The Pricing of Earnings

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Essays on the Post-Earnings Announcement Drift and Earnings Quality Risk

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To my family

Preface

This report is a result of a research project carried out at the Department of Accounting at the Stockholm School of Economics (SSE).

This volume is submitted as a doctor's thesis at SSE. The author has been entirely free to conduct and present her research in her own ways as an expression of her own ideas.

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Part I

Introduction and Summary of Dissertation

Introduction

The stock market provides an important mechanism for resource allocation in society. It is thus important that this market functions in an efficient way. According to Fama (1970) a market is efficient (in the semi-strong sense) if stock prices incorporate all public information. Consequently, in such a market there should be a prompt and complete price reaction when new accounting information is announced to the market. There is nevertheless ample empirical evidence from many stock markets that the pricing process is not in line with this description.[1] At times, stock prices tend to drift upwards after the announcement of good news and downwards after the announcement of bad news, making it possible for an investor to earn abnormal returns when trading on the information. In particular, earnings announcements seem to be followed by such a drift, which has given rise to the term post-earnings announcement drift (PEAD). The drift is a central theme of this dissertation.

The dissertation consists of the following papers:

Paper 1: Swedish post-earnings announcement drift and momentum return
Paper 2: Information uncertainty in unexpected earnings signals
Paper 3: Earnings quality and the implied cost of equity capital – the Swedish case

The three papers, which all use a sample of firms listed on the Stockholm Stock Exchange (1990-2008), are interlinked in the following way. The first paper documents the existence of PEAD in the Swedish stock market. Two interesting empirical observations from this study are that the drift is only significant for longer holding periods and that the drift on the short position, i.e. after bad earnings news, is negligible. The lack of downward drift on the short position is interpreted as an indication of PEAD, at least partly, being explained by investors demanding a compensation for a risk factor that is omitted in the test design.

This is the theme of Paper 2. Here a framework is outlined to illustrate under what conditions information risk in the earnings signal might explain a low announcement reaction and a price drift in the post-announcement period. In the empirical sections, I investigate two earnings signals - GAAP earnings and core earnings - which are hypothesized to have different levels of information uncertainty.[2] It is concluded that the low immediate announcement reaction and high post-announcement drift for the GAAP earnings signal is due to this signal being perceived

[1] This does not necessarily mean that markets are inefficient as discussed in this introductory chapter. In addition, the question of whether markets are inefficient or not is unfortunately impossible to answer due to the problem of joint hypotheses as pointed out in Fama (1970). The two hypotheses jointly tested are about market efficiency and the expected returns model.

[2] GAAP stands for Generally Accepted Accounting Principles.

by investors as containing more uncertainty than the core earnings signal. Faced with this uncertainty, investors demand risk compensation in terms of a higher expected return.

The positive relation between information risk and expected return is further investigated in Paper 3, where information risk is proxied by two earnings quality metrics; *value relevance* and *timeliness*. Using a new approach to estimate the implied cost of capital, it is found that investors demand a higher expected return for firms with poor earnings quality, i.e. firms associated with higher information risk.

The purpose of this introductory chapter is to discuss some common themes in the three papers. First, the relation between accounting earnings and stock prices is discussed. Then, prior research on the post-earnings announcement drift is reported, in terms of results, methodological considerations and potential explanations for the drift. Further, I highlight some sample and data issues in the dissertation, summarize the findings, discuss the contributions and the limitations of the dissertation, and finally propose some topics for future research.

The role of accounting earnings information in the stock market

In the stock market investors presumably buy and sell shares based on their assessment of the shares' expected future pay-offs and investment risks. In making these assessments they use a broad set of information, of which accounting information constitutes an important subset. Of all accounting numbers made public in the financial statements, accounting earnings seem to be especially important. This is not surprising considering that earnings summarize what is available to shareholders for the financial period, after other stakeholders have received their parts. If positive, reported earnings either increase the book value of equity (through retained earnings) or are distributed to shareholders as dividends. Under ideal mark-to-market accounting, reported earnings are equal to the investors' return for the period (change in market value of equity plus dividends).[3] This is the concept of "economic earnings".[4] Under these assumptions the reported economic earnings are *all* of the return. Whenever ideal mark-to-market accounting is not available, reported earnings can be considered a *signal* of the underlying economic earnings and the value creation

[3] In addition one has to assume that the clean surplus relation (CSR) holds so that all changes in owners' equity emanate from earnings and net dividends.

[4] Economic earnings are also referred to as "Hicksian income" following Hicks (1939). The concept of economic earnings is developed more extensively in Paper 2.

of the period. As such, a high empirical association between earnings and stock returns is expected.[5]

Ball and Brown (1968) reported empirical evidence of this association. They studied how stock prices change when new earnings information is released to the stock market and report that announcement returns on average are positive for firms reporting good news and negative for firms reporting bad news. This is interpreted as if the stock market *does* find earnings news to be important for share value. As referred to above, in order for the stock market to be efficient, prices should change rapidly to incorporate fully the new earnings information. Market efficiency is not under investigation in Ball and Brown (1968), but there are in their study some indications of a price drift in the post-announcement period (see Figure 1, p 169), potentially contradicting the market efficiency hypothesis.

The post-earnings announcement drift

Since the first empirical indications, many researchers have analyzed PEAD (e.g., Jones and Litzenberger, 1970; Foster *et al.*, 1984; Bernard and Thomas, 1989 and 1990; Bernard *et al.*, 1997). The study by Bernard and Thomas (1989) is considered to be of high methodological quality. Since it is a reference study for the first two papers of the dissertation, it is described in some detail below.

Bernard and Thomas (1989) studied the drift after quarterly earnings announcements for a sample of US firms over the period 1974-1986. They find that an investment strategy which involves taking a long position in firms with the highest earnings surprises (good news) and a short position in firms with the lowest earnings surprises (bad news), and holding these positions for 60 trading days, generates a size-controlled return of 4.2% (or 18% on an annualized basis).[6] They also find that the drift lasts up to 240 trading days (approximately 12 months), but that most of the return on the combined portfolio (long position minus short position) is generated during the first couple of months. The long and the short positions contribute about the same to the return of the combined portfolio. In addition they find that the drift is more pronounced for smaller firms, but still significant for large firms.

An essential variable in PEAD studies is the *earnings surprise* variable. In order to capture the "news" content of the announcement, the market's expectation of

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[5] Prices in the stock market can change also for other reasons, such as market liquidity changes or personal tax issues, which are not linked to fundamental earnings information. Consequently, the observed stock prices and returns can only be considered to be a noisy indicator of investors' usage of earnings information.

[6] A short position, or "selling short", is a way for investors to gain profits when stock prices go down. The short-selling investor borrows shares from another investor or broker (putting up collateral and paying an interest rate) and then sells the shares in the stock market. After some time the investor buys back the shares and returns them to the lender. If the price of the share has gone down the short-seller makes a profit, and if the price of the share has gone up the short-seller makes a loss.

earnings prior to the announcement has to be controlled for. Bernard and Thomas (1989) calculated the *unexpected* earnings (the earnings surprise) as the difference between the reported earnings and the earnings forecasted by a time-series model.[7] They further scaled the unexpected earnings with the standard deviation of the forecast error and refer to this measure of earnings surprise as SUE (Standardized Unexpected Earnings).[8]

Subsequent to each firm's announcement, the firms are assigned to one out of ten portfolios, ranging from high SUE to low SUE. To avoid hindsight bias in determining the ranking of firms, it is the distribution of SUEs from the prior quarter that determines the cut-offs points for the ten portfolios.[9] The return to each portfolio is subsequently evaluated. As a first step Bernard and Thomas (1989) calculated the "abnormal" return by taking the raw stock return minus the equally-weighted mean return to the size portfolio that the firm belonged to in the beginning of the calendar year. This procedure aims to control for the size effect on returns, i.e. that small stocks tend to have higher returns (Banz, 1981). In a second step, they accumulated this abnormal return by summing the daily abnormal returns over different holding periods.[10] Values of cumulative abnormal return (CAR) are their main metric to evaluate the profitability of the ten SUE portfolios. This evaluation is partly done graphically and has given rise to the classic PEAD graph where the drifts upwards and downwards for the two extreme portfolios are evident. In Figure 1 the CARs for the long and short position are presented in a stylized fashion. Note that if there is a drift in prices after the announcement, there will also be a drift in accumulated returns. PEAD has in prior research therefore been referred to as both a drift in prices and a drift in returns.[11]

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[7] Reported earnings are here "earnings before extraordinary items and discontinued operations".

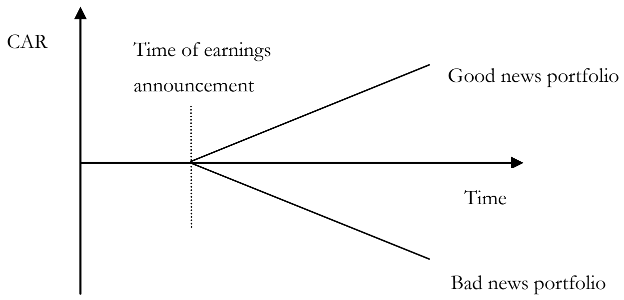
[8] The post-earnings announcement drift is sometimes therefore referred to as the SUE effect (e.g., Bernard *et al*. 1997).

[9] Earlier work on the drift ranked the firm's SUE relative to the distribution of SUEs for the same quarter. Since not all earnings had been announced at that point in time, this methodology introduced a hindsight bias. This was noted by Holthausen (1983).

[10] They also compound the returns and find no difference in results (Bernard and Thomas, 1989, p 7).

[11] In the dissertation I use both "price drift" and "return drift", as well as "price reaction" and "return reaction".

Figure 1. Stylized graph of the post-earnings announcement drift



Bernard and Thomas (1989) furthermore explore possible methodological issues that might explain the drift. However, they do not find sufficient evidence that leads them to think that these issues can explain the drift. What they find though, is that the returns to the PEAD strategy are concentrated around subsequent earnings announcements. They propose that the drift might be due to investors irrationally failing to update their expectations after an earnings announcement, and thus experience a surprise effect at subsequent announcement dates. As such, their findings are a challenge to the efficient market hypothesis.

Many studies of the PEAD phenomenon have followed since Bernard and Thomas (1989), in the main confirming their results for the US stock market. The drift is accordingly argued to be persistent over time.[12] In addition, PEAD has been studied in "out-of-sample" tests, where the US market is referred to as the "main sample". The results are mixed. In several stock markets there are indications of a drift, but there are also markets in which the drift has not been possible to document (international evidence on PEAD is described in detail in Appendix 1.A of Paper 1).

In Table 1 I present an overview of previous PEAD studies. This presentation is however not exhaustive. For each study the stock market, time period, holding period, measurement of key variables, and some results on the drift are highlighted. The table reveals that the main variables can be measured in various ways. Methodological considerations are discussed in the next section.

[12] It is in these studies common that new time periods are just added to the previously evaluated time-series. This approach is not very powerful in detecting if the drift in later time periods is less persistent than in earlier time periods. Consequently, it is not clear that the drift is as persistent as argued by many (cf. Jacob *et al.*, 2000). Skogsvik and Skogsvik (2010) is an exception. They evaluate the profitability of an accounting based trading strategy for different subsamples in their overall sample. Using hold-out samples, they find that the profitability of the strategy has decreased over time, indicating that investors have become more sophisticated.

Table 1. Overview of empirical PEAD studies

Authors	Market	Time period	Portfolio formation	Holding period	Earnings Metric	Expected Earnings	Return Metric	Risk control	PEAD Return	Long position	Short position
Jones and Litzenberger (1970)	US	1962-1967	calendar-time	2 years	reported earnings	time-series model		market-adjusted		positive	not reported
Bernard and Thomas (1989)	US	1974-1986	event-time	240 days	reported earnings	time-series model	CAR	size-adjusted	18% a year	positive	negative
Booth *et al*. (1996)	Finland	1989-1993	event-time	10 days	aggregated reported earnings		CAR	CAPM		positive	negative
Hew *et al*. (1996)	UK	1989-1992	event-time	180 days		time-series model	CAR	size-adjusted	7.3%	positive	negative
van Huffel *et al*. (1996)	Belgium	1990-1993	event-time	90 days		time-series model	CAR	market-adjusted or size-adjusted		no drift	no drift
Kallunki (1996)	Finland	1990-1993	event-time	10 days	reported earnings	time-series model	CAR	CAPM and/or accounting based risk adjustment	0.02-0.05% over ten days	no drift	negative
Bernard *et al*. (1997)	US	1973-1992	event-time	8 quarters	reported earnings	time-series model	CAR	market-adjusted	Yes	not reported	not reported
Dische (2002)	Germany	1987-2000	calendar-time	12 months	forecast revisions	analyst forecasts	CAR	market-adjusted	1.0% a month	positive	negative (barely significant)
Liu *et al*. (2003)	UK	1988-1998	calendar-time	3,6,9,12 months	reported earnings	time-series model or analyst forecasts	BHAR or monthly alpha	three-factor model	BHAR: 10.8% monthly alpha: 0.706%	mixed results	mixed results
Vieru *et al*. (2005)	Finland	1996-2000	event-time	10 days	returns based		CAR			no drift	negative
Livnat and Mendenhall (2006)	US	1987-2003		4 quarters	reported earnings	time-series model or analyst forecasts	CAR	size and B/M-adjusted	5.21% per quarter	not reported	not reported
Booth *et al*. (2006)	Finland	1995-2003	event-time	30 days	returns based		CAR			positive (small)	negative
Francis *et al*. (2007)	US	1982-2001	calendar-time	6 months	reported earnings	analyst forecasts	monthly aplha	three-factor and/or four-factor model	monthly alpha: 0.68%	not reported	not reported
Forner *et al*. (2009)	Spain	1994-2003	calendar-time	12 months	reported earnings or forecast revisions or returns based	time-series model	BHAR or monthly alpha	three-factor model	monthly alpha: 0.45%	positive	positive (not significant)

* A monthly alpha is estimated in regressions with hedge portfolio return as the dependent variable and risk factors as independent variables. CAR is the Cumulative Abnormal Return and BHAR is the Buy-and-hold Abnormal Returns. Note that "abnormal return" is defined differently in the studies, where the column "Risk control" gives information about how expected return is measured.

Methodological considerations in PEAD studies

The field of research studying PEAD has a long history and consequently the methodologies used have developed much over time. Some problems in the earlier studies have been alleviated. Below I will highlight some of the methodological considerations that any PEAD study faces. These issues are important to consider before discussing the potential explanations for the drift.

Portfolio formation

Similar to Bernard and Thomas (1989) the most common way to evaluate the PEAD is to form trading strategies based on unexpected earnings. In earlier studies two problems related to trading strategies were the use of assumed - rather than actual - announcement dates (e.g., Jones and Litzenberger, 1970) and the use of strategies that involve a look-ahead bias when sorting the stocks on their unexpected earnings (e.g., Holthausen, 1983). In later studies, these problems have been avoided. The most common approach in later studies is to sort all stocks at the first day of a calendar quarter, based on the unexpected earnings announced during the previous calendar quarter.[13] As a consequence, any price drift between the announcement date and the first day of the subsequent calendar quarter is not measured. As such, this "calendar-time" approach avoids look-ahead bias but loses some power.

Measuring portfolio return, expected return and "abnormal" return

In early studies of PEAD, the most common way to evaluate the returns subsequent to the announcement was to measure so-called buy-and-hold returns (BHAR).[14] In this measure a return is defined as "abnormal" if it exceeds the return of a benchmark firm or the market index. The abnormal return is then compounded over the holding period. One advantage of the BHAR measure is that it mimics investor experience, noted by Barber and Lyon (1997). It does not require monthly rebalancing of the portfolio as is assumed when using a CAR measure where the monthly abnormal returns are summed. However, the BHARs can give a false impression of the adjustment speed.[15] Even though there is no additional difference between the returns

[13] One could distinguish between PEAD studies in "event-time" and "calendar-time". With studies in event-time, I refer to studies that take the positions just after each firm's earnings announcement date. In calendar-time studies, which are nowadays more common, the positions are taken at the first day of the quarter (or month) subsequent to the quarter (or month) in which earnings are announced.

[14] Bernard and Thomas (1989) use both CAR and BHAR in their tests.

[15] Another problem, pointed out by Fama (1998), arises if one deducts the measure of expected returns after compounding over time. As Fama discusses, for longer time horizons it is not possible to use asset-pricing models to measure expected returns, which is a limitation. Expected returns must be modeled by return on a benchmark firm or portfolio.

of the event firm and the benchmark firm in a specific time period, the method might give an impression of additional abnormal return being generated in that period. Fama (1998) gives an example: after the first year subsequent to the event, the return to the event firm is 10% and 0% for the benchmark firm, i.e. the value of the event firm is now 1.1 compared to the benchmark firm, which still has a value of 1.0. BHAR is thus 10% after the first year. Now suppose that for the second year the value of both the event firm and the benchmark firm increases by 300%, that is, they increase exactly the same. The value of the event firm is thus after two years 3.3 (1.1*300%) and for the benchmark firm it is 3.0 (1.0*300%). After two years, the return of the event firm is then 330% (3.3/1.0), whereas it is 300% for the benchmark firm (3.0/1.0). BHAR will thus be 30% after two years (330%-300%), compared to 10% after one year. Consequently, even though there was no increase in the difference between the event firm and the benchmark firm during the second year, the BHAR measure might give a false impression that additional abnormal return was earned during the second year. Consequently, making inferences from the BHARs about *when* the abnormal return is generated, might lead to erroneous conclusions.

In addition to the problem mentioned above, the measure of BHAR does not lend itself easily to statistical inference. For example Mitchell and Stafford (2000) have shown that the distribution of firm-specific BHARs are skewed and generally not centered on zero. In addition the series of BHARs might suffer from overlapping observations which introduces the problem of autocorrelation. One solution, used by for example Ikenberry *et al.* (1995), is to use a bootstrapping procedure which provides an empirical distribution under the null hypothesis of no abnormal return. This distribution can then be used for statistical testing.

An alternative to using the BHARs is to evaluate the drift after the announcement of earnings through calendar-time regressions (e.g., Chan *et al.*, 1996). This method was also proposed by Fama (1998) to control for the problems referred to above, and is now widely used in the PEAD literature. In the calendar-time regressions, average monthly portfolio excess returns are regressed on risk factors and the intercept (alpha) is the measure of abnormal return. The drawback of this method is that it implicitly assumes that portfolios are rebalanced every month, introducing higher trading costs.[16]

The measurement of the expected return is crucial when defining the abnormal return. Earlier PEAD studies controlled for the size effect, where small firms were assumed to have a higher expected return (e.g., Banz, 1981). Nowadays, the most common procedure is to control for expected return by the so-called three-factor model (Fama and French, 1993). In addition to controlling for the co-variation with the excess market return according to the capital asset pricing model – CAPM (Sharpe,

[16] In Paper 1 and Paper 2 I use both calendar-time regressions and BHARs to evaluate the drift.

1964; Lintner, 1965) – Fama and French propose that *size* and *book-to-market* are additional risk factors. However, the three-factor model is not a theoretical model of expected returns, but rather a model fitted to the empirical returns pattern (during a specific sample period). In fact, the returns to the *size* and *book-to-market* portfolios (referred to as SMB and HML) were initially thought of as anomalies.[17] Considering these problems, it is uncertain whether the alpha in the calendar-time regressions really is a measure of abnormal returns. Currently there are really no competing models to the three-factor model.[18] The question of whether an omitted risk factor can explain the existence of the drift is discussed below.

Feasibility to investors

Before interpreting the abnormal returns generated by a trading strategy as a sign of market inefficiency, two things have to be considered; 1) can investors implement such a strategy and 2) *if* the strategy can be implemented, is *all* the return possible to access for an investor?

In general, a PEAD strategy is considered to be fairly easy to implement since information about reported earnings are accessible to all investors. The largest restrictions might be on the short position, making the return on this position harder for investors to access. In many countries short-selling has certain legal restrictions (for example the up-tick rule in the US) and/or has not been allowed at all during some time periods.[19] Many times these market restrictions are not considered in the research design of PEAD studies.

Most PEAD studies do not consider the transaction costs that an investor would face when implementing the PEAD strategy, but there are some exceptions (e.g., Bernard and Thomas, 1989 and 1990; Bhushan, 1994; Mendenhall, 2004). In general they find that transaction costs would make the PEAD strategy less profitable to investors but that the magnitude of these costs is not large enough to motivate the whole drift. Some recent empirical studies have tried to use a more comprehensive estimate of transaction costs, also taking into consideration more indirect costs such as

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[17] The estimation procedure for *SMB* (Small minus Big) and *HML* (High minus Low) are described in Paper 1.

[18] A factor controlling for momentum in returns (the momentum effect) is sometimes considered to be a fourth factor (e.g., Carhart, 1997; Chan *et al*., 1996). Also, returns to a factor-mimicking portfolio based on *accruals quality* have been proposed to be a fifth factor (e.g., Francis *et al*., 2005). This result is however debated.

[19] The up-tick rule in the US stock market was implemented in 1938 and removed in 2007. It restricts short-selling by only allowing short sales to a price that is higher than the last traded price of the share, or to the last traded price if this price was above the price in the previous trade. During the financial crisis in 2008, further short-selling restrictions were temporarily introduced, banning short-selling of securities of financial firms. In Sweden, short-selling has been formally allowed since 1992 and it is generally less restricted than in many other markets. For example, Sweden was one of the few markets that during 2008 did not introduce restrictions in short-selling. However, besides legal restrictions, the supply of shares possible to borrow might be a restriction facing an investor who wishes to sell short.

price impact and opportunity costs (Chordia *et al.*, 2007; Ng *et al.*, 2008). They indicate that the costs associated with the PEAD strategy might be high enough to render it unprofitable. In addition, Ng *et al.* (2008) suggest that transaction costs provide an explanation for the *existence* of PEAD, which is described in the section about market frictions below.

Skogsvik and Skogsvik (2010) point to the importance of distinguishing between *statistical* and *realistic* return metrics when evaluating the profitability of trading strategies. A statistical return metric might be biased upwards, since it might require foreknowledge of, for example, stocks that will be delisted during a holding period. As such, this is not really the return available to an investor who implements the trading strategy. The realistic return metric on the other hand is solely based on information that is available at the time of portfolio formation. It is common in PEAD studies not to consider these issues.

Potential explanations for the post-earnings announcement drift

The discussion of methodological considerations in PEAD studies highlights that the observed returns pattern should be interpreted with caution. However, many of these problems have explicitly been considered in research and none of them seems to be able to fully explain PEAD. It thus seems like we are left with explanations that do not hinge upon methodological problems in the test design.

There is to date no consensus on what can explain PEAD. In fact, Fama (1998) call the drift the "granddaddy of underreaction events". Over the years, the following factors have been proposed to fully or partially explain the drift: underestimation of earnings persistence (e.g., Bernard and Thomas, 1989 and 1990; Abarbanell and Bernard, 1992), underweighted forecasts due to the integral approach of quarterly reporting[20] (Rangan and Sloan, 1998) or to accounting conservatism (Narayanamoorthy, 2006), inflation illusion (Chordia and Shivakumar, 2005), surprise risk (Kim and Kim, 2003), opinion divergence (Garfinkel and Sokobin, 2006), trading activity by unsophisticated investors (Bartov *et al.*, 2000), information processing biases (Liang, 2003), structural uncertainty and rational learning (Francis *et al.*, 2007), liquidity risk (Sadka, 2006), and transaction costs (e.g., Ng *et al.*, 2008).

