The Profitability of Momentum Strategies Based on the Release of Firms' Quarterly Results: Evidence from the Constituents of the DAX 30

PAUL RYAN AND INGO OVERMEYER[*]

INTRODUCTION

A large number of studies, predominantly US based, document predictability in equity returns, whereby stocks that performed well in the past continue to do so in the future (see for example Jegadeesh and Titman, 1993; Chan et al., 1996). Such studies are referred to as momentum (relative strength) studies and document that for holding periods of three to twelve months, purchasing past "winners" and disposing of past "losers" generates statistically significant abnormal returns.

Such strategies are a violation of market efficiency at its most basic (weak-form) level. It is not surprising, therefore, that the very nature of the levels of return generated by such momentum-based trading strategies has spawned considerable academic debate. Some have argued that the profitability of such strategies can be explained by market microstructure-related effects, serial correlation in common-factor realisations, the presence of a delayed price reaction to a common factor, use of an inappropriate return-generating model and the size effect (for example Lo and MacKinley, 1990; Conrad and Kaul, 1993; Fama and French, 1996). Others have argued that the profitability of such strategies can be explained by the market's systematic under-reaction to firm-specific news (for example Chan et al., 1996; Liu et al., 1999).

Very little research has been conducted on momentum strategies outside the US. Following the methodology of Jegadeesh and Titman (1993), Liu et al. (1999) document profitable price-momentum strategies in the UK market that are consistent with market under-reaction to industry- or firm-specific news. Ryan and Overmeyer (2003) investigate the profitability of price-momentum strategies on the DAX 100. They find that such strategies are profitable and readily exploitable by institutional investors who tend to concentrate their portfolio

* Department of Banking and Finance, University College Dublin.

weights in large capitalisation stocks. Such profitability is not explained by failure to adjust for systematic risk, delayed reaction to a common factor or serial correlation in common-factor realisations. They conclude their results may be consistent with under-reaction to firm- or industry-related news.

In this paper, we explore whether the profitability of the price-momentum strategies on the largest capitalisation stocks on the German market as reported in Ryan and Overmeyer (2003) is related to the market's reaction to firm-specific news or, more specifically, accounting-related news. Concentrating on the largest capitalisation stocks has a number of advantages. Firstly, no previous research explicitly investigates the under-reaction to firm-specific news in the context of the very largest stocks quoted on a national market. Secondly, by focusing on the largest capitalisation German stocks, we can explicitly investigate the potential for large institutional investors, who tend to concentrate their portfolio weights in such large stocks to exploit potentially any profitability that may arise. Thirdly, such stocks are less likely to be subject to microstructure biases (Conrad and Kaul, 1993; Ball et al., 1995). Finally, chasing momentum profits is trading intensive, so much of the potential profits may potentially be dissipated by transaction costs. Transactions costs, such as commissions and bid-ask spreads, are lower for our stocks than for their smaller counterparts.[1,2]

In the next section, we provide our rationale for exploring the profitability of accounting-based momentum strategies and in the following section, we present our data and methodology. In the subsequent section, we report the returns associated with the momentum strategies and in the final section, we summarise and present our conclusions.

MOMENTUM STRATEGIES BASED ON A FIRM'S ACCOUNTING RELEASES

In order to examine more precisely whether the predictability of future returns from past returns and, therefore, momentum profits are due to the market's under-reaction to information, the market response to past accounting-based news is examined. It is natural to look to a firm's accounting releases to try to understand stock price movements, as they are the primary routine mechanism by which companies communicate with the market and are, therefore, obvious candidates to consider first as underlying causes of the momentum effect.

In this study, we attempt to relate the evidence on momentum in stock prices to the evidence on the market's under-reaction to accounting-based information. For instance, among others, Bernard and Thomas (1989), Bernard et al. (1995) and Liu et al. (2000) find that firms reporting unexpectedly high earnings outperform firms reporting unexpectedly poor earnings. The superior performance persists over a period of about six months after the earnings announcement. Givoly and Lakonishok (1979) report similar patterns in the response of prices to revisions in analysts' forecasts of earnings. Affleck-Graves and Mendenhall (1992) examine the Value Line timeliness ranking system (a model based on a combination of past earnings and price momentum, among other variables) and suggest that earnings surprises account for Value Line's ability

to predict future returns.

