

r = required rate of return

g = expected stable growth rate of dividends

Equation 2 indicates that the greater the expected dividend, the lower the earnings yield is. High expected stable growth rate of dividends also generates a low earnings yield. Additionally, strong expected earnings per share show a lofty EPS_1/P_0 ratio. This form of earnings yield, however, fails to take the plowback ratio into account (Bodie, Kane & Miller 2005, p. 624-625). Thus, if a company raises its plowback ratio, it has a greater proportion of its net income for investments which may boost the component g and therefore lower the earnings yield ratio.

If the constant-growth DDM formula ($P_0 = D_1/(r - g)$, where $g = b * ROE$) is now accompanied with the definition of the plowback ratio b and the fact that dividends equal the earnings that are not reinvested in the firm (i.e. $D_1 = EPS_1 (1 - b)$), the earnings yield can be formulated as follows:

$$\frac{EPS_1}{P_0} = \frac{r - ROE \times b}{1 - b} \qquad \text{(Eq. 3)}$$

where

ROE = Return On Equity

b = plowback ratio

As the ROE (Return On Equity) increases the earnings yield decreases (Bodie et. al 2005, p. 624) which implies that high-ROE investments provide the firm a growth opportunity appropriable by plowing back more earnings than before. As long as ROE surpasses r, the earnings yield ratio is tapering. Thus the firm is rewarded with a low earnings yield by the market. Across the board, earnings yield ratio is feasible for comparing companies in terms of EPS_1/P_0 within the boundaries of a specific industry.

Basu (1977) studied empirically the relationship between investment performance of equities and their E/P ratios with NYSE Industrial firms during a period April 1956-

March 1971. Portfolios were formulated yearly on the April 1 and the data was divided into new quintiles according to E/P figures calculated from earnings of previous fiscal year. During the period, high E/P portfolios tended to earn, on average, both higher absolute and higher risk-adjusted returns. General result was that the quintile of highest E/P ratios earned systematically highest returns and the quintile of lowest E/P ratios yielded lowest returns.

Following Basu's (1977) footsteps, Jaffe et al. (1989) re-examined the effect of E/P ratio in the US with a substantially longer sample period, 1956 - 1986. In contrast to Basu's research, Jaffe et al. (1989) employed also companies with negative earnings leaving these into an own portfolio. They added five more portfolios in a descending order of earnings yield. Then, the stocks in each E/P group were ranked on the March 31 market value. Next, each E/P group was divided into five subgroups according to size. Jaffe et al. (1989) document significant E/P and size effects when estimated across all months during the test period. In all size groups, however, the highest E/P portfolio produced highest return.

Dreman and Berry (1995) theorise that mispricing-correction hypothesis (MCH) explains the superior returns of strategies relying on E/P anomaly. They used positive and negative earnings surprises to test price reactions to new information. The highest and lowest E/P quintiles were employed to show the effect of surprises on best and worst stocks. According to the MCH, exceeding analysts' consensus should favour high E/P shares. According to the study conducted by Dreman and Berry (1995), the MCH produced following results:

1) Positive earnings surprises favour high E/P equities over low E/P securities in relation to market portfolio return.
2) Negative earnings surprises favour high E/P stocks over low E/P shares in relation to market portfolio return.
3) Positive surprises on high E/P companies and negative surprises on low E/P firms result in a much larger impact on absolute prices than negative surprises on high E/P companies and positive surprises on low E/P firms.
4) The net effect of surprises is significant only on the extreme quintiles and has minimum impact on the 60 percent of the stocks in the middle quintiles.

Bauman and Miller (1997) hypothesise that investors rely too much on past returns when formulating their expectations about the future. According to this adaptive expectations hypothesis investors tend to adapt their expectations with the most recent quarterly and yearly reports. Lakonishok et al. (1994) and Haugen (1995) argue that the value premium in average returns arises because the market undervalues distressed stocks (high E/P) and overvalues growth stocks (low E/P). To test the adaptive expectations hypothesis, samples of stocks were selected on March 31 for each year in the period 1980-1993. The data contained stocks quoted in NYSE, AMEX and NASDAQ. The adaptive expectations hypothesis gains support. First, high E/P shares evince superior investment performance. The difference in performance might be attributable to large negative earnings surprises for low E/P equities. There was found no significant relation between returns for low E/P securities and positive surprises. The market doesn't expect high E/P firms to increase earnings whereas low E/P companies already bear high earnings expectations. That is to say, even relatively high reported earnings don't lead to a rise in the stock price, and returns are to flounder.

Other broadly employed earnings based valuation ratio is *EV/EBIT* or *EV/EBITDA* ratio. It is calculated by proportioning the enterprise value (EV = equity + net debt) to its earnings before interest and taxes (EBIT) or operating income (EBITDA = Earnings Before Interest, Taxes, Depreciations and Amortizations). The enterprise value (EV) constitutes of the equity and the net debt. The net debt of the firm is, on one hand, compounded of liabilities with interest, convertible bonds and warrants extracted with liquid assets at interest. On the other hand, the enterprise value can be calculated as the sum of the market value and liabilities at interest deducted with the liquid assets. Both ways should lead to the very same result. By applying the market value of the firm, the value of business operations (i.e. enterprise value) is captured. Employing EV/EBIT(DA) ratio requires an assumption of an efficient stock market. EV/EBIT(DA) is widely considered as a more appropriate measure of valuation than the earnings yield. In contrast to the earnings yield it figures better on the financing structure. It is also more applicable for describing the operating profit.

Pätäri and Leivo (2009) show that ranking on EV/EBITDA results in the highest average value portfolio returns in the Finnish stock market during 1993-2008 with respect to earnings multiples. For the whole sample period, EV/EBITDA is more efficient selection criterion than P/E both in absolute return terms and in total risk adjusted framework. Not being said aloud but visible in the study, EV/EBITDA and P/E appear to differ from each other in terms of the success in terms market sentiment. During the bull market periods, EV/EBITDA value portfolio generates higher returns than the corresponding P/E portfolio. Instead, the P/E value portfolio outperforms the comparable EV/EBITDA portfolio during the bear markets.

2.1.2 Book Value Multiples

The best-known balance sheet based valuation multiple is book-to-market ratio visibly placed on the map by both Graham and Fama and French. Book-to-market measures the relationship between firm's book value and its market value. It translates as investors' return expectations. Analysts occasionally regard a stock with a high book-to-market as a safer investment seeing that the minimum value for B/P should be one (i.e. B/P > 1). Lakonishok et al. (1994) argue that even though firms with low financial risk can have low B/P ratio, more commonly they are overvalued stocks that have low book-to-market. Investors and analysts presumably see book value as the level below (at least not radically) which market price won't drop due to the possibility of liquidation or selling its assets for their book value. There is, however, companies that trade for less than their book value would suggest. Anyhow, high book-to-market is generally viewed as providing a margin of safety. Proponents of the book-to-market screen would argue that if all other fundamental attributes are same for two stocks, the one with the higher B/P ratio is safer.

High book-to-market (i.e. B/P > 1) generally indicates that investors' don't put their faith on the top management. Relatively low book-market-value ratio (i.e. B/P < 1) translates often as investors' robust confidence on the management meaning investors believe that the firm will generate return on equity (ROE) and have strong margins (EPS) in the future. Promising economic outlook affects positively firm's market value, but it doesn't have impact on its book value. Thus high book-to-market might justifiably project high growth expectations. High book-market-value ratio often indicates relatively strong profitability. B/P is a function of earnings yield (E/P) and return of equity and can be written:

$$\frac{B}{P_0} = \frac{EPS_1/P_0}{ROE} = \frac{Earnings\ Yield}{\text{Re}turn\ Of\ Equity} \qquad \text{(Eq. 4)}$$

According to equation 4, the higher the earnings-price ratio or the lower the return of equity, the higher the B/P ratio is. If high expected return of equity is incorporated in the stock price, earnings yield should be less than ROE. Subsequently book-market value ratio should be below 1.

Assets in the balance sheet are appreciated firm-specifically, which means that the balance sheet may not reflect the real value of assets. This complicates the appropriate interpretation of B/P ratio. Funds invested in innovations, patents and other immaterial property rights don't show in balance sheet which means that it's difficult to compare firms in terms of B/P ratio and if they do show, it's more than hard to say if they're properly appreciated. For instance, stocks might appear inexpensive in terms of their book-to-market. Book value may, nonetheless, include goodwill from acquisitions which shows as excessively high B/P. That is to say, the firm has gone in excess of the book value.

Since the two publications of Fama and French (1992 and 1993), the book-to-market has garnered support as a prominent determinant of expected returns. They analysed stocks that enter into NYSE, AMEX and NASDAQ in the period 1963-1990. As well as Fama and French, also Chan, Jegadeesh and Lakonishok (1995) and Davis (1994) provide robust evidence that book-to-market has significant explanatory power in terms of expected stock returns. Fama and French (1998) extended their study to comprise also Japan, Great Britain, France, Germany, Italy, Switzerland, Sweden, Australia, Hong Kong, and Singapore during the period 1975-1995. The value portfolio for high B/P ratio included firms whose B/P was among the highest 30 percent for a country. The difference between average returns on global portfolios of low and high B/P shares is 7.68 percent per year. Only Italy made an exception providing higher earnings on the low B/P portfolio than that of the high B/P portfolio.

This was the case also when using E/P as proxy for relative valuation. Since the results are international, they suggest that value premium for value stocks is real and not a country-specific phenomenon alone.

In a similar fashion, the findings of Capaul et al. (1993) support the existence of a value premium. Capaul et al. (1993) analyzed the returns obtained from portfolios of stocks with low B/P ratios and those obtained from portfolios of shares with high B/P ratios. Their research included equity markets of France, Germany, Great-Britain, Japan, Switzerland and the U.S. over the period from January 1981 through June 1992. Results suggest the existence of a significant value premium in each country. The returns on portfolios formed according to the value-growth factor differ far more from month to month than would be expected if the securities had been selected randomly. High B/P stocks outperformed low B/P stocks on average in each country during the period studied, both absolutely and after adjustment for risk. Cross-country correlations of monthly value-growth spreads were small, suggesting that forming portfolio by giving more weight to value stocks would have been more effective if it's done globally. It is, however, difficult to study portfolios formed on a global basis due to changing exchange rates and differences in taxation. Capaul et al. (1993) also found that in most cases high B/P stocks had lower beta values than low B/P stocks. In contrast to the fundamental message of CAPM, lower beta values cause them to outperform low B/P stocks.

Trecartin (2001) examined whether the B/P ratio systematically explains the cross-section of stock returns through time. He employed a dataset of stocks included in NYSE, AMEX and NASDAQ during a sample period of 1963-1997. He also tried to track down the possible abnormal returns unfolding in a short investment period attributable to high B/P oriented investment strategy. The results reveal that high B/P ratio is positively and significantly related to return in only 43% of the monthly regressions. The results also suggest that high B/P oriented value strategy doesn't outperform low B/P oriented growth strategy in a short investment period. There was, however, a significant positive correlation between high B/P ratio and stock returns in an investment period of 10 years. Trecartin's (2001) results also imply that while B/P ratio doesn't consistently correlate with expected returns, high B/P might not defend its place as a risk proxy.

2.1.3 Sales Multiples

Sales-to-price measures sales in relation to market value of the firm. The sales-to-price ratio has become a strong contender in valuating start-up firms that usually have no earnings (often negative) at their outset. The fact that earnings yield has little relevance in pricing start-up firms' market value has cleared the path for the wide use of the S/P ratio. Additionally, S/P values are more stable than those of earnings yield. Analogously to earnings yield, the sales-to-price ratio is most feasible within an industry. It can also be used in assessing firm's past performance. Firm's sales-to-price is occasionally employed in comparing to that of a market portfolio, for instance HDAX. Sales-to-price is calculated by dividing the revenue per share for the trailing 12 months or the expected sales per share by stock's current price:

$$\frac{SPS}{P_0} = \frac{Sales\ Per\ Share}{Stock\ \mathrm{Pr}ice} \qquad \text{(Eq. 5)}$$

Suzuki (1998) compared the performance of stocks screened with sales-to-price, book-to-market and earnings yield in the Tokyo Stock Exchange (TSE) over the period 1982-1996. He reported that high S/P portfolio beat high B/P portfolio and high E/P portfolio six times in the 14-year period. In the spirit of Suzuki (1998) equation 5 can be broken into two components: the asset turnover (sales/total assets) and operating leverage (total assets/market value):

$$\frac{S}{P_0} = \frac{Sales}{Total\ Assets} \times \frac{Total\ Assets}{Market\ Value} \qquad \text{(Eq. 6)}$$

The sales/price ratio will go up as a result of a rise in asset turnover or leverage. Asset turnover is somewhat sensitive to market conditions while leverage is substantially influenced by management's risk aversion. Firm that is heavier on debt has better chance to increase its sales set against to a firm that is more averse to leverage. The sales-to-price ratio seemed to be especially meaningful during phases of national economic recovery. By using the S/P ratio, investors have a wider selection of companies and industries to choose from compared to the B/P ratio and earnings yield. This implicates that managing portfolio risk is easier with the sales-to-price ratio than when using the other two.

In a similar fashion, Senchack and Martin (1987) found evidence that investing in stocks with high sales-to-price and high earnings yield produce returns that are well above the market portfolio. They gathered evidence from a sample of NYSE and AMEX stocks over the period 1976-1984. High E/P stocks exhibit both higher absolute return and total risk compared to high S/P stocks. The sales-to-price screen appeared to work also with companies that have negative earnings. However, stocks with high earnings yield seemed to dominate the stocks with high sales-to-price ratio on both absolute and risk-adjusted basis. Relative performance of high E/P stocks was reported to be more concise across different market conditions than that of high S/P stocks. Senchack and Martin found that E/P and S/P strategies are interrelated but there is a significant difference between the two: the small size effect is stronger with high S/P stocks than with that of high E/P stocks. In other words, high S/P companies are smaller and generate more sales per market value than high E/P companies.

2.1.4 Dividend Yield

Dividend yield is a financial ratio that shows how much a company pays out in dividends each year relative to its share price. In the absence of any capital gains, the dividend yield is the return on investment for a stock. Dividend yield is calculated as follows:

$$Dividend\ yield = \frac{Annual\ Dividends\ Per\ Share}{Stock\ Price} \qquad \text{(Eq. 7)}$$

Dividend yield is a way to measure how much cash flow is earned per each euro invested in an equity position - in other words, how much "bang for your buck" is get from dividends. Investors who require a minimum stream of cash flow from their investment portfolio can secure this cash flow by investing in stocks paying relatively high, stable dividend yields (http://www.investopedia.com/terms/d/dividendyield.asp, 18.11.2008).

Many studies have proved dividend yield to have predictive power in expected stock returns. For instance, Kothari and Shanken (1997) found reliable evidence that dividend yield and book-to-market track time-series variation in expected real one-year stock returns in the US stock market (stocks included in the Dow Jones Industrial Average) over the period 1926-91. Book-to-market was stronger in the whole test period, but dividend yield relation was, however, stronger in the sub-period 1941-1991. Additionally, Rozeff (1984) also found support that dividend yield has a significant positive relation with expected stock returns. His time-series analysis on US stocks demonstrates that the higher the dividend yield, the higher the stock returns. He employed the constant dividend growth model and the proposition that real long-term growth equals the real rate of interest in order to show that the dividend yield is directly related to the risk premium. A predictive test shows that dividend yields have superior ability to predict expected equity risk premiums.