Below, I consider in more detail some of these potential explanations: mispricing due to behavioral biases, structural uncertainty and rational learning, market frictions, and compensation for risk.

[20] The integral approach refers to each interim period being viewed as an *integral* part of an annual period. Certain accounting items are allowed to be smoothed across quarters in the same financial year, whereas similar smoothing is not allowed across quarters in different financial years.

Mispricing due to behavioral biases

The observed drift pattern after the earnings announcement date has by many been interpreted as a sign of mispricing, i.e. that the market is not efficient in the semi-strong sense (e.g., Bernard and Thomas, 1990; Abarbanell and Bernard, 1992; Ball and Bartov, 1996). The mispricing is often considered to be attributable to investors underestimating the persistence in unexpected earnings. As a consequence the subsequent earnings announcements generate a surprise in the market, which is reflected in the price drift.

Lately, the field of behavioral finance also proposes some explanations based on human psychological limitations. First, Barberis *et al.* (1998) propose that investors suffer both from a *conservative bias* and a *representativeness bias*, where the first causes investors to underreact and the second, which comes into play after a while, leads investors to overreact in the longer term.[21] Second, Daniel *et al.* (1998) present a model where the initial underreaction and price drift is due to investors suffering from biases such as *overconfidence* and *self-attribution* which lead them to weight private information too high and public information too low. A third behavioral explanation is proposed in Hong and Stein (1999). According to their model, which distinguishes between informed traders and momentum traders, the initial underreaction is due to a slow diffusion of firm-specific information. As momentum traders can gain profits on this slow price adaption, more and more of these traders will enter the market, eventually leading to a long-term overreaction.

It is important to note that all the behavioral explanations rely on two important building blocks; that investors on average are irrational (suffering from biases) and that there exist limitations in the stock market that refrain rational investors from trading away the observed returns (Barberis and Thaler, 2003).

A criticism raised against the behavioral models is that they potentially can explain *both* underreaction and overreaction. In addition, it is often argued that these behavioral predictions are "fitted" to explain a certain empirical pattern and might thus be sample specific (Fama, 1998). In line with this criticism, Forner and Sanabria (2010), in an out-of-sample test using data from the Spanish stock market, find no support for these behavioral explanations in relation to PEAD.

Structural uncertainty and rational learning

Recent research relates *structural uncertainty* and *rational learning* to the returns pattern of underreaction and drift. Brav and Heaton (2002) show in their "rational structural uncertainty model" that a returns pattern such as PEAD can arise even if investors are

[21] *Conservatism* refers to the underweighting of recent information and *representativeness* refers to the overweighting of recent information.

fully Bayesian rational, assuming that they do not have full information. If investors face uncertainty about structural shifts in the value relevant parameter (for example earnings), they will appear to underweight a new signal that is announced just after a structural shift. This underweighting is due to investors mistakenly, but rationally, placing too much weight on old information because they are uncertain whether there has been a shift or not. As time passes and investors learn that there has been a structural shift, investors place more weight on the original signal, leading to a drift in security prices in the same direction as the signal. Note, however, that this return prediction relies on the assumption that investors think the value relevant parameter is stable, when in fact there is a structural shift.[22]

This model is thus not consistent with the characteristics of an efficient market, where it is assumed that investors both have full information and are rational in their processing of this information. However, as Brav and Heaton (2002) point out, it differs from the behavioral models where it is assumed that investors have full information but that this information is not processed in a rational manner. The behavioral and the rational structural uncertainty models give rise to similar return predictions, making them hard to distinguish empirically.

Francis *et al.* (2007) also propose that information uncertainty and learning by rational investors is related to the drift in security prices.[23] They show that stocks in the extreme unexpected earnings portfolios also exhibit higher information uncertainty. Information uncertainty is here defined as the extent to which the reported earnings map into cash flows, and is operationalized using the model specified in Dechow and Dichev (2002). Consistent with their predictions, Francis *et al.* (2007) find that the stocks with the highest information uncertainty are followed by a muted announcement reaction and a drift in stock prices. They interpret these findings as support for structural uncertainty and rational learning, at least partially, driving the drift.[24]

There are two potential problems with this PEAD explanation. First, the framework proposed by Brav and Heaton (2002) is contingent on there being a shift in the underlying value relevant parameter, and it can be argued that this is typically not

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[22] Brav and Heaton (2002) also illustrate the opposite case where investors mistakenly incorporate a probability of a shift in their estimates; even though the parameter is stable (there is no shift). In that case, investors will mistakenly place too much weight on recent information and appear to overreact.

[23] Francis *et al*. (2007) are silent upon how PEAD is related to the opposite returns prediction in Brav and Heaton (2002).

[24] Since the price drift following the announcement of high uncertainty signals in this sense is predictable, there has to be market limitations that can explain why rational investors with this information do not trade away the drift. An alternative interpretation is that mispricing arises for some reason (for example behavioral biases) at the release of new information and that rational learning describes the mechanism through which prices adjust towards a new equilibrium (see Francis *et al*., 2007, p. 409). Note that Francis *et al*. (2007) do not aim to provide a full explanation to PEAD.

descriptive of real-world earnings announcements. Second, the prediction in Francis *et al.* (2007), that rational learning drives the drift, builds on the assumption that the initial uncertainty resolves over time. It is thus implicitly assumed that information in the post-announcement period *on average confirms* (and not contradicts) the original earnings signals. There is no theoretical motivation for this assumption.

Market frictions

In the section on methodological considerations it was discussed that transaction costs might render the PEAD strategy unprofitable to investors. This could potentially explain why investors avoid these positions and we still observe PEAD. Some argue that, in addition to explaining the *persistence* of the drift, these costs can also be an explanation to the *existence* of it. Ng *et al.* (2008) find that transaction costs are higher for firms that drive the returns to the PEAD strategy, i.e. firms in the extreme portfolios. They propose that the higher costs associated with these stocks explain why there is not a "full" reaction at the earnings announcement.

It has also been argued that other market frictions - often referred to as "limits to arbitrage" - impede investors from implementing the PEAD strategy, explaining the persistence and even the existence of the drift (e.g., Barberis and Thaler, 2003; Shleifer and Vishny, 1997).[25] If an arbitrageur attempts to take advantage of the drift pattern (which exists for any reason) but is hindered to do this, the drift would not be traded away.[26] An example is that investors face the risk that prices in the short-run drift against his/her predictions. If the investor has a limited investment horizon, this might force him/her to liquidate the position at a loss. Shleifer and Vishny (1997) show that this risk is higher in an agency setting where the principal (who owns the invested funds) evaluates the agent (the portfolio manager) on returns. Seeing that returns in the short-run are negative, the principal might force an early liquidation. This risk might thus refrain rational agents from pursuing these investment strategies.[27]

It has been shown empirically that stocks in the extreme portfolios of the PEAD strategy have very high idiosyncratic risk (measured as the volatility of the residual from a three-factor model) and that arbitrageurs, not being able to diversify it away, thus avoid these positions (e.g., Mendenhall, 2004; Francis *et al.*, 2007).

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[25] Barberis and Thaler (2003) identify three sources of limits to arbitrage: idiosyncratic risk, noise trader momentum risk, and implementation costs.

[26] Arbitrageurs are assumed to play an important role in capital markets, chasing "risk-free" returns by trading on observed returns patterns, such as PEAD. The PEAD strategy is not really a risk-free arbitrage opportunity. However, if the drift is indeed a sign of mispricing in publicly listed stocks, it is considered to be a low-risk opportunity for a rational investor to make a profit on this mispricing. The profit is generated through the tool of arbitrage, buying stocks considered to be undervalued and shorting stocks considered to be overvalued.

[27] Premature liquidation might also be triggered by creditors.

It is fairly easy to see how market frictions, such as transaction costs, could lead to a muted announcement reaction and that investors might be hindered in various ways to trade on what they perceive to be an underreaction. However, in order to fully explain the post-announcement drift, these costs or market frictions must resolve gradually over time. This mechanism is not described in the literature.

Compensation for risk

As previously noted, the measurement of expected return is crucial in any study concerning stock market efficiency. In fact, any such study is a joint test of market efficiency and the expected returns model in use (Fama, 1970). If the measurement of expected return is biased downwards, the measure of abnormal return will be exaggerated, leading to erroneous conclusions. In relation to PEAD studies, it can be questioned whether the common practice of using the three-factor model when estimating the expected return, really takes into consideration *all* risk factors that investors care about. If not, an omitted risk factor might explain the observed muted announcement reaction and drift in the post-announcement period.

To dismiss the PEAD phenomenon as a result of an omitted risk factor is however not trivial. In addition to assuming that investors in general are risk averse, one has to assume that the risk factor in question is non-diversifiable (systematic) *and* that it resolves over time. More importantly, the implication of an omitted risk factor is that returns on *both* the long and the short position will drift upwards. This is not in line with the empirical findings of for example Bernard and Thomas (1989 and 1990). In fact, this might be the reason why potential risk factors, as explanations for PEAD, have not received a lot of attention in the literature. However, the empirical findings of this dissertation, with hardly any drift on the short position, illustrate that PEAD might, at least partly, be explained by an omitted risk factor.[28] There are also indications in some previous studies (e.g., Forner *et al.* 2009; Dische, 2002) that the drift on the short position does not follow the "classic" PEAD graph presented in Figure 1, suggesting that the observations in the dissertation are not sample-specific.[29]

In the dissertation, I examine *information uncertainty* as a potential omitted risk factor. The aim is not to provide an explanation for PEAD, but rather to highlight under what conditions it might be compatible with markets being efficient. Information risk has in prior literature, both theoretical and empirical, been suggested to affect expected returns (e.g., Diamond and Verrecchia, 1991; Easley and O'Hara,

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[28] Kallunki (1996) also suggests that the drift might be an effect of abnormal returns not being correctly measured. When using an accounting based risk-adjustment, he finds no significant return to the hedge portfolio.

[29] Implementing a trading strategy, based on an accounting based indicator variable, for a Swedish sample of firms, Skogsvik and Skogsvik (2010) also find small positive returns to the short position.

2004; Lambert *et al*., 2011; Francis *et al*., 2004 and 2005). This is also the finding of Paper 3 in the dissertation.

Prior research on PEAD has dismissed the risk explanation due to the empirical finding that the drift is concentrated around subsequent earnings announcements. It is here argued that it is unlikely that any systematic risk factor would change that much around announcements (e.g., Bernard and Thomas, 1989; Bernard *et al*., 1997). In this dissertation I argue that information risk indeed might resolve around subsequent earnings announcements. When new earnings information is announced to the market, investors can learn more also about prior earnings signals which they originally found to be uncertain. This risk revelation is in line with prices drifting.

A potential problem with *explaining* PEAD with information risk (besides that it cannot by itself explain a downward drift on the short position)[30] is whether the compensation to this factor is large enough to be able to explain the return to a PEAD strategy. Empirical studies on a US sample have found that a hedge portfolio strategy, taking a long position in stocks of high information uncertainty (low accruals quality) and a short position in stocks of low information uncertainty, generates on average 0.9-2.25% per year, after controlling for *beta*, *book-to-market* and *size* (e.g., Francis *et al*., 2005). Assuming that these results capture returns to information risk, as defined in this study, and are possible to translate to the Swedish institutional setting, they indicate that the risk compensation investors get for bearing this risk is not high enough to *fully* explain the observed PEAD return of about 10% per year.[31]

To conclude, the PEAD literature is still struggling with the driving forces behind the drift. In recent years, the proposed explanations tend to assume that the drift is a sign of mispricing. The purpose of the above discussion is to highlight a number of arguments for why more research on PEAD and potential risk factors is warranted.

[30] In Paper 2 I discuss how different risk exposure and potential clientele effects might alter the predictions for the short position.

[31] Note though that the study by Francis *et al*. (2005) reports realized returns, which is albeit a noisy estimate of expected returns (e.g., Elton, 1999).

Empirical data

The three papers of the dissertation intend to study a population of larger non-financial firms listed in Sweden. The findings are not possible to generalize to other populations of firms.

In general, the sample used to make inferences to the population, is a sample of non-financial firms listed on the Stockholm Stock Exchange during the time period 1990-2008.[32] The sample includes firms listed on the so-called "A-list" (after 2005, firms listed on the "Large Cap"-list). Firms with a fiscal year different from the calendar year (5 firms) have been excluded as a matter of convenience in the test design. Presumably this does not lead to sampling biases.[33]

Due to data requirements, the specific time period under study differs between the three projects. The time period for each project is:

- Paper 1: 1990-2005,
- Paper 2: 2004-2008,
- Paper 3: 1994-2008.

The time periods under study in Paper 1 and Paper 3 encompass both good and bad times in the stock market, and are thus considered to be representative for the population. The sample period in Paper 2 is, however, potentially biased since it mostly involves years with a booming stock market. Overall, I do not intend to make inferences to time periods that differ to a great extent from the sample period with respect to accounting regime, overall functioning of the stock market etc.[34]

In this section some facts about the Swedish stock market, as well as the overall Swedish economy is presented for the sample period. The Swedish stock market was in June 2005 the largest equity market in the Nordic countries and the fifth largest in Europe, with a total market capitalization of approximately 3 000 billion SEK (approximately 410 billion USD). The average daily turnover was 15 160 million SEK (approximately 2 100 million USD), with about 35 000 trades per day and 253 trading days per year (OMX, 2005).

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[32] Towards the end of the sample period there is really no such thing as a "Stockholm Stock Exchange". In 2006 a Nordic stock market was launched (OMX Nordic) and has since evolved, as of 2011 encompassing the stock markets in Copenhagen, Helsinki, Stockholm, Reykjavik, Tallinn, Riga and Vilnius. In 2007 NASDAQ acquired the whole group and formed NASDAQ OMX. In the dissertation the sample is referred to as the "Swedish stock market" since this description fits most of the sample period. Statistics about the stock market is collected from 2005, before the creation of the Nordic market.

[33] The overall majority of firms are Swedish, but there are a few exceptions. These are primarily Nordic firms listed at the Stockholm Stock Exchange. Nevertheless I sometimes refer to the sample as "Swedish".

[34] During the whole sample period the Stockholm Stock Exchange has used an electronic open-book limit-order trading system. The electronic trading system, called SAX, was introduced in 1989 and fully in place by June 1, 1990.

In June 2010, the direct stock ownership in Sweden was about 17%. The other ownership groups are: foreign investors (37%), financial companies (29%), public sector (7%), non-financial companies (9%) and non-profit organizations (4%) (Sweden Statistics, 2010).

Between 1990 and 2005 the daily turnover and the number of trades per day tripled and foreign ownership increased from 10% to 35% (OMX, 2005; Sweden Statistics, 2005), indicating that the stock market over the sample period has gained in size as well as in international attention.

Regarding the macroeconomic development, the Swedish economy experienced in the beginning of the 1990's the deepest crisis since the 1930's, following a bubble in the banking and financial sector.[35] With high unemployment and a large public sector, the public finances deteriorated rapidly and by 1994 the government budget deficit exceeded 15% of the gross domestic product (GDP). Following the crisis, a large number of reforms took place; a tax reform in 1991, a floating exchange rate in 1992, a restructured economic policy focusing on primarily low inflation, and other measures in order to improve the public finances of Sweden. When Sweden joined the European Union in 1995, the Swedish economy was again in good shape. By the end of the 1990's there was a new bubble in the economy, this time driven by the overvaluation of IT stocks. The bubble burst in 2001 and led to a downturn in the economy, with high unemployment especially in the IT sector. After 2003 the stock market experienced good times with increasing returns up until the financial crisis of 2008-2009. During this financial crisis, the Swedish economy experienced negative growth, but seems to have recovered faster than other European countries.

In Table 2 the development of the GDP growth rate, nominal interest rate, inflation rate and stock market return is reported for the years 1990-2008. The table illustrates that the sample period consists of both "good" and "bad" time periods.

[35] The economic crises also involved a crash in real estate prices.

Table 2. Development of GDP growth, inflation, nominal interest rate and stock market return over the sample period 1990 – 2008

	GDP growth	Nominal interest rate	Inflation	Stock market return
1990	3.72%	14.18%	10.50%	36.58%
1991	2.13%	11.68%	9.30%	-29.43%
1992	0.40%	12.29%	2.30%	10.29%
1993	-1.19%	7.80%	4.70%	6.43%
1994	5.43%	8.16%	2.20%	62.51%
1995	6.27%	9.30%	2.50%	3.70%
1996	2.34%	5.89%	0.50%	16.63%
1997	3.52%	4.51%	0.50%	39.47%
1998	3.91%	4.35%	-0.20%	29.70%
1999	4.84%	3.55%	0.50%	15.04%
2000	5.90%	4.50%	1.00%	90.42%
2001	2.60%	4.13%	2.40%	-15.17%
2002	3.03%	4.33%	2.20%	-20.11%
2003	3.80%	3.07%	1.90%	-43.07%
2004	6.33%	2.32%	0.40%	32.91%
2005	7.50%	1.89%	0.50%	24.80%
2006	7.61%	2.74%	1.40%	28.73%
2007	7.16%	3.78%	2.20%	20.45%
2008	2.77%	3.78%	3.40%	-6.83%

(i) GDP growth is the yearly growth in inflation adjusted GDP, collected from Penn World Tables (http://pwt.econ.upenn.edu). Nominal interest rate is the return on a 1-year T-bill, collected from Sveriges Riksbank. Inflation rate is the yearly change in Consumer Price Index, collected from Sweden Statistics. Market return is the yearly return to the Morgan Stanley Sweden Index, measured at the first trading day of each year. This data is collected from Datastream.

The data used in the dissertation comes from three main sources; I/B/E/S (Institutional Broker's Estimates System), SIX (Scandinavian Information Exchange) and Datastream. Analyst forecasts have been collected from I/B/E/S and all market data (stock prices, stock returns, market return, etc.) have been collected from Datastream. The accounting data has been acquired from SIX for the purpose of obtaining quarterly accounting data. The acquired data was in the form of 3-, 6-, 9- and 12-months reports, but has been converted to quarterly numbers. In addition, data on the number of shares has been collected from the periodical Börsguiden and nominal interest rates from the database EcoWIN.[36]

[36] EcoWIN, I/B/E/S and Datastream are all provided by Thomson Reuters, see www.thomsonreuters.com. More information on SIX can be found at www.six-telekurs.se. The periodical Börsguiden can be found in the library of Stockholm School of Economics.

The papers – short summaries

Swedish post-earnings announcement drift and momentum return

The first paper of the dissertation documents a drift in returns after earnings announcements in the Swedish stock market during the sample period (1990-2005). The empirical results reveal that a trading strategy, taking a long position in the decile of stocks with the highest quarterly earnings surprises and a short position in the decile of stocks with the lowest quarterly earnings surprises, generates an average risk-adjusted monthly return of 0.9% (11.4% per year).[37, 38] The results are statistically significant and robust to conventional risk factors, according to CAPM (Sharpe, 1964; Lintner, 1965) or the three-factor model (Fama and French, 1993). Out of the 28 quarters where the trading strategy is tested, it generates a positive return in 20 quarters and a negative return in 8 quarters.

Finding indications of the post-earnings announcement drift is a bit surprising since previous research (e.g., Rouwenhorst, 1998; Griffin *et al.*, 2003; Doukas and McKnight, 2005; Söderström, 2007; Novak, 2008) has not been able to find the momentum effect in the Swedish stock market and these drift phenomena have been shown to be highly correlated (e.g., Chan *et al.*, 1996; Chordia and Shivakumar, 2006). However, contrary to previous studies I find a momentum effect. When the holding period in the trading strategy is extended from six months (as in previous studies) to 12 months, the average monthly return to a momentum strategy is over 1%, adjusted for risk factors in the three-factor model. In line with previous research by Chan *et al.* (1996) and Chordia and Shivakumar (2006), I find that the two return drifts are not identical. This is in line with what we know about the relation between earnings and returns.

To conclude, this study provides evidence of both PEAD and the momentum effect in the Swedish stock market. In addition, there are two interesting observations. First, it seems like the drift effects are more prolonged in Sweden than in many other markets. Neither of the drifts is significant for a holding period of six months after portfolio formation. However, if the holding period is extended to twelve months, both are significant. Second, both for PEAD and the momentum effect, the drift is

[37] The strategy involves taking positions in the two extreme portfolios of the distribution of unexpected earnings. Depending on the distribution of unexpected earnings, the long position thus contains stocks with the highest (most positive) unexpected earnings or the least negative unexpected earnings (if all announced earnings are below expectations). Similarly, the short position contains stocks with the lowest (least positive) unexpected earnings (if all announced earnings are above expectations) or the most negative unexpected earnings. For simplicity, the extreme portfolios are described as the ones with the highest and lowest unexpected earnings.

[38] The return to a zero-investment hedge portfolio is not easy to interpret. Note that the return is relative to the funds allocated to the long position.

significantly larger after positive news. Almost all of the return to the trading strategies is generated by the long position.

The paper does not provide any explanation for these observations. However, I speculate that the lack of return to the short position might be an important observation in the pursuit of finding the drivers of the drift. In fact, this observation opens up for an omitted risk factor as a potential explanation for the drift. Exposed to such a risk factor, stocks in the short position will be priced so that they render a positive expected return as a compensation for taking on this risk. Consequently, this explanation is in line with an upward drift also after the announcement of bad news, and as such the empirical observations of this paper are interesting. Hence more research on the short position and potential risk factors explaining PEAD is warranted.

Information uncertainty in unexpected earnings signals

Using a Swedish sample of firms for the period 2004-2008, the second paper investigates whether GAAP earnings and core earnings (measured as I/B/E/S earnings) introduce different levels of information uncertainty to stock market investors. Information uncertainty can be viewed as to what extent the earnings signal is informative about the firm's "true" value creation for the period, so-called economic earnings. It is proposed that an uncertain good news signal that is perceived to be risky will give rise to a muted announcement reaction and a price drift in the post-announcement period. The predictions for bad news signals are less straight forward. The price reaction at the announcement of such a signal will be influenced by two effects. First, the price reaction will be muted due to the expected mean being less negative when the signal is perceived to be uncertain. Second, the reaction can be more pronounced (more negative) since investors perceive the uncertain signal to be more risky and want compensation for taking on that risk. Stocks exposed to information uncertainty risk would then have a more pronounced negative announcement reaction and then, as the risk resolves over time, an upward price drift that generates positive average returns (Brown *et al.*, 1988).

The empirical investigation reveals that the announcement reaction to the GAAP earnings signal is more muted than that of the core earnings signal. In addition, it is only the GAAP signal that gives rise to a significant post-announcement drift. On average a trading strategy based on this signal generates an excess return of about 1% per month (after controlling for risk factors according to the three-factor model in Fama and French, 1993). The empirical results also reveal that it is the difference in earnings levels, and not the different forecasting models, that drive the difference in returns between the GAAP and the core earnings signals. Additional tests show that the empirical results are robust to a number of specification issues (length of announcement window, portfolio size, inclusion of a momentum factor, etc.). There are also indications of the drift being generated mostly on the long position, i.e. following good news signals. The lack of a negative drift on the short position might be interpreted as support for the theoretical framework where information uncertainty is proposed to be a risk factor.

