The Return of the Size Anomaly: Evidence from the German Stock Market*

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Abstract

This paper examines the size-effect in the German stock market and intends to address several unanswered issues on this widely known anomaly. Unlike recent evidence of a reversal of the size anomaly we document a conditional relation between size and returns. We also detect strong momentum across size portfolios. Our results indicate that the marginal effect of firm size on stock returns is conditional on the firm's past performance. We use an instrumental variable estimation to address Berk's critique of a simultaneity bias in prior studies on the small firm effect and to investigate the economic rationale behind firm size as an explanatory variable for the variation in stock returns. The analysis in this paper indicates that firm size captures firm characteristic components in stock returns and that this regularity cannot be explained by differences in systematic risk.

Keywords: Size effect, small firm effect, capital market anomaly, capital asset pricing, CAPM, efficient markets

Classification: G11, G12, G15, C31

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I. Introduction

Recent evidence on the long known size anomaly – the finding that small capitalization stocks consistently outperform large capitalization stocks – documents a reversal of this regularity into a size discount and claims "the demise of size" (Dimson and Marsh, 2000). Others argue that it should not in fact be regarded as an anomaly at all (Berk, 2000) or that the out-of-sample expected returns of trading strategies based on discovered anomalies like the small-firm effect are zero (Black, 1993). This paper attempts to address some of the issues raised about the validity of the size effect in the cross-section of expected stock returns.

The paper investigates the relatively neglected German stock market. The evidence on the recent reversal of the size premium is so far confined to the UK and US stock markets. Hence, an investigation whether the size effect exists in the German market could shed light on whether the recent findings are due to the stage of development and sophistication of the stock market as well as the degree of dispersion of ownership and whether the out-of-sample profitability of trading strategies based on firm size is indeed on average zero or even negative.

Secondly, Berk (1995) proposes a theoretical explanation for the size anomaly linking it to the fundamental valuation relation. Given that the market value of an asset is the discounted value of its expected future cash flows he shows that size measured by market value will always be inversely related to returns (similarly Clubb and Naffi, 2007). Therefore, this paper explicitly accounts for methodological problems that originate from the endogeneity of the size factor in

OLS regressions. Similar to Fan and Liu (2005) this paper utilizes an instrumental variable model to overcome the statistical problems associated with the endogeneity bias. However, in contrast to the above mentioned authors, this study concentrates on firm specific factors assumed to drive the size anomaly supported by the recent empirical evidence discussed below. Also, several robustness tests are performed to corroborate the results.

A further purpose of this paper is to add insights to the economic rationales behind the explanatory power of size in stock returns and to find explanations for the many different findings on this anomaly. Despite 25 years of research after the detection of the small firm effect, the economic rationale behind size as a factor to explain the cross-sectional variation in expected returns remains unclear. In this respect the current academic literature in empirical finance still remains divided. In particular, two diametrically opposite schools of thought dominate recent research in this area. Proponents of a rational asset pricing explanation of the size effect argue that the market is efficient in pricing assets, but the CAPM is misspecified. Hence, differences in average returns are due to differences in risk and a size factor in returns is evidence of a common (unknown) risk factor in shocks to expected cash flows (e.g., Fama and French, 2004; Malkiel, 2003). Opponents of this view, behavioral finance theorists, on the other hand try to find explanations for these puzzles using advances in human psychology. Lakonishok et al. (1994) argue strongly against rational investors in the market who drive prices to equilibrium. They assert rather, that there are naïve investors who follow trends in the market or irrationally extrapolate past information into the future. Hong et al. (2000), on the other hand, believe asymmetric information dissemination and limited information flows for smaller firms explain the size effect in stock returns.

In this paper we document a conditional relation between size and returns that calls into question previous ‘unconditional’ findings of a general reversal of the size premium. We are also able to reject Berk’s (1995) critique. The results suggest that it is unlikely that the explanatory power of size can be attributed to differences in market-wide risk, but rather indicate that firm size captures characteristic components. Our results furthermore show that the marginal effect of firm size on stock returns is conditional on the firm’s past performance. These results, however, deserve a caveat since they are drawn from a restricted sample period as explained in detail below due to the limited availability of sufficient accounting data for German firms.

The next section discusses the previous literature on the size effect related to this study. Section three briefly describes the characteristics of the sample and of the German stock market. Section four presents the methodology and the beta estimation procedure. Results based on portfolio returns are presented in section five and extended to preliminary Fama-MacBeth regression results. In section six we examine the economics of size more closely and directly address some of the critiques mentioned above. We test the robustness of our results in section seven and conclude and present different explanations for our findings in section eight.

II. The Size-Effect Revisited

The explanatory power of the firm's market value for the variation in expected stock returns was first documented by Banz (1981) and subsequently labeled as the size effect.[1] Banz (1981) shows that between 1936 and 1975 stocks of small firms had on average higher risk-adjusted returns than stocks of large firms in the US. Banz grouped his sample into portfolios sorted by market value and estimated betas, and performed a time-series of cross-sectional regressions over his sampling period for an arbitrage portfolio comprised of a long position in the small firm portfolio and a short position in the large firm portfolio. He follows a procedure first introduced by Black et al. (1972) and Fama and MacBeth (1973), which will be discussed in more detail in section four. Banz concludes that the CAPM is misspecified, but fails to give an economic explanation why size is a factor in stock returns or whether it is just a proxy for a risk factor not captured in securities' betas.

An explanation that smaller firms are riskier and therefore deserve higher expected returns is provided by Roll (1981). Roll argues that the risk measures in Banz (1981) are biased downward due to autocorrelation in the returns of small firms which are infrequently traded.[2] Barry and Brown (1984), on the other hand, provide evidence that the size effect is at least partly associated with differential information about small and large firms and thus related to the perceived riskiness of small firm stocks. These early findings induced Merton (1987) to derive an

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1 While testing the explanatory power of the price earnings ratio, Reinganum (1981) also confirms that after controlling for market value the P/E-ratio loses its significance.

2 However, this bias is more severe when daily returns are used instead of monthly returns as in Banz's (1981) study. For a detailed discussion the reader should refer to Scholes and Williams (1977) and Dimson (1979).

extended asset pricing model in which returns are also a function of size and the availability of information for that specific asset.[3] This model was tested by Amihud and Mendelson (1989), who proxy the information factor of an asset by its bid-ask spread. Their results suggest that only systematic risk and a stock's illiquidity, measured by its bid-ask spread, affect returns. In fact, the size factor in their model appears to be insignificant and changing in sign over different sample periods.

Further evidence on the predictability of stock returns based on firm size is provided by Chan and Chen (1988 and 1991). Chan and Chen (1988) argue that the size effect is merely an outcome of measurement errors in the estimation of betas and thus just a proxy for underlying risk factors captured by the true beta. They elaborate this assertion in their follow-up paper, in which they find that small firms often suffered from inefficient production and cash flow problems in preceding years causing their share price to fall, which in turn causes higher financial leverage (Chan and Chen, 1991). Hence they conclude that small firms do indeed represent riskier investments justifying higher expected returns. Fama and French (1992, 1995 and 1996) complete this view of size and book-to-market factors as being part of rational asset pricing within the efficient markets framework in a series of papers in which they finally reject the validity of the CAPM in favour of a three factor model. However, they admit that it is difficult to find an economic reason for size (and book-to-market) as risk factors in asset pricing (e.g., Fama and French, 1995).

[3] Merton proposes a generalization of the CAPM including additional factors as residual risk, size and the fraction of all investors investing in the asset. Note however, that, contrary to Banz's size effect, Merton suggests a positive linear relation between size and asset returns.

While there have been several attempts in the behavioural finance literature to explain the book-to-market effect, only a few expand their explanations to the size anomaly. Lakonishok et al. (1994) amongst these argue that investors overreact to past (good and bad) information and drive stock prices away from their intrinsic values. Similarly, Dissanaike (2002) argues that the small-firm effect is merely an indication of investor overreaction and provides evidence for the UK that small size firms are also those with relatively negative stock price performance over the past. Hong et al. (2000), on the other hand, link the size effect to short-term momentum in stock returns. They base their explanation on the gradual information diffusion model developed by Hong and Stein (1999) and assert that small stocks experience slower information flow and less analyst coverage. Hence, they conclude that smaller stocks are those with more pronounced momentum effects as particularly bad news diffuses only slowly among investors in small capitalization stocks. Daniel et al. (1998) provide further theoretical explanation for these regularities using findings in cognitive psychology. They develop a model which explains market anomalies by behavioural biases of investors. According to their theoretical model it is investors' overconfidence and self-attribution bias which drives market prices away from fundamental values.

Berk (1995 and 1997) provides another theoretical explanation for the relation of expected return and size. He argues that size is always inversely related to expected returns, since stocks with high expected returns also have high discount rates which in turn automatically cause lower market values. The size factor therefore does not proxy any specific other risk variable, but captures any residual risk not explained by the factor model under scrutiny (e.g., Berk, 1995). He hence concludes that the small firm effect should not be regarded as an anomaly or as evidence against any asset pricing theory (Berk, 1997). Berk's hypothesis it tested by Fan and Liu (2005), who estimate a simultaneous equation model in order to find the characteristic components of size and book-to-market. Their findings suggest that size and book-to-market are driven by financial distress, the firm's growth options and momentum and contrarian effects in the market.

III. Sample Selection

A. Size and the German Stock Market

There is a plethora of supporting evidence for the size effect in international stock markets, including German stocks (e.g., Fama and French, 1998; Heston et. al., 1999). However, few have examined the determinants of the size anomaly in the German market more closely.[4] A more thorough investigation of the size anomaly in the German market setting promises to reveal further important evidence on this puzzle for several reasons.

Firstly, recent evidence on the size anomaly added a new twist to the existing literature by showing a 'reverse' size effect in stock markets in the US or UK. Already Amihud and Mendelson (1986) and Reinganum (1990) pointed out that the market structure may have a significant impact on the magnitude of the size effect. The recent evidence on the possible size discount in countries with more developed capital markets raises the question whether this is due to increased institutional trading based on previously discovered anomalies in these markets. The international evidence on the size effect provides indications that the magnitude of the size effect is dependent on differences in market structures and

[4] To the authors knowledge Stehle (1997) in German language is one of the few who has documented the size effect in Germany in more detail.

stages of market development (e.g. Dimson and Marsh, 2000; Hawawini and Keim, 2000). Comparing Germany with the UK or US, the German capitalism model does not rely predominantly on financial markets as the primary means of corporate financing, but rather is characterized as a bank-centered financial system (Hall and Soskice, 2001). As such the German equity capital market is far less developed. When measured in terms of the ratio of stock market capitalization to GDP, the German stock market lags in development behind the markets in the UK and US. At the beginning of the new millennium the ratio of stock market capitalization to GDP was only about 66% in Germany compared to 180% in the UK and 155% in the US (see Figure 1).

[Insert figure 1 about here]

Furthermore, ownership structures differ considerably across the markets. In the UK, ownership in publicly traded companies is more dispersed, where the main investors are private investors or institutions such as investment funds, pension funds and insurance companies. All of these normally hold small diversified stakes throughout the entire market. In contrast, in Germany shareholdings seem more concentrated among large strategic investors often supported by an owner-manager relationship (e.g. Vitolis, 2001). Comparing the UK with Germany in the early nineties, Franks and Mayer (2001) report that while in Germany 85% of the largest quoted companies are controlled by a single shareholder owning more than 25% of the voting shares, in the UK only 13% in a similar sample had a single blockholder with more that 25% of the voting shares. In fact, Faccio and Lang (2002) report the lowest percentage of widely held firms in Europe for Germany comprising only 10% of their sample of 704 listed German companies, whereas in the UK widely held firms comprise 63%.[5] As evident in Figure 2 institutional investors and corporations dominate German shareholdings and particularly the share ownership of private households still remains small.

[Insert figure 2 about here]

Secondly, prior findings on the profitability of momentum and contrarian strategies in Germany show the same pattern as in the US markets (Schiereck et al. (1999), Glaser and Weber (2003)). Consequently, it suggests itself that other anomalies such as the small firm effect exhibit similar dynamics. Moreover, recently Walter and Weber (2006) provide evidence that mutual funds in Germany show signs of herding behaviour and positive feedback trading in their portfolio choices. These behavioural biases among the largest shareholders of German stocks calls into question the fundamental efficiency of the German stock market and might lead to persistence of anomalies over time.

Finally, the German stock market increasingly displays patterns synchronous with the S&P500 and US stocks in general due to the international presence and operations of large German corporations listed on the Frankfurt Stock Exchange. This not only encourages out-of-sample investigations of Anglo-Saxon studies to refute often stated data-snooping criticism, but also makes the German market interesting in its own right due to its size and importance within the European Economic Area. As a result, one would expect the recently discovered ‘reverse’ size effect to be equally observable in the behaviour of German stocks.

B. The Sample

5 The authors define ‘widely held’ as single ownership below the 20% control threshold.

Our initial sample comprises all stocks listed in the German composite index CDAX. The CDAX index includes all domestic companies of the Prime and General Standard of the Frankfurt Stock Exchange comprised of large-caps (DAX), mid-caps (MDAX), small-caps (SDAX), technology stocks (TecDAX) and other stocks of the General Standard segment and thus represents the whole breadth of the German stock market. Taking a preliminary look at the performance of the two German stock indices DAX and SDAX, which include large-cap stocks and small-cap stocks, respectively,[6] reveals a remarkable out performance of the smaller firm index compared to the largest companies over a recent 6 year period (see Figure 3). In fact, investors would have earned an astonishing 118% on their investments since April 2001 had they invested in the SDAX compared to ‘only’ 20% on investments in the DAX.

[Insert Figure 3 about here]

Monthly stock returns and accounting data for all companies listed in the German composite index CDAX were obtained through Thomson Financials Datastream database for a 10 year period between March 1996 and March 2006.[7] The initial sample includes 674 companies. Those with less than 24 months of return data for beta estimation purposes before July 2001 or missing accounting data are excluded from the final sample. We also exclude the very smallest stocks (the bottom decile) to avoid confounding effects of thin trading and the bid-ask bounce. In addition, in order to verify the robustness of our results we further

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[6] The DAX Index tracks the price development of the 30 largest and most actively traded companies whereas the SDAX is comprised of 50 small companies of the same Prime Standard ranked in size behind the 30 DAX and 50 MDAX companies.