We explore the possibility that the profitability of price-momentum strategies reported in Ryan and Overmeyer (2003) is largely due to the component of returns that is related to accounting-related news. If this explanation is correct, then the profitability of the price-momentum strategies reported in Ryan and Overmeyer (2003) will not be profitable after accounting for past innovations in earnings and other accounting-based information.

However, it is possible that strategies based on either past returns or a firm's formal accounting releases exploit market under-reaction to different pieces of information. For example, an accounting-results-based momentum strategy may benefit from under-reaction to information related to short-term accounting information, while a price-momentum strategy may benefit from the market's slow response to a broader set of information. In this case, one could expect that each of the momentum strategies is individually successful and that one effect is not completely subsumed by the other.

Chan et al. (1996) investigate this possibility using US data and find that price-momentum strategies are still profitable after controlling for the impact of accounting information. No evidence exists on the contribution of the market's under-reaction to accounting releases in explaining the profitability of price-momentum strategies outside of the US. We will redress this imbalance for the largest capitalisation stocks in the German market.

SAMPLE AND METHODOLOGY

For our purposes, no public database exists that collects firms' formal accounting release announcement dates for publicly listed German companies over the period of the Ryan and Overmeyer (2003) study.[3] Therefore, our sample is restricted to 30 German blue-chip companies that form the DAX 30, where quarterly results are published in the main German financial newspaper, the *Handelsblatt*. Our sample period, January 1995 to June 2000, is chosen because before 1995, most major German companies did not publish quarterly results on a regular basis.[4]

The price-momentum portfolios are formed on the same basis as Ryan and Overmeyer (2003). At the start of each month, all stocks with a return history of at least twelve months are ranked and assigned to portfolios on the basis of their past six-month price performance. A buy-and-hold return is then computed for each portfolio for the subsequent twelve-month period.

To relate the evidence on price momentum to that on accounting momentum, a measure of market surprise as suggested by Chan, Jegadeesh and Lakonishok (1996) is used. Using this approach, we rank the stocks every month based on the cumulative abnormal stock return around the most recent announcement date up to month t.

ABR is defined as:

$$ABR_{it} = \sum_{j=-2}^{+1} \left(r_{ij} - r_{mj} \right)$$

where r_{ij} is stock i's return on day j (with the quarterly results being announced on day o and r_{mj} is the return on the DAX 100).[5] We aggregate returns until one day after the announcement date to account for the possibility of delayed stock-price reaction. This measure is a very clear measure of market surprise, since it does not require an explicit model for investor expectations.[6] Accumulating the return from two days prior to the announcement date is designed to take account of prior information leakage and information search by market participants in the days prior to the *known* release date (Kim and Verrecchia, 1991).

The abnormal return around the announcement is used as a measure of surprise. As Chan et al. (1996) note, to the extent that the market responds slowly to accounting-related news, we should expect to see a drift in future stock returns that can be predicted by the sign and magnitude of the abnormal announcement return. Thus, we should see stocks with large favourable announcement returns subsequently outperform stocks with large unfavourable announcement returns.

RESULTS

Price Momentum

Firstly, the correlation between the price-momentum measure and the accounting-based momentum measure are examined in order to assess whether the performance of the different momentum strategies are based on the same effects. The correlation coefficient between both strategies is calculated using monthly observations pooled across stocks. With a coefficient of 0.201, the strategies are positively correlated with one another, but the coefficients are not large. The relatively low correlation suggests that the six-month price-momentum strategy and the ABR accounting-momentum strategy are not entirely based on the same information.[7] Rather, they may capture different aspects of the change in a company's performance.

Panel A of Table 7.1 reports the stock-price performance of portfolios formed on the basis of prior six-month returns, where portfolio I comprises past "winners" (top-ten companies in terms of prior six-month price performance) and portfolio II comprises past "losers" (bottom-ten companies in terms of prior six-month price performance).[8] We employ the prior six-month return performance to make direct comparisons with Ryan and Overmeyer (2003) and also because this is the standard approach used in prior research (for example Chan et al., 1996; Rouwenhorst, 1998). Panel B of Table 7.1 reports the abnormal return around the release of the quarterly results for the same portfolios of stocks as reported in Panel A.