Henne, Ostrowski and Reichling (2007) examined whether the dividend yield and the dividend stability influence the return, risk and performance of stocks and stock portfolios at the German equity market (HDAX companies). Their main findings imply that the performance generally improves with an increasing dividend yield. Anyhow, the result is somewhat based on total risk reduction than on a higher excess return because there was a negative relation between dividend yield and risk. The other way around, the influence of dividend yield on total risk diminished with an increasing degree of diversification. Henne et al. couldn't, however, find support that low variance of dividend yields as a proxy for high dividend stability would lead to a lower risk of a stock. Nevertheless, when viewing dividend stability as the mean-adjusted standard deviation of dividends and omitting zero-dividend stocks, there was a strong dependence between dividend stability and risk. Thus, by using this approach, dividend stability serves well as an indicator for total risk.

Gombola and Liu (1993) studied shifts in the relationship between stock returns and dividend yields on bull and bear markets. Dividend yield was found to correlate positively with return during bear markets but negatively correlated during bull markets for the entire sample period 1970 - 1984. Even though empirical research demonstrates a notable correlation between stock returns and dividend yields, results vary in terms of the direction. Keim (1985 and 1986) found that the dividend yield and return have non-linear and U-shaped relationship. Both stocks with high dividend yield and those with zero-dividend produce higher revisited returns than medium-yield stocks. Stocks with high dividend yield are found to perform better than zero-beta model would predict. Blume (1980) and Van Horne (1980) argue that stocks with high dividend yield exhibit particular risk characteristics specific to market conditions that make them more resistant to declines during bear markets. Results are consistent with the proposition that stocks with high dividend yield are less-risky during bear markets.

2.2 Beta, CAPM and Revisited Returns

Whether beta predicts future returns has been examined in the academic literature since at least 1970's most visibly studied by Fama and French. Researchers around the world have to date disagreed on whether the market beta unrelated to size and the value-growth characteristic is rewarded by the market. It is vital to distinguish between the historical market beta employed in the investment decision making and the market beta generated during the investment period examined. Market beta is calculated by dividing the covariance between stock return and market portfolio return by the variance of market portfolio return:

$$\beta = \frac{\text{cov}\ (r_i, r_m)}{\sigma_m^2} \qquad \text{(Eq. 8)}$$

where

$cov(r_i, r_m)$ = the covariance between the return of stock i and market portfolio return

σ_m^2 = the market variance

Beta is a measure of the sensitivity, or systematic (undiversifiable) risk, of a security or a portfolio in comparison to the market portfolio as a whole. There should be a positive correlation between undiversifiable market risk and expected returns because investors require higher return as a compensation for taking higher risk.

According to the Capital Asset Pricing Model, the relation between market risk and expected return can be written as follows:

$$R_i = R_f + \beta_i \times (R_m - R_f) \qquad \text{(Eq. 9)}$$

where
R_i = the return of portfolio *i*
R_f = the risk-free rate of return
R_m = the stock market return
β_i = the beta coefficient of portfolio *i*

Fama and French (1992), among other researchers, recognize a value premium in U.S. stock returns for a period extending from 1963 to 2004 meaning that the stocks with a high book-to-market ratio generate higher returns than the stocks with lower B/M ratios. Anyhow, Fama and French (1993) detect that the Capital Asset Pricing Model (CAPM) popularised by Sharpe and Lintner leaves the post-1963 value premium unexplained. Correspondingly, Ang and Chen (2005) found that the CAPM doesn't provide much of support for the value premium even when allowing for time-varying betas.

A wide array of recent empirical studies has been incapable of identifying the relation between the market beta and returns predicted by the CAPM. The conventional tests of the CAPM in the spirit of Fama and McBeth (1973) carry a joint hypothesis that there is a relationship between beta and returns revisited and that the market risk premium is positive. Fama and French (1992) reported that there is no interdependence between market beta and return when firm size and book-to-market are the explanatory variables. The test was replicated in the German stock market by Schlag and Wohlshieß (1997) with a same kind of result. One possible explanation for the results is that realised market risk premiums are often negative even if the expected risk premium is positive.

The conditional test popularised by Pettengil et al. (1995) allows to independently test if there is a relation between beta and realised returns. Their empirical results provide support for the conclusion that there is a positive and statistically significant relationship between beta and returns revisited. Elsas et al. (2003) provide support for the finding of Pettengil et al. (1997) that there is an evident relation between beta and experienced returns. Their dataset is a consistent sample of monthly stock returns on the German equity market for the period 1965-1995. Elsas et al. (2003 postulate that earlier studies have failed to discover connection because the traditional tests neglect the conditional nature of the relation between beta and returns and the fact that the average market risk premium in the test period has been so close to zero.

3 DATA AND METHODOLOGY

This section gives an overview of the sample data used for finding most efficient valuation criteria to screen genuinely undervalued stocks. All strategies are based on a weekly return time series extending from 1.4.2000 to 1.4.2008. First, details on composing the valuation portfolios constituting of HDAX stocks are presented. This is followed by a discussion on the characteristics of the relative performance measures employed in the study. Next, the statistical tests employed to calculate the significance levels of the quantified value premiums are introduced. Finally, the characteristics unique to the selected sample are being described.

3.1 Portfolio Formation

The portfolios are constructed of German equities quoted in the HDAX Index during 2000-2008. The sample data comprises 45 of the 110 HDAX companies traded on the Frankfurt Stock Exchange. The HDAX index is composed of three indices: DAX (Deutscher Aktien IndeX 30), MDAX (Mid-Cap DAX) and TecDAX. Due to the fact that the financial companies' balance sheets are treated in a deviating fashion compared to non-financial companies, banks and insurance companies are left out of the study. Additionally, firms having a fiscal year starting from other month than January are omitted from the observation. Both weekly stock total return data and HDAX total return index data are retrieved from Thomson DataStream database.

Correspondingly, the comparable 1-week Euribor data, the reference data for risk-free rate of return employed in the study, is also gathered from the DataStream database.

The stocks are ranked according to their relative valuation based on an individual or a composite measure at the date of portfolio (re-)formation on the first of April of each year. The stocks are then divided into tertile portfolios based on the selected criterion. All the ratios are based on the most recent information available on the firms' financial situation using financial statements of the previous year. Even though a value investor would be more into a longer investment period, this study aims to contribute more to the portfolio managerial aspect of shorter term value investing. Against this background, a 1-year investment period serves better.

3.2 Performance Evaluation

Tertile portfolio performance is analysed by using the Sharpe Ratio, the Sortino Ratio and the Jensen Alpha. The Sharpe Ratio is calculated by subtracting the risk-free rate (now 1-week Euribor) from the rate of return for a portfolio and dividing the result by the standard deviation of the portfolio returns:

$$Sharpe\ Ratio = \frac{R_i - R_f}{\sigma_i} \qquad \text{(Eq. 9)}$$

where

R_i = the average weekly return of a portfolio i

R_f = the average weekly risk free rate of return (i.e. 1-week Euribor)

σ_i = the volatility of the weekly excess return of a portfolio i

The Sharpe ratio or the Sharpe Index measures risk-adjusted performance of a risky asset or a trading strategy. It indicates whether a portfolio's returns are due to a superior investment strategy or an outcome of excess risk. The greater the Sharpe Ratio, the more superior its risk-adjusted performance observed ex-post has been. The Sharpe Ratio has, however, been widely viewed by academic researchers as too strict measure of risk-adjusted measure because it penalises of both upside and downward variation equally.

The Sharpe ratio has also been criticised of oversimplifying the concept of risk. If the return distribution is left-skewed, standard deviation penalises from the upside return potential that would be positive from investor's point of view. Subsequently, the adjusted Sharpe ratio is employed to account for the skewness and kurtosis characteristics of return distributions. Applying the framework of Favre and Galeano (2002), the adjusted *Z*-value (i.e. Z_{CF}) is first determined. Z_{CF} is calculated by employing the Cornish-Fisher expansion:

$$Z_{CF} = Z_C + \frac{1}{6}\left(Z_C^{\,2} - 1\right)S + \frac{1}{24}\left(Z_C^{\,3} - 3Z_C\right)K - \frac{1}{36}\left(2Z_C^{\,3} - 5Z_C\right)S^2 \qquad \text{(Eq. 10)}$$

where

Z_C = critical value for the probability based on normal distribution

S = skewness of the return distribution

K = kurtosis of the return distribution

Sample skewness and kurtosis are determined, respectively, as follows:

$$S = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{r_t - r}{\sigma}\right)^3 \qquad \text{(Eq. 11)}$$

$$K = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{r_t - \bar{r}}{\sigma}\right)^4 - 3 \qquad \text{(Eq. 12)}$$

Next, the skewness- and kurtosis-adjusted deviation (SKAD) is calculated by multiplying the standard deviation by the Z_{CF}/Z_c relative. 0,9975 confidence level is employed to achieve an approximate Z_{CF}/Z_c level of 2,00 as suggested by Favre and Galeano (2002). Finally, SKAD is substituted for standard deviation and the adjusted Sharpe Ratio can be written as follows:

$$adjusted\ Sharpe\ Ratio = \frac{R_i - R_f}{SKAD_i^{(ER/|ER|)}} \qquad \text{(Eq. 13)}$$

where

$SKAD_i$ = skewness and kurtosis adjusted deviation of the weekly excess returns of a portfolio *i*

For covering the evident shortcoming of the Sharpe Ratio in terms of the direction of the risk, the Sortino Ratio is employed to analyse the downside risk. Markowitz's mean-semivariance approach (1959) is applied to isolate negative deviations from a selected target level (i.e., target semi-standard deviation, TSSD=σ_{downside}). Risk-free rate of return is selected as the target return to ensure the comparability between the Sharpe Ratio and the resulting performance metrics. The Sortino Ratio is calculated as follows:

$$Sortino\ Ratio = \frac{R_i - R_f}{\sigma_{downside}} \quad \text{(Eq. 14)}$$

where

$\sigma_{downside}$ = standard deviation of negative weekly excess returns of portfolio *i*

$$\sigma_{downside} = \sqrt{\frac{\sum_{i=1}^{n}\left(R_i - R_f\right)^2}{n}} \quad \text{for all } R_i < R_f$$

where

n = the number of outcomes in the whole distribution

Jensen's Alpha measures the excess return (ex-post) on a portfolio over its theoretical expected return predicted by the traditional CAPM given the portfolio's weighted beta and the average market risk premium. A positive value of Jensen's Alpha translates into superior performance of the portfolio. Correspondingly, negative Jensen's Measure is indicative of underperformance in terms of expected return of the portfolio modelled in by the traditional CAPM. Jensen's Alpha is calculated as follows:

$$\alpha_i = R_i - R_f - \beta_i(R_m - R_f) \quad \text{(Eq. 14)}$$

where

R_i = the return of portfolio *i*

α_i = the Jensen alpha of portfolio *i*

β_i = the beta coefficient of a portfolio *i*

R_m = the stock market return

3.3 Statistical Tests

In the spirit of Pätäri et al. (2008), the statistical significances of differences between compared pairs of traditional unadjusted Sharpes are indicated by the Jobson-Korkie test. Typographical error in the original article (Jobson and Korkie, 1981) is considered and thus the corrective procedure by Memmel (2003) is applied:

$$z_{JK} = \frac{Sh_i - Sh_j}{\sqrt{V}} \qquad \text{(Eq. 15)}$$

where

V = asymptotic variance of the Sharpe Ratio difference:

$$V = \frac{1}{n}\left[2 - 2\rho_{ij} + \frac{1}{2}\left(Sh_i^2 + Sh_j^2 - 2Sh_i Sh_j \rho_{ij}^2\right)\right] \qquad \text{(Eq. 16)}$$

where

Sh_p = the Sharpe Ratio of a portfolio *p*

ρ_{ij} = correlation between returns of portfolios *i* and *j*

n = number of observations

Similarly to Pätäri and Leivo (2009), the statistical significances of differences between comparable pairs of the adjusted Sharpe Ratios are indicated by P-values of the Ledoit-Wolf test which is based on the circular block bootstrap method. The test procedure is not described in detail due to its high complexity.

In addition, statistical significance of differences between portfolio alphas (i.e. alpha spread) is tested by applying the Welch's *t*-test:

$$t = \frac{\alpha_i - \alpha_j}{\sqrt{SE_{\alpha i}^2 + SE_{\alpha j}^2}} \qquad \text{(Eq. 17)}$$

where

α_p = the Jensen Alpha of a portfolio p

SE_p = the standard error of a portfolio p

The degrees of freedom for the t-statistic are calculated as follows:

$$v = \frac{\left(SE_{\alpha i}^2 + SE_{\alpha j}^2\right)^2}{\frac{SE_{\alpha i}^4}{v_i} + \frac{SE_{\alpha j}^4}{v_j}} \qquad \text{(Eq. 18)}$$

where

v_i, v_j = the degrees of freedom defined on the basis of number of time series returns in samples i and j $(v = n - 1)$

3.4 Sample Description

The sample period is coloured by a negative average market risk premium of -1,61 % which provides an interesting starting point for this study. The descriptive statistics of the sample data for the extreme tertile portfolios is exhibited in Table 1 where T1, T2 and T3 are value, neutral and growth tertile portfolio, respectively. Since the extreme values of sample characteristics are included in the study and the sample size is rather small, the most informative characteristic illustrated in Table 1 is the median. It indicates the characteristic valuation of the extreme tertile portfolios as well as that of the whole sample during the period examined (i.e. 2000-2008). Yearly descriptive statistics (not reported) would reveal the time-varying nature of the median value indicating the relative valuation of each valuation class at the time of portfolio (re-)formation. The descriptive statistics for the portfolios based on individual criteria are presented in the Panel A. The corresponding statistics for the portfolios based on the composite valuation measures are exhibited in the Panel B.

For calculating the different variants of EV/EBITDA, P/E, P/B and P/S (inverses of these to eliminate the nonlinearity around zero denominators), the absolute values are median adjusted to balance the influence of both valuation multiples in the composite value measure. Comparable median standardised figures are multiplied by each other. In the E/P B/P composite value measure, the unadjusted E/P and B/P values are multiplied as it is the original purpose of the Graham measure. Correspondingly, market betas are also median standardised to ensure the balanced effect of beta and the combined valuation measures. The relatively small sample size and the fact that the stocks acquired at the (re-) formation date are represented with equal weights while they are market value weighted in the HDAX index also speak for the benefit of median standardisation.

Table 1. Descriptive Statistics for Portfolio Formation (2000-2008).