It is also shown that one-year buy-and-hold returns (BHARs) are relatively similar for the two earnings measures. They are however unevenly distributed over the year. When a trading strategy is based on the core earnings signal, 40% of the total BHAR is attributed to the announcement period, whereas only 20% of the BHAR is attributed to this period when the strategy is based on the GAAP signal.

Conclusively, the results are interpreted as if the GAAP earnings signal introduces more uncertainty to investors. It is argued that this uncertainty might be due to this measure encompassing items, such as special items, that prior research has shown to be more likely to be manipulated and/or affected by larger estimation error (e.g., Elliott and Hanna, 1996; McVay, 2006).

Earnings quality and the implied cost of equity capital – the Swedish case

The third paper is related to the issue of whether investors perceive information uncertainty, proxied by earnings quality, as a risk factor or not. Theory predicts a positive relationship between the cost of equity capital and information uncertainty (e.g., Easley and O'Hara, 2004; Lambert *et al.*, 2011). However, the empirical evidence is less clear-cut (e.g., Core *et al.*, 2008; Ogneva, 2010). The studies are typically limited to samples of US firms, and there is hence a need for out-of-sample studies on this relationship.

The main objective of the paper is to examine the association between the *implied cost of capital* and *earnings quality* for a sample of firms listed in Sweden over the period 1994-2008. In the main, it is found that poor earnings quality – measured as either low *value relevance* or low *timeliness* – is associated with a higher cost of equity capital. Going from the group with the highest earnings quality to the group with the lowest earnings quality, the implied cost of capital increases by about 1.2 percentage points after controlling for conventional risk factors (i.e. the three-factor model). This confirms prior empirical research that has found that earnings quality is a priced risk factor.

A new approach for estimating the implied cost of equity capital is proposed in the paper. In order to estimate the implied cost of capital, one has to solve for the internal rate of return that equates the stock price to the equity value in an accounting-based valuation model. The proposed estimation procedure is based on the residual income valuation (RIV) model and uses firm-specific historical mean ROE (return on owners' equity) as forecasts for the first three years. In addition, firm-specific steady state ROE is modeled, assuming it is a function of accounting conservatism, steady state growth and the cost of equity capital.[39] My approach seems to generate cost of capital estimates that are reasonable in the sense that mean values and adjusted R^2s in risk factor regressions are similar those generated by established implied cost of capital approaches.

The proposed cost of capital approach is a methodological contribution to the implied cost of capital literature. Unlike established approaches, my approach can be implemented on a sample that is not restricted to firms with positive earnings, positive earnings growth, analyst following and/or a long time-series of accounting data. The benefits are twofold. First, it increases the number of observations. This can be crucial in empirical tests where both the cross-section and the time-series are limited. Second, it enables a study of the full cross-sectional variation of the variables of interest. For example, non-profitable firms and firms without analyst following are likely to be more risky and potentially also to have higher information risk. A sample excluding these types of firms is hardly representative for the population of firms.

Contribution of the dissertation

There are six main contributions of my dissertation. First, it is the first extensive study of the post-earnings announcement drift in a Swedish stock market context. As such, it contributes to our knowledge of how investors react to accounting information in this market. In addition, it is to the best of my knowledge the first study to investigate how quarterly accounting information is perceived by Swedish investors.

Second, Paper 2 contributes to prior research on how market participants use different earnings levels from the income statement. This research is typically focused on short-term price reactions to different earnings signals, to infer which of the signals that investors find to be most important (e.g., Bradshaw and Sloan, 2002; Bhattacharya *et al.*, 2003; Brown and Sivakumar, 2003). The results in Paper 2 imply that it is crucial to also study the long-term price reaction and consider the dimension of information uncertainty, when evaluating earnings signals.

Third, the dissertation contributes to prior research by using different earnings signals, from different levels in the income statement, as a source of information uncertainty. Prior research relating information uncertainty to PEAD has focused on earnings quality of one earnings metric and more specifically how current accruals map into operating cash flows. Studying the different price reactions to GAAP and core earnings, the dissertation thus contributes to our knowledge of what kind of items investors might perceive as uncertain when evaluating a firm's value creation.

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[39] Industry-specific estimates of the permanent measurement bias (*PMB*) collected from Runsten (1998), are used as proxies for firm-specific accounting conservatism.

Fourth, the results of the dissertation shed additional light on previous empirical results indicating that earnings quality is a priced risk factor. The results in Paper 3 show that Swedish investors appear to demand a higher cost of equity capital for firms with poor earnings quality, supporting the idea that earnings quality *is* a priced risk factor.

Fifth, the implied cost of capital approach developed in Paper 3 is - to the best of my knowledge - the first approach that can be implemented on a dataset which is not restricted to firms with positive earnings, positive earnings growth, analyst following and/or long time-series of accounting data. The approach might be useful in future research, focusing on the cost of capital and characteristics of firms usually excluded from this kind of studies. As such, it is a methodological contribution to the implied cost of capital literature.

Sixth, the dissertation contributes to the PEAD literature by illustrating under what conditions information uncertainty might be driving the drift. To my knowledge, there is no prior discussion on how high information uncertainty in a bad news signal might lead *both* to a muted and a pronounced announcement reaction. Overall, the discussion highlights that under certain assumptions, PEAD is compatible with markets being efficient. The empirical observation that the drift on the short position is negligible (both in Paper 1 and Paper 2) might be interpreted as supporting these assumptions.

Limitations of the dissertation

Any study concerning market efficiency suffers from the problem of joint hypotheses, and so does this dissertation. Another limitation is that information risk is not controlled for in the estimation of expected returns. If indeed the drift is a compensation for information risk, a verifying test could be to see whether the drift is dampened when this risk factor is added in the assessment of expected returns (see for example Francis *et al.*, 2007). Not adding a fourth factor to the expected returns model can be considered a limitation of the dissertation.

Yet another limitation is the hedge portfolio design in Paper 2. If indeed the drift is an effect of information risk, the prediction is that the long and short positions both will drift upwards. A hedge portfolio, subtracting the return of the short position from the long position, might therefore seem somewhat ill-fitted to capture whether the empirical observations are in line with the predictions.

In addition, this dissertation does not consider the impact of transaction costs that might be associated with a trading strategy based on quarterly earnings announcements. If real-world transaction costs are high enough, it cannot be ruled out that the profitability of the PEAD strategy can be totally subsumed.

A related issue is that the return metrics used to evaluate the profitability of trading strategies are of a statistical character. It can therefore not be ruled out that these metrics are upward biased estimates of the realistic return, available to a real-world investor. In addition, the statistical tests in the dissertation do not consider the possibility of statistical overfitting due to autocorrelation between portfolio returns.

A limitation in Paper 2 concerns the use of I/B/E/S earnings as a measure of core earnings. Since this measure is specified by financial analysts, I cannot distinguish whether any alleged uncertainties of the core earnings signal are generated by the earnings level or by analysts making biased exclusions to derive core earnings.

Suggestions for future research

This dissertation identifies a number of questions suitable for future research. As mentioned above, future research on the short position is warranted. In many previous PEAD studies, only the return to the combined portfolio (long minus short) is reported, making it impossible to get a clear picture of the drift on the short position. This pattern is crucial for how we think about the return drift in terms of risk compensation. More research on how the returns to PEAD strategies are distributed between the long and the short position is therefore warranted.

Related is the issue of clientele effects. In order to understand how a risk factor might drive the drift, it is important to understand both the risk exposure of each position, as well as the risk appetite of investors. If there are systematic differences in terms of risk appetite between investors holding the long and the short positions, the returns prediction for these portfolios will change. For example, if investors holding the short position are risk loving, an omitted risk factor will lead to a downward drift on this position. To my knowledge, there is no existing research relating PEAD to these issues.

An observation in the dissertation is that the drift period seems to be longer in Sweden than in many previously studied stock markets. In Paper 1, I briefly discuss what this longer drift might implicate for existing PEAD explanations, such as behavioral biases or information uncertainty. I argue that studies of the cross-sectional variations of the drift, in different stock markets, might be fruitful in future research to see which theoretical framework has the ability to explain any systematic differences between stock markets.

A topic for future research is to use the implied cost of capital approach, suggested in Paper 3, in new settings. Using a Swedish sample, the approach could be implemented to study in more detail firms previously neglected in the earnings quality literature, i.e. non-profitable firms, firms in default, etc. to see whether the association between earnings quality and cost of capital is more pronounced in this subset of firms.

Paper 3 also identifies a need for more research on empirical measures of accounting conservatism, since this is an important input variable in the proposed cost of capital approach. The empirical measures used in this study were estimated for

Swedish industries with data from the period 1966-1993 in Runsten (1998). Research on the development of new estimates, which also can be calculated for firms in other markets, is warranted.

A question that remains unanswered in the dissertation is how specific accounting items introduce uncertainty to investors. There are some indications of income-increasing non-recurring items being one source, but due to data limitations this is not been studied in depth. Studies involving more detailed data on such earnings items, and perhaps using other types of methodologies, are warranted in order to get a better understanding of how investors perceive earnings signals in terms of information uncertainty.

The dissertation identifies that more research is needed on how information risk in earnings signals resolves over time. In the theoretical framework of Paper 2, it is assumed that the information risk resolves over time in a manner consistent with the price drift. It was also argued that the previously documented drift concentration around subsequent earnings announcements could be interpreted as if the information risk is resolved at these points in time, and that as much as three subsequent announcements might be needed in order for the information risk in the original signal to fully resolve. Earnings announcements are thus assumed to be informative on prior earnings signals in a "feed-back loop" manner. In addition, an earnings number depicting value creation for a short time period might be perceived as more uncertain than an earnings number depicting longer time periods.[40] However, these ideas need to be further investigated.

Finally, I find that there is a lack of empirical research studying market frictions in the Swedish stock market. To my knowledge, there are no studies on the transaction costs and potential limits to arbitrage that an investor would face if trying to implement a trading strategy such as PEAD in this stock market. All research on the information efficiency of this market would benefit from knowing more about such market frictions.

[40] This is in line with previous empirical findings showing that the association between earnings and stock returns increases remarkably when the variables are measured over longer time-periods (e.g., Easton *et al.*, 1992; Strong and Walker, 1993; Runsten, 1998).

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Part II

Papers

1 Swedish post-earnings announcement drift and momentum return

Abstract

This paper reports results on the post-earnings announcement drift (PEAD) in Sweden. Sweden is especially interesting to study since previous research has not been able to find a significant momentum effect in this market, whilst the two drift effects have been found to be interlinked. The results reveal that there is both a post-earnings announcement drift and a momentum effect in returns, if the holding period is extended from six to twelve months. On average a PEAD trading strategy, taking a long (short) position in the decile of firms with the highest (lowest) unexpected earnings, can generate a return of about 11% over the 12 months following portfolio formation. This return is robust to risk factors suggested in CAPM and the three-factor model (Fama and French, 1993). In addition it is significant after controlling for the momentum effect, indicating that the two drift effects are not completely overlapping. It is further found that the drift on the short position is negligible. It is argued that this might be an indication of the drift being a compensation for a risk factor omitted in the test design.

1.1 Introduction

There is an extensive body of research reporting empirical evidence of the so-called post-earnings announcement drift (PEAD).[41] PEAD is the phenomenon where prices tend to drift upwards after the announcement of good earnings news and downwards after the announcement of bad earnings news. In the US market the drift was noted already by Ball and Brown (1968) and Jones and Litzenberger (1970). Since these studies, many researchers have extensively analyzed the post-earnings announcement drift (e.g., Foster *et al.*, 1984; Bernard and Thomas, 1989 and 1990; Bernard *et al.*, 1997). These US findings are confirmed in many European stock markets. In particular, a drift subsequent to earnings news has been found in the United Kingdom by Hew *et al.* (1996) and Liu *et al.* (2003), in Spain by Forner *et al.* (2009) and Forner and Sanabria (2010), in Germany by Dische (2002) and by several researchers in Finland (e.g., Booth *et al.*, 1996; Kallunki, 1996; Vieru *et al.*, 2005; Booth *et al.*, 2006).

In Sweden however, quarterly accounting data has not been available in standard databases, which has limited the scope of this type of research. Using a partly new dataset for firms listed in Sweden between 1990 and 2005, this paper is the first extensive study of PEAD in the Swedish stock market.[42]

There is reason to believe that the Swedish market might differ from other European markets when it comes to PEAD and this is the motivation behind this study. Several empirical studies on international returns momentum (the momentum effect) have not been able to find a significant momentum effect in Sweden (e.g., Rouwenhorst, 1998; Griffin *et al.*, 2003; Doukas and McKnight, 2005; Söderström, 2007; Novak, 2008). The momentum in returns is the phenomenon that returns continue to drift upwards (downwards) for stocks that have high (low) recent past returns and was first documented in the US market by Jegadeesh and Titman (1993).

Prior research has shown that the post-earnings announcement drift and the momentum effect are overlapping, but not identical. Both Chan *et al.* (1996) and Chordia and Shivakumar (2006) conclude that although earnings surprises and past returns are related, they have separate explanatory power for future returns. This is in line with what we know about the relationship between earnings and returns. Earnings are value relevant information, but returns can in addition to earnings incorporate

[41] Since PEAD studies focus on price reactions to unexpected earnings, the post-earnings announcement drift is sometimes referred to as the SUE effect, where SUE stands for Standardized Unexpected Earnings.

[42] Griffin *et al.* (2006) investigate market efficiency in 56 international markets. Among other things, they test for the post-earnings announcement drift after annual earnings announcements using data from 1994 to 2005. Looking at Figure 4 in their paper, it seems like they for the Swedish market only find a significant drift in returns after negative earnings announcements of about minus 8-9%. But since the results are only reported graphically, it is not possible for me to relate to these results.

other, more timely, value relevant information about the performance of a firm. As such, PEAD and returns momentum could be seen as indications of a more general tendency of potential underreaction to firm performance, as measured by either quarterly earnings or past returns. For the motivation behind this study it also means that, if there is no returns momentum in the Swedish stock market, as indicated by previous research, we would not expect a post-earnings announcement drift.

The results of this paper indicate that there is a post-earnings announcement drift in Sweden during the studied time period. A trading strategy, taking a long position in the decile of stocks with the highest unexpected earnings and a short position in the decile of stocks with the lowest unexpected earnings, generates an average risk-adjusted monthly return of 0.9% (11.4% per year). These results are statistically significant and robust to conventional risk factors, estimating the expected return according to either CAPM (Sharpe, 1964; Lintner, 1965) or the three-factor model (Fama and French, 1993). Out of the 28 quarters when the trading strategy is implemented, it gains a positive return in 20 quarters and a negative return in 8 quarters. However, the strategy seems sensitive to using quintile portfolios instead of decile portfolios.

Contrary to prior studies I also find a momentum effect. When the holding period in the trading strategy is extended from six months (as in previous studies) to twelve months, the momentum strategy is able to generate abnormal return. Supporting the findings of Chan *et al.* (1996) and Chordia and Shivakumar (2006) I also find that the two drift phenomena are overlapping, but not identical. After introducing a momentum factor in the calendar-time regressions, the returns to the PEAD trading strategy remain, though slightly muted.

This study provides evidence of both PEAD and returns momentum in the Swedish stock market. In addition, two interesting observations are noted. First, in contrast to the findings in many other markets, neither of the drifts is significant for a holding period of six months. However, if the holding period is extended to twelve months, both are significant. Second, for both PEAD and the momentum effect, the drift is significantly larger for positive news. Almost all of the returns to the trading strategies are generated by the long position. This paper provides no explanations for these two observations, but it is in Section 1.6 discussed what these observations would indicate under some alternative drift explanations that exist in the current literature.

The remainder of this paper is organized as follows: Section 1.2 describes the sample and the data sources of this study, Section 1.3 presents the overall test design, Sections 1.4 and 1.5 describe the measurement of key variables, Section 1.6 reports and discusses the empirical results. Concluding remarks are provided in Section 1.7.

1.2 Sample and data

The sample used in this study comprises of 4241 firm-quarter observations from 130 firms listed on the A-list at the Stockholm Stock Exchange during the time period January 1990 to June 2005.[43,44] Financial firms (approximately 15 firms) have been excluded due to their divergent accounting principles, which give their accounting numbers a different interpretation. Firms with a fiscal year different from the calendar year (approximately 5 firms) have been excluded as a matter of convenience in the test design. There is no reason to believe that the choice to exclude these observations has biased the sample selection.

In Table 1.1 descriptive statistics of the sample are reported.

Table 1.1. Descriptive statistics. Sample period 1990-2005.

Variable	Nr Obs.	Mean	Median	Std Dev	Skewness	Kurtosis
total assets	3669	30713	7151	57238	2.96	9.06
debt	3837	18678	4313	37153	3.64	16.45
equity	3905	11303	2315	22692	3.66	15.69
market cap	3579	34370	4947	125426	9.23	109.88
market-to-book	3324	2.62	1.64	6.29	22.33	690.76
debt/equity	3819	2.10	1.70	2.01	7.13	87.26
debt/assets	3655	0.62	0.63	0.16	1.73	27.87
ROA	1306	7%	7%	7%	-3.07	47.31
ROE_pretax	1304	14%	16%	30%	-8.15	140.09
ROE_after tax	1303	9%	11%	22%	-5.61	69.52

(i) This table reports descriptive statistics for a sample of 130 firms listed on the Stockholm Stock Exchange between 1990 and 2005. Besides the number of firm-quarter observations, the mean, median, standard deviation, skewness and kurtosis are reported for some key variables.

(ii) All accounting variables are measured at the end of each quarter. *market cap* is measured as the market price of the share at the end of the quarter, times the number of shares outstanding as of December 31 each year. *market-to-book* is the market cap divided by the book value of owners' equity. The profitability measures are measured yearly. Return on assets (*ROA*) is defined as year-end EBIT divided by year-end total assets. Return on equity (*ROE_pretax* and *ROE_after tax*) is defined as year-end Net Income (before or after tax) divided by year-end owners' equity.

The average company in the sample has total assets of approximately 31 billion SEK and a market capitalization of 34 billion SEK. The median is considerably lower than the mean which is a reflection of the large size differences among firms in the sample. At the end of 2004, the ten firms with the largest market capitalization represented approximately 75% of the total market capitalization. The average market-to-book, i.e. market capitalization divided by book value of equity, is 2.62 and the average debt-to-equity (measured in book values) is 2.10. The average return on equity (ROE) is 14%

[43] In 2005, 52 out of 269 firms were listed on the A-list, making up approximately 80% of the total market value. Other firms are not included in the sample in order to limit the effects on the results from small and illiquid stocks.

[44] On average approximately 60 firms were listed at the same time.

before tax and 9% after tax.[45] These profitability measures are calculated on a yearly basis which explains the lower number of observations for these measures. The data in Table 1.1 also shows that the median ROE is somewhat higher than the mean ROE. This is a reflection of some extremely low and negative observations of profitability in the sample.

As mentioned previously, quarterly accounting data for firms listed in Sweden was not available in the standard databases for the time period studied in this paper, even though these firms did report more frequently than on an annual basis. For the purpose of this study, the accounting data has therefore been collected from other sources. Firm-specific files of income statements and balance sheets have been provided by SIX (Scandinavian Information Exchange) and then compiled by the author.[46] The original data consisted of accumulated results over the year (3-, 6-, 9- and 12-months results) but has been converted to quarterly data.[47] Consequently, there was for some accounting numbers a substantial loss of observations compared to the 4241 firm-quarter observations. For example, if a 9-month report was missing in the original database it has not been possible to calculate either the third or fourth quarter results. The earnings announcement dates (3323 observations) have also been provided by SIX.

The Datastream Return Index (capitalization-adjusted closing prices and gross dividends) has been used for the measurements of firm return and the Morgan Stanley Sweden Index (MSCI) (value-weighted and including dividends) from Datastream has been used as a proxy for the overall market return during the sample period. The return on a Swedish 1-month treasury bill has been used as a proxy for the risk-free rate. This data has been obtained from the EcoWIN database.

The data on the number of shares outstanding for each firm was found to be of very low quality in the standard databases. I have therefore hand-collected this information from the periodical Börsguiden which reports yearly facts about listed firms. As a consequence, the number of shares is as of December 31 each year, which influences the measure of market capitalization, described below.

Market capitalization (*market cap*) has been calculated as the number of shares times the price of the share. If a company has dual-class shares, each class of shares has been weighted with the price of that class of shares. Quarterly observations of *market cap* have been calculated as the number of shares (as of December 31) times the price of the shares at the last day of the quarter. It is here assumed that the number of

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[45] ROE_*pretax* is defined as net income before tax divided by year-end owners' equity. ROE_*after tax* is defined as net income after tax divided by year-end owners' equity.

[46] SIX (Scandinavian Information Exchange) is a Swedish company that delivers financial information to financial market actors and media.

[47] Accounting numbers (if not in SEK) have been converted to SEK using exchange rates at the end of each reporting period. The exchange rates are obtained from the EcoWIN database.

shares is constant over the quarters. This assumption is not valid if there have been splits, new issues or share repurchases during the year. In order to avoid large problems with this assumption I have scanned the data and adjusted observations that were obviously affected by splits, issues and repurchases. In order to get monthly observations of *market cap* I then assume that the quarterly market capitalization is constant over the months of each quarter.[48]

1.3 Overall test design

The test design used in this paper follows prior studies on PEAD and returns momentum. Especially the study by Bernard and Thomas (1989) has, in many ways, been guiding the test design in the present study. Their study is considered to be of very high methodological quality.[49]

The most common way to investigate whether there is a drift subsequent to the release of value relevant information is to formulate a trading strategy based on that information. If the new information is rapidly and correctly incorporated into stock prices it will not be possible to gain any risk-adjusted return to such a strategy. When testing for the existence of PEAD, a common test design is to formulate a trading strategy based on the announced quarterly earnings. Since it is only the part of earnings that is new to the market that will have any effect on prices, the strategy is based on the *unexpected* earnings. The trading strategy implemented in this study rests on the following overall logic: every quarter when the earnings are announced the firms are ranked according to the size of the unexpected earnings and assigned to ten different portfolios. A long position is taken in the portfolio with the highest unexpected earnings ("good news") and a short position is taken in the portfolio with the lowest unexpected earnings ("bad news").[50] Portfolio return is then measured for holding periods of six and twelve months. In addition, the return from a combined portfolio, a hedge portfolio, is measured. The hedge portfolio is the long position financed by the short position. If the return to the hedge portfolio is positive and

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[48] This measure of monthly *market cap* is not perfect and could be considered to be quite stale. But, since the measure has been used as a size proxy, for scaling other variables or value-weighting returns, I do not believe that this measurement has affected the results in any systematic way.

[49] Bernard and Thomas (1989) showed abnormal yearly returns of about 8% from a trading strategy, taking long positions in firms reporting unexpectedly high earnings and short positions in firms reporting unexpectedly low earnings. They also showed that it takes about six months for the prices to adjust to the new earnings information.