In Panel A, we report that subsequent to the portfolio formation date, the portfolio of past winners outperforms the loser portfolio. Three months after portfolio formation, the cumulative excess return of the winner portfolio is 8.5 per cent, compared with 5.6 per cent for the loser portfolio. Thus, the winner portfolio outperforms the loser portfolio by 2.9 per cent (t-stat = 1.07).[9] After 6 months, the pattern is unchanged. With 15.2 per cent, the cumulative return of

the winner portfolio is 3.0 per cent (t-stat = 0.82) higher than the return of the loser portfolio (12.2 per cent). However, after 12 months, the cumulative return differences have reversed. With a return of 27.9 per cent, the cumulative return of the winner portfolio is not significantly different from the cumulative return of the portfolio of past losers (28.5 per cent).

Table 7.1: Characteristics of the Price Momentum Portfolios Based on Six-Month Prior Price Performance*

Panel A: Cumulative returns	Winner	Loser	Difference in return	t-stats
Past 6-month return	0.055	-0.009	0.064	
Return 3 months after portfolio formation	0.085	0.056	0.029	1.07
Return 6 months after portfolio formation	0.152	0.122	0.030	0.82
Return 12 months after portfolio formation	0.279	0.285	-0.006	-0.117

Panel B: Abnormal return around the quarterly results	Winner	Loser	Difference in return	t-stats
Most recent announcement	0.013	-0.011	0.024	
First quarter after portfolio formation	0.005	0.003	0.002	0.42
Second quarter after portfolio formation	0.009	0.002	0.007	2.84**
Third quarter after portfolio formation	0.009	0.001	0.008	2.26**
Fourth quarter after portfolio formation	0.004	0.006	-0.002	-0.58

* Panel A presents the cumulative returns of the portfolios where the momentum portfolios are formed on the basis the six-month price performance prior to portfolio formation. Panel B presents the 3-day abnormal return measured around the release of the quarterly results for those portfolios presented in Panel A.

** = statistically significant at a = 0.05 (student t- distribution).

However, though the differential returns are in the expected direction (past winners outperform past losers) for at least the six-month period after the initial portfolio-formation period, they are not statistically significant. Thus, our results in Panel A contrast with the reported results of Ryan and Overmeyer (2003), who find, for portfolios based on the constituents of the DAX 100, that winners outperform losers for a twelve-month horizon. Therefore, on a face-value basis, it appears that the characteristics of the 30 largest stocks may differ from those of the remaining 70 stocks that make up

the DAX 100. In other words, the profitability of price-momentum strategies may be a function of company size[10] or, alternatively, the characteristics of the investors who dominate the shareholder registers of such companies.[11]

Panel B of Table 7.1 shows that the past price performance of the portfolios is closely related to the price response to the most recent quarterly results. Abnormal three-day announcement returns rise from the loser to the winner momentum portfolio. There is a difference of 2.4 per cent between the loser and the winner portfolio based on the most recently reported quarterly results prior to portfolio formation.

In contrast to the price-momentum strategy, the differences in the price response around the dates of subsequent quarterly results continue over the periods following portfolio formation. The abnormal return around the first subsequent announcement is higher by 0.2 per cent (t-stat = 0.42) for winner stocks compared to loser stocks. In the second and third announcement following portfolio formation, the abnormal return is larger for winner stocks by 0.7 per cent (t-stat = 2.84) and 0.8 per cent (t-stat = 2.26) respectively. Though statistically significant, these returns are, however, unlikely to be economically significant, taking into account reasonable transaction costs. By the fourth quarter, there is a difference of −0.2 per cent but it is not statistically significant (t-stat=-0.58).