Panel A					Panel B				
	minimum	mean	median	maximum		minimum	mean	median	maximum
EBITDA/EV					**2A (E/P B/P)**				
ALL	-6,1691	0,1663	0,1535	1,6752	ALL	-3,9283	0,0171	0,0207	0,6925
T1	0,1433	0,3585	0,2758	1,6752	T1	0,0219	0,0811	0,0571	0,6925
T3	-6,1691	-0,0216	0,0787	0,1555	T3	-3,9283	-0,0548	0,0048	0,0267
E/P					**2B (EBITDA/EV B/P)**				
ALL	-2,1695	0,0346	0,0531	0,5084	ALL	-59,7152	1,3675	0,9585	27,0861
T1	0,0590	0,1003	0,0859	0,5084	T1	1,2830	3,3934	2,5518	27,0861
T3	-2,1695	-0,0512	0,0214	0,0635	T3	-59,7152	-0,3274	0,2589	0,6755
B/P					**2C (EBITDA/EV S/P)**				
ALL	0,0103	0,5324	0,4607	2,2004	ALL	-15,9215	0,3839	0,1589	8,6663
T1	0,4187	0,8803	0,7589	2,2004	T1	0,1561	1,0668	0,5667	8,6663
T3	0,0103	0,2317	0,2162	0,5863	T3	-15,9215	-0,1214	0,0939	0,2061
S/P					**3A (EBITDA/EV B/P S/P)**				
ALL	0,0073	2,2103	1,3811	16,5651	ALL	-286,2221	2,8468	1,0467	86,7038
T1	1,2343	4,5496	3,9612	16,5651	T1	1,5446	9,7084	5,1693	86,7038
T3	0,0073	0,5145	0,4983	1,4107	T3	-286,2221	-2,3795	0,0995	0,5119
D/P					**3B (β^{-1} E/P B/P)**				
ALL	0,0000	0,0222	0,0187	0,7158	ALL	-4,8476	0,0461	0,0229	4,7821
T1	0,0183	0,0416	0,0317	0,7158	T1	0,0269	0,1748	0,0728	4,7821
T3	0,0000	0,0050	0,0025	0,0197	T3	-4,8476	-0,0657	0,0028	0,0309
β^{-1}					**3C (β EBITDA/EV B/P)**				
ALL	-0,3073	0,6808	0,7548	2,7673	ALL	-26,8243	1,4457	0,8609	26,2653
T1	0,4383	1,2487	1,2093	2,7673	T1	1,1166	3,6630	2,7574	26,2653
T3	-0,3073	0,3727	0,3915	0,8559	T3	-26,8243	-0,2590	0,1918	0,7374

The table exhibits minimum, mean, median, and maximum values for both each individual valuation multiple (Panel A) and each composite measure (Panel B) employed as a basis of portfolio formation for the full sample period (April 2000 - April 2008). The sample characteristics of individual multiples are given in Panel A, whereas Panel B provides the corresponding statistics for composite valuation measures. The comparable figures for value portfolio (T1) and growth portfolio (T3) are also reported separately.

4 PERFORMANCE COMPARISON

In this section, light is shed on the relative performance of the portfolios (in respect to all performance metrics employed in the study) formed both on the basis of individual valuation ratios and composite valuation measures. First, the relative performance of the tertile portfolios is discussed excluding the ones with beta enhancement. This is followed by an analysis on how the market beta affects the best individual selection criterion. Thirdly, the effect of beta enhancement to two composite value measures as a screening criterion is studied during four years of negative market risk premium as well as during four years of that with a positive premium. Finally, all the extreme tertile portfolios are compared to each other and to the market portfolio in the Markowitzian risk-return framework.

4.1 Portfolios Based on Individual Valuation Ratios

4.1.1 EV-to-EBITDA Sorting

During the sample period of 2000-2008, EV/EBITDA yields the greatest adjusted Sharpe Ratio for the value portfolio based on the individual portfolio selection criteria. The average annual return of T1 is the highest of the EBITDA/EV tertile portfolios exhibiting a distinctive margin to the second best which is T2 providing support of existing value premium in the German equity market. Consistently, T3 represents the worst average annual return. During the observation period, T2 produced only 75 % of the return of T1 and T3 39 % of the return of T2. This substantial difference is not attributable to higher risk since T1 carries both lower volatility and lower beta compared to corresponding risk metrics of T2 and T3. According to the Jobson-Korkie test, however, only T1 outperforms the market in somewhat statistically significantly, at a risk level of 10 %. The Jensen Alphas of T1 and T2 differ statistically very significantly from zero, even at a risk level of 0,1 % (See Table 2).

The superior performance of two best tertile portfolios during the sample period cannot be explained by higher downside volatility, either. Quite the opposite, namely, downside volatility of T2 is over 15 % higher than that of T1 and the downside risk of T3 is almost twice as high compared to that of T2. In terms of Sortino Ratio, T1 has outperformed T2 which covers only two thirds of the related performance of T1. Even more drastically, T3 exhibits only 18 % of the Sortino performance of T2 (Table 2). In addition, the Jensen Alpha difference (i.e. alpha spread) is statistically significant, at a risk level of 5 % (See Appendix 2, Panel A).

The results from the eight 1-year investment periods are highly consistent with those of the whole sample period; in six investment periods out of the total eight, the average return of the value portfolio is higher. Furthermore, its volatility is over one fifth lower than that of the value portfolio. Investment periods 2005-2006 and 2007-2008 represent the only periods that T3 outperformed T1. During the sample period, T1 yielded more than 410 % whereas T3 provided a total return of 30 % at the same time! In terms of risk-adjusted performance, measured by adjusted Sharpe Ratio, the difference is even more substantial; in seven years out of eight T1 outperforms T3 but only half of these are statistically significant, at a maximum risk level of 10 %. Additionally, the market betas of the value portfolio are clearly lower than those of the growth portfolio in six periods out of eight (Appendix 1, Panel A). It is also interesting to notice that the Sharpe Ratio and the Jensen Alpha disagree on the ranking in two years out of eight (See Appendix 2, Panel A).

4.1.2 Price-to-Earnings Screening

The findings of relative performance of P/E tertile portfolios are very much alike to those of EV/EBITDA. EBITDA/EV is a more efficient screening criterion than P/E during the sample period; the average annual return of Q1 (EBITDA/EV) is higher than that of T1 (P/E) but the volatility of the first is slightly higher than that of the latter. For the T3 portfolios, however, this doesn’t hold. T3 (P/E) carries a slightly higher volatility than T3 (EV/EBITDA) (See Table 2). The adjusted Sharpe Ratios suggest that the performance difference between T1 and T3 portfolios is statistically only slightly more significant when using EV/EBITDA as a ranking criterion compared to a use of P/E. Neither of these differences is, however, significant in statistical sense (Appendix 2, Panel A). In absolute figures, T1 (EV/EBITDA) has a higher adjusted Sharpe than T1 (P/E) but T3 (P/E) outperforms T3 (EV/EBITDA). Market betas for the first two P/E tertiles are lower than those of EBITDA/EV tertiles. For the first EV/EBITDA tertile, the Jensen Alpha is higher than that for the first E/P tertile. For the both selection criteria, the first two tertiles yield statistically extremely significant alphas, even at a risk level of 0,1 % (Table 2).

The results from the single investment periods deviate to some extent from those of EV/EBITDA and resemble those achieved by Pätäri and Leivo (2009) with the decomposition to bull and bear markets in the Finnish equity market. T1 (P/E) is superior to T1 (EV/EBITDA) in three years (2000 - 2003 and 2007 - 2008) out of four when the market risk premium is negative but T1 (EV/EBITDA) is superior to T1 (P/E) in all four years (2003 - 2007) when the market risk premium is positive (Appendix 1, Panel A). Consistently, the market betas for T1 (E/P) are lower than for T1 (EV/EBITDA) during the three out four investment periods when it outperforms T1 (EV/EBITDA). Unsurprisingly, the market betas for T1 (EV/EBITDA) are higher than those for T1 (P/E) for all the investment periods when the market risk premium is positive (Appendix 1, Panel C). One explanation could be that during bearish years investors are anticipating dividend yield to compensate modest capital gains and thus earnings are more closely monitored. During the bull years, investors ought to have more interest in profitability and therefore more detailed glance is taken at the EBIT and EBITDA margins.

P/E is the only sorting criterion that produces results in which the volatility for T1 is lower than for T3 for every investment period whereas volatility for T1 (EV/EBITDA) is higher than for T3 (EV/EBITDA) in three years out of eight. Using P/E as a selection criterion, T1 outperformed T3 in seven years out of eight against the six out of eight of EV/EBITDA in terms of average returns. 2005-2006 is the only period when T3 (P/E) outperformed T1 (P/E) (See Appendix 1, Panel A). In contrast to the Jobson-Korkie tests for EV/EBITDA portfolios, P/E portfolio performance comparison produces only two statistically significant (at 10 % level) differences for the adjusted Sharpe Ratios. All three significant differences of EV/EBITDA tertile portfolios and both of those of corresponding P/E portfolios turn into favour of the value portfolio. Only in the other case of the two, the alpha spread is statistically significant (at 10 % level, Appendix 2, Panel A). Considering risk, the volatilities for the whole sample period except for one year are lower for T1 (P/E) than for T3 (P/E). Market betas of the tertile portfolios follow exactly the same pattern during the sample period (Appendix 1, Panel C).

Table 2. Average Return, Risk and Performance Metrics of Tertile Portfolios (2000-2008).

Variable	Annual Average Return	Annual Average Volatility	Sharpe Ratio	SKAD	Adj. Sharpe Ratio	T_i vs. Market (sign.)	TSSD	Sortino Ratio	Jensen Alpha	(sign.)	Beta
EBITDA/EV											
T1	22,02 %	18,16 %	0,1444	20,49 %	0,1279	1,6544 (0,098)	11,43 %	0,2210	19,99 %	(0,000)	0,6808
T2	16,67 %	19,08 %	0,0984	20,89 %	0,0899	1,3370 (0,181)	13,53 %	0,1456	14,74 %	(0,000)	0,7443
T3	6,51 %	25,35 %	0,0185	26,42 %	0,0177	0,3225 (0,747)	25,12 %	0,0267	4,89 %	(0,353)	0,9368
E/P											
T1	21,27 %	17,46 %	0,1441	20,05 %	0,1255	1,6732 (0,094)	10,40 %	0,2225	19,21 %	(0,000)	0,6626
T2	17,16 %	18,84 %	0,1033	21,93 %	0,0887	1,2742 (0,203)	13,38 %	0,1517	15,20 %	(0,000)	0,7257
T3	6,72 %	26,21 %	0,0190	26,85 %	0,0185	0,3417 (0,733)	26,96 %	0,0273	5,17 %	(0,330)	0,9817
B/P											
T1	22,14 %	19,08 %	0,1382	21,03 %	0,1254	1,5701 (0,116)	12,48 %	0,2129	20,15 %	(0,000)	0,7045
T2	17,28 %	20,99 %	0,0935	23,56 %	0,0833	1,1706 (0,242)	16,25 %	0,0487	15,44 %	(0,000)	0,7999
T3	5,24 %	23,33 %	0,0125	24,74 %	0,0118	0,2573 (0,797)	22,44 %	0,0062	3,51 %	(0,462)	0,8696
S/P											
T1	19,50 %	19,25 %	0,1180	22,12 %	0,1026	1,2482 (0,212)	13,89 %	0,1737	17,49 %	(0,000)	0,6937
T2	21,28 %	20,33 %	0,1238	22,54 %	0,1116	1,6443 (0,100)	13,96 %	0,1921	19,43 %	(0,000)	0,7967
T3	4,19 %	24,31 %	0,0061	25,00 %	0,0059	0,1778 (0,859)	23,83 %	0,0086	2,49 %	(0,630)	0,8864
D/P											
T1	15,96 %	18,53 %	0,0961	23,20 %	0,0767	1,1471 (0,251)	13,36 %	0,1389	13,99 %	(0,000)	0,7196
T2	17,74 %	17,88 %	0,1135	19,21 %	0,1055	1,5413 (0,123)	11,64 %	0,1694	15,74 %	(0,000)	0,6970
T3	7,95 %	26,54 %	0,0252	26,85 %	0,0249	0,3935 (0,694)	26,60 %	0,0370	6,38 %	(0,263)	0,9648
β^{-1}											
T1	21,40 %	15,87 %	0,1598	19,78 %	0,1281	1,4013 (0,161)	8,88 %	0,2425	19,15 %	(0,000)	0,5432
T2	15,79 %	18,82 %	0,0933	21,18 %	0,0829	1,1339 (0,257)	13,44 %	0,1366	13,81 %	(0,001)	0,7090
T3	8,41 %	28,66 %	0,0256	28,62 %	0,0256	0,4748 (0,635)	31,38 %	0,0373	7,08 %	(0,181)	1,1162
2A (E/P B/P)											
T1	22,02 %	17,90 %	0,1463	20,94 %	0,1251	1,5861 (0,113)	11,07 %	0,2229	19,96 %	(0,000)	*0,6645*
T2	16,90 %	19,22 %	0,0994	20,76 %	0,0920	1,3815 (0,167)	13,24 %	0,1487	14,99 %	(0,000)	0,7525
T3	6,30 %	25,87 %	0,0170	26,92 %	0,0163	0,3045 (0,761)	26,77 %	0,0241	4,71 %	(0,383)	*0,9541*
2B (EBITDA/EV B/P)											
T1	22,14 %	18,71 %	0,1409	20,70 %	0,1274	1,6149 (0,106)	11,76 %	0,2177	20,13 %	(0,000)	0,6950
T2	18,20 %	18,98 %	0,1101	20,71 %	0,1009	1,3089 (0,191)	13,13 %	0,1634	16,25 %	(0,000)	0,7297
T3	5,05 %	25,54 %	0,0104	26,60 %	0,0100	0,2331 (0,816)	26,10 %	0,0148	3,45 %	(0,513)	0,9468
2C (EBITDA/EV S/P)											
T1	19,64 %	18,37 %	0,1247	21,03 %	0,1089	1,3611 (0,173)	12,30 %	0,1849	17,60 %	(0,000)	0,6730
T2	19,28 %	20,07 %	0,1116	22,64 %	0,0989	1,2484 (0,212)	14,49 %	0,1666	17,42 %	(0,000)	0,7902
T3	6,33 %	24,99 %	0,0177	25,18 %	0,0176	0,3158 (0,752)	24,28 %	0,0255	4,67 %	(0,375)	0,9167
3A (EBITDA/EV B/P S/P)											
T1	20,43 %	18,25 %	0,1315	20,44 %	0,1174	1,4250 (0,154)	11,57 %	0,1998	18,37 %	(0,000)	0,6612
T2	17,54 %	20,38 %	0,0981	22,76 %	0,0878	1,0975 (0,272)	15,44 %	0,1441	15,72 %	(0,000)	0,8090
T3	7,07 %	24,84 %	0,0220	25,26 %	0,0216	0,3569 (0,721)	23,91 %	0,0317	5,40 %	(0,310)	0,9041
3B (β^{-1} E/P B/P)											
T1	24,69 %	17,16 %	0,1743	20,41 %	0,1465	1,7756 (0,076)	9,93 %	0,2687	22,57 %	(0,000)	0,6274
T2	10,73 %	19,29 %	0,0546	20,92 %	0,0504	0,6908 (0,490)	14,28 %	0,0790	8,82 %	(0,012)	0,7601
T3	9,33 %	26,37 %	0,0326	26,65 %	0,0323	0,5056 (0,613)	26,50 %	0,0473	7,79 %	(0,149)	0,9849
3C (β B/P EBITDA/EV)											
T1	15,79 %	21,22 %	0,0828	23,01 %	0,0763	1,2083 (0,227)	16,68 %	0,1218	14,01 %	(0,000)	0,8390
T2	18,90 %	20,65 %	0,1059	22,51 %	0,0972	1,4965 (0,135)	15,20 %	0,1589	16,99 %	(0,000)	0,7564
T3	8,45 %	23,24 %	0,0318	24,46 %	0,0302	0,4458 (0,656)	21,39 %	0,0452	6,68 %	(0,189)	0,8377
R_m	1,52 %	22,87 %	-0,0102				24,65 %	-0,0140			
r_f	3,13 %	0,93 %									

Average annual return, three risk measures (i.e., volatility, SKAD, TSSD, and beta) and corresponding performance metrics (the Sharpe Ratio, the adjusted Sharpe Ratio, the Sortino Ratio, and the Jensen Alpha) are presented for every tertile portfolio formed on the basis of each portfolio formation criterion. The column that includes the adjusted Sharpe Ratios is followed by the column which indicates performance differences between each tertile portfolio and market portfolio (indicated by the Ledoit-Wolf test statistics). The corresponding significance levels are presented in the parentheses.