[7] The sample period is restricted to 10 years as a result of increasing limitations in accounting data for German firms before 1996. The data limitations force a trade-off between number of firms with complete accounting data and number of years.

exclude firms with very low trading volume and very high bid-ask-spreads. The final sample comprises 447 German firms with complete return and accounting data and the restricted sample adjusted for thin trading and the bid-ask bounce comprises 329 firms. The summary statistics for the sample is given in Table 1. The results presented in this paper do not change significantly whether or not we apply the above adjustments.

[Insert Table 1 about here]

IV. Methodology

A. Fama-MacBeth Procedure

The main underlying research methodology of this study is a modification of the time series cross-section regression method of Fama and MacBeth (1973).[8] The entire sample period between 1996 and 2006 is divided into approximately two five year periods, the pre- and the post-ranking period. In June 2001 all stocks are ranked based on market value and beta estimates. The pre-ranking period is used to estimate asset betas on the basis of at least 24 months of security returns as described in detail below. In each of the 57 months in the post-ranking period a cross-sectional asset pricing test is conducted in which stock returns are regressed on different variables that are assumed to explain the variation in expected returns, in which

$$R_{it} = \sum_j \beta^j x_{it}^j + \varepsilon_{it} \quad i = 1,.., N; \ t = 1,..., T \tag{1}$$

[8] For a formal discussion of the methodology see also Fama (1976).

is the multivariate regression equation with j explanatory variables. These equations have a cross-sectional element for N firms and a time-series element for T observations for each firm. According to Fama and MacBeth (1973) the regression estimates and their standard errors can be obtained by taking the time-series means of the cross-sectional estimates and their standard deviations, respectively:

$$\begin{aligned} \hat{\beta}^j &= \frac{1}{T}\sum_{t=1}^{T}\hat{\beta}_t^j \\ \sigma^2\left(\hat{\beta}^j\right) &= \frac{1}{T(T-1)}\sum_{t=1}^{T}\left(\hat{\beta}_t^j - \hat{\beta}^j\right)^2 \end{aligned} \tag{2}$$

These time-series means of the monthly regression estimates are then used in standard tests for the explanatory power of the independent variables, i.e. to test whether the different variables are on average priced in asset returns.[9] The advantage of this procedure is that it takes into account a possible cross-sectional correlation of the error terms at any given time. Moreover, the procedure also allows for time-varying betas, since new beta estimates enter into the regressions each month. However, it also assumes serially uncorrelated error terms of the asset pricing tests over time.[10] Since all explanatory variables such as size, book-to-market, leverage, etc. except asset beta are directly observable, there is no need to estimate the Fama-MacBeth regressions for portfolios if more precise estimates for individual asset betas can be obtained. This is done following a procedure suggested by Fama and French (1992) described in the subsequent section.

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[9] Assuming normally distributed returns that are IID over time, the regression factors will also be IID, so that the test statistic is distributed student-t and asymptotically normal. For a detailed discussion of the Fama-MacBeth procedure and a comparison with other methods refer to Cochrane (2001) or Campbell (1997).

[10] This assumption should not lead to severe bias in the regression estimates since asset returns are close to independent.

B. Beta Estimation

In order to run cross-sectional regressions to explain security returns on the basis of the CAPM, estimations of asset betas are necessary since the security's systematic risk is not directly measurable. However, these estimates are affected by a sampling error for individual assets causing the so called error-in-variables-problem (e.g. Merton and Scholes, 1972). To mitigate this problem the common approach introduced by Friend and Blume (1970) and Black et al. (1972) is followed and betas for portfolios of individual assets are estimated. Although this procedure improves the precision of the estimations, it is also inefficient, since grouping reduces the range of betas. We alleviate this problem by sorting the securities into five equally weighted portfolios based on their estimated individual betas after having sorted them into five equally weighted portfolios based on their market values (e.g., Fama and French, 1992). Forming portfolios based on size produces a wide spread of returns and betas, but does not take into account the possible high correlation between size and beta. Therefore a second division of the size portfolios based on betas is useful to allow for variations in beta that are unrelated to size. Hence, twenty-five portfolios containing a similar number of securities are formed.

While the first five years of return data were used to estimate the pre-ranking betas of individual securities, the next five years of equally-weighted monthly portfolio returns are calculated to re-estimate portfolio betas.[11] As a market index the broad German CDAX composite index is used. The portfolios are rebalanced

[11] Re-estimating portfolio betas based on aggregate data in the post-ranking period mitigates systematic estimation errors in portfolios sorted according to individual securities' beta since within a size-beta portfolio errors in individual security's beta are most likely random across securities.

monthly to allow securities to be assigned to different portfolios based on their change in market value. After re-estimating portfolio betas for each of the twenty-five size-beta portfolios, these post-ranking betas are allocated to each stock in that portfolio. This procedure allows the Fama-MacBeth regressions to be used for individual securities rather than portfolios in order to retain the security specific information (e.g. Fama and French, 1992).

V. Beta and Size in the Cross-Section of German Stock Returns

A. Portfolio Returns: Simple strategies

The entire sample is ranked according to market values at the beginning of July 2001, the portfolio formation date. Two portfolios are formed containing the 100 smallest and the 100 largest firms, respectively. A summary statistic for both portfolios across all variables is given in Table 2. As evident from the Table the sorting procedure based on size produced two portfolios, which as expected, are significantly different in average market values, sales and total assets (0.01-level, two-sided t-test). Moreover, the smaller firms in the sample on average seem to be less profitable than the larger firms. The table also reveals that the small size portfolio on average contains stocks which are traded less frequently and which have higher book-to-market values. The latter finding suggests a possible correlation between size and book-to-market ratio and is consistent with prior empirical evidence indicating the outperformance of value stocks (see e.g. Fama and French (1992); Lakonishok et al. (1994)). However, there is no significant difference in mean betas, leverage, dividend yield, bid-ask spreads and P/E ratios.

[Insert Table 2 about here]

In order to assess the investment performance over the post-ranking period the portfolios were not rebalanced. Cumulative average portfolio returns are calculated and plotted in Figure 4. The Figure reveals an underperformance of the small stock portfolio in the first 24 months followed by a significant out performance until the end of the post-ranking period compared to the large stock portfolio.

[Insert Figure 4 about here]

Following the critique of Dissanaike (1994) and Roll (1983), that arithmetic cumulative returns do not reflect the returns that investors would actually earn, compounded buy-and-hold returns and returns of a ‘zero-cost’ investment strategy are also calculated.[12] Figure 5 shows the returns of this investment strategy, which reflects the arbitrage returns that would accrue to investors by holding a long position in the small firm portfolio financed by a short position in the large firm portfolio (without taking into account transaction costs). Given that the German composite market index CDAX lost over half of its value from its peak in early 2000 to its trough in May 2003, the pre-May 2003 period is labeled as the ‘down’ or bearish market and the period from May 2003 on is labeled as the ‘up’ or bullish market. The small stock portfolio appears to lose relatively more in value in the ‘down’ market period compared to the large stock portfolio while in the ‘up’ market the same portfolio gains significantly more in value. As evident from Figure 5 the ‘zero-cost’ investment strategy provides investors on average with

[12] Roll finds that using buy-and-hold returns mitigates the upward bias introduced by arithmetic returns when calculating the size premium for mean portfolio returns.

positive excess returns. Moreover, the premium on small firms seems more pronounced during the bullish market period.[13] A premature conclusion would be to attribute this performance to a higher systematic risk of smaller firms. Table 2 shows that the average betas of both portfolios are not significantly different and are both below one.

[Insert Figure 5 about here]

Intriguingly, ranking the entire sample according to their betas and sorting firms into two equally weighted portfolios containing each 100 stocks with the highest and lowest betas, respectively, produces almost the exact opposite significant variation in mean firm characteristics (see Table 3). Low beta stocks have on average significantly higher leverage ratios, dividend yields and bid-ask spreads and are on average more profitable that their larger counterparts, but also exhibit lower trading volumes. Figure 6 plots cumulative average portfolio returns for both portfolios. While the Figure reveals large discrepancies between the return behaviour of high and low beta stocks during the down market, the cumulative returns of both portfolios seem to converge during the up market. Applying the same arbitrage investment strategy gives a similar and even more pronounced picture of negative excess returns during the ‘down’ market period and positive excess returns during the ‘up’ market period (see Figure 7). The results of the beta-sorted portfolios confirm the risk-return relationship suggested by the CAPM.

[Insert Table 3 about here]

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[13] Buy-and-hold returns over the entire period amount to 120% for the small stock portfolio compared to 18% for holding the large stock portfolio.

These initial findings provide some indication that beta and size both might pick up variations in firm specific characteristics in the sample, and that they do so in a complementary way. On the one hand, the size variable seems to capture idiosyncratic components of stocks which correctly are not captured by beta. On the other hand, interestingly, beta also captures some idiosyncrasies – not picked up by the size measure – which according to rational asset pricing advocates should not be reflected in this systematic risk measure. However, it is equally not hard to imagine that both variables capture the correlation with a common market wide risk factor not completely accounted for by the security's beta and correlated to firm size.

[Insert Figure 6 and Figure 7 about here]

B. Portfolio Returns: Size-Beta Portfolios

The preliminary findings above based on the two different sorts highlight the importance of a two-dimensional sort in order to control for the possible correlation between beta and size and to be able to investigate whether idiosyncratic variations explain variations in portfolio returns. Table 4 shows the raw buy-and-hold returns of the 25 size-beta portfolios during the entire post-ranking period. Buy-and-hold returns are calculated following Roll's (1983) 'rebalanced returns' according to

$$BHR_p = \left[\prod_t (1 + \frac{1}{N} \sum_{i=1}^{N} R_i) \right] - 1 , \qquad (3)$$

where R is the monthly stock return of each individual firm i. The results demonstrate that the larger firm portfolios outperformed the smaller firm portfolios on a raw return basis calculated over the entire period.[14] At first sight, consistent to the recent evidence in the UK and US, the size effect appears to have reversed. A similar but weaker reverse relationship between beta and returns is also evident. Large firm portfolios with smaller betas in the sample tend to yield higher returns than the portfolios of smaller firms and/or higher beta. As shown in the previous section these are on average stocks of firms with higher profitability and higher levels of leverage. They are also more frequently traded and exhibit lower book-to-market ratios. This gives rise to the possibility that the CAPM does not appropriately capture the risk inherent in small firms. However, the results from above are not conclusive.

[Insert Table 4 about here]

Prima facie one might conclude that the German market experiences the same 'reverse' size effect as the US or UK market. Yet, there is an obvious caveat in the preceding analysis. The sample period over which returns are cumulated or averaged comprises exactly a period of stock market downturn followed by a period of a general increase in stock prices essentially compensating any possible differences in return behaviour for small firms over this period. Notwithstanding, one might attribute this 'reverse' size effect to the relatively larger losses of smaller firm stocks during the bullish market period after the burst of the stock market bubble. At that time the newly created 'Neuer Markt" index – now TecDax – predominantly consisted of technology firms which lost excessively in market value compared to larger firms in the down market period. These results,

14 Similar results are obtained comparing risk-adjusted portfolio returns (not reported here). The results for risk-adjusted buy-and-hold returns are available on request.

however, cannot easily be reconciled with the apparently superior performance of small firms in the bull market environment (see Figure 3 and 4).

Following the discussion above a division of the post-ranking period into a bearish and bullish period might prove useful to achieve a clearer picture of the performance of the size-beta portfolios. Table 5 summarizes the buy-and-hold returns for the same size-beta portfolios as before, but this time over shorter horizons, the bearish market period July 2001 until April 2003, and then the bullish market period May 2003 until March 2006. As is apparent from the results shown in the tables, the portfolios reveal considerable evidence of a size anomaly during the sub-periods. Smaller firm portfolios seem to earn higher negative returns in absolute terms relative to the large firm portfolios during the bearish market period, whereas the same portfolios also gain relatively more during the bullish market. The results indicate a size discount during downward market conditions and a size premium during upward market movements.[15]

[Insert Table 5 about here]

Moreover, once we take a closer look at the extreme portfolios (small and large size with high and low betas, respectively) we do not find results completely consistent with the aforementioned size anomaly. While the relative under- and out performance of small firm portfolios is apparent for high beta portfolios (Figure 8), it is not so obvious for the low beta portfolios (Figure 9). For the latter ones large firms consistently have higher cumulative returns than smaller firms, yet the increase in returns seems somewhat larger for small firms. An investigation based on the cross-section of individual securities might reveal more

[15] These results are confirmed using risk-adjusted returns (not reported here).

conclusive evidence whether idiosyncratic characteristics or market-wide risk factors are responsible for the variation in average stock returns in Germany.

C. Firm characteristics versus risk loadings

Fama and French (1993, 1996) and Davis et al. (2000) suggest that factors such as size and book-to-market display systematic risk not captured by the CAPM beta. Conversely, Daniel and Titman (1997) and Fan and Liu (2005) propose a characteristics-based explanation for size and book-to-market, stating that these factors are not part of the covariance structure of returns, but rather represent idiosyncratic components.

In order to test whether the anomalous findings above can be at least partly explained by either of these positions, both characteristics-based and risk factor-based asset pricing models are employed within the Fama-MacBeth framework. The characteristics-based asset pricing model is given its empirical expression by

$$R_{it} = \gamma_0 + \gamma_1 BETA_{it} + \gamma_2 BM_{it} + \gamma_3 SIZE_{it} + \gamma_4 DIV_{it} + \gamma_5 PE_{it} + \varepsilon_{it}\,, \tag{4}$$

where BETA is the portfolio beta assigned to the individual stock in the way explained in section IV, BM is the ratio of book value of equity to its market value and SIZE is the market value of equity. Since earlier studies report a relation between risk-adjusted returns, dividend yield and price-to-earnings ratios these characteristics are also included in model (4). The risk-factor based model follows Fama and French (1996), in which in addition to the sensitivity to market risk two factor mimicking portfolios are included.

$$R_{it} = \gamma_0 + \gamma_1 BETA_{it} + \gamma_2 SMB_{it} + \gamma_3 HML_{it} + \varepsilon_{it}\,, \tag{5}$$

where BETA is the same portfolio beta as before, SMB is the difference between the return on quintile portfolios containing the smallest and largest stocks, respectively, and HML is the difference between the return on quintile portfolios containing stocks with high and low book-to-market values, respectively.

All accounting variables used in the characteristics-based regressions are matched with returns with a six month lag in order to ensure that these variables are publicly available and incorporated in stock prices.[16] All ratios such as book to market, price earnings ratio, etc. are calculated on a monthly basis using monthly market values and quarterly accounting data. The factor mimicking portfolios are calculated over the entire sample period and updated monthly.