MOMENTUM STRATEGIES BASED ON THE RELEASE OF FIRMS' QUARTERLY RESULTS

In the last subsection, we find for our sample companies the returns to a price-momentum strategy of buying the ten stocks with the highest performance based on the preceding six months' price performance and selling (shorting) the ten stocks with the worst six months' price performance does not generate statistically significant returns. In contrast, if investors were to concentrate their trading strategy solely in the days surrounding the release of the quarterly results, they would be able to capture statistically significant profits. However, as previously pointed out, the returns from pursuing such a strategy, though statistically significant, are likely to be substantially eroded by reasonable transaction costs and therefore are unlikely to be economically significant and hence not exploitable by investors. In this subsection, in contrast to the approach adopted in the previous subsection, we form our momentum portfolios on the basis of price performance around the most recent quarterly results (rather than on the basis of prior six-month returns) and investigate the profitability of momentum strategies based on such an approach.

Table 7.2 shows the performance of the quarterly results-based momentum portfolios formed on the basis of abnormal returns around the most recent set of quarterly results. The portfolio of winners (losers) consists of those ten stocks that generated the highest (lowest) abnormal return performance in the three-day period surrounding the publication of the quarterly results in the period immediately prior to portfolio formation. Panel A reports the price reaction in the three-day period surrounding the release of the quarterly results for the four

Table 7.2: Characteristics of the Earnings Momentum Portfolios Based on the Abnormal Return around the Earnings Announcement*

Panel A: Abnormal return around the most recent quarterly results	Winner	Loser	Difference in return	t-stats
Most recent announcement	0.045	-0.039	0.079	
First quarter after portfolio formation	0.030	-0.023	0.053	16.97**
Second quarter after portfolio formation	0.008	0.002	0.006	3.12**
Third quarter after portfolio formation	0.006	0.003	0.003	0.87
Fourth quarter after portfolio formation	0.006	0.001	0.005	1.85

Panel B: Cumulative returns	Winner	Loser	Difference in return	t-stats
Past 6-month return	0.099	0.030	0.069	
Return 3 months after portfolio formation	0.048	0.077	-0.029	-1.02
Return 6 months after portfolio formation	0.123	0.130	-0.007	-0.42
Return 12 months after portfolio formation	0.317	0.266	0.051	1.80

* Panel A presents the abnormal return measured around the release of the quarterly results for those portfolios based on the price reaction to the most recent quarterly results prior to portfolio formation. Panel B presents the cumulative price momentum returns of the portfolios presented in Panel A.

** = statistically significant at a = 0.05 (student t- distribution).

quarters after the initial portfolio formation period. Panel B reports the associated price performance in the subsequent four quarters for those portfolios reported in Panel A.

In Panel A we find in the first quarter following their initial formation winners outperform losers by 5.3 per cent in the three-day period surrounding the announcement of the quarterly results (t-stat = 16.97).[12] In the following quarter, the return difference is 0.6 per cent (t-stat = 3.12), but this differential return would not be economically significant after taking into account realistic transaction costs. Thereafter, in the remaining two quarters though the

differential returns are in the expected direction (0.3 per cent in quarter three and 0.5 per cent in quarter four), they are not statistically significant (0.87 and 1.85 respectively).

Table 7.2, Panel B shows that the price performance of the portfolios is closely related to price returns in the period surrounding the release of the most recent quarterly results prior to portfolio formation. There is a difference of 6.9 per cent in price performance between the loser and the winner portfolio. However, after formation the pattern reverses. During the six months following formation, the loser portfolio clearly outperforms the winner portfolio (-0.7 per cent, t-stat = -0.42). After six months, the picture changes again, so that in the first year following formation, the winner portfolio (with a cumulative return of 31.7 per cent) outperforms the loser portfolio (with a cumulative return of 26.6 per cent) but the return differential is not statistically significant (t = 1.80).

In aggregate, investors would not usefully profit by buying past winners and selling past losers based on the abnormal returns around the most recent quarterly results and taking a position in those stocks for a one-year period. Rather, investors would be better advised simply to concentrate their trading activity in the three-day period surrounding the release of the quarterly results in the subsequent quarter. The returns to pursuing such a strategy are both statistically and economically significant.

SUMMARY AND CONCLUSION

In this paper, we evaluate whether the profitability of the price-momentum strategies of Ryan and Overmeyer (2003) are driven by the market's under-reaction to firm news, more specifically accounting-related news. We find that for the constituents of the DAX 30, forming momentum portfolios based on past price performance, the profitability of momentum strategies is not economically significant.