4.1.3 Price-to-Book Ranking

The rank order of P/B screen is fully consistent with that of the earnings multiples in all the observed aspects of portfolio performance. On the basis of an individual valuation multiple, P/B ranking criterion produces the highest average annual return within the T1 comparison. In the total risk framework, however, T1 (EV/EBITDA) and with a narrow margin also T1 (P/E) outperform T1 (P/B). T3 (P/B) portfolio underperforms strongest when compared to the tertile portfolios formed on basis of earnings multiples. The volatility dispersion between the P/B tertile portfolios is the most even among all the valuation measures in the sample (excluding those with beta enhancement) (See Table 2).

In the total risk-adjusted framework, B/P results follow the same rule with the earnings multiples. When downside risk is considered, however, T2 (P/B) is distinctly inferior to corresponding portfolios of both earnings multiples. In a similar fashion, T3 (P/B) underperforms the comparable portfolios of EV/EBITDA and P/E. Interestingly, even though the relative performance (based on both total risk and downside risk) of T1 (P/B) and T2 (P/B) are somewhat inferior to those portfolios formed on the basis of earnings multiples the Jensen Alphas of the two best P/B tertiles are excessive to those of the comparable portfolios of EV/EBITDA and P/E (Table 2).

The sub-period comparison of differences in the average returns between extreme P/B portfolios conveys interesting information. During the 1-year investment periods when the market risk premium is negative, the results are parallel to those based on P/E ranking. In contrast, the findings are closer to those based on EV/EBITDA sorting when the market risk premium is positive. In terms of total risk-adjusted performance, the P/B value portfolio outperforms the P/B growth portfolio in six out of eight investment periods and according to the Jobson-Korkie test, also significantly in three of the six cases (at a risk level of 10 %). At the same risk level, T1 outperformed significantly the comparable portfolio of T3 twice based on the alpha spread test (Appendix 1, Panel A).

4.1.4 Price-to-Sales Classification

The findings for P/S tertile portfolios are somewhat surprising. The P/S value portfolio underperforms compared to the P/S middle portfolio during the sample period in respect of all performance metrics employed (i.e. average returns, the adjusted Sharpe Ratio, and the Jensen Alpha). The top-two portfolios outperformed T3 statistically highly significantly but neither of them was superior to market performance in statistical sense (at a risk level of 10 %). The Jensen Alphas of the top-two portfolios were, nevertheless, very significant (Table 2).

Observing the individual investment periods reveals the volatility of the T1 portfolio is higher than that of the T3 portfolio more often using P/S sorting criterion than using any other classification criterion. In fact, the volatility of the P/S value portfolio is higher than that of the P/S growth portfolio in half of the cases (Appendix 1, Panel A). The market betas for T1 and T3 follow the same pattern for the single investment periods (Appendix 1, Panel C). Supporting the findings of Suzuki (1998), P/S seems to be at its best during a national recovery (i

The average returns for the P/S value portfolio are higher than those for the comparable growth portfolio in every 1-year investment period and the T3 (P/S) average returns are the lowest among all the growth portfolios during the whole sample period. In a T3 comparison, P/S growth portfolio performed worst with respect to all performance metrics used (i.e. the average returns, the adjusted Sharpe Ratio, the Sortino Ratio, and the Jensen Alpha). This holds true also for the individual investment periods except for 2000-2001 when T3 (P/S) outperformed other growth portfolios (See Appendix 1, Panels A and C). The results suggest that P/S is feasible as the final check screening tool for a value investor to make sure that stocks included in the P/S growth portfolio are not acquired.

4.1.5 Dividend Yield Grouping

Perfectly in contrast to the results of Keim (1985), the neutral D/P portfolio outperforms the extreme D/P tertile portfolios in terms of all performance metrics analysed (i.e. the average returns, the adjusted Sharpe Ratio, the Sortino Ratio, and the Jensen Alpha). In a similar fashion, the top-two D/P portfolios outperform both the market portfolio and the D/P growth portfolio. Noteworthy is that the average returns, the adjusted Sharpe Ratio and the Jensen Alpha of T3 (D/P) are higher than those of growth portfolios based on any other individual valuation ratio. In contrast, the Sortino Ratio of the D/P growth portfolio is the highest within the same comparison group in the whole period (Table 2).

The risk analysis reveals that the D/P value portfolio has the highest volatility dispersion among all the value portfolios, formed on the basis of an individual rank, in the whole sample period but it yields almost 100 basis points less than the second worst value portfolio formed on the basis of P/S! Interestingly, in the last investment period (i.e. 2007-2008) the D/P value portfolio, however, beats all other value portfolios in respect of every performance metrics employed (i.e. the average returns, the adjusted Sharpe Ratio, the Sortino Ratio, and the Jensen Alpha) (See Appendix 1, Panels A and C). It would be interesting to get new data to see if this trend has continued and whether the relative weight of dividend yield has changed in the wake of the ongoing financial crisis.

4.1.6 Sorting on Beta

Results produced by sorting on historical market beta show something unforeseen. Namely, the low beta portfolio T1 beats all corresponding T1 value portfolios on an individual valuation measure basis during 2000 - 2008 even though the average market risk premium is only mildly negative (i.e. -1,61 %). In this comparison, T1 (β) carries both the greatest adjusted Sharpe Ratio and the greatest Sortino Ratio translating into superior relative performance over the value portfolios both in terms of total-risk adjusted average return and downside risk adjusted average return

(Table 2). Henceforth, this phenomenon is referred as *the beta anomaly*. To my knowledge, this is the first study to indentify the anomaly in question in German equity market.

Table 3. Performance Comparison of Value (T1) and Growth (T3) Portfolios (2000-2008).

	Sharpe Ratio Difference		Adjusted Sharpe Ratio Difference		Alpha Spread	
	T1 vs. T3	(sign.)	T1 vs. T3	(sign.)	T1 vs. T3	(sign.)
EBITDA/EV	1,1942	(0,232)	1,0338	(0,301)	15,10 %	(0,020)
E/P	1,1567	(0,247)	1,0107	(0,312)	14,04 %	(0,028)
B/P	1,3112	(0,190)	1,0430	(0,297)	16,64 %	(0,008)
S/P	1,0662	(0,286)	0,8220	(0,411)	14,99 %	(0,026)
D/P	0,6670	(0,505)	0,4861	(0,627)	7,61 %	(0,251)
β^{-1}	1,0464	(0,295)	0,9031	(0,366)	12,07 %	(0,062)
2A (E/P B/P)	1,1844	(0,236)	0,9786	(0,328)	15,25 %	(0,021)
2B (EBITDA/EV B/P)	1,2145	(0,225)	1,0799	(0,280)	16,69 %	(0,011)
2C (EBITDA/EV S/P)	1,0065	(0,314)	0,8142	(0,416)	12,92 %	(0,049)
3A (EBITDA/EV B/P S/P)	1,0238	(0,306)	0,8328	(0,405)	12,97 %	
3B (β^{-1} E/P B/P)	1,2481	(0,212)	1,0235	(0,306)	14,78 %	(0,051)
3C (β EBITDA/EV B/P)	0,6180	(0,537)	0,5378	(0,591)	7,34 %	(0,242)

The table presents performance differences between value (T1) and growth (T3) tertile portfolios on the basis of three performance metrics (i.e., the Sharpe Ratio, the adjusted Sharpe Ratio, and the Jensen Alpha) for each portfolio formation criterion (significance levels are in parentheses).

The average return of the low beta portfolio lags only 0,74 basis points behind that of the best T1 (P/B) and it has both the lowest volatility and the lowest downside deviation. In fact, sorting on market beta produces the largest dispersion between the extreme tertile portfolios in terms of volatility (difference between extreme tertile portfolios is 8,84 basis points) and market beta that is being generated during the investment period (Table 2). Accordingly, market beta appears to be a robust measure for adjusting the portfolio for the total-risk as well as for the mere downside risk. Expectedly, the average return of the high beta portfolio (T3) exceeds that of the comparable glamour portfolios. Only the size of *the beta premium* is anomalous accounting for the relatively small average market risk premium during the sample period and that it is greater than that produced by the P/S ranking.

The sub-period breakdown reveals the relative efficiency of market beta strategies during the investment periods in which the average market risk premium is negative and during the periods in which the premium is positive. In all four 1-year investment periods in which the premium is negative, the low beta portfolio (T1) outperforms both the comparable T3 portfolios and the market portfolio. The average beta premium of these periods is 9,78 % (Appendix 1, Panel A). Three of the four sub-periods produce a statistically significant difference in the adjusted Sharpe Ratio and two of the four sub-periods yield a significant alpha spread (at a risk level of 10 %) (See Appendix 2, Panel A).

Results for adjusting the market beta for a period in which the risk premium is positive are, however, controversial. Despite the high beta portfolio (T3) beats the corresponding low beta portfolio in three years out of four of the positive risk premium, it yields only an average beta premium of 4,79 % which is less than half of that produced by the low beta portfolio (T1) during the sub-periods of negative risk premium. When the risk-adjusted approach is applied, the results are more diverse. Namely, the T3 (β) outperforms the T1 (β) in only half of these sub-periods, during 2005-2007. In that sub-period the average beta premium is 12,90 % for the benefit of T3 (β) (See Appendix 1, Panels A and C).

More interestingly, the low beta portfolio (T1) beats the corresponding high beta portfolio during 2003-2004 when the average market risk premium is 43,04 % being at its highest in the whole sample period! Moreover, the T1 (β) beats T3 (β) with a statistically significant difference in the Sharpe Ratio (at 10 % level) and with an alpha spread of 18,05 % (though not statistically significant). During 2004-2005, the T1 (β) outperforms the comparable T3 portfolio both in absolute and risk-adjusted terms. Now the Sharpe difference is significant at a risk level of 5 % and the alpha spread of 16,50 % at a level of 10 % (Appendix 2, Panel A).

4.2 Variants Based on EV/EBITDA, P/E, P/B, and P/S

4.2.1 Graham Strategy

In the composite valuation measure analysis, the Graham Ratio (i.e. P/E multiplied by P/B) was tested first. Ranking by the Graham Ratio produces the greatest difference in average return and alpha spread (though neither statistically significant) between the value portfolio (T1) and the neutral portfolio (T2) when the tested variants of EV/EBITDA, P/E, P/B, and P/S are considered (See Tables 2 and 3).

Within the same comparison, sorting on the Graham Ratio provides the largest dispersion in the tertile portfolio betas indicating a robust capability of distinguishing between different market risk categories which is attributable to even better ability of P/E to classify stocks according to their market risk. The P/E P/B composite produces also the widest set of downside volatilities within the same comparison. Noteworthy is that the Sortino Ratio for the whole sample period is larger for the Graham composite than either T1 (P/E) or T1 (P/B) individually yield (Appendix 1, Panel B). The composite gains relatively more from the superior average return of T1 (P/B) than it loses due to the higher downside volatility of the same portfolio.

The sub-period breakdown reveals the relative strength of the Graham Ratio. Namely, ranking by the Graham Ratio is superior in distinguishing between the value and the growth portfolio during investment periods in which the average market risk premium is negative. The average alpha spread during those periods is 13,73 % (none of the individual alpha spreads were statistically significant in those periods). Only one period of the four produced a significant Sharpe difference in statistical sense. The relative superiority of T1 (P/E) during 2000-2002 tilts more towards that of the T1 (P/B) during the periods 2002-2003 and 2007-2008 ensuring the consistent robustness of the Graham Ratio as a classification criterion during the periods of negative risk premium (Appendix 2, Panel B).

4.2.2 EV/EBITDA P/B Division

The results from sorting stocks on the combination of EV/EBITDA and P/B show the superior total-risk adjusted performance of T1 (EV/EBITDA P/B), also carrying the largest Jensen Alpha among the peer composite group consisting of tested variants based on EV/EBITDA, P/E, P/B, and P/S. Due to relatively small difference in the average returns between T1 (EV/EBITDA) and T1 (EV/EBITDA P/B) for the benefit of the first in relation to the difference between the adjusted volatilities between the same portfolios, the Sharpe Ratio favours EV/EBITDA as a ranking criterion (Table 2).

Dividing stocks according to the EV/EBITDA P/B composite results in the greatest dispersion between the tertile portfolios in all relative performance metrics employed (i.e. average returns, the Sharpe Ratio, the Sortino Ratio, and the Jensen Alpha) compared to the peer combinations (Table 2). In spite of the Sharpe Ratio tilting towards the mere EV/EBITDA in T1 comparison, the composite of EV/EBITDA and P/B generates larger value premium with respect to the Sharpe Ratio (though not statistically significant) and alpha spread (statistically significant at 5 % level) than based on the individual valuation ratios or on the peer combinations during the sample period (Appendix 2, Panel B).

Analogously to the conclusion drawn from the comparative analysis of EV/EBITDA and P/E, the Graham Ratio outperforms the combination of EV/EBITDA and P/B during all four periods of negative average market risk premium (Appendix 1, Panel A). Consistently to the comparison done in the individual valuation ratio section, the difference in relative performance during those periods is attributable to both lower adjusted volatility and higher average returns of P/E. Correspondingly, using the EV/EBITDA P/B composite as a ranking criterion leads to larger value premium in respect of Sharpe Ratio and alpha spread during three periods of four that the risk premium is positive (Appendix 2, Panel B).