[50] The strategy involves taking positions in the two extreme portfolios of the distribution of unexpected earnings. Depending on the distribution of unexpected earnings, the long position thus contains stocks with the highest (most positive) unexpected earnings *or* the least negative unexpected earnings (if all announced earnings are below expectations). Similarly, the short position contains stocks with the lowest (least positive) unexpected earnings (if all announced earnings are above expectations) or the most negative unexpected earnings. For simplicity, the extreme portfolios are described as the ones with the highest and lowest unexpected earnings.

statistically significant it is an indication of quarterly earnings announcements being followed by a drift in prices.

It is important that the trading strategy would be possible to implement in real life. As a consequence any hindsight bias must be avoided. In this study I avoid this bias by forming the portfolios the first day of the quarter subsequent to the calendar quarter when earnings are announced. This guarantees that the unexpected earnings of *all* firms are available when the firms are ranked and divided into portfolios. This calendar-approach, which follows Chan *et al.* (1996), also facilitates the construction of a self-financed portfolio since the long and the short position are taken simultaneously.

Since a number of earnings observations are needed for the estimation of unexpected earnings, it has not been possible to form portfolios for the beginning of the sample period.[51] In addition, the cross-section of observations with non-missing values of both unexpected earnings and announcement date must not be too small. In order for the strategy, taking positions in the top and bottom of the distribution of unexpected earnings, to be meaningful I have only implemented the strategy in quarters with more than 40 observations in the cross-section. As an implication, the portfolio strategy has been implemented in 28 quarters; from Q3-1997 to Q2-2004.

1.4 Measure of earnings surprise

The PEAD phenomenon implies that there is a drift in prices in the same direction as the announced earnings surprise. Consequently, it is necessary to define a measure of earnings surprise (or unexpected earnings).[52] Earnings surprise is the difference between the reported earnings and the earnings that the market expected prior to the announcement. There are a number of ways to operationalize the market's expectations and I have in this study chosen to use a time-series model approach following previous research (e.g., Foster, 1977; Foster *et al.,* 1984; Bernard and Thomas, 1989).[53]

Foster *et al.* (1984) and Bernard and Thomas (1989), used a simple AR(1) model that considers the first autocorrelation between seasonal differences, and so have I done in this study. Following Bernard and Thomas (1990) and Liu *et al.* (2003), I have also included an intercept as a trend term.

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[51] The estimation of SUE is described in the following section.

[52] In this paper I use “earnings surprise” and “unexpected earnings” interchangeably.

[53] Another alternative is to measure the market's expectations by analyst consensus forecasts of earnings, following for example Liu *et al.* (2003). Consensus forecasts of quarterly earnings are not available on a large scale for Swedish firms in any of the standard databases for the time period studied.

$$[Ear_{i,t} - Ear_{i,t-4}] = \alpha_i + \beta_i \times [Ear_{i,t-4} - Ear_{i,t-8}] + \varepsilon_i \tag{1.1}$$

where:

$Ear_{i,t}$ =	quarterly earnings (before extraordinary items) of firm *i* in quarter *t*,
α_i =	firm-specific intercept,
$\beta_{i,t}$ =	autoregressive term for firm *i* in quarter *t*,
$\varepsilon_{i,t}$ =	residual for firm *i* in quarter *t*.

The variables in the model, the seasonal differences, are the differences between quarterly earnings that are one year apart, where earnings are defined as earnings before extraordinary items.[54] The model has been estimated on a firm-specific level in order to get firm-specific parameter estimates that can be used to forecast quarterly earnings for each firm. In these estimations I use a rolling window (following Bernard and Thomas, 1989) with the nine most recent seasonal differences in quarterly earnings.[55] Since I, in the estimation, only use data on quarterly earnings prior to the quarter I want to forecast, hindsight bias is avoided. This method also allows the parameter estimates for each firm to vary over the sample period. When the parameters of the forecasting model have been estimated, forecasts of quarterly earnings (expected earnings) are generated for each firm-quarter.[56]

A total of 1896 earnings forecasts were generated and when subtracting the earnings actually reported the sample was restricted to 1852 observations on unexpected earnings. The mean, maximum and minimum of both forecasted earnings and unexpected earnings are reported in Table 1.2.

Table 1.2. Descriptive statistics of forecasted earnings, unexpected earnings and SUE (MSEK)

Variable	Nr Obs.	Mean	Std Dev	Min	Max
forecasted earnings	1896	432.36	1850.55	-16190.74	30192.82
unexpected earnings	1852	14.35	1746	-28925.82	26748.84
SUE	1852	0.08	2.96	-63.09	42.88

(i) This table reports descriptive statistics for *forecasted earnings*, *unexpected earnings* and standardized unexpected earnings (*SUE*).

(ii) *forecasted earnings* are calculated with firm-specific parameter estimates from an AR(1)-model in seasonal differences, estimated with a rolling window of 9 observations. *unexpected earnings* are the forecasted earnings minus the earnings reported for the same quarter. Standardized unexpected earnings (*SUE*) are the unexpected earnings divided by the standard deviation of forecasted earnings.

[54] It is in prior research more common to use earnings per share (EPS), when estimating expected earnings. Due to data restrictions on this variable, this has not been done in this study.

[55] Bernard and Thomas (1989) use a maximum of 24 observations and a minimum of 16 observations and Foster (1977) use a maximum of 20 observations and a minimum of 10 observations. Liu *et al.* (2003) use a minimum of 9 observations in their estimations.

[56] In this study I use "earnings forecast" and "expected earnings" interchangeably.

The mean unexpected earnings are 14.35 MSEK and the standard deviation is very high. This could be an indication of the forecasting model not working very well. It could also be an effect of the large size differences in the sample. In order to alleviate the problem of heteroskedasticity I have used a scaling factor to scale the unexpected earnings. I follow Bernard and Thomas (1989) and Liu *et al.* (2003) and use the standard deviation of expected earnings as the scaling factor of unexpected earnings. The logic of this measure is that, the more certain the forecast is (low standard deviation), the stronger is the surprise signal. In this sense, the measure of unexpected earnings is standardized and is thus referred to as *standardized unexpected earnings* (SUE).[57]

The expression of SUE is consequently:

$$SUE_{i,t} = \frac{Ear_{i,t} - E_{i,t-1}[Ear_{i,t}]}{\sigma_{i,t}} \tag{1.2}$$

where:

$SUE_{i,t} =$	standardized unexpected earnings for firm *i* in quarter *t*,
$Ear_{i,t} =$	reported quarterly earnings for firm *i* in quarter *t*,
$E_{i,t-1}[\dots] =$	expected value of […] for firm *i* in quarter *t*-1,
$\sigma_{i,t} =$	standard deviation of expected earnings for firm *i* in quarter *t*.

Descriptive statistics for the SUE measure is reported in Table 1.2.

1.5 Measures of return

Two return metrics have been used to evaluate the profitability of the SUE portfolios. First, the buy-and-hold returns (BHARs) for different holding periods have been calculated. The BHARs of the long, short and hedge portfolios are displayed in a classic PEAD graph following the spirit of Bernard and Thomas (1989). Second, for statistical inference I follow Chan *et al.* (1996) and use the intercept of monthly calendar-time regressions as a measure of the average monthly return to the PEAD

[57] Another common scaling factor is the market capitalization (e.g., Bernard and Thomas, 1990; Bernard *et al.*, 1997). It turns out that the SUE measure that is scaled by the standard deviation of expected earnings is highly correlated with the SUE measure that is scaled by *market cap* (a Spearman rank correlation of 0.89, not reported in this paper). The two measures thus seem to be equivalent. But, since there is a larger number of missing observations for *market cap* in the sample, I have chosen to use the SUE measure with the standard deviation as a scalar. In their study Bernard and Thomas (1990) find that the two approaches yield similar magnitudes of the drift. Results using SUE scaled by *market cap* are reported in Table 1.B.1 Appendix 1.B.

strategy. In these regressions, expected return is estimated either through CAPM (Sharpe, 1964; Lintner, 1965) or with a three-factor model (Fama and French, 1993). As a final step, a fourth factor is included in order to control for the momentum effect (e.g., Carhart, 1997; Chan *et al.*, 1996).

1.5.1 Buy-and-hold return

The simple monthly net return for stock *i* can be expressed as:

$$R_{i,t} = \frac{P_{i,t} + DIV_{i,t}}{P_{i,t-1}} - 1 \tag{1.3}$$

where:

$R_{i,t} =$ net return of share *i* at time *t*,
$P_{i,t} =$ price of share *i* at time *t*,
$DIV_{i,t} =$ net dividend of share *i* at time *t*.

Monthly net return for each firm is used as the main return metric. Before compounding the returns over longer holding periods (to produce the PEAD graph), a rough adjustment for expected monthly return is made.[58] Following Bernard *et al.* (1997) I use a value-weighted market index (*market return*) as a proxy for expected return.[59] The difference between net return and expected return is labeled abnormal return:

$$AR_{i,t} = R_{i,t} - Rm_t \tag{1.4}$$

where:

$AR_{i,t} =$ abnormal return of share *i* at time *t*,
$R_{i,t} =$ net return of share *i* at time *t*,
$Rm_t =$ market return, the net return of a value-weighted index at time *t*.

[58] In some BHAR measures the expected return is deducted after compounding returns.

[59] There are other alternative proxies for expected return. Bernard and Thomas (1989) used a matching technique, using the return to a portfolio of firms from the same size decile as the event firm. They do this to control for the size effect first noted by Banz (1981). I control for the size effect later in this paper.

The abnormal returns are then compounded over different holding periods; from 1 month up to 12 months.[60]

$$BHAR_{i,T} = \prod_{t=1}^{T}\left(1 + AR_{i,t}\right) - 1$$

(1.5)

where:

$BHAR_{i,T} =$	buy-and-hold return of firm *i* for holding period *T*,
$T =$	holding period measured in months. *T* = 1, 2, …, 12.,
$AR_{i,t} =$	abnormal return of share *i* at time *t*.

The shares in the SUE portfolios are equally-weighted, so that the portfolio return is the mean return of the shares in that portfolio. The portfolio BHAR is thus:

$$BHAR_{p,T} = \frac{1}{N}\sum_{i=1}^{N} BHAR_{i,T}$$

(1.6)

where:

$BHAR_{p,T} =$	buy-and-hold return of portfolio *p* after *T* months,
$p =$	type of portfolio, *p* = 1 (SHORT), 2, …, 9, 10 (LONG),
$N =$	number of firms in portfolio *p*, *i* = 1, 2, …, *N*.,
$BHAR_{i,T} =$	buy-and-hold return of share *i* after *T* months.

Note that there are ten portfolios and that portfolio $p = 1$ is also called the SHORT position and $p = 10$ is called the LONG position, which mirrors that the strategy implies taking a short position in the decile with the lowest SUE and a long position in the decile with the highest SUE.

When implementing the zero-cost portfolio strategy, a short position in one portfolio finances a long position in another portfolio, so that the cost of investing in the combined portfolio is zero. I refer to this combined portfolio as a PEAD portfolio. To evaluate the return of the PEAD portfolio for holding period *T*, the BHAR of the short position is subtracted from the BHAR of the long position.

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[60] Bernard and Thomas (1989) sum abnormal returns over time, but in a footnote (page 7) they mention that compounded returns give practically the same results.

$$BHAR_{PEAD,T} = BHAR_{LONG,T} - BHAR_{SHORT,T} \tag{1.7}$$

where:

$BHAR_{PEAD,T} =$ BHAR of a PEAD portfolio with holding period *T*,
$BHAR_{LONG,T} =$ BHAR of a LONG portfolio with holding period *T*,
$BHAR_{SHORT,T} =$ BHAR of a SHORT portfolio with holding period *T*,
$T =$ holding period measured in months. *T* = 1, 2, …, 12.

Throughout the entire sample period the strategy is implemented 28 times and thus generates a series of BHARs for the portfolios PEAD, LONG and SHORT.

$$\{BHAR_{PEAD,T,f}; f = 1, 2, 3, \dots\dots\dots, 28\}; T = 1, 2, \dots, 12.$$

$$\{BHAR_{LONG,T,f}; f = 1, 2, 3, \dots\dots\dots, 28\}; T = 1, 2, \dots, 12.$$

$$\{BHAR_{SHORT,T,f}; f = 1, 2, 3, \dots\dots\dots, 28\}; T = 1, 2, \dots, 12.$$

where:

$T =$ holding period measured in months. T = 1, 2, …, 12.,
$f =$ formation date. *f* = 1, 2, …, 28. where *f* = 1 is Q3 1997 and *f* = 28 is Q2 2004.

When evaluating the whole sample period I calculate a total mean for each of the positions:

$$BHAR_{pos,T} = \frac{1}{28}\sum_{f=1}^{28} BHAR_{pos,T,f} \tag{1.8}$$

where:

$BHAR_{pos,T} =$ mean BHAR of all portfolios of the same position,
$pos =$ type of position of the portfolio, pos ∈ {PEAD, LONG, SHORT},
$f =$ formation date. *f* = 1, 2, …, 28. where *f* = 1 is Q3 1997 and *f* = 28 is Q2 2004,
$T =$ end of the holding period. T = 1, 2, …, 12.

In Figure 1.1, these total BHAR means for the positions PEAD, LONG and SHORT are displayed for holding periods 1 to 12 months in a classic PEAD graph.

The advantage of the BHAR measure is that it mimics investor experience, noted by Barber and Lyon (1997). It does not require monthly rebalancing of the portfolio as is assumed when using a CAR measure where the monthly abnormal returns are summed. However, the BHARs can, as pointed out by Mitchell and Stafford (2000), give a false impression on the adjustment speed.[61] Even though there is no additional difference between the returns of the event firm and the benchmark firm in a specific period, the method might give an impression of additional abnormal return being generated in that period. Fama (1998) gives an example: after the first year subsequent to the event, the return to the event firm is 10% and 0% for the benchmark firm, i.e. the value of the event firm is now 1.1 compared to the benchmark firm, which still has a value of 1.0. BHAR is thus 10% after the first year. Now suppose that for the second year the value of both the event firm and the benchmark firm increases by 300%, that is, they increase exactly the same. The value of the event firm is thus after two years 3.3 (1.1×300%) and for the benchmark firm it is 3.0 (1.0×300%). After two years, the return of the event firm is then 330% (3.3/1.0), whereas it is 300% for the benchmark firm (3.0/1.0). BHAR will thus be 30% after two years (330%-300%), compared to 10% after one year. Consequently, even though there was no increase in the difference between the event firm and the benchmark firm during the second year, the BHAR measure might give a false impression that additional abnormal return was earned during the second year. Consequently, making inferences from the BHARs about *when* the abnormal return is generated, might lead to erroneous conclusions.

In addition to the problems mentioned above, the measure of BHAR does not lend itself easily to statistical inferences. For example Mitchell and Stafford (2000) have shown that the distribution of firm-specific BHARs are skewed and generally not centered on zero. In addition, the series of BHARs suffers from overlapping observations which introduces the problem of autocorrelation. One solution, used by for example Ikenberry *et al.* (1995), is to use a bootstrapping procedure which provides an empirical distribution under the null hypothesis of no abnormal return which can be used for statistical testing.

Despite the problems of the BHAR measure, I have chosen to use this measure because of its advantage of mimicking investor behavior. Further, I have only used the BHAR measure to study the drift graphically and do not draw conclusions from this graph about the adjustment speed. Therefore, I do not believe the potential problems of the BHAR metric to distort the conclusions drawn in this study. When testing for the PEAD statistically I have used monthly calendar-time regressions which are proposed by Fama (1998) to control for the problems above.

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[61] Another problem, pointed out by Fama (1998) arises if one deducts the measure of expected returns after compounding over time. As Fama discussed, for longer time horizons it is not possible to use asset-pricing models to measure expected returns, which is a limitation. Expected returns must be modeled by using the return of a benchmark firm or portfolio.

1.5.2 Calendar-time regressions

As a starting point I use each firm's monthly return and then calculate equally-weighted portfolio means as follows:

$$R_{p,t} = \frac{1}{N}\sum_{i=1}^{N} R_{i,t} \tag{1.9}$$

where:

$R_{i,t} =$	net return of share i at month t,
$R_{p,t} =$	net return of portfolio p at month t,
$p =$	type of portfolio, $p = 1$ (*SHORT*), 2, …, 9, 10 (*LONG*),
$t =$	month after formation date. $t = 1, 2, \ldots, 12$.

Note that these portfolio returns are not equivalent to the BHAR above, but rather an average monthly portfolio return.[62]

In the regressions, the focus is on portfolios 1 and 10, equivalent to the SHORT and LONG position. As before, the PEAD position is a combined portfolio of the LONG position minus the SHORT position. Monthly regressions, described below, are run for each of the three positions.

The mean monthly portfolio return in equation (1.9) above is calculated for the twelve months following formation date, which means that I get twelve monthly observations for each portfolio for each formation date. When running the regression on all portfolios with the same position I thus get 12×28=336 observations of monthly portfolio return.

This is a slight difference compared to how the regression is implemented by Chan *et al.* (1996). I have kept all the 28 strategies with different formation dates separate, whereas Chan *et al.* (1996) weighed them all together to get one portfolio return for every calendar month. With a holding period of twelve months I have four overlapping portfolios every calendar month. I show in Table 1.B.1 in Appendix 1.B that using the method exactly like Chan *et al.* (1996) yields the same results. I have however chosen to present the results with my alternative regressions, holding the 28 strategies separate, since this is in line with the results reported in Figure 1.2.

The dependent variable in the calendar-time regressions is *portfolio excess return*, which is defined as the portfolio return minus the monthly risk-free interest rate (following Chan *et al.*, 1996). As a first test I regress the dependent variable on a

[62] Since the portfolio mean is calculated for each month, this average monthly portfolio return assumes that the portfolios are rebalanced every month to keep the weights equal.

constant to see if the intercept is significant.[63] This intercept is obviously not a measure of "abnormal return", but a way to test the significance of the portfolio returns in excess of the risk-free rate. This regression model is denoted Model 1 in the following tables.

$$R_{p,t,f} - Rf_t = \alpha + C + \varepsilon \tag{1.10}$$

where:

$R_{p,t,f} =$	portfolio return at month *t* of a portfolio with position *p* and formation date f,
$p =$	type of portfolio, *p* = 1 (SHORT), 2, ..., 9, 10 (LONG),
$f =$	formation date. f = 1, 2, …, 28. where f = 1 is Q3 1997 and f = 28 is Q2 2004,
$Rf_t =$	monthly risk-free rate, return of a 1-month Swedish Treasury Bill,
$C =$	constant factor.

Second, the monthly portfolio excess returns are regressed on the excess market return (RMRF), which is the risk factor as described by CAPM (Sharpe, 1964; Lintner, 1965). This regression model is denoted Model 2 in the following tables.

$$R_{p,t,f} - Rf_t = \alpha^{capm} + \beta^{capm} RMRF_t + \varepsilon^{capm} \tag{1.11}$$

where:

$R_{p,t,f} =$	portfolio return at month *t* of a portfolio with position *p* and formation date f,
$p =$	type of portfolio, *p* = 1 (SHORT), 2, ..., 9, 10 (LONG),
$f =$	formation date. f = 1, 2, …, 28. where f = 1 is Q3 1997 and f = 28 is Q2 2004,
$Rf_t =$	monthly risk-free rate, return of a 1-month Swedish Treasury Bill,
$RMRF_t =$	excess market return: $R_m - Rf$.

Third, the monthly portfolio excess returns are run in a three-factor model following Fama and French (1993).[64] This regression model is denoted Model 3 in the following tables.

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[63] This approach is also used in Brooks (2002).

[64] No asset pricing model can fully explain the cross-section of average returns. The Fama-French three-factor model which is the most widely used asset-pricing model comes a long way, but still has difficulties explaining the size effect in the lowest book-to-market portfolios. This was pointed out by Fama (1998) as well as by Fama and French (1993), and they conclude that the three-factor model does not even explain return differences along the dimensions that the model's risk factors were designed to explain. Despite its known deficiencies this is the most established asset-pricing model.

$$R_{p,t,f} - Rf_t = \alpha^{3f} + b^{3f} RMRF_t + s^{3f} SMB_t + h^{3f} HML_t + \varepsilon^{3f} \tag{1.12}$$

where:

$R_{p,t,f} =$	portfolio return at month *t* of a portfolio with position *p* and formation date *f*,
$p =$	type of portfolio, *p* = 1 (SHORT), 2, ..., 9, 10 (LONG),
$f =$	formation date. *f* = 1, 2, …, 28. where *f* = 1 is Q3 1997 and *f* = 28 is Q2 2004,
$Rf_t =$	monthly risk-free rate, return of a Swedish Treasury Bill (30 day),
$RMRF_t =$	excess market return: $R_m - Rf$,
$SMB_t =$	monthly return of a hedge portfolio based on size (*market cap*),
$HML_t =$	monthly return of a hedge portfolio based on book-to-market.

Following Fama and French (1993) I estimate the factors *SMB* and *HML* as follows. The SMB portfolios are based on firm size, measured as market capitalization (the share price times the number of shares outstanding). Firms are ranked on *market cap* by June 30 each year and then divided into two portfolios; portfolio Big and portfolio Small. The SMB factor is the monthly value-weighted return of the Small portfolio minus the monthly return of the Big portfolio. Monthly returns are measured from July 1 and 12 months ahead.

The HML portfolios are based on book-to-market (book value of equity divided by market capitalization). Firms are ranked on book-to-market by December 31 each year and divided into three portfolios; portfolio Value (high book-to-market), portfolio Neutral and portfolio Growth (low book-to-market). The HML factor is the monthly value-weighted return of the Value portfolio minus the monthly return of the Growth portfolio. Monthly returns are measured from July 1 (six months after portfolio formation) and 12 months ahead.

The regression models 1, 2 and 3 above, i.e. equations (1.10), (1.11) and (1.12), are run for the long and the short positions. In addition, the following regressions are run with the hedge returns of the PEAD position as the dependent variable.[65]

$$R_{PEAD,t,f} = \alpha + C + \varepsilon \tag{1.13}$$

$$R_{PEAD,t,f} = \alpha^{capm} + \beta^{capm} RMRF_t + \varepsilon^{capm} \tag{1.14}$$

$$R_{PEAD,t,f} = \alpha^{3f} + b^{3f} RMRF_t + s^{3f} SMB_t + h^{3f} HML_t + \varepsilon^{3f} \tag{1.15}$$

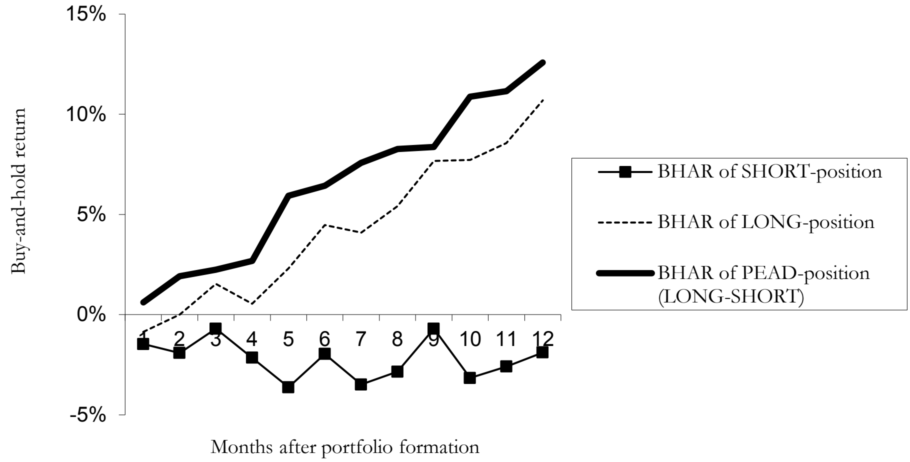
The estimated coefficients for the portfolios LONG, SHORT and PEAD are reported in Table 1.3.