However, we find the magnitude of the potential returns to buying past winners and selling past losers is both statistically and economically significant if investors form their portfolios based on the market's reaction to the most recent quarterly results and buy past winners and sell past losers in the three-day period surrounding the release of the subsequent quarterly results. In other words, the surprise value of the most recent quarterly results is a good predictor of the "surprise" value of the next reported quarterly results.

One possible interpretation of our results is that the profitability of price-momentum strategies reported in prior research may be a function of company size or investor characteristics, as we report no evidence of exploitable profits by pursuing such a strategy by restricting our sample stocks to the very largest capitalisation stocks. In contrast, however, momentum strategies based on the release of firm's quarterly results are profitable. Such results are consistent with evidence in relation to the well-known post-earnings-announcement-drift (PEAD) phenomenon documented in Bernard and Thomas (1989).

We can conclude that institutional investors who concentrate their portfolio holdings in the largest market capitalisation stocks can usefully exploit

momentum strategies conditioned on the market's response to firms' formal accounting disclosures. However, further research is necessary to investigate whether such results are replicable across the very largest stocks in other markets and across different periods to ensure our results are not market or time-period specific.

We may speculate that the differences in profitability between momentum strategies based on prior price performance and those based on the price response surrounding the most recent quarterly results may be explained in the context of Merton's (1987) model of capital market equilibrium with incomplete information. Predictability of future stock returns based on past price changes may be a stock market anomaly that is not exploitable for large stocks that are closely followed by the financial press and related media and by the investment analyst community. Merton argues that such close scrutiny will keep the market in such stocks informationally efficient, so reducing the potential for anomalous behaviour. However, there may still be exploitable opportunities surrounding what Merton terms "complex" information releases, the valuation impact of which is not immediately quantifiable. In these circumstances, the market may take time to assimilate, interpret and process such information. Such arguments on the complexity and difficulty in interpreting accounting information are advanced by Pritamani and Singal (2001) to rationalise the delay in the market's response to accounting news in their study, compared to the more immediate price reaction to other company news categories such as corporate restructuring activity and announcements of capital structure changes.

1   Commissions are set at 0.06 per cent of the market value of shares. However, there are discounts for larger orders. In practice, therefore, commissions are lower for the largest capitalisation stocks as they are more liquid and tend to trade in larger tranches.
2   Strictly speaking, the German market is an auction market whereby trading follows an auction procedure which takes place at twelve noon each day. No bid-ask spreads are quoted. As stocks are called in sequence, all orders are crossed at a single price. In a perfectly efficient market, the time series of prices should behave as if all transactions took place at a price mid-way between the bid and ask price, i.e. prices would behave as if there was no bid-ask spread. However, Haller and Stoll (1989) find evidence of an implicit bid-ask spread, which they attribute to prices being driven away from their true underlying equilibrium value by temporary order imbalances. They also report that the implied spread is larger for small firms than large firms and is negatively related to the volume of trading.
3   The Ryan and Overmeyer (2003) price-momentum study covers the period January 1990 to April 2000 and the sample stocks are drawn from the constituents of the DAX 100.
4   By basing our analysis on the release of firms' quarterly results our study is comparable to the approach adopted in Chan et al. (1996), the only extant study investigating whether the profitability of price-momentum strategies are attributable to investors' under-reaction to firms' formal accounting releases.
5   As we are working with daily data and a short-event period, more sophisticated return-

generating models are unlikely to add to our results (Kothari, 2001 § 4.4.1.1).

6   Another way of measuring the information content of a firm's formal accounting releases is in terms of standardised unexpected earnings. However, this variable requires a model of expected earnings and hence runs the risk of specification error. In addition, this measure is restrictive as it only considers earnings and ignores other accounting-related information.

7   The correlation coefficient between the six-month price-momentum strategy and the accounting-based momentum strategy based on abnormal returns around the release of the quarterly results is very similar to the correlation coefficient between both strategies of 0.16 found by Chan et al. (1996).

8   We omit from our analysis the ten stocks that lie in the middle of the distribution stocks in terms of past price performance.

9   We employ t-statistics based on the student's t-distribution to allow for the fact that our data may not be exactly normally distributed due to sample size restrictions.