4.2.3 EV/EBITDA P/S Ranking

Among the composite variants based on EV/EBITDA, P/E, P/B, and P/S, the value portfolio built upon EV/EBITDA and P/S is the worst in respect of all relative performance metrics used in the study (i.e. average returns, the Sharpe Ratio, the Sortino Ratio, and the Jensen Alpha) (See Table 2). T1 (EV/EBITDA P/S) suffers from both relatively low average return and relatively high volatility brought in by the P/S characteristics. The EV/EBITDA P/S sorting criterion is also extremely indecisive between the value and neutral portfolios in terms of all relative performance metrics mentioned before. This is also attributable to the nature of P/S criterion. The relative performance of tertile portfolios formed on the basis of the composite (EV/EBITDA P/S) is the most evenly dispersed in terms of all relative performance metrics employed.

The EV/EBITDA P/S criterion, however, produces higher average returns for the value portfolio in three out of four bullish years against the corresponding one out of four of the EV/EBITDA P/B criterion. The results for the four bearish years are more diverse. During the period 2000-2002, T1 (EV/EBITDA P/S) produces higher average returns and risk-adjusted returns than T1 (EV/EBITDA P/B). Instead, the EV/EBITDA P/B value portfolio outperforms the corresponding EV/EBITDA P/S portfolio in the two more recent bearish investment periods.

4.2.4 EV/EBITDA P/B P/S Screening

Screening shares based on valuation multiples EV/EBITDA, P/B, and P/S generates the lowest volatility for the value portfolio compared to the other two variants, also lower than any of the components would alone produce. Due to its relatively low average returns for T1 (EV/EBITDA P/B P/S), the relative performance lags behind the peer composites. 2002-2003 is the only period when using the EV/EBITDA P/B P/S ranking criterion the corresponding value portfolio yields better than the portfolios composed based either on the EV/EBITDA P/B or the EV/EBITDA P/S criterion (Appendix 1, Panel A). Additionally, the EV/EBITDA P/B P/S value composite produces lower average returns than the value portfolios based on either of the mentioned composite valuation criterion (Table 2).

4.3 Beta Enhanced Value Portfolio Strategies

4.3.1 Low Beta Enhanced P/E P/B

Low beta characteristics was combined with low valuation with respect to the Graham Ratio to examine whether it can improve the relative performance of P/E P/B value portfolio during the periods in which the average market risk premium is negative. The results are encouraging since the beta enhanced Graham value portfolio outperforms the T1 (P/E P/B) in all four investment periods that the risk premium is negative. The beta enhancement produces an average extra premium of 5,10 basis points per year when the mentioned years are considered (Appendix, Panel B). The average difference in alpha spreads is 8,62 basis points (neither of them statistically significant, Appendix 2, Panel C). The identified performance difference remains also in relative terms. Even though the average return of the T1 (β P/E P/B) is improved by the enhancement, the beta enhanced value portfolio carries approximately the same volatility as the mere P/E P/B based value portfolio. In two out of four periods the beta enhanced portfolio and in the two other periods the pure Graham value portfolio bears lower volatility, respectively. The difference is emphasised when the mean – semi variance approach is applied. Namely, the combination of low beta and low Graham Ratio exhibits lower downside volatility than T1 (P/E P/B) in three out of the four periods (Appendix 1, Panel D).

The results of the relative performance of the beta enhanced value portfolio for the whole sample period are staggering. The low beta enhanced P/E P/B value portfolio yields an average return of 24,69 % which is 2,67 basis points (not statistically significant) above that of the T1 (P/E P/B). On top of that, the enhanced value portfolio beats the corresponding P/E P/B value portfolio also in all other relative performance metrics employed in the study (i.e. the Sharpe Ratio, the Sortino Ratio, and the Jensen Alpha). The surprisingly strong performance over the whole period can be explained by the superior performance of low beta portfolio during the first two periods that the risk premium is positive (i.e. 2003-2005) which, however, remains anomalous. Most interestingly, ranking according to the beta enhanced P/E P/B ratio generates a larger value premium than sorting on P/E, P/S, D/P, the Graham Ratio, the EBITDA/EV P/S variant, or the EBITDA/EV P/B P/S variant in terms of Sharpe Ratio difference. However, classifying by the Graham Ratio yields 0,47 basis points (not statistically significant) higher value premium with respect to alpha spread (Appendix 2, Panel C).

4.3.2 High Beta Enhanced EV/EBITDA P/B

High beta characteristics combined with low relative valuation in respect of the EV/EBITDA P/B composite was tested to find out whether it can provide an extra premium during the bullish years (i.e. the average market risk premium is positive) compared to the unenhanced value portfolio based on the same composite valuation measure. Compared to the results of low beta enhanced value portfolio, the findings of high beta enhanced value portfolio are the contrary. Despite the fact that the average market risk premium is close to zero during the sample period, the performance difference between the low beta P/E P/B value portfolio and high beta EBITDA/EV P/B value portfolio is dazzling. The value premium (in terms of alpha spread) produced by the difference of high beta-low valuation and low beta-high valuation covers only half of that generated by the difference between low beta-low valuation and high beta - high valuation. Furthermore, the low beta - low valuation combination produces four statistically significant value premiums in respect of the Sharpe Ratio while the high beta - high valuation combination generates only two of them (Appendix 2, Panel C).

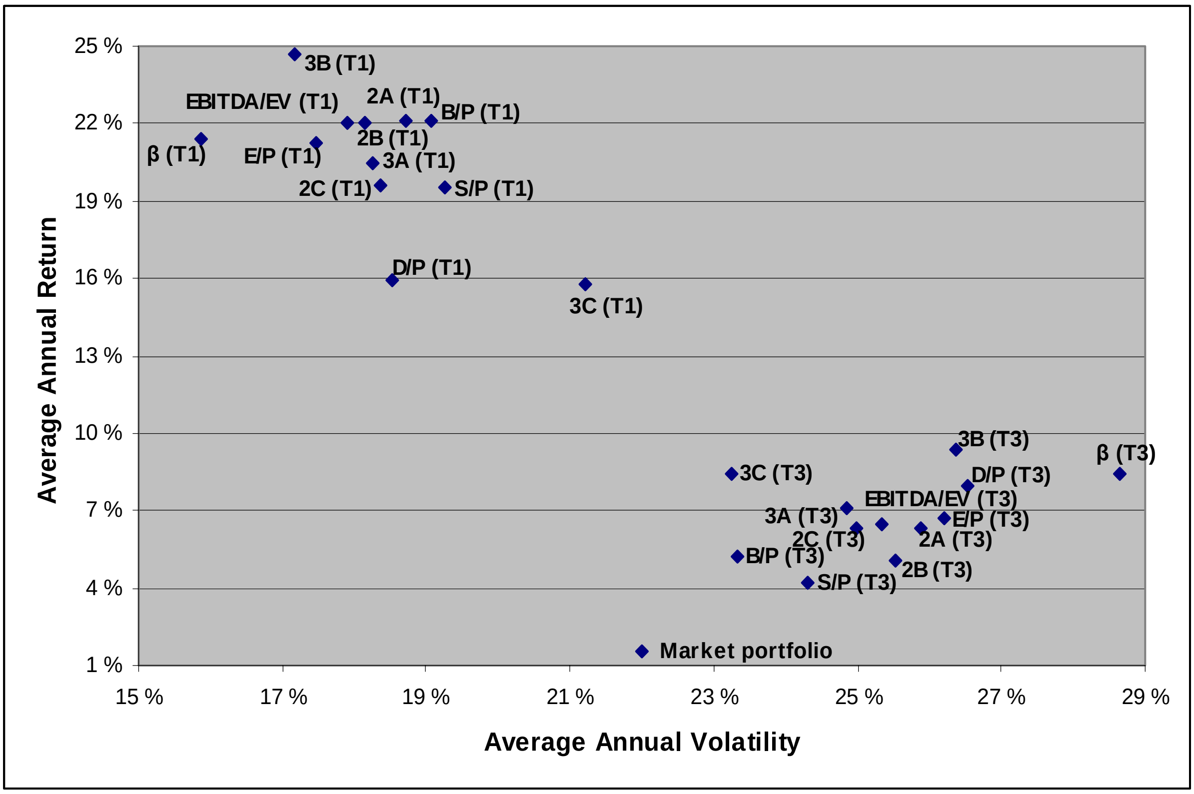
The results are surprising since the high beta enhanced value portfolio lags behind the unenhanced portfolio in all four periods of positive risk premium. In fact, resorting to only low valuation provides a value investor an annual average premium of 3,42 basis points (though not statistically significant) in relation to the high beta enhanced criterion in the periods of positive risk premium! (Appendix 1, Panel B) In three out of the four periods the unenhanced value portfolio yields statistically significant value premium (i.e. the Sharpe Ratio difference) but the high beta – low valuation only in two out of the four years. During those four years the average difference between the value premium in terms of alpha spread differences, the low beta - low valuation combination provides a staggering 9,86 basis point premium over the high beta – low valuation combination! (Appendix 2, Panel C)

4.4 Comparison of All Selection Criteria

To illustrate the relative risk-return characteristics of the extreme tertile portfolios formed on the basis of 12 different screening criteria, the mean-variance framework introduced by Markowitz (1959) is graphically presented for the whole sample period of 2000 – 2008. Figure 1 illustrates visibly the discrete clusters of value and growth portfolios. It also shows clearly the inferior performance of market portfolio during the sample period as all the value portfolios dominate it. D/P (T1) is dominated by all other glamour portfolios.

In this mean-variance framework, it is difficult to compare the market portfolio to the growth portfolios as it has distinctly lower return and clearly lower risk than those with the growth portfolios. 3C (T3), however, appears to dominate the market portfolio. Noteworthy is the distance between 3C (T1) and 3C (T3) tilting towards the favour of high beta – low valuation over a combination of low beta – high valuation. The efficient frontier can be drawn between β (T1), which has the lowest risk and 3B (T1), which has both the highest return and the best Sharpe Ratio.

Figure 1. The Relative Risk-Return Position of Value (T1) and Growth (T3) Portfolios (2000-2008)



The figure illustrates the relative risk-return position of each value (T1) and growth (T3) portfolio formed on the basis of 12 different sorting criteria in the Markowitzian risk-return space.

5 CONCLUDING REMARKS

Several value strategies are tested in the German equity market over a period 2000-2008. In an individual valuation ratio comparison the results are diverse. B/P is the most successful portfolio formation criterion with respect to average returns generating also the greatest alpha and the largest value premium (statistically significant alpha spread). In the mean - semi variance approach, the value E/P portfolio outperforms the other solely valuation based portfolios during the sample period. As for the earnings multiples, the EBITDA/EV value portfolio was more successful during bull years and the E/P value portfolio during the bearish years, respectively. Due to different weights in the HDAX index compared to the equal weights of the study as well as tertile portfolio division, coupled with relatively small sample size result in a slightly superior performance of the growth portfolios over the market portfolio during the period examined.

In the total-risk framework, the low beta portfolio slightly outperforms the best value portfolio (EBITDA/EV) which is anomalous since the average market risk premium is very close to zero (i.e. -1,61 %) during the sample period. Again, when only downside risk is considered, the low beta portfolio clearly beats the best value portfolio (E/P). Nothing to be expected, the low beta portfolio outperformed on a risk-adjusted basis the corresponding high beta portfolio during 2003 – 2004 when the average market risk premium was at its highest (i.e. 43,04 %). Unlike the fundamental message of the CAPM, higher risk doesn’t garner support in explaining higher returns in the German equity market. All the value portfolios carry both lower volatility and lower market risk (i.e. beta) than the equivalent glamour portfolios (See Figure 1).

Consistently with the findings of Dhatt et al. (2004), Leivo et al. (2009), and Pätäri and Leivo (2009), the value premium can be somewhat improved with basing the portfolio selection criterion on a combination of several valuation multiples. The highest average returns as well as the greatest alpha are attributable to a combination criterion of beta (low), B/P, and E/P. Particularly useful is adding the low beta characteristics to the Graham Ratio. Combining low beta characteristics with low valuation in terms of the Graham Ratio (i.e. P/E multiplied by P/B) results in a superior performance both on a total-risk and downside risk -adjusted basis. In the German equity market for this sample, including high beta characteristics or S/P to the composite valuation measure has a negative value added.

Analogously to Pätäri and Leivo (2009), the difference in relative performance between value and growth portfolios is emphasised when composite valuation measures are employed as a screening criterion. Even though, the performance difference shows no statistical significance in terms of the Sharpe Ratio, the alpha spread analysis reveals that 4 out of 6 composites are distinguishing between under- and overvalued stocks in a statistically significant sense. Furthermore, the greatest value premium was achieved by combining EBITDA/EV and B/P exhibiting superior performance in favour the value portfolio both with respect to the Sharpe difference and alpha spread. Interestingly, without adjustment to the Sharpe Ratio, B/P solely would have survived as the winner which highlights the importance of taking account the skewness and kurtosis characteristics of the return distributions (See Table 3).

For further examination, it would be interesting to see whether the firm size (i.e. market capitalisation) has any impact on the results achieved in this study. I would also like to see whether the sentiment specific conclusions made on an annual basis would still hold when the sample period is decomposed to bull and bear periods. It would also be appropriate to employ a larger sample data with some more years to ensure the representativeness of the stock market examined the consistency of the results in terms of time, respectively. Finally, the benefits from short-selling in context with the value investing would be interesting to analyse.

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APPENDICES

Appendix 1 (Panel A). Annual Average Return, Risk and Performance Metrics of Extreme Tertile Portfolios Based on Individual Valuation Multiples (2000-2008).