[65] The variable definitions are the same as for regression models 1, 2 and 3 above.

1.6 Results

Figure 1.1 presents the classic PEAD graph.[66] It displays the mean buy-and-hold abnormal return (market-adjusted) for each of the positions LONG, SHORT and PEAD (LONG-SHORT) for one to twelve months after portfolio formation.

Figure 1.1. Mean buy-and-hold return (market-adjusted) over the twelve months following portfolio formation. Equal-weighted portfolios (deciles) formed on SUE signals announced Q3-1997 to Q2-2004



By looking at the graph, it seems like there is indeed a drift in BHAR after the announcement of quarterly earnings in the Swedish stock market. The mean BHAR of all the PEAD positions over the sample period seems to be about 12% after a holding period of twelve months. This indicates that it is on average possible to earn a market-adjusted return of 12% with a trading strategy that takes a long position in the decile of firms with the highest SUE and a short position in the decile of firms with the lowest SUE. It is worth noting that most of the return comes from the long position which has a BHAR of about 10% over twelve months, whereas the short position seems to be only slightly below zero. It also seems like most of the return to the PEAD position is generated in the middle of the holding period. The low returns in the first three months diverge from the results of Bernard and Thomas (1989). They find a cumulative abnormal return to the hedge portfolio of about 4.2% during the

[66] The PEAD graph in Bernard and Thomas (1989) is constructed in event-time whereas my positions are taken the first day of the quarter subsequent to the quarter when the SUE was announced in order to ensure that the trading strategy is implementable. If the drift starts right after the day of the earnings announcement, I consequently lose some power in my tests compared to Bernard and Thomas (1989).

first 60 trading days (approximately 3 calendar months).[67] However, Figure 1.1 should be interpreted with caution since the BHAR metric, as noted previously, might give a false impression of when abnormal return is generated.

Before investigating the drift in more detail, I test the statistical significance and make sure that the observed return is not just a compensation for risk. If the long position and the short position have different risk exposure, the hedge position will also be exposed to risk and the hedge return might be a reward for taking on that risk. I run the monthly portfolio returns (twelve month holding period) in three different regressions; with a constant as the explaining variable (Model 1), with the *excess market return* (*RMRF*) as the explaining variable (Model 2) and finally with *RMRF, SMB* and *HML* as the explaining variables (Model 3). In Table 1.3 the coefficients of the calendar-time return regressions are reported for the positions LONG, SHORT and PEAD respectively.

[67] This comparison of results assumes that my rough risk-adjustment (adjusting for market return) is working equally well as the risk-adjustment made by Bernard and Thomas (1989) (adjusting for return on a portfolio from the same size decile).

Table 1.3. Coefficient estimates from calendar-time portfolio returns regressions for a PEAD trading strategy, with a holding period of 12 months. The sample comprises 4241 firm-quarter observations for firms listed at the Stockholm Stock Exchange between 1990 and 2005.

	Position LONG (high SUE)			Position SHORT (low SUE)			Position PEAD (LONG-SHORT)		
Variable	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
intercept	0.011***	0.008***	0.007***	0.003	0.000	-0.002	0.009**	0.009**	0.009**
t-Stat	*(3.07)*	*(3.24)*	*(2.74)*	*(0.65)*	*(-0.06)*	*(-0.60)*	*(2.39)*	*(2.33)*	*(2.29)*
RMRF		0.584***	0.692***		0.542***	0.664***		0.042	0.028
t-Stat		*(18.69)*	*(18.07)*		*(15.03)*	*(14.76)*		*(0.95)*	*(0.48)*
SMB			0.075			0.140**			-0.065
t-Stat			*(1.28)*			*(2.04)*			*(-0.74)*
HML			0.143***			0.089*			0.054
t-Stat			*(3.24)*			*(1.70)*			*(0.82)*
N	336	336	336	336	336	336	336	336	336
Adj. R2	0.000	0.510	0.559	0.000	0.402	0.442	0.000	0.000	-0.004

(i) Position LONG is a long position in the decile with the highest SUE and Position SHORT is a short position in the decile with the lowest SUE. Position PEAD is the combined hedge portfolio (LONG minus SHORT). All positions are taken the first day of the quarter subsequent to the quarter when the earnings are announced and held for twelve months.

(ii) The dependent variable is the monthly portfolio excess returns (monthly portfolio return minus the return of a Swedish 1-month Treasury Bill).

(iii) The explanatory variables are defined as follows: *RMRF* is the excess market return measured as the return of the Morgan Stanley Sweden Index (MSCI) minus the return of a Swedish 1-month Treasury Bill; *SMB* is the monthly value-weighted return of the Small portfolio (low market cap) minus the monthly value-weighted return of the Big portfolio (high market cap), where firms are ranked on market cap by June 30 each year, positions taken on July 1 and held for twelve months; *HML* is the monthly value-weighted return of the Value portfolio (low market-to-book) minus the monthly value-weighted return of the Growth portfolio (high market-to-book), where firms are ranked on market-to-book by December 31 each year, positions taken on July 1 and held for twelve months. N is the number of observations.

(iv) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

From Table 1.3 it can be noted that for the PEAD position the intercept in regression Model 1 has a t-value of 2.39 which is significant on a 5%-level. It indicates a monthly return of 0.9%. Compounded over a year this is equivalent to about 11% in return and it thus confirms the results from Figure 1.1. From Models 2 and 3 it is also clear that the monthly return to the PEAD position is robust to risk factors such as described by CAPM and the three-factor model by Fama and French (1993). Neither the excess market return, the return on the SMB portfolios nor the return on the HML portfolios can explain the return of the PEAD position.

It is also confirmed in Table 1.3 that the return to the PEAD position is generated by the long position. The average monthly return to position LONG is 0.7% when controlling for risk factors, whereas the average monthly return to position SHORT is not significant in any of the three regressions. For both the long and short positions the loading on *RMRF* is highly significant. It should also be noted that the *beta* is almost the same for the two positions, which is also confirmed by the insignificant beta in the regression for the hedge position. This is an indication that the two positions have similar risk exposure in terms of co-movement with the overall market. Regarding the co-movement with the SMB and HML factors, the two positions differ slightly. The long position has a significant loading on the HML factor, indicating that the returns to this position can be an effect of stocks with high book-to-market. In contrast, the short position has a significant loading on the SMB factor, indicating that the returns to this position partially can be explained by a size effect. However, in the combined portfolio, the long and short positions seem to control for each other in terms of these risk exposures.

Overall, the results from Table 1.3 strengthen the results from Figure 1.1: there are strong indications of a post-earnings announcement drift in the Swedish stock market.[68] A PEAD trading strategy implemented in the Swedish stock market seems to be able to generate a yearly abnormal return which is in line with what has been found in other stock markets. Bernard *et al.* (1997) showed that the PEAD strategy implemented on a US sample on average earned 6.3% over four quarters. The strategy implemented by Forner *et al.* (2009) on a Spanish sample of firms earned an average cumulative return of 7.3% over twelve months. Liu *et al.* (2003) found a hedge return of 10.8% over the twelve months following the earnings announcement in their study of the PEAD in the UK market.

Bernard *et al.* (1997) propose yet another way to evaluate a trading strategy: to study how many of the times the strategy is implemented it succeeds and how many times it fails. Figure 1.2 presents the BHAR (with a holding period of twelve months) for the PEAD position for each of the 28 formation periods.

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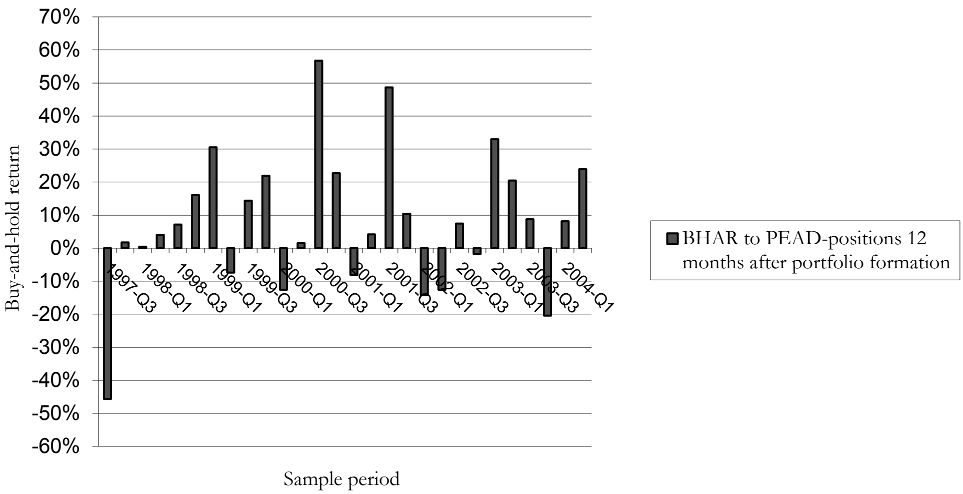
[68] In Table 1.B.1 in Appendix 1.B the results from calendar-time regressions implemented as in Chan *et al.* (1996) are presented. The pattern is the same as in Table 1.3, but the coefficients are now only significant on a 10%-level which is an effect of a lower number of observations.

Figure 1.2. Buy-and-hold return twelve months after portfolio formation to all PEAD positions (LONG-SHORT) taken during the sample period (Q3-1997 to Q2-2004)



It can graphically be noted that most of the returns are positive. Out of the 28 quarters when the trading strategy is implemented, it gains a positive return in 20 quarters and a negative return in eight quarters. Additionally, it can be noted that in nine quarters the hedge return is more than 15%, but when the strategy loses, only at two times does it lose more than 15%. A statistical test also shows that if the 28 "trials" can be considered independent and the underlying probability of the strategy succeeding is 50%, the probability of succeeding more than 19 out of 28 trials is only about 1.8%.[69] The success of the strategy can thus not be explained by chance and this adds to the robustness of the results.

As described earlier, the regressions have only been run on extreme portfolios (the highest and lowest deciles). In order to get a more nuanced picture I present in Table 1.4 some descriptive statistics for all the ten portfolios and their average monthly return (with a holding period of twelve months) during the sample period.

[69] Assuming a binomial distribution.

Table 1.4. Mean SUE and mean monthly return for decile portfolios ranked on SUE. Sample period 1990-2005.

Portfolio	SUE		Return	
1 (SHORT)	-3.562	*(-28.04)*	0.004	*(0.60)*
2	-1.213	*(-25.75)*	0.008	*(1.65)*
3	-0.624	*(-18.04)*	0.012	*(2.21)*
4	-0.268	*(-9.60)*	0.011	*(2.02)*
5	-0.041	*(-1.81)*	0.006	*(1.11)*
6	0.189	*(9.73)*	0.007	*(1.33)*
7	0.423	*(22.42)*	0.007	*(1.22)*
8	0.739	*(35.83)*	0.009	*(1.44)*
9	1.308	*(42.49)*	0.010	*(1.74)*
10 (LONG)	4.515	*(20.30)*	0.011	*(1.84)*

(i) This table reports descriptive statistics for decile portfolios formed on SUE (t-statistics in parentheses). Portfolios are formed at the first day of the quarter preeceding the quarter when the earnings are announced. SUE is measured as [Reported Earnings - Expected Earnings]/std of Expected Earnings. Expected Earnings are measured through a firm-specific time-series model of seasonal differences with a rolling window of nine observations. Return is the average monthly equal-weighted portfolio return over the whole sample period (96 months). Holding period is twelve months.

Indeed, Table 1.4 gives a more nuanced picture. The short position (with the lowest/most negative SUE) also has the lowest average monthly return following the earnings announcement and the long position has the highest average monthly return. However, there is no monotonic rise in returns from the lowest to the highest SUE portfolio. This pattern indicates that the drift might not be very robust in the Swedish market. It might also be an effect of the small sample. Each SUE portfolio consists of a maximum of ten stocks, and during some periods only four stocks are included in the same SUE portfolio. That means that small variations in returns have large effects on the portfolio return.[70]

In order to investigate the possible effect of size, the monthly regressions have been run on value-weighted SUE portfolios as well. When SUE portfolios are value-weighted each stock gets a weight in proportion to its market capitalization (*market cap* is lagged one month to avoid hindsight bias). Consequently, larger stocks get a higher weight. In Table 1.B.1 in the appendix the results of this regression are presented. It turns out that the coefficient for the PEAD position is no longer significant on a reasonable level and I conclude that the results reported in Table 1.3 are mainly driven by small stocks in the extreme portfolios, which is in line with the results of Bernard and Thomas (1990).

I can conclude that the trading strategy of taking a long position in the decile of the highest SUE and a short position in the decile with the lowest SUE, on average is profitable during the sample period. After controlling for conventional risk factors, the monthly average return to the hedge portfolio is 0.9%. However, the strategy is not risk-free. As can been seen in Table 1.B.1 in the appendix, the results are sensitive to

[70] In Table 1.B.1 in the appendix results for portfolios formed on quintiles are reported and the abnormal return is no longer significant.

the use of quintiles instead of deciles in portfolio formation. In addition, the return to the PEAD position is not significant if a holding period of six months is used instead of twelve months.[71]

Still the main results indicate that there is a post-earnings announcement drift in Sweden and this confirms the results of studies in other European markets. As an out-of-sample test this study thus dismisses "data-snooping" as an explanation for the previously observed drift after earnings announcements. The drift subsequent to the announcement of earnings news seems to be a robust phenomenon.

If the momentum effect and PEAD are indeed manifestations of the same phenomenon the finding of PEAD in the Swedish market is surprising. Either the link between returns momentum and PEAD should be reconsidered, or prior studies on momentum in Sweden are sample-specific. Before investigating this further, I test for the momentum effect as a fourth factor in the calendar-time regressions, following Carhart (1997) and Chordia and Shivakumar (2006).[72]

The studies that have not been able to confirm a momentum effect in Sweden all follow Jegadeesh and Titman (1993) and rank firms on past six months returns and hold them for six months. I have constructed my momentum factor in the same way to be able to compare the results.[73]

As can been seen from Table 1.5, the momentum factor (*MOM*), when included as a fourth factor in the regressions, is not significant. Since the holding period for the PEAD positions is also six months, the intercept is barely significant on a 10%-level (as previously reported in Table 1.B.1). In Table 1.B.2 in the appendix I also present results from a trading strategy based only on returns momentum. Here a long position is taken in the decile of stocks with the highest past return and a short position is taken in stocks with the lowest past return. The table shows that, with a holding period of six months, the return to such a hedge portfolio is not significant after controlling for risk factors suggested in CAPM or in a three-factor model. This confirms the results about the Swedish market found in Rouwenhorst (1998), Griffin *et al.* (2003), Doukas and McKnight (2005), Söderström (2007) and Novak (2008).

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[71] The results of all robustness checks are summarized in Table 1.B.1 in the appendix.

[72] An alternative would to be to follow Chan *et al.* (1996) and test the two momentum strategies by a double sorting of stocks. Due to the small number of firms in the cross-section this is not possible in this study.

[73] To be consistent with the PEAD-strategy I also form the momentum factors based on decile portfolios.

Table 1.5. Coefficient estimates from calendar-time portfolio returns regressions for a PEAD trading strategy, with a holding period of six months. Sample period 1990 - 2005.

Variable		Position LONG (High SUE)	Position SHORT (Low SUE)	Position PEAD (LONG-SHORT)
intercept		0.007**	-0.001	0.008
	t-Stat	*(2.16)*	*(-0.20)*	*(1.63)*
RMRF		0.666***	0.590***	0.076
	t-Stat	*(12.20)*	*(9.21)*	*(0.94)*
SMB		0.151*	0.097	0.054
	t-Stat	*(1.90)*	*(1.04)*	*(0.46)*
HML		0.148**	0.067	0.080
	t-Stat	*(2.45)*	*(0.97)*	*(0.92)*
MOM		-0.060	-0.057	0.003
	t-Stat	*(-1.58)*	*(-1.28)*	*(-0.05)*
N		168	168	168
Adj. R2		0.569	0.447	-0.002

(i) Position LONG is a long position in the decile with the highest SUE and Position SHORT is a short position in the decile with the lowest SUE. Position PEAD is the combined hedge portfolio (LONG minus SHORT). All positions are taken the first day of the quarter subsequent to the quarter when the earnings are announced and held for six months.

(ii) The dependent variable is the monthly portfolio excess returns (monthly portfolio return minus the return of a Swedish 1-month Treasury Bill). The explanatory variables are defined as follows: *RMRF* is the excess market return measured as the return of the Morgan Stanley Sweden Index (MSCI) minus the return of a Swedish 1-month Treasury Bill; *SMB* is the monthly value-weighted return of the Small portfolio (low market cap) minus the monthly value-weighted return of the Big portfolio (high market cap), where firms are ranked on market cap by June 30 each year, positions taken on July 1 and held for twelve months; *HML* is the monthly value-weighted return of the Value portfolio (low market-to-book) minus the monthly value-weighted return of the Growth portfolio (high market-to-book), where firms are ranked on market-to-book by December 31 each year, positions taken on July 1 and held for twelve months; *MOM* is the monthly equal-weighted return to hedge portfolios (with holding period six months), taking a long position in the decile with the highest past six months returns and a short position in the decile with the lowest past six months return. N is the number of observations.

(iii) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

However, when extending the holding period from six months to twelve months for both the PEAD position and the momentum factor, the results change noticeably.

The momentum factor is now highly significant, as can be seen in Table 1.6.[74] The return to the PEAD position is still significant on a 10%-level, though slightly subsumed by the momentum factor. It can thus be concluded that there is *both* a momentum effect and a post-earnings announcement drift present in the Swedish stock market. These results thus contribute to, and in fact alter the view, about what we previously knew about momentum in the Swedish stock market. Sweden is not an exception to other developed stock markets.

[74] Results from the momentum strategy alone (with a holding period of 12 months) are presented in Table 1.B.2 in the appendix.

Table 1.6. Coefficient estimates from calendar-time portfolio returns regressions for a PEAD trading strategy, with a holding period of twelve months. Sample period 1990 - 2005.

Variable		Position LONG (High SUE)	Position SHORT (Low SUE)	Position PEAD (LONG-SHORT)
intercept		0.008***	0.001	0.007*
	t-Stat	*(3.20)*	*(0.039)*	*(1.83)*
RMRF		0.648***	0.563***	0.085
	t-Stat	*(15.48)*	*(11.77)*	*(1.34)*
SMB		0.081	0.154**	-0.073
	t-Stat	*(1.40)*	*(2.32)*	*(-0.84)*
HML		0.128***	0.055	0.074
	t-Stat	*(2.90)*	*(1.08)*	*(1.11)*
MOM		-0.103**	-0.237***	0.134**
	t-Stat	*(-2.47)*	*(-4.98)*	*(2.14)*
N		336	336	336
Adj. R2		0.565	0.479	0.007

(i) Position LONG is a long position in the decile with the highest SUE and Position SHORT is a short position in the decile with the lowest SUE. Position PEAD is the combined hedge portfolio (LONG minus SHORT). All positions are taken the first day of the quarter subsequent to the quarter when the earnings are announced and held for twelve months.

(ii) The dependent variable is the monthly portfolio excess returns (monthly portfolio return minus the return of a Swedish 1-month Treasury Bill). The explanatory variables are defined as follows: *RMRF* is the excess market return measured as the return of the Morgan Stanley Sweden Index (MSCI) minus the return of a Swedish 1-month Treasury Bill; *SMB* is the monthly value-weighted return of the Small portfolio (low market cap) minus the monthly value-weighted return of the Big portfolio (high market cap), where firms are ranked on market cap by June 30 each year, positions taken on July 1 and held for twelve months; *HML* is the monthly value-weighted return of the Value portfolio (low market-to-book) minus the monthly value-weighted return of the Growth portfolio (high market-to-book), where firms are ranked on market-to-book by December 31 each year, positions taken on July 1 and held for twelve months; *MOM* is the monthly equal-weighted return to hedge portfolios (with holding period six months), taking a long position in the decile with highest past six months returns and a short position in the decile with the lowest past six months return. N is the number of observations.

(iii) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

The results also confirm the results of Chan *et al.* (1996) and Chordia and Shivakumar (2006), that PEAD and returns momentum are interlinked but not totally subsumed by each other. Additional indication that the two drift effects are interlinked can be seen in Table 1.7. It shows the average *SUE* and *RET-6* (return during six months prior to portfolio formation) for the ten portfolios, ranked on *SUE*. Portfolio 1 with the lowest SUE also has the lowest past return and portfolio 10 with the highest SUE also has the highest past return. The two measures of a firm's performance are thus, as expected, highly correlated.

Table 1.7. Mean SUE and mean past six months returns for decile portfolios ranked on SUE. Sample period 1990 - 2005.

Portfolio	Mean SUE		Mean RET-6	
1 (SHORT)	-3.562	*(-28.04)*	0.028	*(1.89)*
2	-1.213	*(-25.75)*	0.063	*(4.85)*
3	-0.624	*(-18.04)*	0.075	*(4.81)*
4	-0.268	*(-9.60)*	0.069	*(4.62)*
5	-0.041	*(-1.81)*	0.058	*(4.22)*
6	0.189	*(9.73)*	0.057	*(3.93)*
7	0.423	*(22.42)*	0.057	*(3.82)*
8	0.739	*(35.83)*	0.067	*(4.13)*
9	1.308	*(42.49)*	0.081	*(5.32)*
10 (LONG)	4.515	*(20.30)*	0.109	*(6.32)*

(i) This table reports descriptive statistics for decile portfolios formed on SUE (t-statistics in parentheses). Portfolios are formed at the first day of the quarter preceding the quarter when the SUE is announced. SUE is measured as [Reported Earnings - Expected Earnings]/std of Expected Earnings. Expected Earnings are measured through a firm-specific time-series model of seasonal differences with a rolling window of nine observations. RET-6 is measured as the sum of the six monthly return preceding portfolio formation.

It is worth noting that both PEAD and the momentum effect are weak for a holding period of six months, but highly significant with a holding period of twelve months. This is not in line with previous research of Bernard and Thomas (1989 and 1990) and Chan *et al.* (1996) which has shown that most of the drift occurs within six months of portfolio formation. Another observation in this study is that the average return to the short position is insignificant, both when implementing a PEAD trading strategy (Table 1.3) and a momentum trading strategy (Table 1.B.2). This is not in line with the classic PEAD graph with upward drift after good news and a downward drift after bad news. It is however in line with the empirical findings of some other studies (e.g., Forner *et al.*, 2009; Dische, 2002), indicating that these results are not sample-specific.