10   Merton (1987) argues that "smaller" firms are more likely to exhibit anomalous behaviour, such as momentum, than are "larger" firms, as they are less closely followed by the financial press and the community of investment analysts.

11   Behavioural theories have been advanced as to why certain types of traders may depart from the paradigm of rational economic behaviour and systematically under-react to corporate news (for example Barberis et al., 1998; Daniel et al., 1998; and Hong and Stein 1999).

12   This return differential remains statistically significant even after taking into account realistic transaction costs of 1 per cent.

REFERENCES

Affleck-Graves, J. and Mendenhall, R.R. (1992) "The Relationship between the Value Line Enigma and Post Earnings Announcement Drift", *Journal of Financial Economics*, Vol. 31, No. 1, pp. 75–96.

Ball, R., Kothari, S.P. and Shanken, J. (1995) "Problems in Measuring Portfolio Performance: An Application to Contrarian Investment Strategies", *Journal of Financial Economics*, Vol. 38, No. 1, pp. 79–107.

Barberis, N., Shleifer, A. and Vishny, R. (1998) "A Model of Investor Sentiment", *Journal of Financial Economics*, Vol. 49, No. 3, pp. 307–43.

Bernard, V.L. and Thomas, J.K. (1989) "Post-earnings Announcement Drift: Delayed Response or Risk Premium", *Journal of Accounting Research*, Vol. 27, pp. 1–36.

Bernard, V.L., Thomas, J.K. and Wahlen, J. (1995) "Accounting-based Stock Price Anomalies: Separating Market Inefficiencies from Research Design Flaws". Working Paper, University of Michigan.

Chan, L., Jegadeesh, N. and Lakonishok, J. (1996) "Momentum Strategies", *Journal of Finance*, Vol. 51, No. 5, pp. 1681–713.

Conrad, J. and Kaul, G. (1993) "The Returns to Long-Term Winners and Losers: Bid-Ask Biases or Biases in Computed Returns", *Journal of Finance*, Vol. 48, No. 1, pp. 39–63.

Daniel, J., Hirshleifer, D. and Subrahmanyam, A. (1998) "Investor Psychology and Security Market Under- and Overreactions", *Journal of Finance*, Vol. 53, No. 6, pp. 1839–86.

Haller, A. and Stoll, H. (1989) "Market Structure and Transaction Costs: Implied Spreads in the German Stock Market", *Journal of Banking and Finance*, Vol. 13, pp. 697–708.

Hong, H. and Stein, J. (1999) "A Unified Theory of Under-Reaction, Momentum Trading, and Overreaction in Asset Markets", *Journal of Finance*, Vol. 54, No. 6, pp. 2143–84.

Jegadeesh, N. and Titman, S. (1993) "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency", *Journal of Finance*, Vol. 48, No. 1, pp. 65–91.

Kothari, S.P. (2001) "Capital Markets Research in Accounting Theory", *Journal of Accounting and Economics*, pp. 105–231.

Liu, W., Strong, N. and Xu, X. (1999) "The Profitability of Momentum Investing", *Journal of Business Finance and Accounting*, No. 9/10, pp. 1043–91.

Liu, W., Strong, N. and Xu, X. (2000) "Post Earnings Announcement Drift in the UK". Working paper, University of Manchester.

Lo, A.W. and MacKinlay, A.C. (1990) "When are Contrarian Profits Due to Market Overreaction", *Review of Financial Studies*, Vol. 3, No. 2, pp. 175–205.

Merton, R. (1987) "A Sample of Capital Market Equilibrium with Incomplete Information", *Journal of Finance*, Vol. 42, pp. 483–510.

Pritamani, M. and Singal, V. (2001) "Return Predictability following Large Price Changes and Information Releases", *Journal of Banking and Finance*, Vol. 25, pp. 631–56.

Rouwenhorst, K.G. (1998) "International Momentum Strategies", *Journal of Finance*, Vol. 53, No. 1, pp. 267–84.

Ryan, P. and Overmeyer, I (2003) "The Profitability of Price-momentum Strategies: Evidence from the DAX 100", *Journal of Investing*, forthcoming.