Variable	Annual Average Return		Annual Average Volatility		Sharpe Ratio		SKAD		Adjusted Sharpe		Adj. Sharpe (sign.) T1 vs. Market	
	T1	T3	T1	T3	T1	T3	T1	T3	T1	T3		
EBITDA/EV												
00-01	19,92 %	-42,84 %	15,06 %	31,98 %	0,1424	-0,2051	15,65 %	29,49 %	0,1370	-0,2224	2,3577	(0,018)
01-02	13,10 %	12,59 %	21,97 %	38,95 %	0,0580	0,0309	30,61 %	40,28 %	0,0416	0,0299	0,8873	(0,375)
02-03	-23,57 %	-33,95 %	24,69 %	34,34 %	-0,1499	-0,1497	19,66 %	19,53 %	-0,1882	-0,2632	2,6047	(0,009)
03-04	70,36 %	42,08 %	18,66 %	15,07 %	0,5069	0,3674	18,86 %	17,11 %	0,5014	0,3235	2,6542	(0,008)
04-05	30,86 %	14,02 %	11,58 %	14,61 %	0,3450	0,1136	11,85 %	15,43 %	0,3372	0,1075	2,3616	(0,018)
05-06	39,79 %	49,02 %	11,52 %	13,29 %	0,4614	0,4980	12,06 %	12,94 %	0,4364	0,5066	0,8914	(0,373)
06-07	32,08 %	16,44 %	16,30 %	19,56 %	0,2461	0,0942	19,14 %	23,59 %	0,2095	0,0781	2,9324	(0,003)
07-08	-6,70 %	-6,11 %	18,22 %	18,60 %	-0,0815	-0,0469	18,68 %	14,77 %	-0,0795	-0,0950	-0,1954	(0,845)
E/P												
00-01	18,97 %	-41,73 %	14,24 %	32,47 %	0,1413	-0,1973	14,72 %	27,65 %	0,1368	-0,2316	2,3286	(0,020)
01-02	31,46 %	7,22 %	25,17 %	35,42 %	0,1518	0,0130	32,59 %	35,79 %	0,1172	0,0128	2,1023	(0,036)
02-03	-27,99 %	-45,88 %	22,79 %	37,70 %	-0,1892	-0,1802	15,74 %	27,63 %	-0,2741	-0,2459	1,5075	(0,132)
03-04	56,57 %	52,51 %	17,39 %	16,42 %	0,4340	0,4254	17,99 %	19,53 %	0,4196	0,3575	1,9749	(0,048)
04-05	24,96 %	11,91 %	10,00 %	14,79 %	0,3175	0,0923	10,35 %	15,26 %	0,3069	0,0896	1,8537	(0,064)
05-06	37,50 %	50,73 %	11,24 %	14,61 %	0,4441	0,4697	11,65 %	14,54 %	0,4244	0,4672	0,7051	(0,481)
06-07	24,85 %	23,21 %	14,48 %	21,24 %	0,2079	0,1310	17,12 %	25,59 %	0,1758	0,1087	1,7508	(0,080)
07-08	3,52 %	-5,09 %	16,38 %	21,08 %	-0,0042	-0,0599	16,93 %	19,08 %	-0,0040	-0,0662	0,8786	(0,380)
B/P												
00-01	13,55 %	-40,23 %	14,67 %	32,42 %	0,0860	-0,1911	14,39 %	29,54 %	0,0876	-0,2098	1,9157	(0,055)
01-02	29,70 %	10,04 %	27,68 %	33,11 %	0,1292	0,0256	32,65 %	33,25 %	0,1095	0,0255	1,7802	(0,075)
02-03	-23,74 %	-36,69 %	20,95 %	28,90 %	-0,1794	-0,1910	17,41 %	21,76 %	-0,2138	-0,2537	2,1160	(0,034)
03-04	61,79 %	43,44 %	20,69 %	13,48 %	0,4036	0,4287	22,04 %	15,07 %	0,3753	0,3799	1,3266	(0,185)
04-05	19,58 %	10,32 %	12,70 %	12,57 %	0,1914	0,0912	13,29 %	13,71 %	0,1829	0,0836	0,8222	(0,411)
05-06	38,43 %	44,59 %	13,49 %	12,51 %	0,3762	0,4743	14,46 %	11,26 %	0,3508	0,5271	-0,0642	(0,949)
06-07	33,20 %	16,96 %	18,64 %	19,04 %	0,2236	0,1006	21,51 %	23,83 %	0,1938	0,0804	1,8473	(0,065)
07-08	4,32 %	-7,28 %	17,61 %	19,68 %	0,0024	-0,0795	17,91 %	20,15 %	0,0024	-0,0777	0,9904	(0,322)
S/P												
00-01	12,70 %	-36,64 %	16,39 %	32,08 %	0,0697	-0,1776	16,84 %	30,28 %	0,0679	-0,1882	1,8462	(0,065)
01-02	17,84 %	4,71 %	23,14 %	35,97 %	0,0834	0,0031	32,81 %	34,61 %	0,0588	0,0032	1,2394	(0,215)
02-03	-32,83 %	-38,85 %	21,52 %	33,35 %	-0,2316	-0,1745	18,26 %	24,10 %	-0,2730	-0,2414	1,2511	(0,211)
03-04	62,93 %	42,61 %	18,53 %	15,03 %	0,4548	0,3731	19,20 %	16,86 %	0,4389	0,3328	2,2639	(0,024)
04-05	17,62 %	10,96 %	12,74 %	14,42 %	0,1693	0,0856	12,48 %	15,15 %	0,1729	0,0815	0,6850	(0,493)
05-06	46,19 %	45,14 %	13,90 %	10,57 %	0,4432	0,5689	15,22 %	10,28 %	0,4046	0,5848	0,4883	(0,625)
06-07	36,79 %	15,72 %	19,01 %	18,48 %	0,2454	0,0943	22,65 %	22,27 %	0,2060	0,0783	1,7671	(0,077)
07-08	-5,77 %	-10,88 %	22,81 %	16,68 %	-0,0594	-0,1237	23,82 %	14,45 %	-0,0569	-0,1429	0,1024	(0,918)
D/P												
00-01	-4,70 %	-42,61 %	14,67 %	31,72 %	-0,0865	-0,2058	14,84 %	28,84 %	-0,0855	-0,2263	0,7491	(0,454)
01-02	14,08 %	22,51 %	27,49 %	40,41 %	0,0513	0,0638	37,87 %	41,11 %	0,0372	0,0627	0,9123	(0,362)
02-03	-28,99 %	-35,83 %	22,77 %	36,34 %	-0,1955	-0,1486	20,13 %	21,75 %	-0,2213	-0,2483	2,5462	(0,011)
03-04	55,98 %	52,47 %	16,90 %	18,20 %	0,4416	0,3833	19,86 %	18,30 %	0,3758	0,3812	1,6307	(0,103)
04-05	19,98 %	7,27 %	11,36 %	14,40 %	0,2188	0,0503	12,04 %	13,91 %	0,2064	0,0520	1,0819	(0,279)
05-06	38,25 %	48,03 %	12,04 %	14,76 %	0,4194	0,4350	12,45 %	14,91 %	0,4055	0,4305	0,6367	(0,524)
06-07	28,12 %	16,03 %	16,38 %	20,80 %	0,2115	0,0859	19,05 %	25,32 %	0,1818	0,0705	1,7230	(0,085)
07-08	4,55 %	-5,01 %	18,43 %	18,14 %	0,0041	-0,0690	18,64 %	17,13 %	0,0041	-0,0730	1,2495	(0,211)
β^{-1}												
00-01	22,86 %	-39,72 %	16,79 %	31,84 %	0,1484	-0,1924	19,33 %	28,09 %	0,1320	-0,2181	2,3752	(0,018)
01-02	27,91 %	10,75 %	23,64 %	41,84 %	0,1407	0,0227	30,98 %	41,07 %	0,1074	0,0231	1,5874	(0,112)
02-03	-14,20 %	-54,99 %	15,90 %	40,55 %	-0,1510	-0,1987	15,54 %	28,22 %	-0,1546	-0,2855	2,4277	(0,015)
03-04	53,86 %	58,09 %	13,28 %	22,53 %	0,5399	0,3443	13,90 %	24,09 %	0,5159	0,3220	2,2136	(0,027)
04-05	25,32 %	14,45 %	9,28 %	14,48 %	0,3477	0,1187	8,52 %	15,12 %	0,3786	0,1136	2,4625	(0,014)
05-06	35,00 %	52,49 %	11,02 %	14,47 %	0,4167	0,4866	11,84 %	14,06 %	0,3879	0,5008	0,2869	(0,774)
06-07	23,76 %	32,07 %	16,96 %	21,31 %	0,1685	0,1882	21,07 %	24,91 %	0,1357	0,1610	0,5554	(0,579)
07-08	-6,53 %	-6,68 %	13,74 %	23,77 %	-0,0761	-0,0624	13,61 %	22,61 %	-0,0768	-0,0655	-0,1477	(0,833)

Annual average return, two risk measures (i.e. volatility and SKAD) and corresponding performance metrics (the Sharpe Ratio and the Adjusted Sharpe Ratio) are presented for extreme tertile portfolios formed on the basis of individual valuation ratios. The column that includes the adjusted Sharpe Ratios is followed by the column which indicates performance difference between the extreme tertile portfolios compared to the market portfolio.

Appendix 1 (Panel B). Annual Average Return, Risk and Performance Metrics of Extreme Tertile Portfolios Based on Composite Valuation Measures (2000-2008).

Variable	Annual Average Return		Annual Average Volatility		Sharpe Ratio		SKAD		Adjusted Sharpe		Adj. Sharpe (sign.)	
	T1	T3	T1	T3	T1	T3	T1	T3	T1	T3	T1 vs. Market	
2A (B/P E/P)												
00-01	12,81 %	-40,25 %	14,92 %	31,64 %	0,0777	-0,1960	14,19 %	28,36 %	0,0816	-0,2186	1,9121	(0,056)
01-02	25,34 %	7,96 %	25,28 %	36,60 %	0,1175	0,0153	34,35 %	36,91 %	0,0865	0,0152	1,5354	(0,125)
02-03	-24,20 %	-44,51 %	19,60 %	36,21 %	-0,1932	-0,1824	15,51 %	24,12 %	-0,2442	-0,2739	1,6531	(0,098)
03-04	61,74 %	53,10 %	19,52 %	16,26 %	0,4233	0,4346	20,51 %	18,92 %	*0,4029*	0,3734	1,8756	(0,061)
04-05	24,39 %	10,25 %	11,35 %	14,56 %	0,2730	0,0780	11,29 %	14,51 %	0,2743	0,0783	1,7254	(0,084)
05-06	36,55 %	47,20 %	11,16 %	13,40 %	0,4225	0,4608	12,02 %	12,49 %	0,3921	0,4944	0,4117	(0,681)
06-07	30,77 %	22,03 %	15,79 %	21,96 %	0,2427	0,1192	18,57 %	27,20 %	0,2063	0,0963	2,4405	(0,015)
07-08	9,18 %	-5,28 %	19,09 %	20,00 %	0,0376	-0,0644	19,43 %	20,82 %	0,0369	-0,0618	1,5582	(0,119)
2B (B/P EBITDA/EV)												
00-01	12,30 %	-40,82 %	14,66 %	31,19 %	0,0742	-0,2013	14,60 %	29,00 %	0,0745	-0,2165	1,8561	(0,063)
01-02	19,65 %	14,77 %	23,60 %	41,63 %	0,0925	0,0362	32,27 %	42,14 %	0,0676	0,0357	1,3640	(0,173)
02-03	-29,35 %	-36,62 %	22,04 %	31,53 %	-0,2043	-0,1748	16,84 %	20,04 %	-0,2674	-0,2750	1,3661	(0,172)
03-04	75,47 %	39,49 %	21,18 %	15,13 %	0,4801	0,3421	21,55 %	17,34 %	0,4718	0,2987	2,1904	(0,028)
04-05	22,48 %	8,45 %	12,77 %	14,85 %	0,2218	0,0597	12,28 %	15,40 %	0,2307	0,0576	1,5085	(0,131)
05-06	40,08 %	45,94 %	12,65 %	13,50 %	0,4110	0,4447	13,63 %	13,17 %	0,3814	0,4558	0,3201	(0,749)
06-07	35,68 %	18,41 %	16,98 %	20,92 %	0,2657	0,1012	19,44 %	25,56 %	0,2321	0,0828	3,3557	(0,001)
07-08	1,23 %	-9,15 %	19,00 %	17,80 %	-0,0203	-0,1025	19,43 %	16,40 %	-0,0198	-0,1112	0,7106	(0,477)
2C (S/P EBITDA/EV)												
00-01	12,73 %	-40,82 %	15,67 %	31,19 %	0,0820	-0,2013	16,37 %	29,00 %	0,0786	-0,2165	2,0480	(0,041)
01-02	20,39 %	14,17 %	22,75 %	39,49 %	0,1004	0,0360	32,03 %	37,85 %	0,0713	0,0376	1,3657	(0,172)
02-03	-32,74 %	-34,70 %	21,25 %	32,95 %	-0,2340	-0,1592	17,41 %	20,90 %	-0,2855	-0,2509	1,1076	(0,268)
03-04	64,25 %	42,26 %	17,70 %	14,12 %	0,4866	0,3940	17,76 %	16,48 %	0,4848	0,3375	2,6390	(0,008)
04-05	20,70 %	9,78 %	11,80 %	14,27 %	0,2191	0,0750	11,34 %	14,98 %	0,2280	0,0715	1,3017	(0,193)
05-06	41,71 %	52,45 %	12,67 %	12,94 %	0,4278	0,5331	13,76 %	12,11 %	0,3940	0,5696	0,4185	(0,676)
06-07	36,47 %	16,29 %	16,86 %	19,74 %	0,2742	0,0924	19,50 %	24,06 %	0,2370	0,0758	2,6822	(0,007)
07-08	-6,99 %	-8,71 %	21,70 %	16,71 %	-0,0703	-0,1056	22,48 %	14,74 %	-0,0678	-0,1197	-0,0163	(0,987)
3A (B/P S/P EBITDA/EV)												
00-01	12,03 %	-35,22 %	14,74 %	31,32 %	0,0713	-0,1757	15,51 %	29,11 %	0,0677	-0,1890	1,8108	(0,070)
01-02	18,85 %	16,68 %	22,83 %	38,04 %	0,0907	0,0465	31,69 %	37,50 %	0,0653	0,0472	1,2716	(0,203)
02-03	-24,66 %	-35,53 %	21,40 %	33,96 %	-0,1800	-0,1578	17,28 %	21,87 %	-0,2229	-0,2450	1,6692	(0,095)
03-04	65,64 %	41,06 %	19,09 %	13,71 %	0,4611	0,3935	18,57 %	15,62 %	0,4740	0,3454	2,2768	(0,023)
04-05	20,95 %	10,87 %	12,57 %	14,24 %	0,2084	0,0858	11,75 %	14,66 %	0,2229	0,0833	1,2234	(0,221)
05-06	40,21 %	50,99 %	13,27 %	12,34 %	0,3930	0,5427	14,62 %	12,11 %	0,3568	0,5529	-0,0086	(0,993)
06-07	32,71 %	17,32 %	16,80 %	20,12 %	0,2440	0,0977	19,40 %	24,54 %	0,2113	0,0801	2,4798	(0,013)
07-08	-1,87 %	-9,49 %	19,78 %	16,60 %	-0,0412	-0,1127	19,90 %	14,32 %	-0,0410	-0,1307	0,3579	(0,720)
3B (β^{-1} B/P E/P)												
00-01	24,78 %	-35,01 %	14,62 %	31,43 %	0,1929	-0,1741	14,80 %	27,29 %	0,1905	-0,2005	2,5791	(0,010)
01-02	27,93 %	14,57 %	24,63 %	37,57 %	0,1353	0,0393	33,37 %	37,01 %	0,0998	0,0399	1,7050	(0,088)
02-03	-22,49 %	-39,20 %	20,14 %	36,00 %	-0,1763	-0,1630	15,84 %	24,45 %	-0,2241	-0,2400	1,8801	(0,060)
03-04	58,41 %	56,83 %	16,41 %	17,89 %	0,4755	0,4237	17,18 %	19,55 %	0,4542	0,3878	2,0427	(0,041)
04-05	29,96 %	9,22 %	9,25 %	15,31 %	0,4183	0,0649	8,53 %	15,96 %	0,4536	0,0623	3,3061	(0,001)
05-06	36,33 %	52,41 %	11,67 %	14,68 %	0,4012	0,4696	12,58 %	14,71 %	0,3723	0,4687	0,1850	(0,853)
06-07	29,76 %	23,61 %	15,15 %	23,08 %	0,2436	0,1229	17,27 %	28,40 %	0,2138	0,0999	2,4846	(0,013)
07-08	13,30 %	-7,60 %	18,48 %	20,06 %	0,0698	-0,0802	19,22 %	19,98 %	0,0671	-0,0805	1,9958	(0,046)
3C (β B/P EBITDA/EV)												
00-01	-9,19 %	-31,64 %	27,81 %	31,94 %	-0,0680	-0,1567	27,74 %	28,66 %	-0,0682	-0,1746	1,1775	(0,239)
01-02	11,38 %	16,80 %	25,57 %	36,88 %	0,0405	0,0485	32,67 %	37,13 %	0,0317	0,0481	1,0270	(0,304)
02-03	-33,50 %	-33,80 %	26,23 %	24,64 %	-0,1936	-0,2082	18,87 %	18,05 %	-0,2691	-0,2842	1,9220	(0,055)
03-04	69,41 %	44,30 %	21,66 %	13,35 %	0,4307	0,4380	22,42 %	15,06 %	0,4160	0,3881	1,8738	(0,061)
04-05	18,58 %	16,62 %	12,97 %	13,40 %	0,1766	0,1506	13,12 %	13,62 %	0,1746	0,1482	0,7076	(0,479)
05-06	37,62 %	48,04 %	12,24 %	12,42 %	0,3971	0,5068	12,58 %	12,38 %	0,3865	0,5085	0,4824	(0,630)
06-07	34,41 %	15,52 %	17,20 %	19,73 %	0,2521	0,0870	19,85 %	23,74 %	0,2183	0,0723	2,9678	(0,003)
07-08	-2,10 %	-7,98 %	16,44 %	17,59 %	-0,0515	-0,0945	17,14 %	17,85 %	-0,0494	-0,0931	0,3079	(0,758)

Annual average return, two risk measures (i.e. volatility and SKAD) and corresponding performance metrics (the Sharpe Ratio and the Adjusted Sharpe Ratio) are presented for extreme tertile portfolios formed on the basis of composite portfolio formation criterion. The column that includes the adjusted Sharpe Ratios is followed by the column which indicates performance difference between the extreme tertile portfolios compared to the market portfolio.