It is not within the scope of this study to find explanations for these two observations. However, it is interesting to note to what extent they line up with previously proposed explanations for the drift. For example, given that the drift is driven by psychological biases in information processing (e.g., Barberis *et al.*, 1998), the results of this paper would suggest that Swedish investors for some reason need a longer time to rationally process information. Or alternatively, that potential limits to arbitrage, that prevent rational investors to trade on the drift pattern, evaporates more slowly in the Swedish market. To my knowledge, there is no existing research on how such trading limitations might differ between the Swedish stock market and other stock markets.

Similarly, if the drift is driven by slow diffusion of information as proposed by Hong and Stein (1999), the results of this study must indicate that information diffusion is slower in the Swedish stock market compared to other markets. Arguably, the fact that the mean analyst coverage is quite small in Sweden, which was noted by Doukas and McKnight (2005), supports this speculation. However, it is a subject for further research.

The lack of drift on the short position is interesting since it opens up for an omitted risk factor potentially explaining the drift. If stocks in the short position are exposed to such a risk factor they will be priced so that they yield a higher expected return, consistent with an *upward* drift on this position. Given that the "classic" studies on PEAD report a drift downwards after bad news signals, risk factors have lately not been much considered in the literature. The results of this paper thus identify a need for more empirical research on the short position as well as potential risk factors that might drive the drift in the post-announcement period.

The lack of return on the short position might also be interpreted as support for the explanation that structural uncertainty and investor learning are driving forces behind the drift. Francis *et al.* (2007) argue that there are two forces of information uncertainty at play; one learning effect and one risk effect. The first effect means that investors over time learn more about the initial earnings signal and as uncertainty resolves around this signal, there is a drift upwards for favorable earnings news and a drift downwards for unfavorable earnings news. The second effect is associated with the compensation for higher information risk. Since both the long and the short position, according to Francis *et al.* (2007), contain stocks of high information risk the higher return for these stocks will cause a drift upwards for both favorable and unfavorable earnings news. For the long position the effect is unambiguous, but for the short position there are two opposite effects on the drift. In their paper, Francis *et al.* (2007) hypothesize that the learning effect will be higher than the risk effect, causing a drift downwards for the short position. The results in my paper could however be interpreted as if the risk effect in this case cancels out the learning effect. It is not within the scope of this paper to measure the information uncertainty of the earnings surprise signal, but this empirical observation of the short position could be a subject for future research.

1.7 Conclusions

Due to the lack of available data there is not much research on how Swedish investors react to quarterly accounting information. This paper draws on a partly new dataset of firms, listed during the period of 1990 to 2005, to reveal that there is a drift in stock prices subsequent to the announcement of quarterly earnings. Using this return pattern to adopt a trading strategy, taking a long position in stocks with good news and a short position in stocks with bad news, it is on average possible to generate a return of more than 11% over the twelve months following portfolio formation.

Also shown is that the return gained on the trading strategy is robust within both the CAPM and the three-factor models. The long and the short positions have practically the same exposure to risk as measured by the CAPM-model, so the hedge position is not exposed to risk in that sense. Further, the additional risk factors suggested by Fama and French (1993) do not explain the returns to the hedge portfolios. The results also show that small stocks generate the drift in the extreme portfolios, confirming prior research on the drift.

Initially, the finding of a post-announcement drift was somewhat surprising, since previous studies have not been able to find a momentum effect in the Swedish market, whilst the two drift effects are considered to be interlinked. However, in contrast to previous studies, here a momentum effect is evident; stocks that perform well in the stock market during a six month period, continue to outperform stocks with low past returns. With a holding period of twelve months the average monthly return to a momentum strategy is over 1%, adjusted for risk factors in a three-factor model. In line with previous research by Chan *et al.* (1996) and Chordia and Shivakumar (2006) I find that the two return drifts, although overlapping, are not identical. This is in line with what we know about the relation between earnings and returns. Earnings are value relevant information, but returns can in addition to earnings incorporate other, more timely, value relevant information about the performance of a firm.

The study suffers from the limitation that the profitability of the two trading strategies is only evaluated using statistical return metrics. The evaluation does not consider how feasible these returns are to a real-world investor. In addition, transaction costs are not considered. The profitability of the two trading strategies is therefore likely overstated and should be interpreted with caution.

To conclude, this study provides evidence of both PEAD and returns momentum in the Swedish stock market. The results augment what we previously knew about momentum in Sweden. In addition, there are two interesting observations in this paper. First, it seems like the two drift effects last longer in Sweden than in many other markets. Neither of the return drifts is significant for a period of six months after portfolio formation. However, if the holding period is extended to twelve months they are both significant. Second, it is worth noting that for both

PEAD and returns momentum, the drift is significantly larger for positive news. Almost all of the return to the trading strategies is generated by the long position.

The paper does not provide any explanations for these two observations. I speculate that the lack of return to the short position might be an important observation in the striving for finding the drivers of the drift. In fact, this observation opens up for an omitted risk factor as a potential explanation for the drift. Exposed to such a risk factor, stocks in the short position will be priced so that they will render a positive expected return as a compensation for taking on this risk. Consequently, this explanation is in line with an upwards drift also after the announcement of bad news and as such the empirical observations of this paper is interesting. I argue that more research on the short position and potential risk factors explaining PEAD is warranted.

Appendix 1.A - International findings on PEAD

United Kingdom

Hew *et al.* (1996) investigate the post-earnings announcement drift in the UK. They study a limited sample of 206 companies listed on the London Stock Exchange from 1989 to 1992, covering seven half-year earnings announcements. Their results show a drift in returns after the announcements, but it is not statistically significant for larger companies. Hence, they conclude that the drift might be explained by trading costs, trading volumes and the amount of information available to investors before the announcement.

In a more comprehensive study of British data, Liu *et al.* (2003) find strong evidence of a post-earnings announcement drift in the UK stock market. Mean buy-and-hold returns are reported for equal-weighted decile portfolios for a number of holding periods. For a hedge portfolio (high minus low) based on a time-series SUE measure, they report a raw return of 2.9%, 5.2%, 8.2% and 10.8% for holding periods of 3-, 6-, 9- and 12-months respectively. When controlling for the Fama-French risk factors the return to the hedge portfolio is 0.706% per month (with a holding period of 6 months).

They further test three alternative earnings surprise measures; based on i) time-series of earnings, ii) market prices and iii) analyst forecasts, and find that the results are robust to all of these measures. The drift is strongest for the price based SUE measure and when tested together the drift from this measure largely subsumes the drift from the other two SUE-measures. However, the SUEs based on time-series of earnings and analyst forecasts both have marginal predictive power for the drift, which the authors interpret as if each measure captures somewhat different dimensions of earnings news. Contrary to Hew *et al.* (1996), Liu *et al.* (2003) find no evidence that the drift can be explained by size and market microstructure effects. There are no significant differences between the highest and lowest SUE deciles when it comes to analyst coverage or market values.

The authors also confirm the results from the US market that a disproportionate component of the drift occurs around the subsequent earnings announcement and that SUE at the earnings announcement has predictive power for SUE at the subsequent announcement. This is consistent with investors underestimating the correlation between successive earnings changes. Liu *et al.* (2003) conclude that the UK market is inefficient in processing earnings information.

Finland

From the Finnish market there is mixed evidence on PEAD. Kallunki (1996) finds a drift after the announcement of bad earnings news, but no corresponding drift after the announcement of good earnings news. He explains this pattern with the restrictions in short-selling that were present in the Finnish market during the sample period. Since investors were not allowed to short sell, they could not take advantage of the bad news to the same extent as the good news.

However, in another study, Booth *et al.* (1996) find that the drift after the announcement of positive earnings surprises (measured as market-adjusted return around the announcement) is actually larger than the one after negative earnings surprises. It should be noted however that the drift in this study is only measured over ten trading days after the announcement of earnings. Booth *et al.* (1996) also find that the drift is larger for firms that do not smooth their income series and they explain this by higher information processing costs related to these firms. When not incorporating these costs in the measurement of returns, these firms will be generating an illusive abnormal return.

In yet another study of the Finnish stock market, Vieru *et al.* (2005) confirm the results of Kallunki (1996) that there is only a drift in returns after negative interim earnings news. Again, the drift is only measured for ten trading days after the announcement. Vieru *et al.* (2005) measure SUE by the abnormal returns during the announcement day. The companies in the portfolio with the highest (lowest) returns are considered to have announced a positive (negative) earnings surprise. The authors find negative returns of 2.8% for the quintile of companies with the least favorable earnings news (all events are lumped together before grouping).

The main purpose of the Vieru *et al.* (2005) study is to investigate the association between post-earnings announcement drift and the trading activity of non-institutional investors. They use data from all trades executed on the Helsinki stock exchange during 1996-2000 and classify all traders into five categories based on their trading activity. The results are strongest for the portfolio of firms with the least favorable earnings news, i.e. the short position. The returns to this portfolio are associated with excess buying (positive net trades) by passive and intermediate active investors and the authors interpret this as a sign of this non-institutional trading intensifying the negative post-earnings announcement drift. For positive earnings news, there are only weak results and for moderate earnings news the authors do not find any association between returns and trading activity class.

The trading database used in Vieru *et al.* (2005) is also employed in a working paper by Booth *et al.* (2006). They examine the trading behavior of foreign and domestic investors around interim earnings announcements. They stipulate that foreign institutional investors are more sophisticated in their information processing than domestic institutional investors. The least sophisticated and thus the slowest to react to the information content is hypothesized to be the domestic non-institutional investors. They find evidence of such a pattern in their study. Foreign investors are the first to react to announced information and they buy (sell) shares of firms with positive (negative) earnings news (measured as day -1 to day +1 returns minus the return of a value-weighted index). The domestic investors react in the opposite direction and are thus found to have a contrarian strategy. The difference in trading behavior lasts many days after the announcement day and the authors argue that their results support the notion that the post-earnings announcement drift is the result of heterogeneous investor information processing abilities.

Belgium

van Huffel *et al.* (1996) study the post-earnings announcement drift in the Belgian stock market for the years 1990-1993. They measure expected earnings with a naive forecast model, assuming that semi-annual earnings follow a random walk. Expected returns are measured either with a market model (following Sharpe, 1964) or through a size-adjusted returns model (following Foster *et al.*, 1984). They do not find a significant drift for either of the return measures. However, when splitting the sample on size they find size-adjusted returns for large companies subsequent to the announcement that are in line with previous studies on the PEAD. They argue that a plausible explanation for the difference in drift between small and large companies is that the naive earnings expectations model is more accurate for large firms.

Poland

In his working paper Szyszka (2002) reports some preliminary results on the post-earnings announcement drift for the Warsaw Stock Exchange. He measures earnings surprise following Foster *et al.* (1984), but finds only a statistically significant drift for the least favorable SUE group. For this group of companies (29 events) the average cumulative market-adjusted return was -12.5% for the trading days +2 to +60 after the announcement. The beta is equivalent in the top and bottom SUE-groups but he does not control for risk according to Fama and French (1993).

Szyszka (2002) does not use a method that mimics an implementable trading strategy. In addition he also mentions that an investor in the Polish stock market cannot take advantage of the results since short selling his prohibited in this market.

Germany

Dische (2002) describes his study as the first out-of-sample test of some behavioral models on how investors react to earning information. His results confirm the model by Barberis *et al.* (1998) who states that investors are conservative and adjust their beliefs slowly to new evidence. This model is based on the theories of Griffin and Tversky (1992) that showed that people focus too much on the strength of information and too little on its statistical weight, relative to a rational Bayesian model. Based on the behavioral model Dische (2002) predicts that investors should underestimate the importance of a reliable signal, i.e. an earnings forecast revision (the change in the mean of several analyst earnings forecasts) that has a low dispersion should have a higher drift than an earnings forecast revision with a high dispersion. He finds this in his data.

Using a German sample of firms between 1987 and 2000 he finds a raw return of 10.6% for a holding period of twelve months, from a trading strategy taking long position in the portfolio of firms (quintiles) with the most favorable earnings revision (approximately high SUE) and a short position in the portfolio of firms with the least favorable earnings revision (low SUE). Most of this return is generated by the long position, with the returns to the short position being barely significant. He also finds that the optimal trading strategy is 6 months and with this holding period the strategy earns an average market-adjusted return of approximately 1% per month. A strategy that, in addition to the earnings revisions, also forms portfolios on the *dispersion* of the earnings revisions, earns an incremental return of 0.96% per month. That is: the drift is even stronger for firms with low dispersion in earnings revisions. Dische argues that a low dispersion indicates lower risk and hence the returns to the strategy could not be explained as a compensation for higher risk.

Spain

Forner *et al.* (2009) find evidence of a very robust post-earnings announcement drift in the Spanish stock market. They measure SUE in three alternative ways: with a time-series model (using a random walk and then scaling unexpected earnings with book value of equity), with the revision in analyst forecasts (scaled by book value of equity) and by the cumulative market-adjusted return around the announcement day. They do not find a significant drift for the last SUE measure.

Forner *et al.* (2009) use the calendar-time approach (e.g., Chan *et al.*, 1996) when evaluating the portfolios. At the beginning of each calendar month they select and rank all stocks that had an earnings surprise in the previous three months (if there were more than one SUE they choose the most recent one). They divide the stocks into three equally-weighted portfolios which are held for three, six, nine and twelve months. They also use a second approach where they measure the monthly return that an investor would have gained if he/she had several parallel PEAD portfolios. Each month a new PEAD strategy is implemented and held for three, six, nine and twelve months, so with a holding period of twelve months the investor will have invested in twelve PEAD portfolios at the same time. When investing in a new PEAD portfolio, it replaces the oldest PEAD portfolio which has then been held for twelve months already. The return during a specific calendar month is the return from the twelve parallel PEAD portfolios.

The results show an average cumulative hedge return of 7.3% over a holding period of twelve months for the time-series based SUE measure. For the earnings forecast revisions they find a smaller drift and an average cumulative return of 3.4%. In addition they find that the two measures have marginal explanatory power when they are controlled for each other in a double-rank portfolio construction procedure following Liu *et al.*, 2003. The average monthly calendar-time return with a holding period of six months is 0.45% and for a holding period of twelve months it is 0.4%.

For a holding period of six months, all of the hedge return is generated by the long position. The average monthly calendar-time return for the short position is in fact positive, though not significant. The regression results are robust to risk-controls such as described by CAPM and the Fama-French three-factor model.

In addition, Forner *et al.* (2009) form control portfolios by size and book-to-market ratio in order to secure that these effects cannot explain the drift in returns. As an extra robustness check, a fourth factor is added to the three-factor model. This momentum factor is a control for the momentum effect discovered by Jegadeesh and Titman (1993). When SUE is measured by a time-series model, the four-factor model explains the post-earnings announcement drift. However, when testing the momentum and PEAD with a double-criterion portfolio construction procedure, the PEAD controlled for momentum is still significant (for both of the SUE measures). The momentum is also significant when controlled for PEAD, indicating that the two phenomena are related but not exactly the same. A combined strategy using both momentum and PEAD also yields a greater return than that provided by both strategies separately.

As a final robustness check, Forner *et al.* (2009) test if their results can be explained by conditional risk models. In this way they allow risk and return to vary over time, depending on the economic cycle, which is measured as the aggregate book-to-market ratio. They find that the PEAD results are robust to these risk controls.

Sweden

There are no previous extensive studies of PEAD in the Swedish stock market. However, Griffin *et al.* (2006) investigate market efficiency in 56 international markets, and the Swedish market is one of them. Among other things, they test for the post-earnings announcement drift after annual earnings announcements using data from 1994 to 2005. Earnings surprise is measured as the difference between the actual reported earnings per share and the mean analyst earnings per share forecast from I/B/E/S, and then scaled by the price as of six days prior to the announcement date (which they proxy for by the reporting date). The authors divide all SUEs into groups of positive and negative surprises and then report the 60% of positive and 60% of negative earnings surprises. They then measure the market-adjusted cumulative return over the trading days +2 to +126 after the announcement (approximately six months). Looking at Figure 4 in their paper it seems like they, for the Swedish market, find a negative significant drift in returns after negative SUE of about 8-9%. But since the results are only reported graphically, it is not possible for me to relate to these results.

Other markets

Hong *et al.* (2003) in their working paper investigate PEAD returns in international markets for the years 1987 to 2001. They find evidence of a significant post-earnings announcement drift in Australia, Canada, France, Germany, Hong Kong and the UK, but not in Malaysia, South Korea, Japan, Singapore or Taiwan. They measure earnings surprise as the revision in earnings forecasts during the previous 3 or 6 months (and scale by price) and argue that the advantage of this measure is that they get a more timely measure even in markets where only annual earnings are reported. In addition, using time-series models for expected earnings have little power when only annual earnings data is available.

Appendix 1.B - Robustness tests

Table 1.B.1. Main PEAD results and robustness checks. Sample period 1990 - 2005.

Variable	Main PEAD Results	As in Chan *et al.* (1996)	SUE scaled by market cap	Quintile portfolios	6 months holding period	Value-weighted portfolio returns	Market return measured as sample mean return
intercept	0.009**	0.007*	0.008**	0.004	0.008	0.008	0.009**
t-Stat	*(2.29)*	*(1.96)*	*(2.18)*	*(1.56)*	*(1.64)*	*(1.19)*	*(2.38)*
RMRF	0.028	0.048	0.158***	0.092**	0.077	0.037	-0.031
t-Stat	*(0.48)*	*(0.81)*	*(2.77)*	*(2.42)*	*(1.02)*	*(0.37)*	*(-0.39)*
SMB	-0.065	-0.043	0.083	-0.102*	0.054	-0.052	-0.099
t-Stat	*(-0.74)*	*(-0.48)*	*(0.95)*	*(-1.75)*	*(0.46)*	*(-0.34)*	*(-1.23)*
HML	0.054	0.037	-0.068	0.087**	0.081	0.024	0.066
t-Stat	*(0.82)*	*(0.54)*	*(-1.03)*	*(1.98)*	*(0.92)*	*(0.21)*	*(0.97)*
N	336	93	336	336	168	336	336
Adj. R2	-0.004	-0.013	0.023	0.045	0.004	-0.007	-0.004

(i) This table presents the main results for the PEAD position (LONG minus SHORT) as well as six robustness checks. The main results are based on equal-weighted decile PEAD-portfolios ranked on SUE scaled by the standard deviation of expected earnings. All positions are taken the first day of the quarter subsequent to the quarter when the earnings are announced and held for twelve months. The market return is proxied by the Morgan Stanley Sweden Index (MSCI). In the five robustness checks I test, one at a time, the following alternative operationalizations; following Chan *et al.* (1996), SUE scaled by *market cap*, quintile portfolios, a holding period of six months, value-weighted portfolios and the sample mean as a proxy for market return.

(ii) In all regressions the dependent variable is the monthly portfolio excess returns (monthly portfolio return minus the return of a Swedish 1-month Treasury Bill).The explanatory variables are defined as follows: *RMRF* is the excess market return measured as the return of the Morgan Stanley Sweden Index (MSCI) minus the return of a Swedish 1-month Treasury Bill; *SMB* is the monthly value-weighted return of the Small portfolio (low market cap) minus the monthly value-weighted return of the Big portfolio (high market cap), where firms are ranked on market cap by June 30 each year, positions taken on July 1 and held for twelve months; *HML* is the monthly value-weighted return of the Value portfolio (low market-to-book) minus the monthly value-weighted return of the Growth portfolio (high market-to-book), where firms are ranked on market-to-book by December 31 each year, positions taken on July 1 and held for twelve months. N is the number of observations.

(iii) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

Table 1.B.2. Coefficient estimates from calendar-time portfolio returns regressions evaluating momentum trading strategies with holding periods of 6 and 12 months. Sample period 1990 - 2005.

	Holding period 6 months			Holding period 12 months		
Variable	Position LONG (Past winners)	Position SHORT (Past losers)	Position MOM (LONG - SHORT)	Position LONG (Past winners)	Position SHORT (Past losers)	Position MOM (LONG - SHORT)
intercept	0.016**	0.001	0.014	0.011***	-0.002	0.013**
t-Stat	*(2.46)*	*(0.22)*	*(1.58)*	*(2.79)*	*(-0.38)*	*(2.12)*
RMRF	0.535***	0.979***	-0.445***	0.556***	0.953***	-0.397***
t-Stat	*(5.29)*	*(9.56)*	*(-3.12)*	*(9.05)*	*(10.93)*	*(-4.12)*
SMB	0.153	0.060	0.093	0.151	0.083	0.068
t-Stat	*(0.98)*	*(0.38)*	*(0.42)*	*(1.60)*	*(0.62)*	*(0.46)*
HML	0.044	0.150	-0.110	0.020	0.162	-0.142
t-Stat	*(0.38)*	*(1.30)*	*(-0.67)*	*(0.27)*	*(1.60)*	*(-1.27)*
N	168	168	168	336	336	336
Adj. R2	0.246	0.573	0.132	0.512	0.632	0.208

(i) This table reports coefficient estimates from calendar-time portfolio return regressions for the positions LONG, SHORT and MOM, using two alternative holding periods; six and twelve months. Position LONG is a long position in the decile with the highest past six months returns (*RET-6*) and Position SHORT is a short position in the decile with the lowest *RET-6*. Position MOM is the combined hedge portfolio (LONG minus SHORT). All positions are taken the first day of the month subsequent to the six months when the past returns are evaluated. *RET-6* is the measure of past returns and is calculated as the sum of six monthly returns prior to portfolio formation.

(ii) The dependent variable is the monthly portfolio excess returns (monthly portfolio return minus the return of a Swedish 1-month Treasury Bill).The explanatory variables are defined as follows: *RMRF* is the excess market return measured as the return of the Morgan Stanley Sweden Index (MSCI) minus the return of a Swedish 1-month Treasury Bill; *SMB* is the monthly value-weighted return of the Small portfolio (low market cap) minus the monthly value-weighted return of the Big portfolio (high market cap), where firms are ranked on market cap by June 30 each year, positions taken on July 1 and held for twelve months; *HML* is the monthly value-weighted return of the Value portfolio (low market-to-book) minus the monthly value-weighted return of the Growth portfolio (high market-to-book), where firms are ranked on market-to-book by December 31 each year, positions taken on July 1 and held for twelve months. N is the number of observations.

(iii) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

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2 Information uncertainty in unexpected earnings signals

Abstract

This paper investigates empirically whether GAAP earnings and core earnings (measured as I/B/E/S earnings) introduce different levels of information uncertainty to stock market investors. Information uncertainty is here defined as to what extent the earnings signal is informative about the firm's value creation for the period, so-called economic earnings. It is in the theoretical framework proposed that an uncertain signal will be perceived to be more risky and thus give rise to a muted announcement reaction and a price drift in the post-announcement period, at least following good news signals. The empirical investigation reveals that the announcement reaction to the GAAP earnings signal is much more muted than that of the core earnings signal. In addition, it is only the GAAP signal that gives rise to a significant post-announcement drift. It is further shown that buy-and-hold returns are unevenly distributed over the year. When a trading strategy is based on the core earnings signal, 40% of the total BHAR is attributed to the announcement period, whereas only 20% of the BHAR is attributed to this period when the strategy is based on the GAAP signal. Conclusively, the results are interpreted as if the GAAP earnings signal introduces more uncertainty to investors. It is argued that this uncertainty might be due to GAAP earnings encompassing items that prior research has shown more likely to be manipulated and/or to contain estimation error.