Table 6 summarizes the regression results. The regressions over the entire sample period reveal a significant inverse relationship between size and realized returns. The coefficient on SIZE remains statistically significant (10%-level, two-tailed test) even after including Fama-French factors in the asset pricing regressions. Intriguingly, the coefficient on book-to-market is also significant (5%-level, two-tailed test) although not with the expected sign. The coefficient is consistently negative. All other coefficients remain insignificant. Only the intercept becomes significant and changes sign once Fama-French factors are included. This is somewhat counterintuitive since the dependent variable is realized returns and the constant term should therefore approximately reflect the monthly risk-free rate. On the other hand, the intercept might also capture persistent trends in returns not entirely picked up by the other explanatory variables. The results lend support for the supposition that not systematic risk factors, but idiosyncratic risk explains the

[16] Banz (1983) only assumes a three month lag until accounting data is known in the market, but Fama and French (1992) give a rationale for the conservative six month lag.

cross-sectional variation in stock returns. The results somewhat support Daniel and Titman's (1997) conjecture.

Pettengill et al. (1995) argue that the results in many studies that reject the risk-return relationship proposed by the CAPM are likely to be spurious since using realized returns to proxy expected returns neglects the implicit condition of the CAPM that expected excess market returns have to be positive. They assert that whenever the market return is less than the risk-free rate the relationship between beta and returns will be inverse. Acknowledging Pettengill et al.'s (1995) findings and our previous findings about a similar conditional relationship between size and returns, we run the asset pricing test over separate sub-periods when market returns are negative (the bear market period, columns (IV) to (VI) in Table 6) and positive (the bull market period, columns (VII) to (IX) in Table 6). The results are somewhat puzzling. While in the bear market period SIZE loses its significance in explaining cross-sectional returns and BM stays highly significant, this finding reverses during the bull market. Now SIZE is significant, but BM is not. The results are also consistent with Pettengill et al.'s (1995) assertion. The coefficient on BETA is negative in the down market – although not significant at standard levels – but positive and significant during up markets. The same relationship seems to hold for the intercept.[17] After a similarly separating up and down market periods Lakonishok and Shapiro (1986) also find that size explains average stock returns, but reject any explanatory power for beta.

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[17] Similar to the conditional relationship of the security's beta the sign of the risk-free rate also seems to be dependent on market conditions. After all this might not be surprising. In falling markets investors reduce their leverage and shift their portfolio weights towards riskless assets. Consequently, the yield on the risk-free rate should decrease, while during up markets the reverse should be true.

On the other hand, the initial puzzling sign on BM may not be so surprising after all. During the bear market period a negative coefficient on BM suggests that growth stocks fare better during deteriorating market conditions while value stocks perform worse. This seems counterintuitive as investors seem to turn away from stocks with stronger fundamentals during down markets. Size does not seem to matter. In contrast, during the up market this growth premium disappears and small firms are favoured by investors. However, we might in fact observe the same phenomenon as small firms tend to be value firms in our sample (see table 2) and are those firms which underperform large firms in down markets but outperform in up markets.

[Insert Table 6 about here]

VI. The Economics of Size

A. Instrumental Variable Estimation

The findings in the previous section that firm size as an idiosyncratic characteristic is able to explain part of the variation of stock returns is unsettling with regard to rational asset pricing. Fama and French (1995 and 1996) as well as Chan and Chen (1991) argue that the explanatory power of size for stock returns in earlier studies captures the compensation for an underlying unknown risk factor, for which size serves as a proxy; and hence it is not inconsistent with a rational asset pricing story. They particularly mention financial distress as one possible risk factor that is not captured by the market factor in the CAPM. If, on the other hand, firm size is indeed capturing firm characteristics in stock returns, the question remains what the economic rationale is behind this regularity.

Moreover, the explanatory power of firm size could equally be due to several other factors omitted in the original CAPM. This unobserved heterogeneity leads to biased and inconsistent estimators when an ordinary least square regression estimation is used to find the linear relationship between risk and return, since the error terms in the regression will be correlated with one or more explanatory variables. Additionally, Berk (1995) shows that since size is usually measured by the market value of equity it is not only endogenous, but simultaneously related to expected returns, thus inducing the so called simultaneity bias.

In the light of these findings we use a set of instrumental variables in a modified Fama-MacBeth two-stage least squares regression in order to control for the endogenous variable size and to test the robustness of our previous findings. We will also try to shed light on the economic characteristics of firm size.

B. Choice of Instrumental Variables

In the first step of the two-stage least squares regression SIZE is regressed on its set of instrumental variables **Z**. It is crucial for the choice of instruments that they are exogenous in the structural equation (4) and correlated to the endogenous explanatory variable SIZE, i.e. $E[\mathbf{z_{it}}, \varepsilon_{it}] = 0$ and $E[\mathbf{z_{it}}, SIZE_{it}] = \delta$ for some nonzero δ, respectively. Furthermore, the reduced form regression must have at least as many instruments as there are explanatory variables in the structural equation (4).[18]

Berk (2000) emphasizes the misspecification of size measured by the market value of equity in explaining stock returns due to the simultaneous relation with expected returns. He thus suggests non-market measures of size in asset pricing tests. We therefore use the book value of total assets (BA) and total sales (SAL) as instrumental variables. Moreover, Fama and French (1996), Chan and Chen (1991) and more recently Vassalou and Xing (2004) suggest that smaller firms suffer more from financial distress and thus are expected to experience higher stock returns. To model for default risk, leverage (LEV), measured by the ratio of long-term debt to market equity and the profitability ratio (PRFT), measured by the ratio of earnings before interest and taxes to total sales, are also included in the reduced form equation. Finally, bid-ask-spread (BAS) and trading volume (VOL) are used as IVs for firm size as well, since smaller stocks are usually also illiquid stocks and thus traded less frequently giving rise to higher holding period risk (e.g., Amihud and Mendelson, 1989). Hence, the reduced form regression is obtained as

$$SIZE_{it} = \lambda_0 + \lambda_1 BA_{it} + \lambda_2 SAL_{it} + \lambda_3 LEV_{it} + \lambda_4 PRFT_{it} + \lambda_5 BAS_{it} + \lambda_6 VOL_{it} + \eta_{it}\,, \qquad (6)$$

The orthogonal projection of SIZE onto the matrix of instrumental variables **Z** gives the fitted values for SIZE. Replacing SIZE in equation (4) with its fitted values of the first-step regression in (6) results in the second-step regression

$$R_{it} = \gamma_0 + \gamma_1 BETA_{it} + \gamma_2 BM_{it} + \gamma_3 P*SIZE_{it} + \gamma_4 DIV_{it} + \gamma_5 PE_{it} + e_{it}\,, \qquad (7)$$

[18] Although the asymptotic efficiency increases with the number of instruments, the finite sample bias also increases (e.g., Phillips, 1980).

where **P** is the projection matrix of the reduced form regression defined by

$$\mathbf{P} = \mathbf{Z}(\mathbf{Z}'\mathbf{Z})^{-1}\mathbf{Z}'. \tag{8}$$

Although the IV estimation gives consistent estimators when the covariance conditions stated above hold, the 2SLS estimators will be asymptotically biased towards OLS if the endogenous explanatory variable and the instruments are only weakly correlated. Nelson and Startz (1990) derive that

$$\frac{OLS\,bias}{2SLS\,bias} \leq 1 \tag{9}$$

whenever the inequality

$$\frac{1}{\hat{\rho}_{xz}^{2}} >> n \tag{10}$$

holds, where $\hat{\rho}_{xz}^{2}$ is the bias-corrected R^2 statistic of the reduced form regression and n is the number of observations.[19] Moreover, low estimators in the first-step regression induce an upward bias in the t-statistic, rejecting the null in regression (3), $H_0 : \lambda_j = 0 \quad j = 1,...,6,$ where in fact it is true. Hence, a choice of poor IVs might lead to erroneous inference.

Additionally, Hahn and Hausman (2003) state that even with a high R^2 in the first-step regression, the 2SLS-estimators will be biased if the disturbances of the structural form and the reduced form equations are correlated. A high correlation might particularly occur when many instruments are used. This study therefore

[19] The authors also show that the R^2 of the first-step regression is upward biased by approximately 1/n, hence suggesting a downward correction (e.g., also Nelson and Startz, 1990).

mainly differs from Fan and Liu (2005) with respect to the number of instrumental variables. While Fan and Liu use up to 152 IVs in their simultaneous equation model in order to explain the cross-section of expected returns, not only including idiosyncratic components but also macroeconomic variables, we only implement firm characteristics hypothesized to be highly related to firm size. Adding less important variables such as macroeconomics variables will add little explanatory power, but increase the bias dramatically (e.g. Buse, 1990).

C. First-Step Regressions

Given the rationale for a two-stage least squares estimation discussed above, the regression in (6) is estimated, in order to investigate whether a linear relation between size and the hypothesized instruments exists. The results of the reduced form regression are presented in Table 7, Panel A. All explanatory variables are highly statistically significant at the 0.01-level (two-tailed test) in explaining the variation in firm size with an overall goodness of fit of 88%. Such a high correlation between firm size and the IVs is a reasonable indicator of an adequate choice of instruments. Consistent with Fan and Liu (2005), particularly book value of assets and sales as physical size measures capture the variation in size based on market value.

Panel B in Table 7 provides similar results when BM is instrumented. Just as with firm size, book-to-market might also be simultaneously related to stock returns as is easily verifiable by a decomposition of the log-ratio into its book value and market value components.

Since a high R-squared is not a guarantor for non-spurious IV estimators, the downward adjustment and simple test given in inequality (9) suggested by Nelson and Startz (1990) is conducted. Also, the Kleibergen-Paap Wald F-statistic is computed to test for weak instruments with robust standard errors (Kleibergen and Paap, 2006).[20] The results confirm the justification of an IV approach. With multiple explanatory variables in the first-step regression spurious estimators might also result from high correlation among the variables. The correlation coefficients of the instrumental variables are given in Table 7, Panel C. Only the correlations between SAL and BA could give rise to concern. Collinearity test do not confirm these concerns.[21] With the number of instruments large enough that the first and second moments estimators exist,[22] but still moderate enough to avoid over-identifying problems and correlation among the disturbances between the structural and reduced form equations, the two-stage least squares estimation appears to be appropriate to produce unbiased and consistent estimators.

D. Second-Step Regressions

Having confirmed the endogeneity of the size factor, the second step of the two-stage least squares regression is estimated containing the predictions of size as regressors as in equation (7). The mean slopes of the 2SLS Fama-MacBeth regressions are presented in Table 8. As in the previous section the asset pricing tests are run over separate sub-periods, the full sample period (columns (I) to

[20] The traditional Cragg-Donald (1993) weak instruments test is no longer valid on computation with a heteroskedasticity-consistent covariance matrix.

[21] We also re-estimate the regressions dropping SAL or BA. The results do not change significantly.

[22] For a derivation of the conditions for the existence of moments in simultaneous equation models refer to Kinal (1980).

(IIIb)), the bear market period (columns (IV) to (VIb)) and the bull market period (columns (VII) to (IXb)). The results in general resemble the OLS regression results, with two major differences. The instrumented size variable displays the same behaviour as the actual firm size – it is significant over the entire sample period and the bull market period, but insignificant during the bear market. This finding rejects Berk's critique of a simultaneity bias being a possible reason for the explanatory power of size in asset prizing regressions. Moreover, although book-to-market seems to be consistently significant in all sub-periods, when replacing the actual value with its projection, unlike SIZE, the variable loses its significance. These results seem to confirm our presumption that size and book-to-market capture the same firm characteristics in our sample, some of which are reflected by BM more appropriately during down markets and by SIZE during up markets.

The second stage results of the 2SLS regression also confirm prior results of the coefficient on BETA, which is negative in the down market but positive during up markets, although not statistically significant in both occasions. Moreover, the constant term is also again statistically significant in the bear and bull market periods with changing signs. The Fama-French factors still do not have any explanatory power for the stock returns in our sample. Both the intercept and the projection of SIZE seem to capture some of the variation of stock returns which was reflected in book-to-market before. Particularly, there appears to be a strong trend or momentum in stock returns over the sub-periods. Hong et al. (2000) and Dissanaike (2002), for instance, provide evidence that much of the small firm effect is driven by short-term momentum and long-term reversal in stock returns. We will investigate this more closely in the following section.

VII. Does momentum in the market drive the size anomaly?

A. Momentum in Size Portfolios

The analysis of the previous section indicates that the size effect could be due to reversals or momentum in stock returns. The small firms in our sample seem to be penalized more heavily by investors in down markets, but are preferred over large firms in up markets. Figure 10 illustrates this relative performance of the size quintile portfolios during the post ranking period. The average market values of the portfolios are rebased to 100 at the beginning of the period. The large rebound of the small size portfolio relative to the larger portfolios hints at a long-term reversal effect and short-term momentum in the size portfolios.

[Insert Figure 10 about here]

Momentum and reversal effects in stock markets are widely documented in the literature (see e.g. DeBondt and Thaler (1985), Dissanaike (1997), Jegadeesh and Titman (1993)). Dissanaike (2002) finds that small firms are also those which have lost in market value in prior periods before they outperform larger firms in subsequent periods. The author hence concludes that the size effect might very well just be another manifestation of the return reversal anomaly. Fan and Liu (2005), on the other hand, find that momentum effects contribute to the significance of firm size in explaining stock returns. Moreover, Schiereck et al. (1999) provide evidence of the profitability of momentum strategies in Germany, but are not able to detect any dissimilarity in size between the momentum portfolios. One indication in favor of reversal in the size portfolios of our sample would be if the portfolios changed their quintile rank over time. Despite the relatively large gains in value over the post-ranking period the smallest size portfolio nevertheless remains in the smallest quintile rank (Figure 11). Dissanaike's (2002) suggestion of the size effect serving as a proxy for investor over-reaction does not hold for our sample. At least over the post-ranking period we examine here there is rather a sign of momentum within size quintile ranks. A caveat, however, might be that our sample period only comprises one full business cycle and hence might not be long enough to allow for a significant reversal.

[Insert Figure 11 about here]

A further indication of momentum is provided by examining the monthly cumulative average raw returns of the size quintile portfolios. Figure 12 reveals larger swings of the smallest quintile portfolio compared to the largest quintile portfolio indicating higher short-term to medium-term momentum for small firms.