Appendix 1 (Panel C). Annual Average Return, Risk and Performance Metrics of Extreme Tertile Portfolios (2000-2008).

Variable	TSSD		Sortino Ratio		Alfa		Alfa		Beta	
	T1	T3	T1	T3	T1 (sign.)		T3 (sign.)		T1	T3
EBITDA/EV										
00-01	0,92 %	6,58 %	0,2241	-0,2557	25,68 %	(0,059)	-14,55 %	(0,475)	0,3853	1,2356
01-02	2,66 %	7,56 %	0,0781	0,0438	13,11 %	(0,283)	15,87 %	(0,418)	0,6155	1,1270
02-03	3,17 %	5,27 %	-0,2078	-0,2239	19,61 %	(0,134)	20,00 %	(0,393)	0,6593	0,8127
03-04	0,75 %	0,79 %	1,0951	0,6227	35,30 %	(0,003)	13,60 %	(0,144)	0,7647	0,6116
04-05	0,41 %	0,92 %	0,6224	0,1729	20,29 %	(0,006)	0,39 %	(0,958)	0,7349	0,9988
05-06	0,33 %	0,37 %	0,9103	1,0828	14,73 %	(0,045)	22,21 %	(0,019)	0,7432	0,8040
06-07	1,18 %	2,21 %	0,3697	0,1241	16,39 %	(0,000)	-0,96 %	(0,906)	0,9600	1,0920
07-08	2,01 %	1,43 %	-0,1047	-0,1173	-2,52 %	(0,772)	-2,77 %	(0,760)	0,8864	0,7950
E/P										
00-01	0,80 %	6,27 %	0,2244	-0,2559	23,96 %	(0,064)	-13,00 %	(0,530)	0,3562	1,2521
01-02	3,01 %	6,37 %	0,2203	0,0182	32,26 %	(0,011)	9,81 %	(0,591)	0,7381	1,0190
02-03	2,70 %	7,31 %	-0,2624	-0,2513	11,91 %	(0,312)	17,13 %	(0,464)	0,6127	0,9418
03-04	0,80 %	0,90 %	0,8459	0,7369	22,56 %	(0,020)	23,43 %	(0,040)	0,7404	0,6258
04-05	0,32 %	0,96 %	0,5577	0,1394	15,95 %	(0,020)	-1,87 %	(0,806)	0,6001	1,0114
05-06	0,33 %	0,48 %	0,8640	0,9817	13,60 %	(0,070)	19,81 %	(0,038)	0,6970	0,9223
06-07	0,99 %	2,46 %	0,3032	0,1773	10,75 %	(0,023)	4,77 %	(0,609)	0,8392	1,1714
07-08	1,45 %	2,22 %	-0,0057	-0,0847	6,74 %	(0,418)	-0,28 %	(0,982)	0,7830	0,9551
B/P										
00-01	0,87 %	6,51 %	0,1348	-0,2428	18,13 %	(0,181)	-11,67 %	(0,575)	0,3410	1,2458
01-02	3,53 %	5,29 %	0,1904	0,0369	30,78 %	(0,044)	12,49 %	(0,388)	0,7826	0,9974
02-03	2,43 %	4,55 %	-0,2388	-0,2589	11,13 %	(0,344)	10,85 %	(0,545)	0,5409	0,7216
03-04	1,28 %	0,59 %	0,7298	0,7449	23,10 %	(0,058)	19,64 %	(0,038)	0,8489	0,5028
04-05	0,63 %	0,77 %	0,3072	0,1304	7,47 %	(0,256)	-1,47 %	(0,830)	0,8678	0,8408
05-06	0,58 %	0,28 %	0,6685	1,1172	7,85 %	(0,311)	17,23 %	(0,033)	0,9116	0,8080
06-07	1,54 %	2,21 %	0,3354	0,3605	16,20 %	(0,022)	0,16 %	(0,985)	1,0610	1,0459
07-08	1,62 %	2,23 %	0,0034	-0,1049	8,14 %	(0,354)	-3,11 %	(0,789)	0,8477	0,8854
S/P										
00-01	1,23 %	6,40 %	0,1031	-0,2253	19,14 %	(0,194)	-9,16 %	(0,667)	0,4112	1,2047
01-02	3,00 %	6,34 %	0,1115	0,0044	18,22 %	(0,118)	7,59 %	(0,652)	0,6734	1,0651
02-03	2,85 %	5,81 %	-0,2954	-0,2413	1,86 %	(0,889)	10,74 %	(0,658)	0,5384	0,7506
03-04	0,85 %	0,76 %	0,9144	0,6443	26,52 %	(0,009)	14,00 %	(0,126)	0,7960	0,6146
04-05	0,61 %	0,94 %	0,2753	0,1273	5,47 %	(0,405)	-2,14 %	(0,792)	0,8706	0,9534
05-06	0,57 %	0,19 %	0,8171	1,3832	17,37 %	(0,071)	23,90 %	(0,003)	0,8523	0,6096
06-07	1,67 %	1,93 %	0,3610	0,1256	19,91 %	(0,019)	-1,02 %	(0,888)	1,0519	1,0412
07-08	3,11 %	1,47 %	-0,0769	-0,1702	-0,81 %	(0,957)	-7,91 %	(0,417)	0,9708	0,7555
D/P										
00-01	1,19 %	6,42 %	-0,1162	-0,2575	0,85 %	(0,947)	-15,08 %	(0,466)	0,3776	1,2068
01-02	4,19 %	7,70 %	0,0689	0,0930	15,24 %	(0,278)	26,09 %	(0,200)	0,7947	1,1743
02-03	3,06 %	5,93 %	-0,2544	-0,2219	12,38 %	(0,229)	20,72 %	(0,411)	0,6337	0,8499
03-04	1,01 %	0,87 %	0,7436	0,7464	21,70 %	(0,010)	22,22 %	(0,102)	0,7465	0,6529
04-05	0,51 %	0,91 %	0,3468	0,0759	9,09 %	(0,143)	-5,73 %	(0,488)	0,7622	0,9446
05-06	0,39 %	0,54 %	0,8041	0,8708	10,24 %	(0,122)	19,13 %	(0,081)	0,8213	0,8384
06-07	1,24 %	2,54 %	0,3113	0,1120	12,70 %	(0,029)	-2,01 %	(0,829)	0,9397	1,1407
07-08	1,76 %	1,69 %	0,0057	-0,0963	9,14 %	(0,226)	-1,64 %	(0,883)	0,9305	0,7994
β^{-1}										
00-01	1,18 %	6,23 %	0,2293	-0,2455	30,28 %	(0,043)	-12,87 %	(0,550)	0,4521	1,1816
01-02	2,60 %	8,37 %	0,2062	0,0328	28,09 %	(0,050)	14,65 %	(0,475)	0,6418	1,2243
02-03	1,48 %	8,70 %	-0,1977	-0,2733	9,78 %	(0,348)	16,60 %	(0,460)	0,3860	1,0641
03-04	0,37 %	1,63 %	1,1835	0,6084	31,50 %	(0,002)	13,45 %	(0,232)	0,4695	0,9874
04-05	0,20 %	0,91 %	0,7129	0,1800	16,94 %	(0,010)	0,43 %	(0,946)	0,5463	1,0323
05-06	0,36 %	0,43 %	0,7663	1,0795	13,32 %	(0,112)	20,39 %	(0,021)	0,6258	0,9060
06-07	1,57 %	2,11 %	0,2280	0,2762	8,70 %	(0,293)	12,96 %	(0,085)	0,9016	1,2232
07-08	1,07 %	3,01 %	-0,1008	-0,0855	-1,44 %	(0,834)	-0,59 %	(0,965)	0,6597	1,0931

TSSD, beta, and corresponding performance metrics (i.e. the Sortino Ratio and the Jensen Alpha) are presented for extreme tertile portfolios formed on the basis of each portfolio formation criterion.

Appendix 1 (Panel D). Annual Average Return, Risk and Performance Metrics of Extreme Tertile Portfolios (2000-2008).

Variable	TSSD		Sortino Ratio		Jensen Alpha		Jensen Alpha		Beta	
	T1	T3	T1	T3	T1 (sign.)		T3 (sign.)		T1	T3
2A (B/P E/P)										
00-01	0,88 %	6,18 %	0,1230	-0,2493	17,68 %	(0,186)	-12,96 %	(0,533)	0,3530	1,1976
01-02	3,24 %	6,73 %	0,1650	0,0217	26,04 %	(0,054)	10,82 %	(0,557)	0,7227	1,0615
02-03	2,16 %	6,59 %	-0,2576	-0,2573	7,83 %	(0,500)	13,72 %	(0,566)	0,5006	0,8738
03-04	1,06 %	0,85 %	0,8035	0,7678	23,17 %	(0,025)	25,31 %	(0,034)	0,8462	0,5956
04-05	0,41 %	0,91 %	0,4822	0,1189	13,92 %	(0,046)	-3,46 %	(0,633)	0,7263	1,0059
05-06	0,37 %	0,36 %	0,7789	1,0246	10,85 %	(0,115)	17,42 %	(0,047)	0,7328	0,8573
06-07	1,10 %	2,86 %	0,3655	0,1549	15,66 %	(0,002)	3,39 %	(0,746)	0,9167	1,1866
07-08	1,85 %	2,29 %	0,0527	-0,0851	13,78 %	(0,131)	-1,17 %	(0,925)	0,9316	0,8783
2B (B/P EBITDA/EV)										
00-01	0,93 %	6,26 %	0,1126	-0,2509	17,21 %	(0,198)	-13,85 %	(0,497)	0,3533	1,1855
01-02	2,94 %	8,42 %	0,1272	0,0519	20,12 %	(0,091)	18,56 %	(0,377)	0,6871	1,2073
02-03	2,68 %	4,79 %	-0,2751	-0,2517	6,90 %	(0,600)	14,39 %	(0,480)	0,5607	0,7709
03-04	1,00 %	0,88 %	1,0186	0,5508	37,21 %	(0,008)	11,01 %	(0,241)	0,8391	0,6115
04-05	0,54 %	1,03 %	0,3865	0,0872	10,23 %	(0,114)	-5,23 %	(0,509)	0,8798	1,0031
05-06	0,48 %	0,40 %	0,7535	0,9485	10,21 %	(0,151)	16,44 %	(0,069)	0,8644	0,8491
06-07	1,19 %	2,60 %	0,4132	0,1313	19,51 %	(0,000)	0,15 %	(0,987)	0,9976	1,1577
07-08	2,01 %	1,71 %	-0,0272	-0,1395	5,80 %	(0,518)	-5,55 %	(0,575)	0,9283	0,8234
2C (S/P EBITDA/EV)										
00-01	1,13 %	6,18 %	0,1207	-0,2493	20,90 %	(0,122)	-12,96 %	(0,533)	0,4389	1,1976
01-02	2,80 %	7,23 %	0,1366	0,0529	20,65 %	(0,082)	17,62 %	(0,367)	0,6552	1,1528
02-03	2,72 %	5,13 %	-0,3013	-0,2316	1,44 %	(0,913)	16,98 %	(0,449)	0,5311	0,7804
03-04	0,68 %	0,70 %	1,0459	0,6641	30,09 %	(0,004)	16,53 %	(0,082)	0,7437	0,5479
04-05	0,48 %	0,94 %	0,3744	0,1102	9,61 %	(0,152)	-3,02 %	(0,718)	0,7796	0,9267
05-06	0,48 %	0,27 %	0,7849	1,3261	13,22 %	(0,102)	25,93 %	(0,008)	0,8192	0,7493
06-07	1,18 %	2,29 %	0,4255	0,1205	20,76 %	(0,001)	-1,41 %	(0,854)	0,9624	1,1146
07-08	2,83 %	1,46 %	-0,0907	-0,1459	-2,02 %	(0,876)	-5,57 %	(0,547)	0,9718	0,7742
3A (B/P S/P EBITDA/EV)										
00-01	1,03 %	6,00 %	0,1036	-0,2247	17,01 %	(0,205)	-7,94 %	(0,695)	0,3560	1,1970
01-02	2,77 %	6,77 %	0,1244	0,0680	19,12 %	(0,111)	19,76 %	(0,313)	0,6552	1,0966
02-03	2,49 %	5,52 %	-0,2441	-0,2280	8,20 %	(0,567)	17,02 %	(0,470)	0,5123	0,7928
03-04	0,78 %	0,64 %	0,9996	0,6730	30,45 %	(0,013)	16,46 %	(0,083)	0,7677	0,5216
04-05	0,52 %	0,91 %	0,3619	0,1284	9,31 %	(0,197)	-2,05 %	(0,800)	0,8265	0,9376
05-06	0,57 %	0,27 %	0,6895	1,2852	9,92 %	(0,217)	25,78 %	(0,007)	0,8778	0,7083
06-07	1,22 %	2,38 %	0,3712	0,1273	16,86 %	(0,003)	-0,47 %	(0,956)	0,9728	1,1217
07-08	2,19 %	1,42 %	-0,0551	-0,1573	2,85 %	(0,778)	-6,33 %	(0,482)	0,9445	0,7758
3B (β^{-1} B/P E/P)										
00-01	0,77 %	5,76 %	0,3205	-0,2281	29,08 %	(0,035)	-7,26 %	(0,716)	0,3303	1,2152
01-02	3,10 %	6,55 %	0,1893	0,0577	28,51 %	(0,032)	17,57 %	(0,363)	0,7032	1,0831
02-03	2,19 %	6,36 %	-0,2401	-0,2326	10,44 %	(0,385)	19,17 %	(0,414)	0,5133	0,8758
03-04	0,66 %	0,93 %	0,9598	0,7877	28,08 %	(0,009)	25,31 %	(0,042)	0,6547	0,6823
04-05	0,16 %	1,09 %	0,9649	0,0950	21,33 %	(0,001)	-4,85 %	(0,550)	0,5677	1,0367
05-06	0,41 %	0,46 %	0,7299	1,0119	9,62 %	(0,182)	20,20 %	(0,038)	0,7652	0,9323
06-07	0,97 %	3,10 %	0,3753	0,1613	15,18 %	(0,003)	3,82 %	(0,705)	0,8756	1,2749
07-08	1,67 %	2,25 %	0,0997	-0,1072	17,62 %	(0,048)	-2,99 %	(0,786)	0,9016	0,9326
3C (β B/P EBITDA/EV)										
00-01	4,31 %	5,86 %	-0,0912	-0,2067	12,95 %	(0,507)	-4,85 %	(0,824)	1,0034	1,1788
01-02	3,55 %	6,49 %	0,0550	0,0702	12,43 %	(0,247)	19,72 %	(0,290)	0,7774	1,0701
02-03	3,66 %	3,35 %	-0,2652	-0,2801	15,22 %	(0,174)	3,80 %	(0,821)	0,7383	0,5810
03-04	1,21 %	0,56 %	0,8474	0,7797	27,99 %	(0,025)	20,95 %	(0,031)	0,9124	0,4926
04-05	0,65 %	0,71 %	0,2833	0,2398	6,25 %	(0,351)	4,38 %	(0,569)	0,8860	0,8789
05-06	0,41 %	0,34 %	0,7557	1,0857	7,02 %	(0,205)	20,56 %	(0,014)	0,8896	0,7830
06-07	1,27 %	2,26 %	0,3846	0,1141	18,10 %	(0,000)	-1,86 %	(0,829)	1,0082	1,0902
07-08	1,60 %	1,82 %	-0,0670	-0,1231	1,58 %	(0,811)	-4,27 %	(0,640)	0,8324	0,8352