2.1 Introduction

Post-earnings announcement drift (PEAD) is the phenomenon where security prices following extreme positive earnings surprises continue to drift upwards and security prices following extreme negative earnings surprises continue to drift downwards. This pattern in stock returns was first documented for the US market (e.g., Ball and Brown, 1968; Jones and Litzenberger, 1970; Foster *et al.*, 1984; Bernard and Thomas, 1989 and 1990), but has also been found in other stock markets (e.g., Kallunki, 1996; Dische, 2002; Liu *et al.*, 2003; Forner *et al.*, 2009).[75] The drift in stock prices seemingly goes against the definition of efficient markets, where prices are assumed to adapt to new information in a timely and correct manner. As such, the empirical findings of a price drift have spurred a great deal of research.[76]

In this study a theoretical framework, linking PEAD to information uncertainty, is proposed. The framework highlights under what conditions the drift is compatible with information uncertainty as a priced risk factor. Information uncertainty is here defined as the extent to which accounting earnings map into economic earnings, where economic earnings are defined as the firm's "true" value creation for the period.[77] An important purpose of accounting earnings is to provide information to outsiders about the value creation of the firm for a certain time period. An accounting earnings number that perfectly captures the economic earnings would introduce no uncertainty to investors about the value creation of the firm. Such an earnings number, however, does not exist in reality. Accounting earnings are influenced by a number of measurement problems which may distort the depiction of economic earnings and thus introduce uncertainty to investors.

The purpose of this study is to investigate whether two measures of accounting earnings, *core earnings* and *GAAP earnings*, introduce different levels of uncertainty to investors with regard to the value creation of the firm.[78] Based on the theoretical framework it is proposed that the earnings measure introducing the highest uncertainty will be followed by a muted market reaction at the earnings announcement and then a drift in security prices as time passes.[79]

[75] See also the first paper of the dissertation.

[76] Note that if there is a drift in prices after the announcement, there will also be a drift in accumulated returns. PEAD has in prior research therefore been referred to as both a drift in prices and a drift in returns. In this paper I use both "price drift" and "return drift", as well as "price reaction" and "return reaction".

[77] Economic earnings are also referred to as "Hicksian income" following Hicks (1939). The concept of economic earnings is developed more extensively in Section 2.2.1. Using economic earnings as the benchmark for assessing earnings quality is proposed by Schipper and Vincent (2003).

[78] GAAP stands for Generally Accepted Accounting Principles.

[79] In the theoretical framework it is made clear that the prediction of returns following bad news signals is more complicated.

More specifically, the empirical investigation finds that a GAAP earnings signal (measured as GAAP earnings minus a time-series forecast of GAAP earnings) is followed by a lower initial reaction and a higher drift than a core earnings signal (measured as I/B/E/S actual earnings minus the I/B/E/S consensus forecast).[80] The empirical analyses are based on a Swedish sample of non-financial firms, quoted on the Stockholm Stock Exchange over the period 1994-2008. In a within-firm design, I find that the initial market reaction to the core earnings signal is more than six times higher than the reaction to the GAAP earnings signal. In addition, it is only the GAAP earnings signal that generates a significant post-earnings announcement drift over the twelve months following the announcement. On average, a trading strategy based on this signal generates a risk-adjusted return of about 1% per month (after controlling for expected return as measured by the three-factor model developed in Fama and French, 1993). The empirical results also reveal that it is the difference in earnings levels, and not the different forecasting models that drives the difference in returns between the GAAP and the core earnings signals. Additional tests show that the empirical results are robust to a number of different specifications (length of announcement window, portfolio size, inclusion of a momentum factor in the expected returns model, etc.). There are also indications of the drift being generated mostly on the long position, i.e. following good news signals.

I interpret the empirical results of this study as if GAAP earnings, compared to the core earnings measure, introduce more uncertainty to investors about the underlying value creation for the period. Faced with this uncertainty, risk averse investors react more mutedly to this signal at the announcement date. As time passes more information becomes available and, as the uncertainty or perceived risk is reduced, prices drift upwards, at least after good news signals.

It is argued in this study that the higher uncertainty introduced to investors by GAAP earnings can arise for the following reasons. First, going further down in the income statement the complexity of the accruals increases, leaving more room for estimation error and uncertainty (for example, it is typically harder to estimate restructuring costs than cost of goods sold). Second, by construction GAAP earnings can include items that have low or no value relevance (for example, effects of accounting changes) and that are thus not informative about the firm's value creation. In fact, analysts' use of the core earnings level is argued to be due to the possibility of excluding items that are not believed to be value relevant (Penman, 2009). Third, prior research has shown that earnings management is more prevalent in accruals, such as special items, that are included in GAAP earnings and often excluded from core earnings (e.g., Elliott and Hanna, 1996). Consequently, there might be a higher

[80] I/B/E/S stands for Institutional Broker's Estimates System and refers to the agency that collects and provides earnings forecasts.

probability of earnings manipulations within the GAAP earnings signal, introducing uncertainty to investors.

This study is related to the large financial accounting literature that investigates how financial market participants evaluate and react to different earnings levels in the income statement (e.g., Booth *et al*., 1997; Bradshaw and Sloan, 2002; Bhattacharya *et al*., 2003; Brown and Sivakumar, 2003). This line of research usually focuses on the short-term market reaction to different earnings signals, measuring the return reaction during a couple of days around the announcement day.[81] In contrast, the current study investigates *both* the announcement reaction and the prolonged reaction over the months following the announcement date, providing a more complete measurement of the returns associated with the different earnings signals.

The study is also related to prior research that investigates how the measurement of an earnings surprise affects the magnitude of the drift. Livnat and Mendenhall (2006) find that the drift is significantly higher when measuring the earnings surprise using analysts' forecasts and actual earnings form I/B/E/S, than when using a time-series model based on the Compustat earnings data.[82] In further tests they find that neither special items, nor Compustat restatements can explain the differences.[83] They conclude that the I/B/E/S measure is a more precise measure of an earnings surprise and therefore captures the mispricing better.

This study differs from Livnat and Mendenhall (2006) in two ways. First, I develop a framework to illustrate why the drift ought to differ between different measures of earnings surprise.[84] Second, I measure the drift over four quarters instead of only one quarter, since previous research has shown the drift to be longer in the Swedish market (see the first paper of the dissertation).[85]

Additionally, the study is related to prior studies that empirically have tried to measure the effect of information uncertainty on stock market reactions. These studies support the prediction that investors react mutedly to earnings signals that are perceived to be uncertain.[86] Imhoff and Lobo (1992) measure information uncertainty

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[81] In their study of the Finnish market, Booth et al. (1997) use an announcement window of ten days.

[82] This confirms the results in Doyle *et al*. (2006). They also use I/B/E/S data to define the earnings surprise. However, they do not explicitly compare the drift for different measures of earnings surprise.

[83] Compustat follows a policy of changing firms' recorded earnings numbers to reflect restated values (due to for example a merger or auditor actions).

[84] Richardson *et al*. (2010) in their review of accounting anomalies call for explicit hypotheses in future research of accounting anomalies, where "a research study should attempt to highlight the friction through which market prices do not incorporate this fundamental information in a timely fashion" (pp 420-421 in Richardson *et al*., 2010).

[85] Empirical studies of the US stock market have shown varying lengths of the drift, with the majority of the studies focusing on holding periods of 6 to 12 months.

[86] It is however not easy (at least for the good news) to distinguish whether this muted reaction is an effect of lower expected mean due to higher uncertainty (as described in Section 2.2.3) or due to investors demanding a compensation for risk (as described in Section 2.2.4).

with the variance in analysts' forecasts just prior to the announcement and find that the announcement reaction is lower for firms with high information uncertainty. In a similar vein Teoh and Wong (1993) find that the announcement reaction is lower for firms with auditors perceived to be less credible, which they argue introduce uncertainty to investors. Francis *et al.* (2007) confirm these results.[87] They find that the higher the uncertainty in the earnings signal, in terms of poorer *accruals quality*, the more muted is the announcement reaction. Similar to this study, they also investigate the returns in the post-announcement period and find that the drift is higher for firms reporting extreme earnings surprises with high information uncertainty.[88]

Assuming that information uncertainty is positively associated with investor opinion divergence around earnings announcements, the results of Garfinkel and Sokobin (2006) are also related to this study.[89] They show that the higher the opinion divergence among investors at the announcement, the higher is the drift in the post-announcement period. They argue that this drift is a compensation that risk averse investors demand for taking on the additional risk that opinion divergence introduce. Similarly, Dontoh *et al.* (2003) argue in their theoretical model that prices, due to non-information based trading, are noisy with respect to the fundamental values. Investors' inferences about fundamental values drawn from prices thus become less precise, increasing the total risk. Faced with this risk, risk averse investors demand less of these risky assets, which in turn dampens the stock price reaction around the announcement. Dontoh *et al.* (2003) argue that as information becomes increasingly available and the precision of the information increases, these investors will react more fully.

The remainder of this paper is structured as follows. The next section develops the theoretical foundations, linking information uncertainty to earnings signals and stock returns. Section 2.3 develops and motivates the research question. Section 2.4 defines the key variables and describes the sample in terms of data and descriptive statistics. In Section 2.5 I describe the test design and more specifically how the initial returns reaction and the returns in the post-announcement period are measured. Section 2.6 reports the empirical results, robustness checks and some extensions. In Section 2.7 some critical assumptions of the study are elaborated more in depth and in

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[87] Francis *et al.* (2007) use *accruals quality* (*AQ*) as a proxy for information uncertainty. Accruals quality is measured using the model by Dechow and Dichev (2002) which focuses on the mapping of the current accruals part of earnings into operating cash flows. The higher the mapping, the higher the earnings quality and the lower the information uncertainty of the earnings signal.

[88] In Francis *et al.* (2007) the prediction that high information uncertainty will lead to a drift in prices relies on a different theoretical framework than the one in this study. They base their return prediction on information uncertainty and rational learning, not on information uncertainty as a priced risk factor. This is further discussed in Section 2.8.

[89] Garfinkel and Sokobin (2006) measure opinion divergence as the unexplained trading volume around the announcement.

Section 2.8 some alternative interpretations of the results are discussed. Section 2.9 concludes the paper.

2.2 Theoretical background

This section is divided into four subsections where the first (2.2.1) describes the underlying link between the firm's value creation and stock return, the second (2.2.2) introduces the concept of earnings signals, the third (2.2.3) discusses how information uncertainty in these signals influences the stock market reaction at the announcement date, and the fourth (2.2.4) discusses how information uncertainty as a priced risk factor influences the stock market reaction, both at the announcement date and in the post-announcement period.

2.2.1 Value creation and stock return

In firms there is a continuous process of value creation. This value will ultimately go to the owners of the firm, the shareholders, as a return to the initial investment that they made when buying the firm's shares. Shareholders receive information about this value creation through the accounting system where the value created is allocated to periods (usually quarters and years).

Different accounting systems have different principles for valuing assets and liabilities and hence give rise to different earnings numbers as metrics of value creation. However, we could think of a theoretical earnings number that perfectly captures the value creation of the previous period and call this "economic earnings" (e.g., Ohlson, 2009). This earnings number would then be equivalent to the return (in absolute terms) on the shareholder's investment for the period.

Ohlson (2009) shows this formally within the framework of PVED (Present Value of Expected Dividends). Assuming a clean surplus relation (CSR) and perfect mark-to-market accounting, current economic earnings are equal to the change in value (price) adjusted for dividends as expressed in (2.1).

$$EcEAR_{i,t} = \Delta b_{i,t} + d_{i,t} = \Delta P_{i,t} + d_t \tag{2.1}$$

where:

$EcEAR_{i,t} =$	economic earnings for firm *i* accrued in period *t*,
$b_{i,t} =$	book value of equity for firm *i* at time *t*,
$d_{i,t} =$	dividends for firm *i* at time *t*,
$P_{i,t} =$	price of firm *i* 's share at time *t*.

Ohlson (2009) also proposes that the economic earnings satisfy the following dynamic:

$$EcEAR_{i,t+1} = r_{i,t} \times b_{i,t} + \varepsilon_{i,t+1} \tag{2.2}$$

where:

$r_{i,t} =$	required rate of return (or cost of equity capital) for firm *i* over the period *t*,
$\varepsilon_{i,t+1} =$	zero mean disturbance term for firm *i*, expressing uncertainty about the value creation.

The forecast of next period's economic earnings is thus the required rate of return times the period's beginning book value of equity or price (since they are assumed to be equal).

Assuming that stock markets are efficient in such a way that underlying value changes are transferred into equivalent price changes in the stock market, then; 1) economic earnings are equal to the stock return (cum dividend) for the same period and 2) the expectation on economic earnings is always equal to the expected stock return for that period.

It can further be assumed that shareholders at the announcement of the quarterly report (the event) get information about the economic earnings of the preceding quarter (*q*), and thus the return to their investment for the same quarter.[90] Consequently there should, at the earnings announcement event, be a price reaction in the stock market that mirrors this return.[91]

Three things must be considered when relating the stock market's announcement reaction to the economic earnings. First, the stock market reaction is measured in relative terms. The return defined in expression (2.1) is therefore set in relation to the price before the event (*pre event*) to yield the *rate of return*. Second, it is only the unexpected part of the economic earnings that will give rise to a stock market reaction, since the expected part is already impounded into stock prices. The stock market reaction at the announcement is consequently the unexpected rate of return, equal to the unexpected economic earnings (in relation to the stock price prior to the event).[92]

Third, expectations are formed just prior to the event, which is typically sometime after the quarter *q* has ended. This impacts the expectations on economic

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[90] The time index *t* is thus replaced with *q* below.

[91] It is assumed that the cost of equity capital is constant, i.e. both the risk-free interest rate and the risk attitudes of investors are constant.

[92] For simplicity, rate of return is in this paper often referred to as just "return", but is still considered to be a percentage number.

earnings. As defined in expression (2.2), the expectations on economic earnings in the beginning of quarter q are equal to the required rate of return times the stock price before the quarter q that generates the economic earnings. However, the stock return at the announcement date of economic earnings will reflect the expectations that are prevalent just before the announcement, and not the expectations at the beginning of quarter q. The expectation just before the announcement thus has to be discounted back to the beginning of quarter q, so that it really expresses the unexpected economic earnings of that quarter.

Expression (2.3) describes the expectations on economic earnings in relation to the price just prior to the announcement event (*pre event*). It is here assumed that the economic earnings are announced just after quarter q has ended, so that the expectations can be discounted back one quarter with the quarterly required rate of return.

$$Exp_{pre}\left[EcEAR_{i,q}\right] = \frac{P_{i,pre}}{1 + r_q} \times r_q \tag{2.3}$$

To summarize, expression (2.4) below defines the stock market reaction (unexpected rate of return) for share i at the time of the announcement of unexpected economic earnings, where the expected economic earnings are defined in expression (2.3).

$$R_{i,event} - Exp_{pre}\left[R_{i,event}\right] = \frac{\left(EcEAR_{i,q} - Exp_{pre}\left[EcEAR_{i,q}\right]\right)}{P_{i,pre}} \tag{2.4}$$

where:

$R_{i,event} =$ stock return for firm i around the announcement event,[93]
$Exp_{pre}\left[R_{i,event}\right] =$ pre event expectations on firm i's stock return around the announcement event,
$P_{i,pre} =$ price of firm i's share before the announcement event,
$EcEAR_{i,q} =$ economic earnings for firm i and quarter q, which are announced at the announcement event,
$Exp_{pre}\left[EcEAR_{i,q}\right] =$ pre event expectations on firm i's economic earnings for quarter q.

[93] The event window could be of different lengths which will be discussed further in the empirical sections.

It is from expression (2.4) obvious that with this definition of economic earnings, the economic earnings are *all* of the stock return (and unexpected economic earnings are equal to unexpected stock return). There is no capital gain in excess of the change in price cum economic earnings. This is due to the fact that economic earnings are exhaustive in nature, i.e. they do not change the expectations about future economic earnings.

2.2.2 Unexpected earnings – a signal of value creation

Above it was clear that the announcement of unexpected economic earnings should give rise to an equivalent return reaction in the stock market. However, economic earnings is a theoretical concept and not available in the accounting reports. What are available to shareholders though, are accounting measures that can act as signals of the underlying value creation. The most common signal and the focus in most stock markets is earnings from the income statement (or earnings per share, EPS). And since it is the stock market reaction to this signal that is interesting, it is really the *unexpected earnings* (UE) that are in focus.[94]

In general an unexpected earnings signal, referred to as the UE signal, is the difference between reported earnings in the income statement and the same earnings expected by the market before the announcement. This is defined more formally in (2.5):

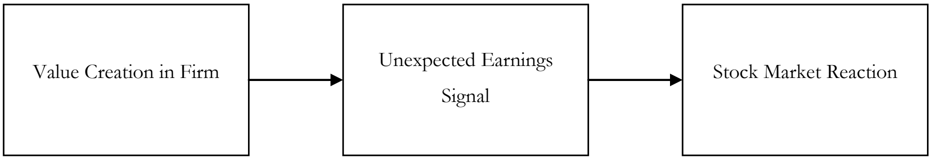
$$UE_{i,q} = EPS_{i,q} - E\left[EPS_{i,q}\right] \tag{2.5}$$

where EPS is earnings per share for quarter q for firm i, and E[EPS] the expected EPS for the same firm and for the same quarter.

Since the economic earnings are not available, investors instead have to make investment decisions based on the available UE signals. Figure 2.1 aims at illustrating how the stock price reaction is really a reaction to the unexpected earnings signal and not the "true" value creation.

[94] For simplicity, I sometimes suppress "unexpected" both referring to economic earnings, earnings and return.

Figure 2.1. Value creation, unexpected earnings signal and stock market reaction



With the help of the signal, investors hope to separate "good news" firms from "bad news" firms (firms with good and poor economic earnings). If the UE signal is perfectly correlated with the unexpected economic earnings, the stock market reaction would be equal to the unexpected economic earnings (as defined in expression (2.4)). However, typically the correlation between the signal and the value creation is not perfect. Different earnings signals might also vary in their ability to signal the true value creation, which is the focus of this study.[95] This imperfect correlation between the UE signal and the unexpected economic earnings will have effects on the stock market reaction, so that the unexpected return now deviates from the unexpected economic earnings. In the next section it is illustrated how information uncertainty in the earnings signal can influence the stock market reaction. This illustration will be done with numerical examples within the theoretical concept of information structures.[96] The examples serve to illustrate how an average Bayesian-rational investor incorporates uncertainty in his/her reaction to earnings signals.

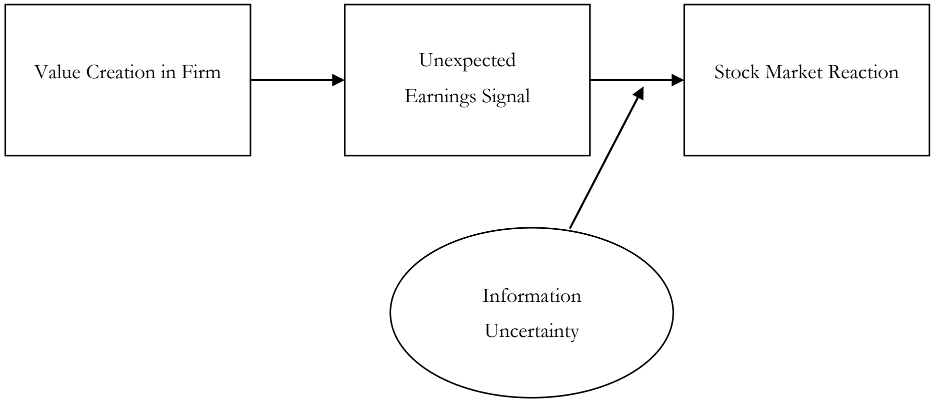
2.2.3 Information uncertainty in the unexpected earnings signal

The previous section discussed how the stock market reaction is really a reaction to UE signals, since the economic earnings are not readily available to investors. This section discusses how information uncertainty in the UE signal can influence the stock market reaction (simply illustrated in Figure 2.2). Information uncertainty is here defined as the extent to which the unexpected earnings signal introduces uncertainty to investors about the underlying unexpected economic earnings.

[95] I study the variation in signaling ability between UE signals from different earnings levels in the income statement and different expectations models. However, one can also think of studying the variation in signaling ability between UE signals from different accounting systems.

[96] For another application within the field of financial accounting, namely bankruptcy prediction, see Skogsvik (1988).

Figure 2.2. Value creation, unexpected earnings signal, stock market reaction and information uncertainty



The relation between the unexpected economic earnings and the unexpected earnings signal can be described through a so-called information structure. First, looking at the definition of the UE signal in (2.5), there could be an infinite number of possible UE signals. The same holds for unexpected economic earnings. In order not to get an infinitely large information structure, the UE signals and economic earnings are divided into three categories each.

The UE signals are categorized into "good news", "no news" and "bad news".[97] Good news is a signal where the reported earnings exceed the expectations, no news is a signal where the reported earnings equal the expectations and bad news is an earnings signal where the reported earnings are lower than the expectations. Equivalently, the unexpected economic earnings are placed into three categories; positive, zero and negative unexpected economic earnings respectively.

Before introducing uncertainty, an information structure with no information uncertainty is set up. In such a structure, investors have complete faith in the UE signal being perfectly correlated with the underlying value creation. In Table 2.1 below, a numerical example of such an information structure is presented.

[97] In a PEAD strategy it is common to use ten categories or portfolios of earnings signals.

Table 2.1. Information structure A: No information uncertainty

		Unexpected earnings signal (UE signal)		
		Good news	No news	Bad news
Underlying state of unexpected economic earnings	A priori probability	Ear > E[Ear]	Ear = E[Ear]	Ear < E[Ear]
25 %	0.20	1	0	0
0 %	0.60	0	1	0
-25 %	0.20	0	0	1

The information structure is filled with conditional probabilities that describe the relationship between the underlying state, i.e. the unexpected economic earnings, and the UE signal. Given some underlying state, it denotes the probability that a certain UE signal will be observed. In this example; if investors have perfect faith in the earnings signal, the conditional probability (given an underlying state of positive unexpected economic earnings) for a good news signal will be one. Equally, investors would estimate a zero probability that, given this underlying state, a bad news signal would be observed.

In this numerical example the possible outcomes of the value creation (the underlying states) are categorized into three categories of unexpected economic earnings, +25%, 0%, and -25%. The positive outcome of 25% means that the value creation in terms of economic earnings is 25% after adjusting for the expectations of economic earnings. As discussed previously, the true underlying state is not possible to observe; investors can only have a probabilistic belief about the possible distribution of value creation over the population of firms. These a priori probabilities of the underlying value creation are dependent on investors' perceptions of the overall economic conditions. In this information structure the a priori probabilities are arbitrarily set to 0.20, 0.60 and 0.20 respectively. The bulk of the probability is set on 0% in unexpected economic earnings, which means that a priori investors believe that the economic earnings will be in line with expected economic earnings.

In Information Structure A (Table 2.1) investors have complete faith in the earnings signal; the conditional probabilities are thus, given an underlying state of +25%, 1 for good news, 0 for no news and 0 for bad news. That is, when investors observe a signal, there is no uncertainty that this signal captures the true underlying state.