[Insert Figure 12 about here]

B. Portfolio Returns: Size-Momentum Portfolios

Table 9 provides further evidence on the relationship between firm size and momentum. The Table shows buy-and-hold returns for 25 size-momentum portfolios. Momentum is measured as cumulative average returns of each portfolio over a 6-month period prior to portfolio formation and subsequently updated monthly. The size-momentum portfolios are constructed by first sorting the entire sample into five quintiles based on their monthly market values beginning with the smallest followed by a second sort into five quintiles based on their cumulative stock returns 6 months prior to portfolio formation beginning with the lowest. Portfolios are rebalanced each month and annualized buy-and-hold returns are calculated by equally weighting the stocks in each portfolio. Table 9 reveals very pronounced return momentum across size portfolios. Portfolios with negative past returns over the previous 6 months continue to earn negative returns, while portfolios with positive past returns continue to earn positive returns. Furthermore, the small size portfolio with negative momentum exhibits larger negative returns than the large size portfolio with negative past returns, while the small size portfolio with positive past returns outperforms the large size portfolio with positive past returns. Firm size appears to amplify momentum returns in an inverse relation.

[Insert Table 9 about here]

Figure 13 illustrates cumulative average returns of the extreme portfolios. The momentum differential (positive – negative) is much larger between the small size portfolios than the large size portfolios.

[Insert Figure 13 about here]

Furthermore, Figure 14 shows consistent and economically significant positive arbitrage returns for a ‘zero-cost’ strategy in which investors would hold a long position in the small firm and large firm portfolio with positive past returns financed by a short position in the small firm and large firm portfolio with negative past returns (without taking into account transaction costs). Excess returns for this strategy using the small firm portfolios exceed those using large firm portfolios. One might suggest that at least economically significant arbitrage returns based on the momentum strategy almost only exist using the small firm portfolios. Then, of course, the small firm effect might in fact be a momentum effect. This supposition warrants a closer look in the next section.

[Insert Figure 14 about here]

C. Momentum and Size – One effect or two?

Table 10 shows the Fama-MacBeth regression results repeating the asset pricing tests earlier including a momentum (MM) and reversal factor (RR). Momentum is measured as cumulative average returns over a 6 month period prior to the month under consideration. Reversal is measured similarly over a 24 month period. The factors are updated monthly. As the full sample period results in column (I) and (II) demonstrate, once momentum is controlled for, the instrumented size variable loses its significance in explaining the variation in monthly returns. Similar to the results in the previous sections book-to-market, initially significant, becomes insignificant once instrumented. Prima facie these results confirm the earlier supposition that size could be subsumed under the momentum effect. However, as discussed above, momentum seems to be stronger with smaller firms. To explore this relationship an interaction term between size and momentum is included in column (III). The results confirm the existence of a joint effect of size and momentum on stock returns. In particular, the following relationship between momentum and the marginal effect of size on stock returns can be derived: Taking the first derivative with respect to SIZE of the underlying equation in column (III), gives

$$\frac{\partial E(R_i \left| SIZE, MM \right.)}{\partial SIZE} = -0.015 - 3.41MM \ . \tag{11}$$

The relation illustrates the inverse relationship of a marginal increase in firm size on stock returns without the presence of momentum. Including momentum, however, the marginal effect of firm size is positive when the stock experienced negative past returns (negative MM) and negative when the stock experienced positive past returns (positive MM). In other words with negative momentum investors fare better investing in larger firms, while with positive momentum the contrary is true.[23] A division of the sample into bear and bull market conditions does not reveal additional insights. Interestingly, the coefficient on HML becomes significant once the interaction term enters the regression, yet with a negative sign.

[Insert Table 10 about here]

VIII. Conclusions

This paper examines the size-effect in the German stock market and addresses several unanswered and hotly debated issues concerning this widely known anomaly. First, the findings in this paper confirm the existence of a size anomaly in the German stock market. Unlike recent evidence of a reversal of the size anomaly (Dimson and Marsh, 2000) we document a conditional relation between size and returns. Similar to prior findings on a conditional relation between beta and stock returns (Pettengill et. al., 1995) we find that small firms underperform

[23] Firm size has no marginal effect on stock returns in our sample when there is slight negative momentum in returns (MM = -0.0044). The median momentum in the sample is 0.04 and the mean 0.055. The 1% MM percentile takes on the value -1.33 and the 99% MM percentile the value 1.77.

large firms during bear market periods, but outperform their larger peers during bull market periods. These results question previous 'unconditional' findings of a size discount in stock markets. Rather the size anomaly should be interpreted as the tendency of small capitalization stocks to perform differently from large capitalization stocks. Although the empirical findings have undergone a series of robustness test, one should however bear in mind that the sample period comprises a relatively shorter time period than previous studies due to data limitations for the German sample of firms.

Secondly, we examine the economics of firm size as a source of cross-sectional variation in stock returns. We find that our size portfolios do not exhibit any differences in market risk. Instead the small and large firms differ considerably in various idiosyncratic characteristics. Our asset pricing tests reveal that the explanatory power of firm size for stock returns cannot be attributed to differences in fundamental risk. Using instrumental variable regressions we address Berk's (1995) critique of a simultaneity bias in asset pricing tests containing market value as an explanatory variable. Our results reject his conjecture. Furthermore, the analysis in this paper indicates that firm size captures firm characteristic components in stock returns consistent with prior findings of Daniel and Titman (1997) and Fan and Liu (2005). In addition, in our sample we also find that beta is able to explain some of the variation in stock returns, but Fama-French risk factors are not. Portfolios sorted based on firm size and betas seem to capture complementary firm characteristics. In particular, firm size seems to capture differences in profitability, book-to-market, bid-ask spread and trading volume.

Finally, we detect strong momentum across size portfolios. Our results indicate that the marginal effect of firm size on stock returns is conditional on the firm's past performance. Small firms with negative momentum perform considerably worse than large firms with negative momentum, while small firms with positive momentum outperform large firms. Stock return reversal does not seem to explain expected returns and the size anomaly cannot be subsumed by either momentum or reversal effects in the market. This last result might however be due to the limited time period we examine in this study which prohibits stronger conclusions to be drawn.

We offer several explanations for our findings. Although prior studies have suggested a risk-based explanation of the size anomaly (e.g. Fama and French 1996; Chen and Chan, 1988), we find little evidence in support of this proposition. Our findings that firm-specific characteristics are able to explain some variation of stock returns adds to the growing literature at odds with the efficient markets hypothesis and leads us to seek salvation in behavioural explanations.

Our findings are in line with Hong and Stein (1999) who maintain that information about small firms possibly diffuses more slowly among the investing public. Unlike Hong et al. (2000) who present empirical evidence that the gradual diffusion of firm specific information occurs asymmetrically – good news seems to spread more quickly than bad news – our empirical results rather suggest a symmetric behaviour of information flow. As investors are most likely faced with limited information about small firms (bad and good news) compared to large firms they revise their expectations about small firms more slowly.[24] Hence, small firms face stronger downward momentum in bear markets and stronger upward momentum in bull markets. This observation would also be consistent with a conservatism bias of investors in general suggested by Barberis, Shleifer and Vishny (1998).

On the other hand, Walter and Weber (2006) find evidence of herding behaviour among institutional investors in Germany. As discussed above share ownership is not widely dispersed in Germany and institutional investors maintain substantial shareholdings. Following Walter and Weber (2006) German fund managers would become victims of positive feedback trading (DeLong et al., 1990) and thus overreact to news about small firms. Additionally, limited information about small firms makes these firms problematic for institutional portfolio holdings. Presumably a more prudent investment strategy, *perceived* riskier firms are screened out during the investment process. Particularly during bear markets small firms could be perceived as more prone to financial distress and trading their shares as more illiquid, causing investment strategies to shift towards large caps, which in subsequent bull markets will be reversed. The results of the instrumental variable estimation presented above confirm that size captures firm specific characteristics associated with default risk and trading constraints.

There might very well be alternative explanations for the evidence beyond the ones we propose and in fact we are confident that new evidence will shed more light on long-known anomalies and particularly on the interaction between seemingly unrelated regularities. We are also aware of the caveats of this

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[24] In general analyst coverage will also be lower for smaller firms which should exacerbate this phenomenon.

particular sample and sample period under consideration. The re-examination of the size effect presented here at best provides a partial explanation for the behaviour of small firm stocks in Germany. We nevertheless hope to have made a good case against the ‘demise of size’. It is always difficult to write a sequel for a story in which the protagonist is said to have died. But there is indeed life in the old dog yet.

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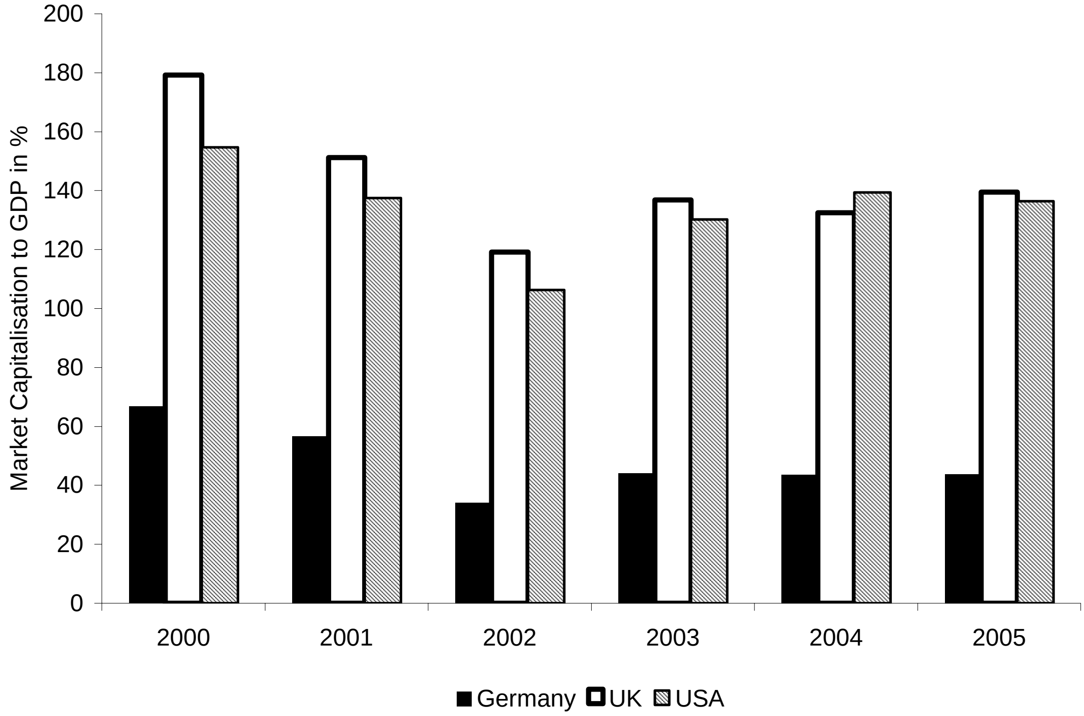
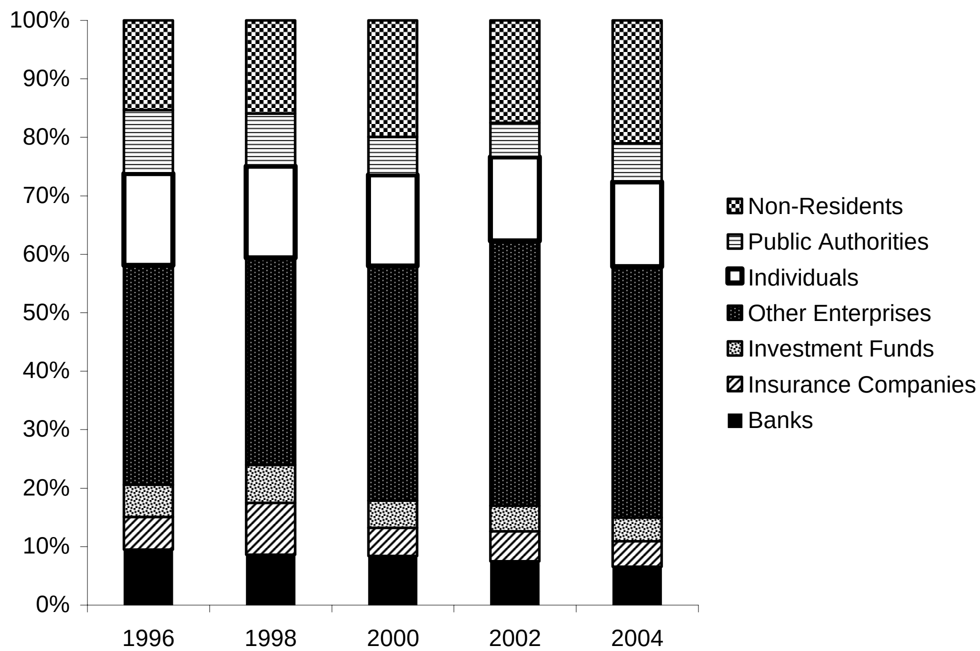
Figure 1: Market capitalisation of all listed companies in percentage of GDP in Germany, the UK and US 2000-2005



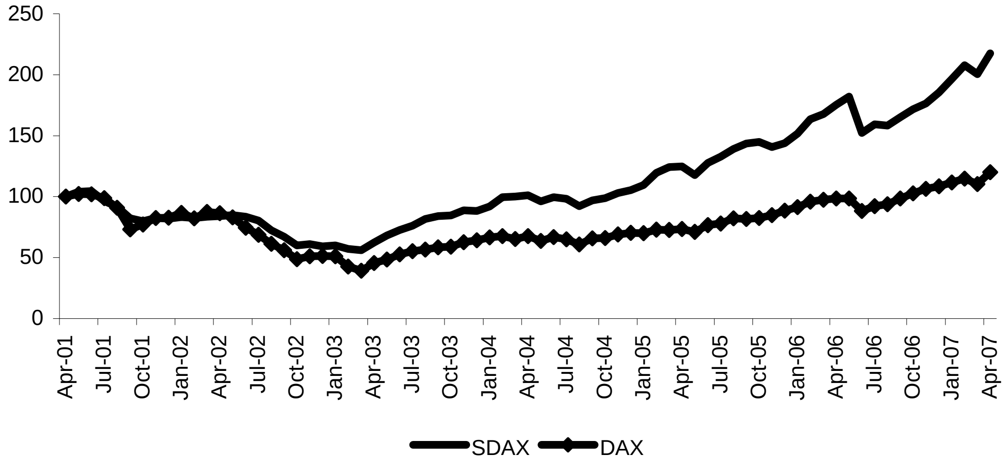
Source: World Development Indicators, World Bank