TSSD, beta, and corresponding performance metrics (i.e. the Sortino Ratio, and the Jensen Alpha) are presented for extreme tertile portfolios formed on the basis of each portfolio formation criterion.

Appendix 2 (Panel A). Annual Performance Comparison of Value (T1) and Growth (T3) Portfolios (2000-2008).

Variable	Sharpe Ratio Difference		Adjusted Sharpe Difference		Alpha Spread	
	T1 vs. T3	(sign.)	T1 vs. T3	(sign.)	T1 vs. T3	(sign.)
EBITDA/EV						
00-08	1,1942	(0,232)	1,0338	(0,301)	15,10 %	(0,020)
00-01	2,2109	(0,027)	2,2840	(0,022)	40,22 %	(0,100)
01-02	0,2330	(0,816)	0,1332	(0,894)	-2,76 %	(0,904)
02-03	-0,0028	(0,998)	0,7818	(0,434)	-0,39 %	(0,988)
03-04	1,9944	(0,046)	1,7667	(0,077)	21,70 %	(0,136)
04-05	2,0747	(0,038)	1,9991	(0,046)	19,90 %	(0,055)
05-06	-0,3580	(0,720)	-0,6535	(0,513)	-7,48 %	(0,523)
06-07	1,7399	(0,083)	2,1885	(0,029)	17,36 %	(0,061)
07-08	0,0283	(0,977)	0,2017	(0,840)	0,25 %	(0,984)
E/P						
00-08	1,1567	(0,247)	1,0107	(0,312)	14,04 %	(0,028)
00-01	2,1168	(0,034)	2,2970	(0,022)	36,95 %	(0,130)
01-02	1,3943	(0,163)	1,1617	(0,245)	22,44 %	(0,307)
02-03	-0,0921	(0,927)	-0,2739	(0,784)	-5,22 %	(0,841)
03-04	0,1655	(0,869)	0,6114	(0,541)	-0,87 %	(0,953)
04-05	1,8927	(0,058)	1,9017	(0,057)	17,82 %	(0,080)
05-06	-0,2122	(0,832)	-0,3667	(0,714)	-6,21 %	(0,601)
06-07	0,7504	(0,453)	1,0408	(0,298)	5,98 %	(0,565)
07-08	0,5675	(0,570)	0,8571	(0,391)	7,02 %	(0,635)
B/P						
00-08	1,3112	(0,190)	1,0430	(0,297)	16,64 %	(0,008)
00-01	1,6541	(0,098)	1,7728	(0,076)	29,80 %	(0,229)
01-02	1,0951	(0,273)	1,1125	(0,266)	18,29 %	(0,379)
02-03	0,2916	(0,771)	0,3401	(0,734)	0,27 %	(0,990)
03-04	-0,2265	(0,821)	-0,0404	(0,968)	3,46 %	(0,819)
04-05	1,4224	(0,155)	1,1771	(0,239)	8,94 %	(0,345)
05-06	-1,1659	(0,244)	-1,7511	(0,080)	-9,38 %	(0,395)
06-07	1,3911	(0,164)	1,6981	(0,089)	16,05 %	(0,144)
07-08	0,9531	(0,341)	1,1982	(0,231)	11,25 %	(0,439)
S/P						
00-08	1,0662	(0,286)	0,8220	(0,411)	14,99 %	(0,026)
00-01	1,4646	(0,143)	1,5150	(0,130)	28,30 %	(0,274)
01-02	0,7871	(0,431)	0,6133	(0,540)	10,63 %	(0,602)
02-03	-0,6354	(0,525)	-0,2542	(0,799)	-8,88 %	(0,747)
03-04	0,9404	(0,347)	1,0030	(0,316)	12,52 %	(0,349)
04-05	0,8684	(0,385)	0,9413	(0,347)	7,62 %	(0,465)
05-06	-1,8653	(0,062)	-1,5923	(0,111)	-6,53 %	(0,594)
06-07	1,7061	(0,088)	1,9842	(0,047)	20,93 %	(0,058)
07-08	0,8251	(0,409)	0,8757	(0,381)	7,10 %	(0,688)

The table exhibits performance differences between value (T1) and growth (T3) portfolios on the basis of several performance metrics (i.e., the Sharpe Ratio, the Adjusted Sharpe Ratio, and the Jensen Alpha) for each portfolio formation criterion (significance levels are in brackets).

Appendix 2 (Panel B). Annual Performance Comparison of Value (T1) and Growth (T3) Portfolios (2000-2008).

Variable	Sharpe Ratio Difference		Adjusted Sharpe Difference		Alpha Spread	
	T1 vs. T3	(sign.)	T1 vs. T3	(sign.)	T1 vs. T3	(sign.)
D/P						
00-08	0,6670	(0,505)	0,4861	(0,627)	7,61 %	(0,251)
00-01	0,7122	(0,476)	0,8396	(0,401)	15,93 %	(0,513)
01-02	-0,1071	(0,915)	-0,2906	(0,771)	-10,85 %	(0,658)
02-03	-0,5483	(0,584)	-0,2386	(0,811)	-8,34 %	(0,758)
03-04	2,7683	(0,006)	-0,0568	(0,955)	-0,52 %	(0,973)
04-05	1,6906	(0,091)	1,5275	(0,127)	14,81 %	(0,151)
05-06	-0,1425	(0,887)	-0,2289	(0,819)	-8,89 %	(0,482)
06-07	1,2434	(0,214)	1,6222	(0,105)	14,72 %	(0,180)
07-08	1,3135	(0,189)	1,0719	(0,284)	10,78 %	(0,422)
β^{-1}						
00-08	1,0464	(0,295)	0,9031	(0,366)	12,07 %	(0,062)
00-01	2,1205	(0,034)	2,1550	(0,031)	43,15 %	(0,099)
01-02	0,9295	(0,353)	0,8466	(0,397)	13,44 %	(0,587)
02-03	0,3983	(0,690)	1,1450	(0,252)	-6,82 %	(0,782)
03-04	1,5323	(0,125)	1,7223	(0,085)	18,05 %	(0,228)
04-05	1,9198	(0,055)	2,1989	(0,028)	16,50 %	(0,069)
05-06	-0,5343	(0,593)	-1,0238	(0,306)	-7,07 %	(0,554)
06-07	-0,1749	(0,861)	-0,3410	(0,733)	-4,25 %	(0,700)
07-08	-0,1211	(0,904)	-0,1268	(0,899)	-0,85 %	(0,955)
2A (E/P B/P)						
00-08	1,1844	(0,236)	0,9786	(0,328)	15,25 %	(0,021)
00-01	1,6493	(0,099)	1,8018	(0,072)	30,64 %	(0,214)
01-02	0,9545	(0,340)	0,8396	(0,401)	15,22 %	(0,502)
02-03	-0,1086	(0,914)	0,2430	(0,808)	-5,89 %	(0,824)
03-04	-0,1762	(0,860)	0,2820	(0,778)	-2,15 %	(0,889)
04-05	1,7949	(0,073)	1,9108	(0,056)	17,38 %	(0,082)
05-06	-0,3739	(0,708)	-0,9241	(0,355)	-6,57 %	(0,548)
06-07	1,1509	(0,250)	1,6226	(0,105)	12,27 %	(0,291)
07-08	1,1793	(0,238)	1,1839	(0,236)	14,95 %	(0,329)
2B (B/P EBITDA/EV)						
00-08	1,2145	(0,225)	1,0799	(0,280)	16,69 %	(0,011)
00-01	1,6668	(0,096)	1,7585	(0,079)	31,06 %	(0,202)
01-02	0,4716	(0,637)	0,3799	(0,704)	1,56 %	(0,948)
02-03	-0,3944	(0,693)	0,0682	(0,946)	-7,49 %	(0,757)
03-04	2,5432	(0,011)	1,7059	(0,088)	26,19 %	(0,113)
04-05	1,6150	(0,106)	1,9067	(0,057)	15,46 %	(0,130)
05-06	-0,3496	(0,727)	-0,7540	(0,451)	-6,23 %	(0,583)
06-07	1,6553	(0,098)	2,4056	(0,016)	19,36 %	(0,060)
07-08	1,3718	(0,170)	1,0916	(0,275)	11,34 %	(0,394)

The table exhibits performance differences between value (T1) and growth (T3) portfolios on the basis of several performance metrics (i.e. the Sharpe Ratio, the Adjusted Sharpe Ratio, and the Jensen Alpha) for each portfolio formation criterion (significance levels are in brackets).

Appendix 2 (Panel C). Annual Performance Comparison of Value (T1) and Growth (T3) Portfolios (2000-2008).

Variable	Sharpe Ratio Difference		Adjusted Sharpe Difference		Alpha Spread	
	T1 vs. T3	(sign.)	T1 vs. T3	(sign.)	T1 vs. T3	(sign.)
2C (S/P EBITDA/EV)						
00-08	1,0065	(0,314)	0,8142	(0,416)	12,92 %	(0,049)
00-01	1,8672	(0,062)	1,9920	(0,046)	33,86 %	(0,171)
01-02	0,5598	(0,576)	0,3770	(0,706)	3,04 %	(0,893)
02-03	-0,8521	(0,394)	-0,2897	(0,772)	-15,54 %	(0,549)
03-04	0,9267	(0,354)	1,2864	(0,198)	13,56 %	(0,322)
04-05	1,4333	(0,152)	1,5229	(0,128)	12,63 %	(0,237)
05-06	-1,0429	(0,297)	-1,5653	(0,118)	-12,71 %	(0,306)
06-07	1,9128	(0,056)	2,3564	(0,018)	22,17 %	(0,025)
07-08	0,5326	(0,594)	0,5893	(0,556)	3,55 %	(0,823)
3A (B/P S/P EBITDA/EV)						
00-08	1,0238	(0,306)	0,8328	(0,405)	12,97 %	(0,051)
00-01	1,5068	(0,132)	1,5652	(0,118)	24,96 %	(0,304)
01-02	0,3981	(0,691)	0,2059	(0,837)	-0,64 %	(0,977)
02-03	-0,2235	(0,823)	0,1784	(0,858)	-8,82 %	(0,748)
03-04	0,7094	(0,478)	1,0995	(0,272)	13,99 %	(0,355)
04-05	1,2166	(0,224)	1,4226	(0,155)	11,37 %	(0,293)
05-06	-1,7079	(0,088)	-1,8139	(0,070)	-15,86 %	(0,193)
06-07	1,5369	(0,124)	2,2074	(0,027)	17,33 %	(0,085)
07-08	1,6365	(0,102)	0,9883	(0,323)	9,17 %	(0,496)
3B (β^{-1} B/P E/P)						
00-08	1,2481	(0,212)	1,0235	(0,306)	14,78 %	(0,024)
00-01	2,1279	(0,033)	2,2635	(0,024)	36,34 %	(0,133)
01-02	0,8681	(0,385)	0,7150	(0,475)	10,94 %	(0,637)
02-03	-0,1349	(0,893)	0,1240	(0,901)	-8,74 %	(0,793)
03-04	0,8068	(0,420)	0,6454	(0,519)	2,77 %	(0,862)
04-05	2,8725	(0,004)	3,3828	(0,001)	26,17 %	(0,010)
05-06	-0,5913	(0,554)	-0,8860	(0,376)	-10,58 %	(0,375)
06-07	1,0579	(0,290)	1,7232	(0,085)	11,36 %	(0,313)
07-08	1,7113	(0,087)	1,9648	(0,049)	20,61 %	(0,144)
3C (β B/P EBITDA/EV)						
00-08	0,6180	(0,537)	0,5378	(0,591)	7,34 %	(0,242)
00-01	1,5527	(0,120)	1,8530	(0,064)	17,80 %	(0,541)
01-02	-0,0800	(0,936)	-0,2167	(0,828)	-7,28 %	(0,733)
02-03	0,1567	(0,875)	0,1388	(0,890)	11,42 %	(0,571)
03-04	-0,0626	(0,950)	0,2445	(0,807)	7,04 %	(0,647)
04-05	0,3086	(0,758)	0,2652	(0,791)	1,88 %	(0,853)
05-06	-1,7114	(0,087)	-1,1652	(0,244)	-13,54 %	(0,170)
06-07	1,8315	(0,067)	2,4138	(0,016)	19,96 %	(0,046)
07-08	0,9921	(0,321)	0,5428	(0,587)	5,85 %	(0,603)

The table exhibits performance differences between value (T1) and growth (T3) portfolios on the basis of several performance metrics (i.e. the Sharpe Ratio, the Adjusted Sharpe Ratio, and the Jensen Alpha) for each portfolio formation criterion (significance levels are in brackets).