Figure 2: Share ownership in Germany by group of direct shareholders 1996-2004



Source: Deutsche Bundesbank (2005)

Figure 3: Performance of the German Dax and SDAX stock indices April 2001 - April 2007



Source: Thomson Financial Datastream

Table 1: Summary Statistics (all values in million euros except ratios)

Companies	329				
Months	57				
Variables	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
return	25,468	0.0082	0.25	-0.94	19.14
Beta	329	1.1	1.03	-0.57	5.56
Market value	25,467	2,788.75	10,192	1.11	83,677
Book assets	21,421	1,442.77	5,895	1.76	68,415
Sales	21,421	5,066.64	15,898	0.06	162,000
EBIT	25,468	199.09	1,247	-21,100	15,300

Table 2: Summary statistics and test of difference of large size and small size portfolios

Portfolio	Statistic	Beta	Market Value (in EUR mm)	Book-to-Market	Total Assets (in '000 EUR)	Sales (in '000 EUR)	Leverage	Div-Yield	Profitability	Trading Vol. (in '000)	Bid-Ask-Sprd	P/E-Ratio
Large Size	Mean	0.80	9,074.59	0.57	4,669,369	15,378,632	1.48	2.25	0.10	695.10	0.46	28.46
	Median	0.69	2,221.97	0.44	1,096,040	5,147,281	0.20	1.37	0.07	320.65	0.30	7.66
	SD	0.61	17,124.99	0.53	10,106,519	25,920,376	4.31	6.01	0.16	1,146.37	0.43	153.62
Small Size	Mean	1.19	27.37	2.08	27,578	317,579	0.28	2.79	-0.11	160.11	0.28	9.80
	Median	0.97	27.53	1.10	20,159	42,277	0.01	0.00	0.00	54.20	0.20	0.00
	SD	1.00	15.11	4.03	24,290	1,849,017	0.60	8.37	0.79	297.75	0.35	78.40
t-stat of difference		(-0.77)	(5.30)***	(-2.77)***	(4.63)***	(5.91)***	(-0.05)	(-0.93)	(3.94)***	(4.55)***	(-1.30)	(0.61)

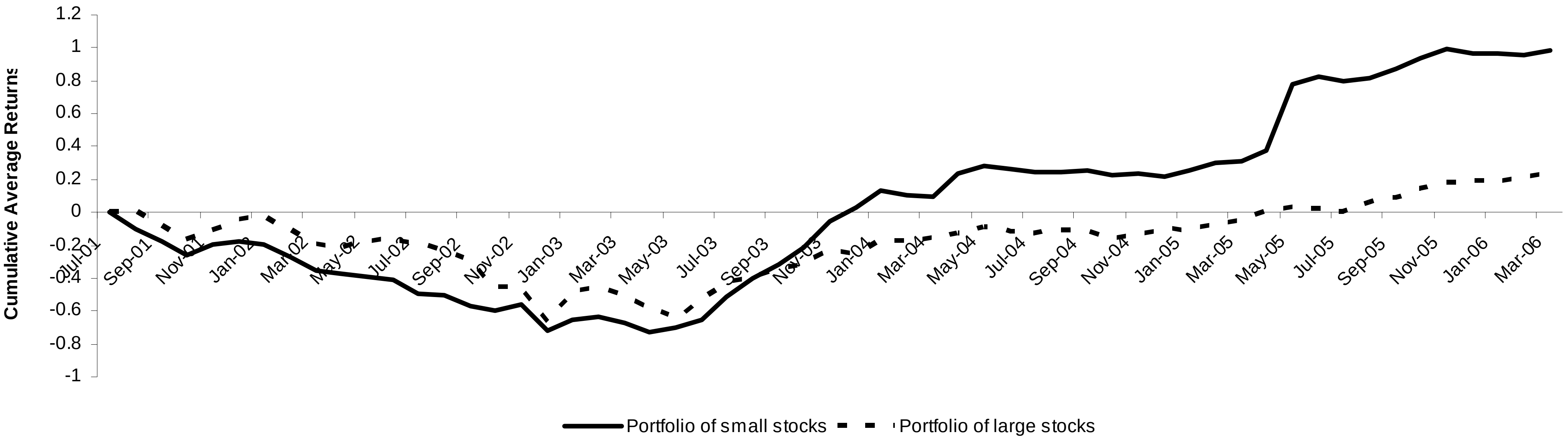
The Table presents summary statistics for the large size and small size portfolios measured by market values at the beginning of the post-ranking period. The portfolios are each comprised of the hundred largest and smallest stocks of the German CDAX index after adjusting for thin trading. Beta is measured using five years of return data during the pre-ranking period. Book-to-market ratios are calculated as the book value of equity divided by the market value of equity. Leverage is calculated as the debt-to-equity ratio and dividend yield is the ratio of the cash dividends per share to share price. Profitability represents the profit margin measured by the ratio of EBIT to sales. T-statistics are given for tests of the difference in means of the two size portfolios.

* Significantly different from zero at the 10% level using a two-tailed test

** Significantly different from zero at the 5% level using a two-tailed test

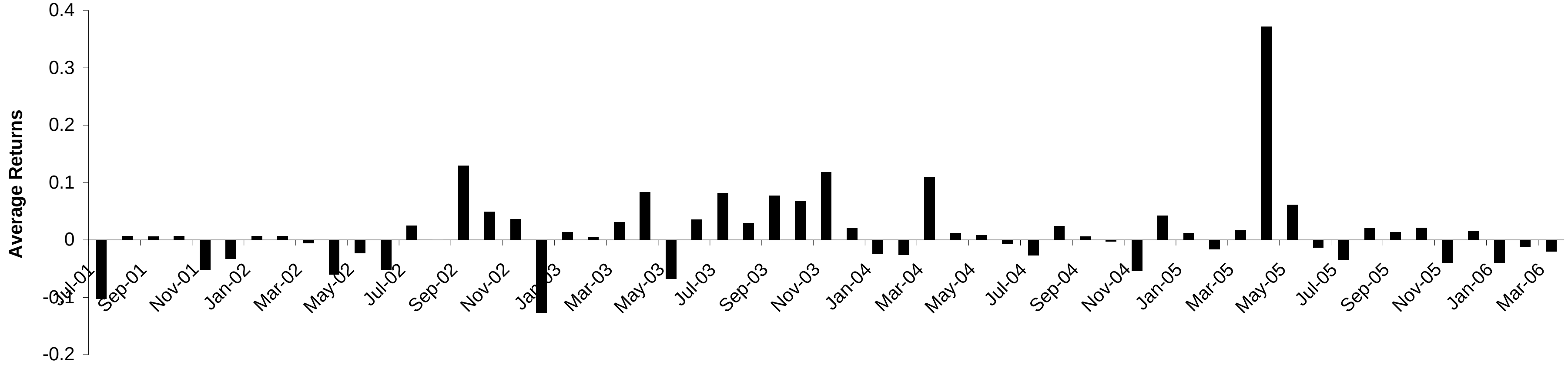
*** Significantly different from zero at the 1% level using a two-tailed test

Figure 4: Cumulative average returns of two equally weighted portfolios comprised of the largest and smallest 100 stocks of the CDAX measured by market value



First, all firms in the sample are ranked according to their market values at the beginning of the post-ranking period in July 2001. The small stock portfolio is formed by equally weighting 100 firms in the sample with the lowest market capitalization. The large stock portfolio is formed by equally weighting 100 firms in the sample with the highest market capitalization. Then average portfolio returns are calculated and the time-series cumulative is plotted in this figure.

Figure 5: Monthly average 'zero cost' portfolio returns (small firm portfolio – large firm portfolio) July 2001 – March 2006



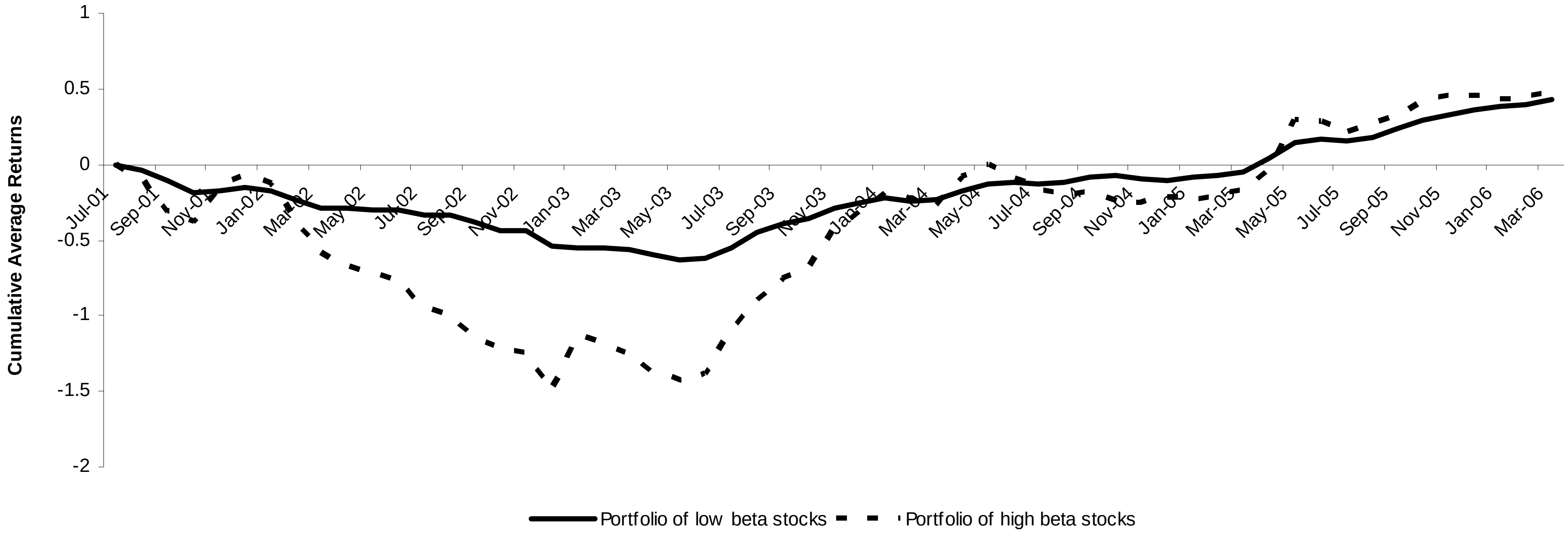
‘Zero cost’ portfolio returns are calculated as the average monthly raw return to investors holding a long position in the small stock portfolio with the 100 smallest CDAX firms and a short position in the large stock portfolio with the 100 largest CDAX firms. Transaction costs and margin requirements are not considered.

Table 3: Summary statistics and test of difference of high beta and low beta portfolios

Portfolio	Statistic	Beta	Market Value (in EUR mm)	Book-to-Market	Total Assets (in '000 EUR)	Sales (in '000 EUR)	Leverage	Div-Yield	Profitability	Trading Vol. (in '000)	Bid-Ask-Sprd	P/E-Ratio
High Beta	Mean	2.39	1,364.05	1.58	371,284	1,061,673	0.05	0.56	-0.16	535.10	0.34	5.82
	Median	2.26	80.37	0.60	37,691	57,253	0.00	0.00	0.00	167.15	0.20	0.00
	SD	0.93	8,234.02	4.08	2,467,207	7,933,101	0.12	1.42	0.82	1,269.31	0.39	32.00
Low Beta	Mean	0.22	724.08	0.87	314,336	2,422,708	1.13	4.02	0.16	155.37	0.34	12.97
	Median	0.25	94.62	0.64	60,496	336,258	0.17	2.90	0.03	62.75	0.25	3.50
	SD	0.19	2,064.77	1.13	818,058	7,228,779	3.32	8.20	1.13	261.46	0.34	91.18
t-stat of difference		(25.04)***	(0.75)	(0.08)	(0.60)	(0.12)	(-2.17)**	(-6.58)***	(-3.03)***	(3.62)***	(-0.17)	(-1.58)

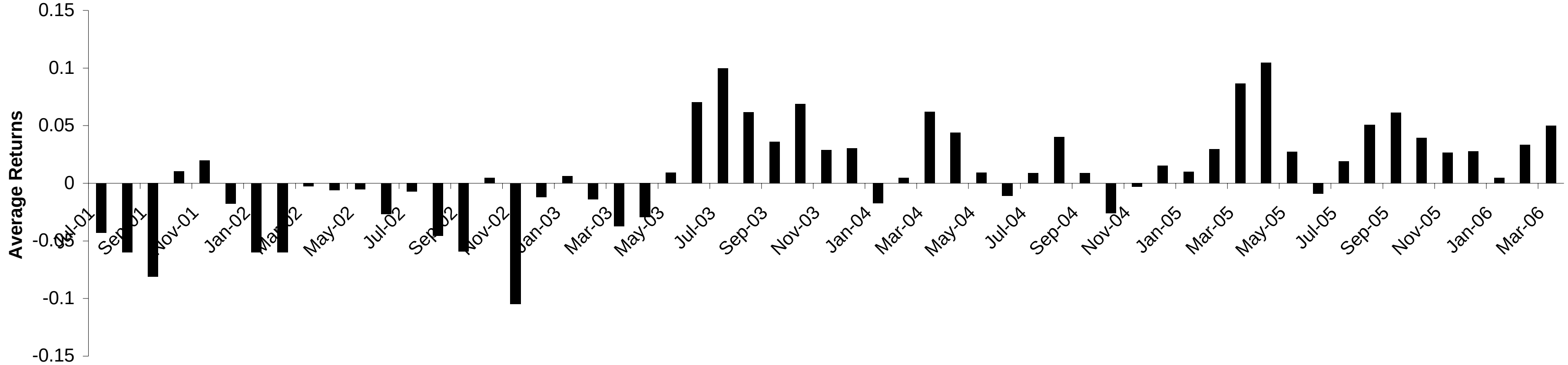
* Significantly different from zero at the 10% level using a two-tailed test
** Significantly different from zero at the 5% level using a two-tailed test
*** Significantly different from zero at the 1% level using a two-tailed test

Figure 6: Cumulative average returns of two equally weighted portfolios comprised of 100 stocks of the CDAX with the highest and lowest betas



First, all firms in the sample are ranked according to their estimated betas at the beginning of the post-ranking period in July 2001. Betas are estimated using 60 months of return data prior to July 2001. The CDAX composite is used as the market index. The high beta stock portfolio is formed by equally weighting 100 firms in the sample with the highest estimated betas. The low beta stock portfolio is formed by equally weighting 100 firms in the sample with the lowest estimated betas. Then average portfolio returns are calculated and the time-series cumulative is plotted in this figure.

Figure 7: Monthly average 'zero cost' portfolio returns (high beta portfolio – low beta portfolio) July 2001 – March 2006



‘Zero cost’ portfolio returns are calculated as the average monthly raw return to investors holding a long position in the high beta stock portfolio containing the 100 CDAX firms with the highest betas and a short position in the low beta stock portfolio comprised of the 100 CDAX firms with the lowest betas. Transaction costs and margin requirements are not considered.

Table 4: Buy-and-Hold Raw Returns of the 25 Size-Beta Portfolios over the 57 Months During the Post-Ranking Period

		Beta Quintile Portfolios				
		1	2	3	4	5
Size Quintile Portfolios	1	-0.1688	-0.4793	0.0504	-0.5179	-0.3469
	2	0.3066	0.3335	0.7430	1.1364	-0.6542
	3	0.6643	0.6735	0.3205	0.2463	0.3666
	4	0.9639	1.3349	1.0325	0.8073	0.0331
	5	0.9084	0.7093	0.4925	0.4954	-0.0268

1 = small size / low beta 5 = large size / high beta

The size-beta portfolios are constructed by first sorting the entire sample into five quintiles based on their monthly market values beginning with the smallest followed by a second sort into five quintiles based on their pre-ranking beta beginning with the lowest. Portfolios are rebalanced each month and buy-and-hold returns are calculated on equally weighting the stocks in each portfolio. The returns represent the actual investment return of each portfolio from 7/2001 until 3/2006 after maintaining equal weighting assuming reinvestment of any dividends.

Table 5: Buy-and-hold Raw Returns of the 25 Size-Beta Portfolios during bull and bear market period

Portfolio Returns 7/2001 - 4/2003 (bear market period)

		Beta Quintile Portfolios				
		1	2	3	4	5
Size Quintile Portfolios	1	-0.5476	-0.6952	-0.5698	-0.8080	-0.8685
	2	-0.7078	-0.5268	-0.5589	-0.6256	-0.9118
	3	-0.4369	-0.4267	-0.4386	-0.6629	-0.8136
	4	-0.2006	-0.3298	-0.2323	-0.4433	-0.6783
	5	-0.1971	-0.2405	-0.4422	-0.3166	-0.6189

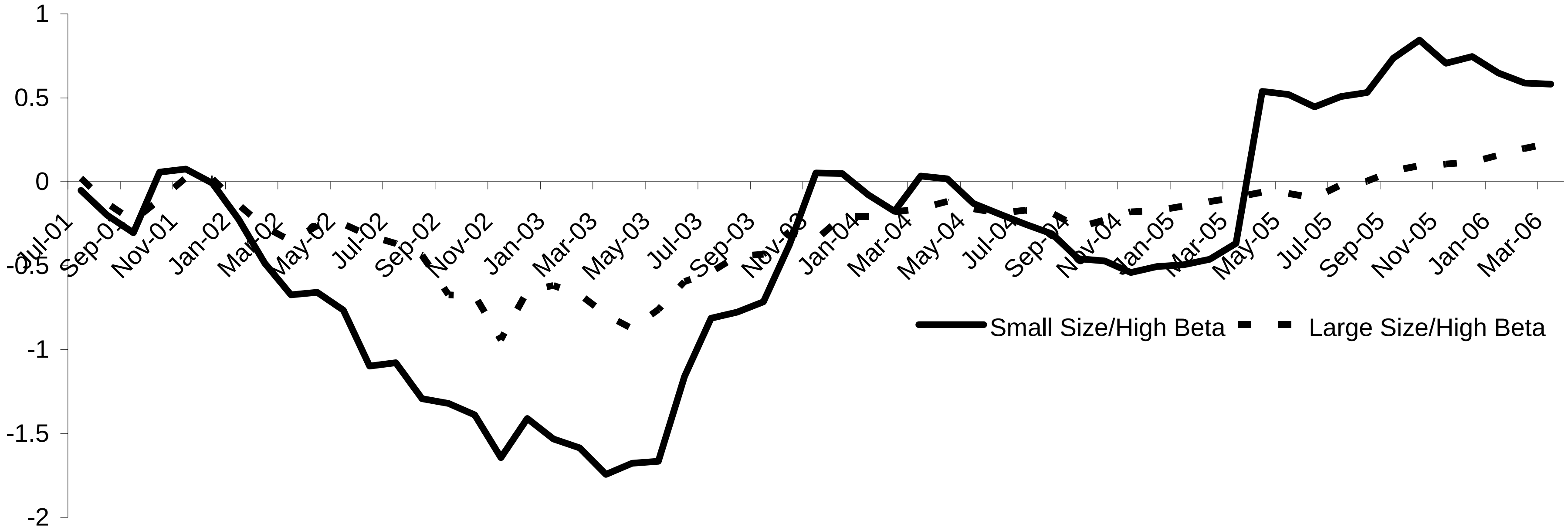
Portfolio Returns 5/2003 - 3/2006 (bull market period)

		Beta Quintile Portfolios				
		1	2	3	4	5
Size Quintile Portfolios	1	0.8372	0.7080	1.4416	1.5114	3.9648
	2	3.4708	1.8182	2.9514	4.7067	2.9194
	3	1.9557	1.9189	1.3523	2.6969	6.3306
	4	1.4567	2.4840	1.6475	2.2463	2.2111
	5	1.3769	1.2505	1.6758	1.1882	1.5535

1 = small size / low beta 5 = large size / high beta

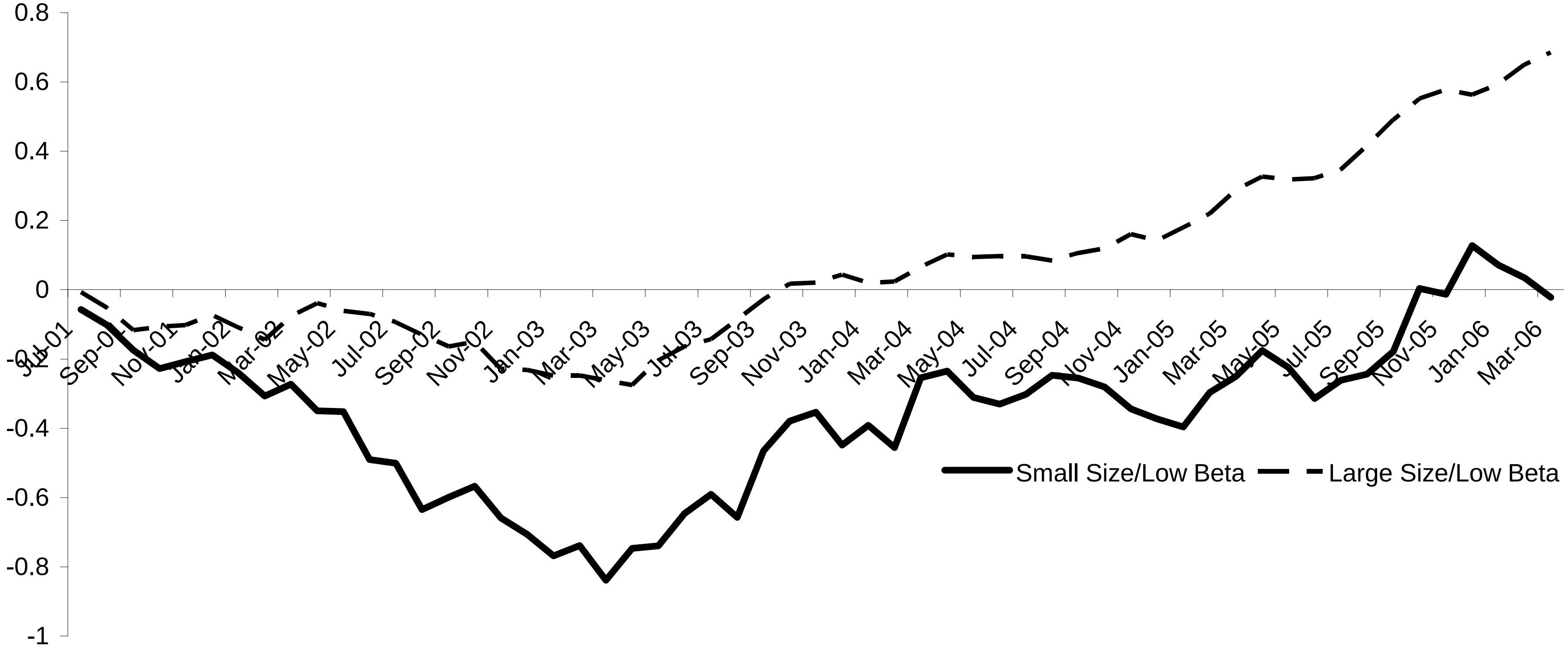
The size-beta portfolios are constructed by first sorting the entire sample into five quintiles based on their monthly market values beginning with the smallest followed by a second sort into five quintiles based on their pre-ranking beta beginning with the lowest. Portfolios are rebalanced each month and buy-and-hold returns are calculated on equally weighting the stocks in each portfolio. The returns represent the actual investment return of each portfolio for the specified holding period after maintaining equal weighting assuming reinvestment of any dividends.

Figure 8: Cumulative Average Portfolio Returns for the Small Size/High Beta and Large Size/High Beta Portfolio



All firms in the sample are ranked according to their market values at the beginning of the post-ranking period in July 2001 to form 5 equally weighted quintile portfolios. These portfolios are each subsequently subdivided into 5 equally weighted quintile portfolios according to pre-ranking beta estimates. Average portfolio returns are calculated for the smallest and largest size portfolios with the highest beta estimate and the time-series cumulative is plotted in this figure.

Figure 9: Cumulative Average Portfolio Returns for the Small Size/Low Beta and Large Size/Low Beta Portfolio



All firms in the sample are ranked according to their market values at the beginning of the post-ranking period in July 2001 to form 5 equally weighted quintile portfolios. These portfolios are each subsequently subdivided into 5 equally weighted quintile portfolios according to pre-ranking beta estimates. Average portfolio returns are calculated for the smallest and largest size portfolios with the lowest beta estimate and the time-series cumulative is plotted in this figure.

Table 6: Average Fama-MacBeth OLS regression coefficients and t-statistic

Dependent Variable: Monthly Stock Returns

	Full Sample Period			Bear Market Period			Bull Market Period		
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
BETA	0.039	0.021	0.022	-0.015	-0.053	-0.053	0.093	0.072	0.073
	(1.13)	(0.78)	(0.79)	(-0.42)	(-1.12)	(-1.10)	(1.59)	(2.33) **	(2.33) **
SMB			-0.334			0.074			-0.610
			(-0.95)			(1.06)			(-1.04)
HML			-0.249			0.007			-0.422
			(-1.55)			(1.03)			(-1.58)
SIZE	-0.565	-0.353	-0.370	-0.702	-0.372	-0.351	-0.428	-0.340	-0.383
	(-2.13) **	(-1.80) *	(-1.89) *	(-1.44)	(-0.91)	(-0.87)	(-1.92) *	(-1.87) *	(-2.04) **
BM	-0.004	-0.007	-0.007	-0.010	-0.015	-0.015	0.002	-0.001	-0.001
	(-1.16)	(-2.05) **	(-2.02) **	(-3.08) ***	(-3.36) ***	(-3.38) ***	(0.27)	(0.79)	(-0.25)
DIV	0.000			0.000			-0.001		
	(-0.44)			(0.82)			(-2.71) **		
PE	0.000			0.000			0.000		
	(-0.80)			(0.23)			(-1.65)		
CONS	0.005	0.003	-0.060	-0.020	-0.026	-0.050	0.029	0.023	-0.066
	(0.59)	(0.48)	(-1.92) *	(-1.80) *	(-2.19) **	(-2.50) **	(3.53) ***	(4.33) ***	(-1.31)
Obs	25468	25468	25468	10276	10276	10276	15192	15192	15192
Mean R-Sq	0.05	0.05	0.05	0.06	0.06	0.06	0.04	0.04	0.04

* Significantly different from zero at the 10% level using a two-tailed test
** Significantly different from zero at the 5% level using a two-tailed test
*** Significantly different from zero at the 1% level using a two-tailed test

This table shows the average OLS regression coefficients of the monthly Fama-MacBeth regressions. The respective t-statistics are given in parentheses. Columns (I) to (III) show the results for regressions over the entire sample period. Columns (IV) to (VI) and columns (VII) to (IX) show results for the bear market and bull market sub-periods, respectively. The first two columns of each respective sample period show the results for the characteristics-based asset pricing tests, the last columns show results of the equations including Fama and French (1996) SMB and HML risk factors. SMB is a factor mimicking portfolio calculated as the difference between the average return of a quintile portfolio including the smallest firms and the average return of a quintile portfolio including the largest firms of the sample. Equivalently, HML is a factor mimicking portfolio calculated as the difference between the average return of a quintile portfolio including firms with the highest book-to-market ratios and the average return of a quintile portfolio including firms with the lowest book-to-market ratio. BETA is the securities beta calculated in the way explained in section IV.B. SIZE is the natural logarithm of the market value of equity, BM the natural logarithm of the firm's book value to market value of equity, DIV the dividend yield calculated as the ratio of dividends per share to price per share on a monthly basis and PE is the price to earnings ratio calculated as the market value of equity divided by earnings before interest and taxes. Heteroskedasticity consistent standard errors are calculated according to White (1980).

Table 7: Average Slopes from Month-by-Month First-Step Fama-MacBeth Regressions

Panel A: First-Step Regression Results	Dependent variable: SIZE						
	CONS	BA	SAL	LEV	VOL	BAS	PRFT
Mean Coefficient	-6.4280	0.8377	0.1286	-0.0225	0.0001	0.2192	0.0634
t-Statistic	(-87.62)***	(96.79)***	(24.11)***	(-14.81)***	(10.66)***	(10.59)***	(3.89)***

Panel B: First-Step Regression Results	Dependent variable: BM						
	CONS	BA	SAL	LEV	VOL	BAS	PRFT
Mean Coefficient	-0.4797	0.1625	-0.1286	0.0225	-0.0001	-0.2192	-0.0548
t-Statistic	(-6.54)***	(18.72)***	(-24.11)***	(14.81)***	(-10.66)***	(-10.59)***	(-3.39)***

Panel C: Correlation Coefficients						
BA	1					
SAL	0.87	1				
LEV	0.23	0.01	1			
VOL	0.59	0.41	0.24	1		
BAS	0.46	-0.47	-0.07	-0.25	1	
PRFT	0.42	0.43	-0.01	0.56	-0.23	1

*** Significantly different from zero at the 1% level using a two-tailed test

Panel A shows the regression results of the first-step regression of SIZE on the set of instrumental variables following the Fama-MacBeth methodology. SIZE is regressed on the IVs in each of the post-ranking months. The mean coefficients are the time series means of the month-by-month OLS regressions. Standard errors are calculated according to the heteroskedasticity-consistent method suggested by White (1980).

Panel B shows the equivalent regression results of the first-step regression of BM on the same set of instrumental variables following the Fama-MacBeth methodology.

Panel C shows the time series mean correlation coefficients between each independent variable of the OLS regression. Re-estimation of the regressions dropping BA as explanatory variable does not alter the results significantly (not reported here, available on request)

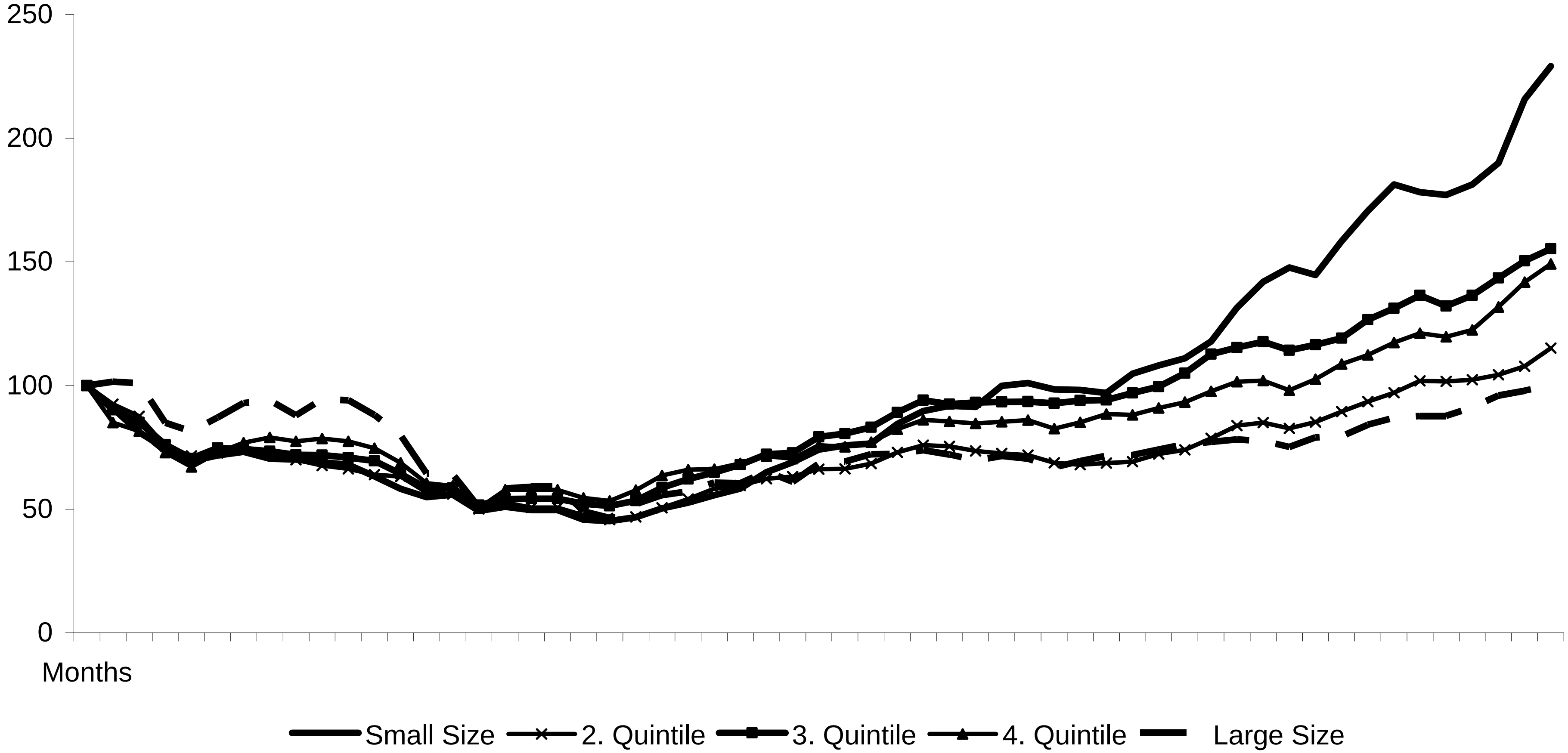
Table 8: Average Fama-MacBeth 2SLS regression coefficients and t-statistic

Dependent Variable: Monthly Stock Returns

	Full Sample Period					Bear Market Period				Bull Market Period			
	(I)	(IIa)	(IIb)	(IIIa)	(IIIb)	(IV)	(V)	(VIa)	(VIb)	(VII)	(VIII)	(IXa)	(IXb)
BETA	0.033	-0.004	-0.011	-0.004	-0.011	-0.038	-0.036	-0.036	-0.034	0.021	0.009	0.020	0.007
	(1.12)	(-0.15)	(-0.34)	(-0.14)	(-0.35)	(-0.67)	(-0.62)	(-0.62)	(-0.59)	(0.72)	(0.25)	(0.67)	(0.19)
SMB				0.059	0.033			0.086	0.078			0.039	-0.003
				(0.79)	(0.40)			(0.97)	(0.91)			(0.34)	(-0.02)
HML				-0.007	0.037			0.009	0.007			-0.020	0.060
				(-0.10)	(0.50)			(0.96)	(0.76)			(-0.15)	(0.46)
P*SIZE	-0.656	-0.362	-0.386	-0.366	-0.387	-0.379	-0.362	-0.327	-0.310	-0.348	-0.404	-0.397	-0.445
	(-2.51) **	(-1.83) *	(-1.95) *	(-1.80) *	(-1.90) *	(-1.03)	(-0.98)	(-0.86)	(-0.81)	(-1.63) *	(-1.91) *	(-1.82) *	(-2.07) **
BM	-0.008	-0.013		-0.013		-0.019		-0.019		-0.008		-0.008	
	(-3.49) ***	(-4.93) ***		(-4.89) ***		(-4.45) ***		(-4.47) ***		(-2.69) **		(-2.61) **	
P*BM			-0.007		-0.008		-0.016		-0.015		-0.001		-0.003
			(-0.94)		(-1.01)		(-1.34)		(-1.31)		(-0.13)		(-0.25)
DIV	0.000												
	(-0.57)												
PE	0.000												
	(-0.07)												
CONS	0.005	0.004	0.007	-0.009	-0.001	-0.027	-0.026	-0.054	-0.053	0.027	0.032	0.026	0.038
	(0.59)	(0.52)	(0.89)	(-0.59)	(-0.09)	(-2.21) **	(-1.96) *	(-2.28) **	(-2.24) **	(5.79) ***	(4.37) ***	(1.58)	(2.42) **
Obs	25468	25468	25468	25468	25468	10276	10276	10276	10276	15192	15192	15192	15192
Mean R-Sq	0.06	0.04	0.02	0.05	0.02	0.04	0.02	0.05	0.02	0.04	0.02	0.05	0.02

* Significantly different from zero at the 10% level using a two-tailed test
** Significantly different from zero at the 5% level using a two-tailed test
*** Significantly different from zero at the 1% level using a two-tailed test
This table shows the average 2SLS second-step regression coefficients of the monthly Fama-MacBeth regressions. The respective t-statistics are given in parentheses. Columns (I) to (III) show the results for regressions over the entire sample period. Columns (IV) to (VI) and columns (VII) to (IX) show results for the bear market and bull market sub-periods, respectively. The first two columns of each respective sample period show the results for the characteristics-based asset pricing tests, the last columns show results of the equations including Fama and French (1996) SMB and HML risk factors. SMB is a factor mimicking portfolio calculated as the difference between the average return of a quintile portfolio including the smallest firms and the average return of a quintile portfolio including the largest firms of the sample. Equivalently, HML is a factor mimicking portfolio calculated as the difference between the average return of a quintile portfolio including firms with the highest book-to-market ratios and the average return of a quintile portfolio including firms with the lowest book-to-market ratio. BETA is the securities beta calculated in the way explained in section IV.B. P*SIZE is the average projection of firm size of the monthly first-step regressions, P*BM the equivalent projection of the book-to-market ratio. BM is the natural logarithm of the firm's book value to market value of equity, DIV the dividend yield calculated as the ratio of dividends per share to price per share on a monthly basis and PE is the price to earnings ratio calculated as the market value of equity divided by earnings before interest and taxes. Heteroskedasticity consistent standard errors are calculated according to White (1980).

Figure 10: Average monthly market values in percentage terms of size quintile portfolios during post-ranking period (rebased at 100)



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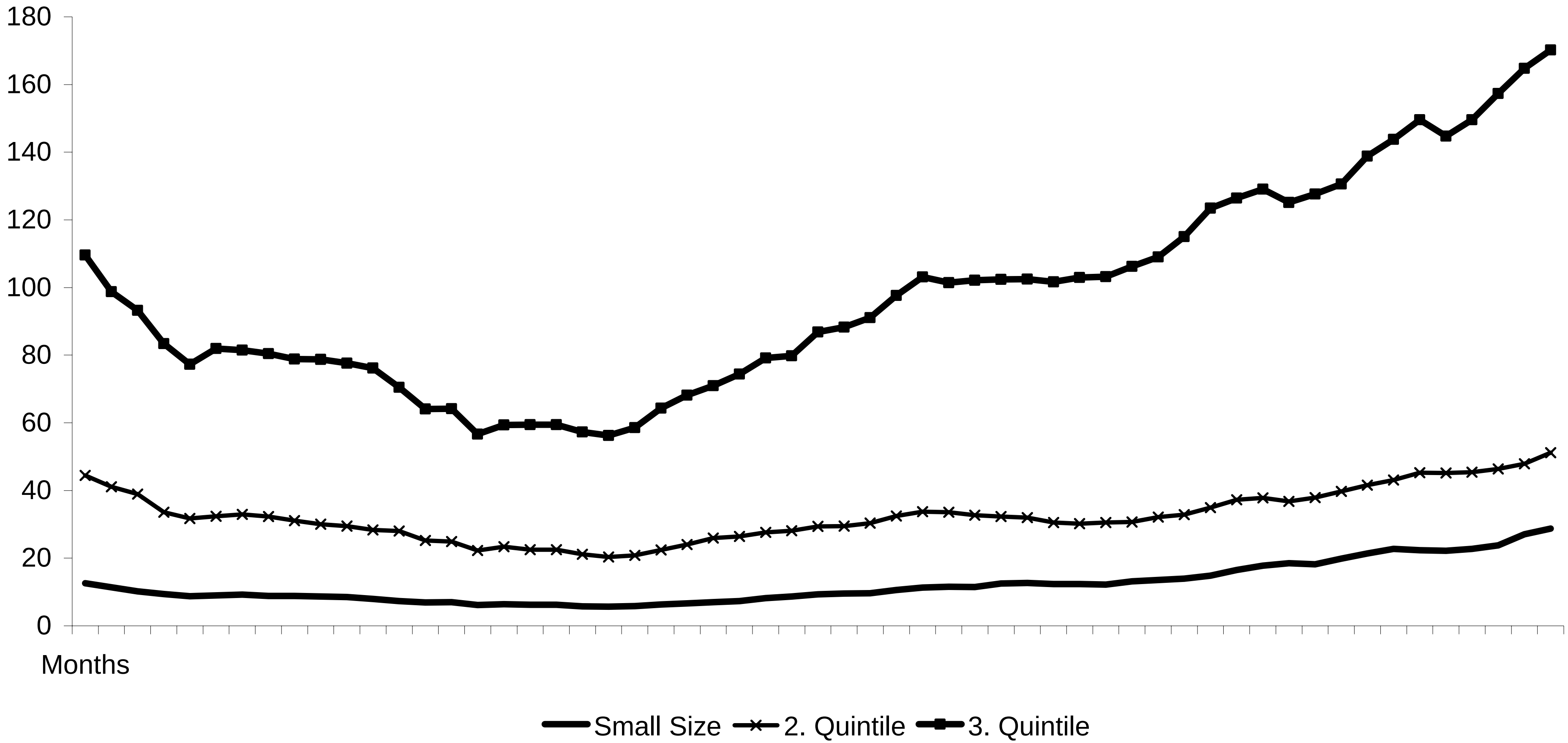
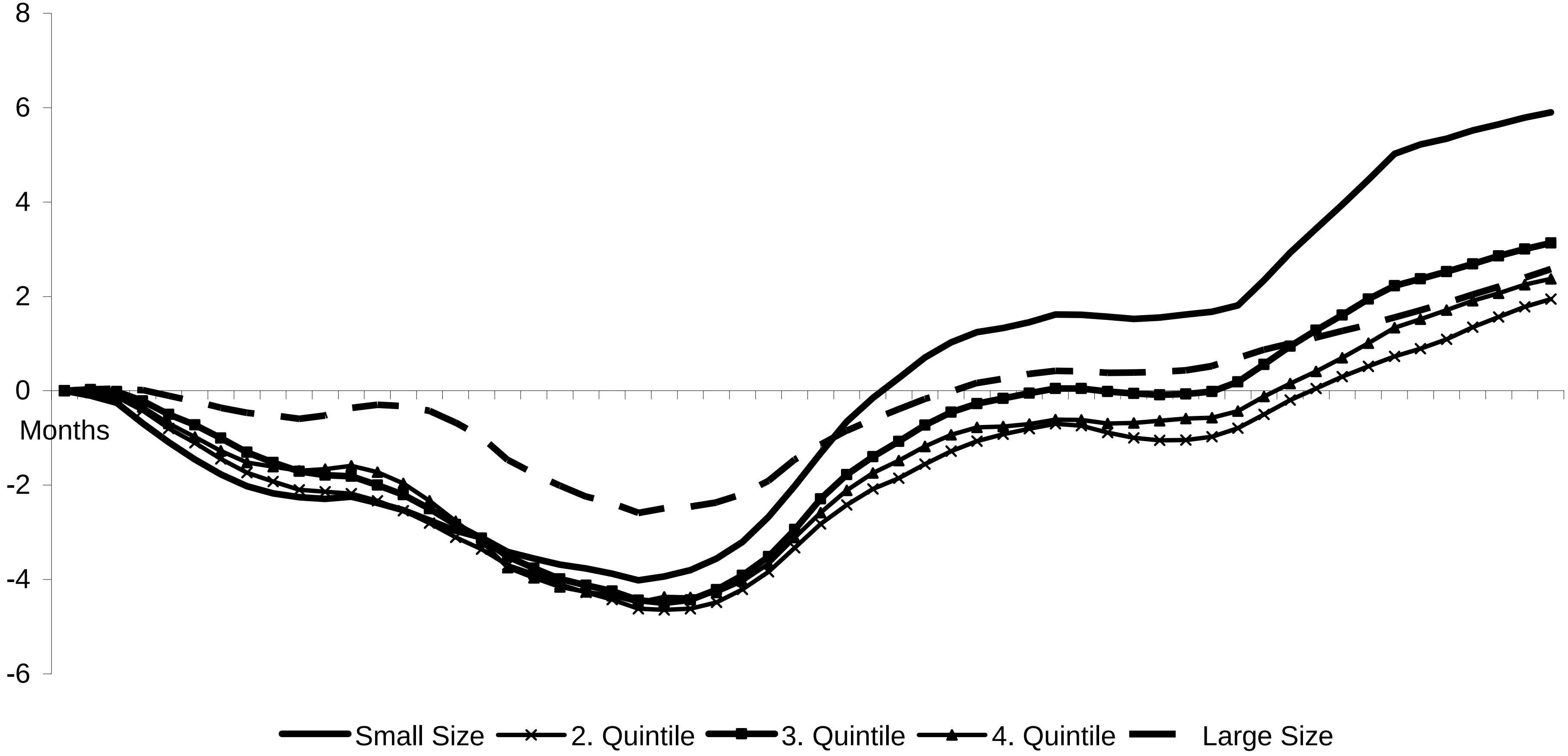
This figure plots monthly market values of equity in percentage terms of 5 size quintile portfolios during the post-ranking period. The quintile ranks are obtained by sorting the entire sample of firms according to their market value of equity at the beginning of the period. 5 equally weighted size portfolios are constructed and monthly average market values are calculated. The values are rebased at 100 at the beginning of the period.

Figure 11: Average monthly market value of equity of the three smallest size quintile portfolios (in million EUR)



This figure plots monthly market values of equity of 3of the 5 size quintile portfolios during the post-ranking period. The quintile ranks are obtained by sorting the entire sample of firms according to their market value of equity at the beginning of the period. 5 equally weighted size portfolios are constructed and monthly average market values are calculated.

Figure 12: Cumulative average raw returns of size quintile portfolios during post-ranking period



This figure plots monthly cumulative average stock returns of the 5 size quintile portfolios during the post-ranking period. The quintile ranks are obtained by sorting the entire sample of firms according to their market value of equity at the beginning of the period. 5 equally weighted size portfolios are constructed.

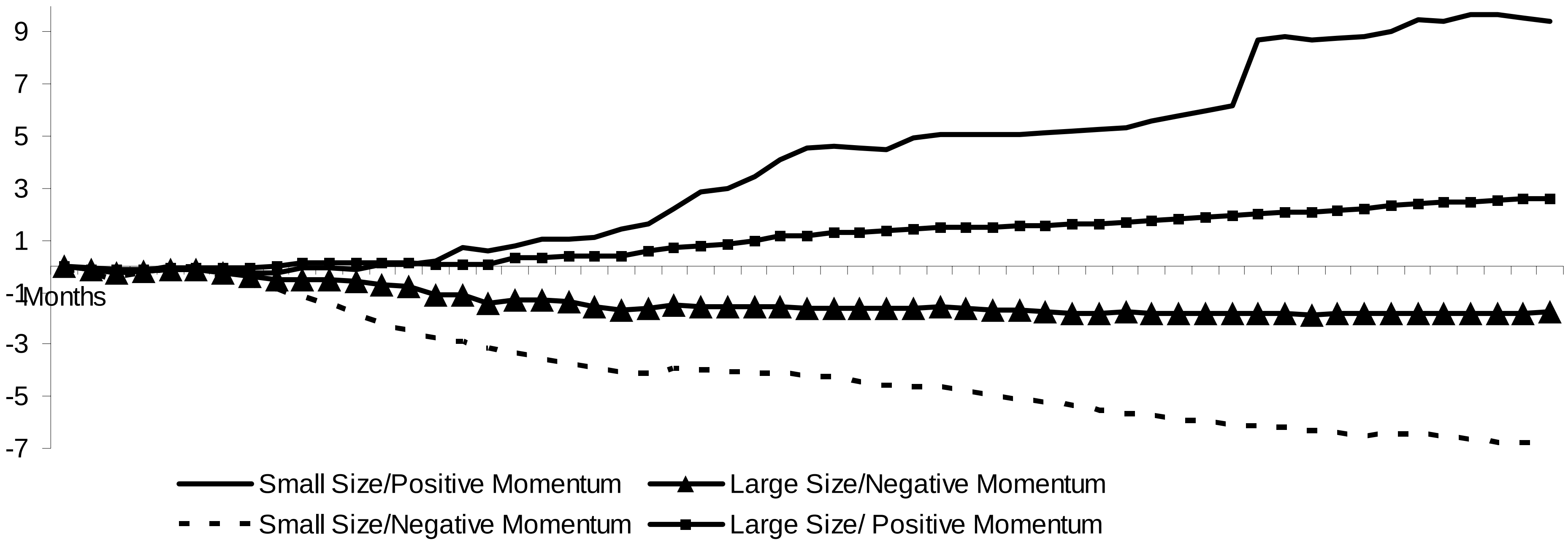
Table 9: Annualized Buy-and-Hold Raw Returns of the 25 Size-Momentum Portfolios over the 57 Months during the Post-Ranking Period

		Momentum Quintile Portfolios				
		1	2	3	4	5
Size Quintile Portfolios	1	-0.804	-0.526	-0.098	0.318	3.305
	2	-0.644	-0.242	0.036	0.346	2.230
	3	-0.474	-0.194	0.019	0.339	1.411
	4	-0.376	-0.072	0.121	0.334	1.039
	5	-0.339	-0.053	0.063	0.256	0.681

1 = small size / negative past returns 5 = large size / positive past returns

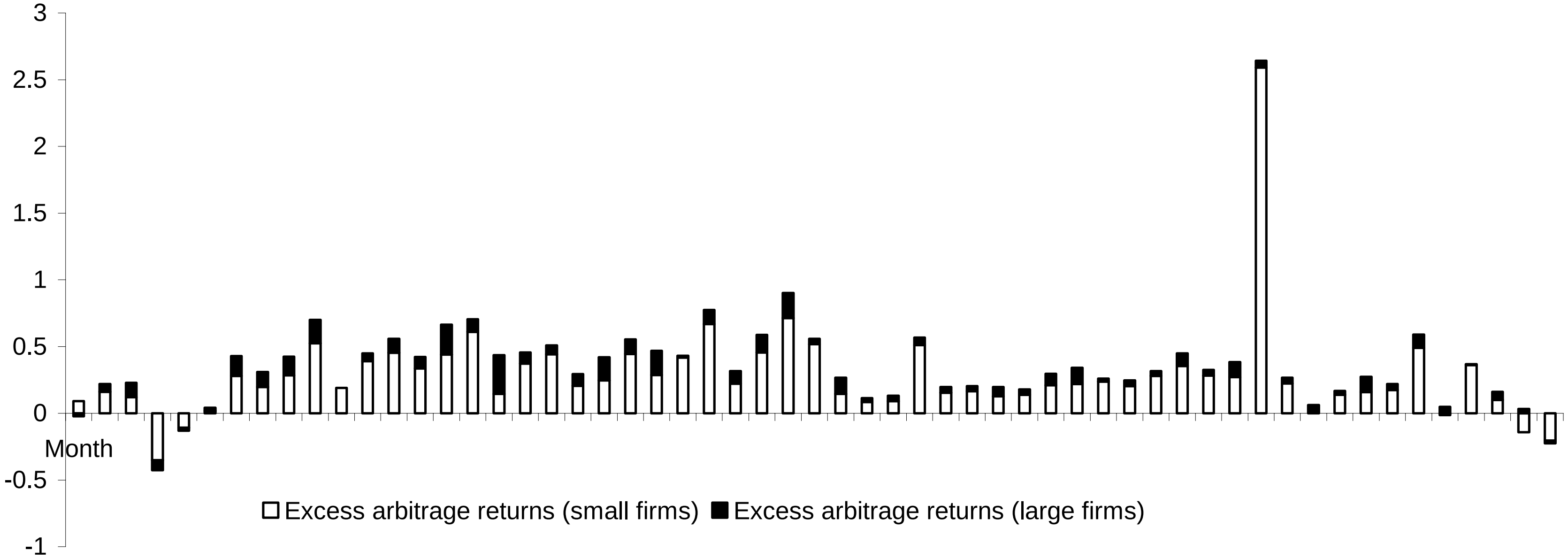
The size-momentum portfolios are constructed by first sorting the entire sample into five quintiles based on their monthly market values beginning with the smallest followed by a second sort into five quintiles based on their cumulative stock returns 6 months prior to portfolio formation beginning with the lowest. Portfolios are rebalanced each month and annualized buy-and-hold returns are calculated on equally weighting the stocks in each portfolio. The returns represent the actual investment return of each portfolio from 7/2001 until 3/2006 after maintaining equal weighting assuming reinvestment of any dividends.

Figure 13: Cumulative average portfolio returns of size-momentum portfolios



This Figure shows cumulative average portfolio returns for the small size portfolios with positive and negative momentum as well as the returns for the large size portfolios with positive and negative momentum. Momentum is measured as cumulative average returns of each portfolio over a 6-months period prior to portfolio formation and subsequently updated monthly. The size-momentum portfolios are constructed by first sorting the entire sample into five quintiles based on their monthly market values beginning with the smallest followed by a second sort into five quintiles based on their cumulative stock returns 6 months prior to portfolio formation beginning with the lowest. The portfolios are rebalanced each month.

Figure 14: Monthly average 'zero cost' portfolio returns (small size/ positive momentum – small size/ negative momentum) July 2001 – March 2006



‘Zero cost’ portfolio returns are calculated as the average monthly raw return to investors holding a long position in the small stock portfolio with positive average returns over the past 6 months and a short position in the small stock portfolio with negative average returns over the past 6 months. Similarly, ‘zero cost’ portfolio returns are calculated for the large stock portfolio Transaction costs and margin requirements are not considered.

Table 10: Average Fama-MacBeth coefficients in regressions on monthly returns including momentum and interaction effects

Dependent Variable: Monthly Stock Returns

	Full Sample Period			Bear Market Period		Bull Market Period	
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
BETA	-0.012	-0.011	-0.001	-0.025	-0.031	-0.001	0.019
	(-0.51)	(-0.43)	(-0.05)	(-0.60)	(-0.80)	(-0.06)	(0.90)
SMB	0.046	0.034	-0.421	-0.027	0.996	0.103	-0.687
	(0.86)	(0.68)	(-0.05)	(-0.64)	(-0.56)	(1.15)	(-1.14)
HML	-0.010	0.034	-0.284	0.008	0.009	-0.023	-0.481
	(-0.16)	(0.58)	(-1.73) *	(0.73)	(0.10)	(-0.22)	(-1.77) *
MM	0.132	0.134	0.144	0.122	0.135	0.141	0.150
	(9.26) ***	(9.18) ***	(8.13) ***	(4.49) ***	(5.33) ***	(9.58) ***	(6.13) ***
RR	-0.001	0.000	-0.002	-0.005	-0.004	0.502	-0.001
	(-0.19)	(-0.08)	(-0.57)	(-0.68)	(-0.65)	(0.57)	(-0.15)
SIZE			-0.015		-0.304		0.181
			(-0.07)		(-0.80)		(0.71)
P*SIZE	-0.041	0.088		-0.049		-0.035	
	(-0.19)	(0.16)		(-0.12)		(-0.15)	
BM	-0.006		-0.005	-0.011	-0.007	-0.002	-0.003
	(-2.45) **		(-1.69) *	(-2.69) **	(-1.57)	(-0.64)	(-0.87)
P*BM		-0.001					
		(-0.12)					
SIZE*MM			-3.410		-2.800		-3.820
			(-2.60) ***		(-2.65) ***		(-1.83) *
CONS	0.000	0.004	-0.054	-0.009	-0.015	0.007	-0.081
	(0.03)	(0.40)	(-1.67) *	(-0.65)	(-1.30)	(0.50)	(-1.50)
Obs	25468	25468	25468	10276	10276	15192	15192
Mean R-Sq	0.13	0.13	0.19	0.13	0.19	0.13	0.18

* Significantly different from zero at the 10% level using a two-tailed test
** Significantly different from zero at the 5% level using a two-tailed test
*** Significantly different from zero at the 1% level using a two-tailed test

This table shows the average OLS and 2SLS second-step regression coefficients of monthly Fama-MacBeth regressions. The respective t-statistics are given in parentheses. Columns (I) to (III) show the results for regressions over the entire sample period. Columns (IV) to (V) and columns (VI) to (VII) show results for the bear market and bull market sub-periods, respectively. The explanatory variables in the regressions are a set of firm characteristics, projections of firm characteristics and risk factors. BETA is the securities beta calculated in the way explained in section IV.B. SMB is a factor mimicking portfolio calculated as the difference between the average return of a quintile portfolio including the smallest firms and the average return of a quintile portfolio including the largest firms of the sample. Equivalently, HML is a factor mimicking portfolio calculated as the difference between the average return of a quintile portfolio including firms with the highest book-to-market ratios and the average return of a quintile portfolio including firms with the lowest book-to-market ratio. SIZE is the natural logarithm of the firm's market value of equity, P*SIZE is the average projection of firm size of the monthly first-step regressions. BM is the natural logarithm of the firm's book value to market value of equity, P*BM the equivalent projection of the book-to-market ratio. MM is a proxy for momentum or relative strength and measured as the cumulative average monthly returns of the individual stocks over the 6 previous months. RR is a proxy for return reversal and measured as the cumulative average monthly returns of the individual stocks over the 24 previous months. SIZE*MM is the interaction term between SIZE and MM calculated as the product of both variables. Heteroskedasticity consistent standard errors are calculated according to White (1980).