Assuming that Information Structure A captures the beliefs of investors around an earnings announcement, this information structure can be used to calculate the expected market reaction to a certain earnings signal. Using the conditional probabilities in the information structure, the market reaction to a good news signal (s) is:

$$E["reaction"|s = goodnews] = 25\% \times \frac{0.20\times1}{0.20\times1+0.60\times0+0.20\times0} + 0\% \times \frac{0.60\times0}{0.20} + (-25\%) \times \frac{0.20\times0}{0.20} = 25\%$$

That is, the stock market reaction (25%) is equal to the unexpected economic earnings, just as in expression (2.4). The numerical example above is simply introducing the possibility of different outcomes of unexpected economic earnings and different probabilities to each outcome.

As discussed in Section 2.2.2, a perfect correlation between unexpected economic earnings and the UE signal is not plausible. There is most likely some uncertainty about how well the observed signal depicts the underlying value creation. The conditional probabilities in Information Structure B in Table 2.2 below reflect this uncertainty.[98]

Table 2.2. Information structure B: High information uncertainty

		Unexpected earnings signal		
		Good news	No news	Bad news
Underlying state of unexpected economic earnings	A priori probability	Ear > E[Ear]	Ear = E[Ear]	Ear < E[Ear]
25 %	0.20	0.60	0.30	0.10
0 %	0.60	0.20	0.60	0.20
-25 %	0.20	0.10	0.30	0.60

In Information Structure B the conditional probabilities are more evenly distributed over the different categories of UE signals. Given an underlying state of 25% in unexpected economic earnings, the probability of observing a good news signal is 0.60, a no news signal is 0.30 and a bad new signal is 0.10. That is, in one out of ten times, investors expect to observe a bad news signal even though the true value creation is 25% in unexpected economic earnings.

With information structure B, the expected price reaction if the signal "good news" is observed, is:

$$E["reaction"|s = goodnews] = 25\% \times \frac{0.20\times0.60}{0.20\times0.60+0.60\times0.20+0.20\times0.10} + 0\% \times \frac{0.60\times0.20}{0.26} + (-25\%) \times \frac{0.20\times0.10}{0.26} = 9.62\%$$

[98] I label this information structure as having high information uncertainty. However, information uncertainty is of course always in relative terms.

The expected price reaction if the signal (*s*) "no news" is observed is:

$$E["reaction"|s = nonews] = 25\% \times \frac{0.20 \times 0.30}{0.48} + 0\% \times \frac{0.60 \times 0.60}{0.48} + (-25\%) \times \frac{0.20 \times 0.30}{0.48} = 0\%$$

The expected price reaction if the signal (*s*) "bad news" is observed is:

$$E["reaction"|s = badnews] = 25\% \times \frac{0.20 \times 0.10}{0.26} + 0\% \times \frac{0.60 \times 0.20}{0.26} + (-25\%) \times \frac{0.20 \times 0.60}{0.26} =$$

$$-9.62\%$$

The example above illustrates that even though the underlying state of unexpected economic earnings is at the most +25% and at the least -25%, the expected market reaction to an observed good news signal is +9.62%, and -9.62% for an observed bad news signal. Since there is uncertainty whether the earnings signal really captures the underlying true state there is a muted reaction to the earnings announcement.

Now consider Information Structure C in Table 2.3 where the conditional probabilities are more clear-cut in their distribution across the signals (the underlying states and their a priori probabilities have not changed). This information structure expresses less information uncertainty as compared to Information Structure B. Accordingly there is a stronger reaction to the observed signals.

Table 2.3. Information structure C: Low information uncertainty

		Unexpected earnings signal		
		Good news	No news	Bad news
Underlying state of unexpected economic earnings	A priori probability	Ear > E[Ear]	Ear = E[Ear]	Ear < E[Ear]
25 %	0.20	0.80	0.20	0
0 %	0.60	0.10	0.80	0.10
-25 %	0.20	0	0.20	0.80

If this information structure mirrors the beliefs of investors at the time of the earnings announcement, it gives the following market reactions; +18.18% for an observed good news signal, 0% for an observed no news signal, and -18.18% for an observed bad news signal.[99] Compared to the more "blurry" Information Structure B above,

[99] $E["reaction"|s = goodnews] = 25\% \times \frac{0.20 \times 0.80}{0.20 \times 0.80 + 0.60 \times 0.10 + 0.20 \times 0} + 0\% \times \frac{0.60 \times 0.10}{0.22} + (-25\%) \times \frac{0.20 \times 0}{0.22} = 18.18\%$

Information Structure C thus gives a more pronounced market reaction at the announcement of the earnings signal.

The comparison between the information structures B and C illustrates the difference in expected market reaction at the announcement date for two different UE signals with varying information uncertainty (different information structures). The uncertainty relates to how reliable the earnings are perceived to be as a signal of the underlying value creation.

2.2.4 Information uncertainty as a priced risk factor

The above examples illustrate that the price reaction to an uncertain signal will be muted because the conditional probabilities generate a lower expected mean for an uncertain signal compared to a certain signal. It was not considered that investors might perceive uncertain signals to be more risky and thus demand a compensation for that risk. This additional dimension will be considered in this section.

Information uncertainty is both in theoretical and empirical research suggested to be a risk factor that risk averse investors would like compensation for (e.g., Brown *et al.*, 1988; Easley and O'Hara, 2004; Francis *et al.*, 2004 and 2005; Lambert *et al.*, 2011). Assuming that investors are risk averse, this would impact the market reactions to the earnings signals from information structures B and C, not only in the announcement period but also in the post-announcement period.

Brown *et al.* (1988) illustrate how security prices are affected by information uncertainty if investors are risk averse. They show that a positive signal, perceived by investors to be risky, seemingly will be followed by an initial underreaction and then a price drift upwards as the risk resolves, if not controlling for this risk factor in the expected returns model.[100] In other words, at the news announcement, risk averse investors price the stock so that it would yield a higher expected rate of return to compensate for the increase in systematic risk (see Brown *et al.* 1988, p 357). It follows from this reasoning that, if investors are risk averse, the announcement reaction to a good news signal from Information Structure B will be somewhat lower than 9.62%. As an example, assume that the initial reaction is 8%. Then, if the risk resolves in the post-announcement period, prices will drift upwards, eventually generating a return of 9.62%. The difference (9.62%-8%=1.62%) will thus be the compensation for the risk averse investor. Note that if there is no revelation of risk in the post-announcement period, there will be no price drift.

[100] Subsequent to the earnings announcement more information is available to the stock market, either from the firm or from other market participants (e.g., analysts and other financial information intermediaries). This information can help investors interpret and learn more about the original earnings signal. As such, the initial uncertainty and risk that investors experience at the announcement will, at least partially, resolve over time.

Comparing the information structures B and C, it is noticeable that the spread of possible outcomes (the variance) for a good news signal is larger in Information Structure B that has higher information uncertainty. Risk averse investors would thus consider a good news signal from this information structure to be more risky, demanding higher risk compensation. The price reaction at the announcement date will thus be lower for a good news signal from Information Structure B due to two effects, a lower expected mean *and* a higher variance (higher risk).[101] It also follows that the good news signal from the more risky Information Structure B is followed by a higher price drift in the post-announcement period, assuming the risk is resolved when more information becomes available.

The return prediction after bad news signals is less straight-forward. If investors are risk averse, negative signals perceived to be risky will seemingly be followed by an "overreaction" with a large drop in prices at the announcement date and then a price drift upwards as the risk resolves (Brown *et al.*, 1988). Thus, all things equal, a risky bad news signal will have a more pronounced initial reaction than a bad news signal that is perceived to be less risky. Given that Information Structure B, compared to Information Structure C, is perceived by investors to be more uncertain (generating a lower expected mean) *and* more risky in terms of a higher variance in expected outcomes, it is hard to say which bad news signal would generate the highest initial price reaction. The lower expected mean for a signal from Information Structure B will lead to a muted initial reaction (illustrated in Section 2.2.3), whereas the perceived higher risk will generate a more pronounced reaction. It is difficult to say which effect would dominate the other. Accordingly, adding the dimension of information risk, it is not obvious anymore that a bad news signal of high uncertainty, compared to a signal of low uncertainty, will have a more muted price reaction at the announcement date. However, equivalent to the good news signal, if information risk is priced by investors it is the signal of higher uncertainty that will yield the highest drift in prices in the post-announcement period.

[101] One could think of an information structure that for a certain signal leads to the same expected mean, but where the variance is higher. Then a lower announcement reaction will only be an effect of information uncertainty being perceived as a priced risk factor.

Within the framework proposed above, assuming information risk is a priced risk factor,[102] the predictions for market reactions to uncertain earnings signals can be summarized as:

Good news signals perceived to be uncertain will be followed by a muted price reaction at the announcement date and a price drift upwards in the post-announcement period. The higher the perceived uncertainty, the more pronounced is the drift in the post-announcement period.

Bad news signals perceived to be uncertain will be followed by an ambiguous price reaction at the announcement date and a price drift upwards in the post-announcement period. The higher the perceived uncertainty, the more pronounced is the drift in the post-announcement period.

Thus, it is within this framework predicted that *both* negative and positive signals will have positive returns in the post-announcement period. This is not consistent with the empirical PEAD studies that report a drift upwards after good new signals and a drift downwards after bad news signals, and could thus be considered a limitation of the proposed framework. However, in some prior studies there are indications of the PEAD returns being generated almost solely by the long positions (e.g., Forner *et al.*, 2009).[103]

Additionally, it might be argued that the upward drift after bad news signals is not a very robust returns prediction. First, I discuss in detail in Section 2.7 that there are circumstances where the information risk framework is consistent also with a downward drift after bad news, for example considering clientele effects. Second, it is important to acknowledge that we do not really know the driving forces behind the drift, and the proposed framework can only be considered a partial explanation. There are other theoretical frameworks, related to the post-announcement drift, that predict an upward drift after good news signals and a downward drift after bad news signals. These alternative explanations are discussed in Section 2.8. If multiple forces are generating the drift (i.e. information risk *and* some alternative explanation), then the drift after a good news signal will be magnified. After bad news signals, however, these forces might work in opposite directions.[104] In essence, the return prediction after bad news signals is ambiguous, *both* at the announcement and in the post-announcement period.

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[102] Assuming that this risk resolves in the post-announcement period.

[103] The first paper of the dissertation also reports that the drift on the short position is negligible. Implementing a trading strategy based on ROE on a Swedish sample of firms, Skogsvik and Skogsvik (2010) also find a positive return on the short position.

[104] Francis *et al*. (2007) also make a note of this and try to control for the expected return effect of information uncertainty by including an AQ factor as a fourth factor in the expected returns model. The drift on both the long and the short positions are still significant.

2.3 Research question and motivation

The purpose of this paper is to study two different earnings signals, based on different levels in the income statement, and the extent to which these signals introduce uncertainty to investors regarding the underlying value creation. The focus is here on bottom-line GAAP earnings and so-called core earnings. GAAP earnings are defined by accounting rules and readily available in all income statements. Core earnings are not defined by accounting standards and rules, and are thus more complicated to specify. It is often described as an earnings number that is higher up in the income statement and supposedly excludes transitory and value-irrelevant items.[105] For the purpose of this study, core earnings are measured with financial analysts' measure of this earnings level. The reason is that this measure is more readily available than the firms' measure of core earnings (often labeled pro forma earnings). Analysts report their forecasts of core earnings to analyst agencies (i.e. I/B/E/S, Reuters, Bloomberg and similar agencies) and then these agencies provide a reported earnings number that matches exactly the consensus analyst forecast, i.e. it includes exactly the same inclusions/exclusions from GAAP earnings as the earnings forecast.[106] In this study this earnings signal will be labeled either core earnings or I/B/E/S earnings (since the data is collected from I/B/E/S).

We do not know exactly which exclusions analysts make from GAAP earnings to arrive at core earnings. The exclusions might differ between industries (i.e. an item can be considered to be transitory in one industry and not in another). It is nevertheless common to assume that analysts exclude so-called special items and certain other items (Doyle *et al.*, 2003; McVay, 2006; Kolev *et al.*, 2008).[107] Bradshaw and Sloan (2002) list the following items as common exclusions; restructuring charges, write-downs and impairments, R&D expenditures, M&A costs, mandatory stock compensation expense and goodwill amortization. These items are examples of potential differences between the GAAP and the core earnings level under investigation in this study.

The research question of this study is related to a strand of accounting literature which focuses on different earnings signals in the income statement. This research, which has evolved over the last decades, is motivated by the findings that GAAP

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[105] There are several labels to core earnings, for example sustainable earnings (Penman, 2009), persistent earnings (Ohlson, 1999), pro forma earnings and "street earnings". Pro forma earnings are often used as the name for core earnings when disclosed by firms in their earnings announcements (e.g., Lougee and Marquardt, 2004). "Street" (i.e. Wall Street) earnings are the core earnings as defined by analysts who in their earnings forecast try to give an estimate of future core earnings. These numbers are not necessarily the same, but they are all supposed to be some kind of core earnings.

[106] This is a caveat of my empirical study since I cannot separate between for example the uncertainty effects of different levels in the income statement, and the effect of analysts making biased inclusions/exclusions.

[107] In Swedish special items are labeled "jämförelsestörande poster", i.e. items affecting comparability.

earnings over time appear to have lost some value relevance (Collins *et al.*, 1997; Francis and Schipper, 1999). The development is also stimulated by firms more frequently reporting and highlighting other earnings numbers than bottom-line GAAP earnings in their quarterly reports. A general result in this literature is that earnings higher up in the income statement typically are perceived by investors as being more value relevant (Bradshaw and Sloan, 2002; Bhattacharya *et al.*, 2003; Brown and Sivakumar, 2003). Bradshaw and Sloan (2002) find that when regressing the announcement return on I/B/E/S and GAAP earnings signals, the *earnings response coefficient* (ERC) is significantly higher for the I/B/E/S earnings signal.[108] In addition they find that the difference between the two signals has increased over time (both in terms of ERC and explained variation, R^2). Bradshaw and Sloan (2002) interpret these results as an indication of investors having shifted their focus to core earnings over time.

There is no previous research that elaborates how different earnings levels differ in their depiction of economic earnings, and how that can introduce varying levels of uncertainty to investors. It is however important to investigate also this dimension of earnings, since any stock market reaction is a joint effect of how investors perceive both the relevance *and* the reliability of accounting numbers (Schipper and Vincent, 2003). In this sense, information uncertainty can be translated into how reliable investors perceive a signal to be.

There are a number of reasons why GAAP earnings might introduce higher uncertainty to investors than core earnings. First, going further down in the income statement, the complexity of the accruals increases, leaving room for estimation error (e.g., it is harder to estimate restructuring costs than for example costs of goods sold). Second, by construction GAAP earnings might include items that are not value relevant (for example effects of accounting changes) and thus not informative about the firm's value creation. In fact, the very reason for analysts to use the core earnings level is to exclude items that they believe are not value relevant (Penman, 2009). Third, prior research has shown that earnings management is more prevalent in the accruals that are included in GAAP earnings and typically excluded from core earnings (Elliott and Hanna, 1996). One example is the overstatement of restructuring charges (taking a "big bath") in order to boost earnings in future periods. Another example can be found in Jones (1991), where it is reported that some firms understate their earnings for political reasons. It can thus be argued that there is a higher probability of earnings manipulation within the GAAP earnings framework, introducing uncertainty to investors.

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[108] Bradshaw and Sloan (2002) label this signal "street earnings", but also use I/B/E/S as their data source. When discussing their results I use my label, "I/B/E/S earnings".

However, there are also findings in previous research that can be interpreted as if also *core earnings* introduce uncertainty to investors. First, it has been found that firms might use the core earnings level to mislead the market. More often firms tend to classify a positive income number as part of core earnings than a negative number (McVay, 2006). This way to manage the core earnings usually has the objective to meet or beat an earnings benchmark (e.g., Lougee and Marquardt, 2004; Bhattacharya *et al.*, 2003; Doyle and Soliman, 2005). Consistent with firms classifying core operating expenses as non-recurring, Doyle *et al.* (2003) find that such expenses have predictive ability for future earnings and cash flows, i.e. they are in fact recurring items. That is, if analysts do not see through this type of disclosure management, their measure of core earnings will also be biased. An additional source of bias is that analysts themselves might provide upward biased forecasts in order to secure access to more private information from firm management (e.g., Francis and Philbrick, 1993).

Previous research can hence be interpreted as if both GAAP earnings and core earnings might introduce information uncertainty to investors. Consequently, no explicit hypothesis regarding which earnings level introduces the highest information uncertainty is formulated. This is considered to be an empirical question and thus the focus of this study:

Do GAAP and core earnings levels introduce different levels of uncertainty, concerning the underlying value creation for the period, to stock market investors?

In line with the theoretical framework outlined in Section 2.2, the earnings level that is associated with the highest uncertainty should for good news be followed by a more muted announcement reaction and a more pronounced drift in the post-announcement period. For bad news signals, the return predictions regarding both the announcement reaction and the post-announcement drift are not clear.

2.4 Definitions, sample, data and descriptive statistics

In this section the empirical measures of the earnings signals are defined, the sample and data sources are described, and some descriptive statistics are reported.

2.4.1 Definition of earnings signals

I focus on two earnings signals in this study; the I/B/E/S earnings signal (core earnings) and the GAAP earnings signal. It was argued in Section 2.2 that it is only the unexpected part of earnings that should generate a price reaction. Thus, all earnings signals comprise two parts: reported earnings and the market's expectation of these earnings. The difference between reported and expected earnings is sometimes referred to as the earnings surprise and depending on whether this difference is positive, zero or negative, it will be interpreted as a signal of good news, no news and bad news, respectively.

I define the I/B/E/S earnings signal as the I/B/E/S actual earnings minus the consensus analyst forecast:

$$UE\_1_{i,q} = \frac{EPS_{IBES,i,q} - ConsensusEPSforecast_{i,q}}{P_{i,q-1}} \tag{2.6}$$

where UE stands for unexpected earnings.[109] I scale all unexpected earnings by the firm's stock price in order to take care of size differences and alleviate the problem of heteroskedasticity.[110]

EPS_{IBES} is the actual earnings per share that match the earnings measure that analysts have forecasted. This figure is provided by the analyst agency (I/B/E/S) which ensures that the earnings number has the same inclusions/exclusions as the analyst forecast. The consensus EPS forecast is the median of analysts' earnings forecasts for the firm. Whether this is a good proxy for the market's expectation of earnings is an empirical question, occupying a large body of research that studies the forecasting ability of financial analysts. Nevertheless, this measure of unexpected earnings is probably the most common in contemporary financial accounting research.

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[109] All earnings signals are defined on a per share basis.

[110] The price of the share is taken from the last day of the preceding quarter (e.g., Ramnath *et al.,* 2005; Livnat and Mendenhall, 2006; Francis *et al.,* 2007).

A classic measure of earnings surprise is the GAAP earnings signal, i.e. reported GAAP earnings minus GAAP earnings four quarters ago, scaled by price:

$$UE\_2_{i,q} = \frac{EPS_{GAAP,i,q} - EPS_{GAAP,i,q-4}}{P_{i,q-1}} \tag{2.7}$$

where $EPS_{GAAP,i,q}$ is bottom-line earnings, before extraordinary items and discontinued operations, for firm *i* in quarter *q*, according to Swedish GAAP. The expected earnings are here assumed to follow a seasonal random walk. This is a very simple model of earnings innovation, but research has shown that it appear to work as well as more complicated time-series models (e.g., Foster, 1977; Brown and Rozeff, 1979; Bernard and Thomas, 1989).[111]

The problem with the above definitions of the I/B/E/S and GAAP earnings signals is that they differ both in their measures of reported earnings and in their expectation models of earnings. To be able to draw more specific conclusions on what might drive any return differences, I have to control for this. Compared to a time-series forecast, the analyst consensus forecast is likely to be a better proxy for the market's expectations of earnings (e.g., Brown and Rozeff, 1978; Givoly and Lakonishok, 1984; Liljeblom, 1989). Brown *et al.* (1987) show that this superiority of analyst forecasts is due to both a timing advantage (more recent information can be used) and a contemporaneous advantage (more information can be incorporated).

One way to control for the differences in the expectation models is simply to use the consensus forecast as a proxy for earnings expectations also for the GAAP earnings signal. I have chosen not to do so, since previous research has shown that to get a good measure of earnings surprise it is important to use the same type of earnings measure (Philbrick and Ricks, 1991; Ramnath *et al.*, 2005).

Instead I have defined a third earnings signal which is a combination of the other two. This signal comprises the I/B/E/S reported earnings (same as UE_1), but is instead matched to a time-series forecast of I/B/E/S earnings (as in UE_2) equal to the reported I/B/E/S earnings four quarters ago, i.e.:

[111] This measure of unexpected earnings is sometimes scaled by the standard deviation of the forecast error and is then called "standardized unexpected earnings" or SUE (e.g. Bernard and Thomas, 1989). I do not want to use this deflator since it might wash away some of the uncertainty of the earnings signal and thus make it less comparable to the core earnings signal.

$$UE\_3_{i,q} = \frac{EPS_{IBES,i,q} - EPS_{IBES,i,q-4}}{P_{i,q-1}} \tag{2.8}$$

If this signal is equal to the GAAP earning signal (UE_2), in terms of initial reaction and drift, then any difference between the I/B/E/S and the GAAP signal is related to the expectations model, and not to the earnings measure.

2.4.2 Sample

The sample consists of 790 firm-quarter observations from 61 firms listed on the Nasdaq OMX Stockholm Exchange (previously Stockholmsbörsen) during the time period January 2004 to September 2008. In the beginning of this period only firms that were listed on the major list (the so-called A-list) have been included in the sample. Subsequent to the list changes on October 2, 2006, firms listed on Large Cap (but not previously on the A-list) have been included in the sample.[112] As a consequence, 16 companies have been added to the sample as of October 2, 2006.

Financial companies have been excluded in order to increase the comparability with previous studies. Firms with a reporting year other than the calendar year have also been excluded, as a matter of convenience in the test design. There is no reason to believe that the choice to exclude these observations has biased the sample selection.

The sample of companies is limited with regard to the time period and to the cross-section. The limited time period is mainly due to the fact that quarterly analyst forecasts are not available for Swedish firms prior to 2004. The limited cross-section (61 firms) is also due to data availability. The quarterly accounting information that was acquired for this study only covers the firms on the major lists. However, these firms make up a large part of the Swedish equity market. In 2005, 52 out of a total of 269 listed firms were listed on the A-list and their market value was approximately 80% of the total market value.

2.4.3 Data

Two main sources for the accounting data have been used in this study; I/B/E/S (Institutional Brokers' Estimate System) and SIX (Scandinavian Information Exchange). The I/B/E/S database, which is provided by Thomson Reuters, is an established data provider for both financial markets and academia. Generally the data for the UE_1 signal has been collected from I/B/E/S.

[112] These changes implied that the "A-list" and "O-list" were merged and divided into "Large Cap", "Medium Cap" and "Small Cap".

The GAAP earnings signal, UE_2, is based on accounting data provided by SIX, a Swedish company that sells financial information to financial market participants. The acquired data was in the form of 3-, 6-, 9- and 12-month reports, which subsequently has been converted into quarterly accounting numbers. Financial statements have been converted to SEK with the exchange rate from the last date of the reporting period.[113]

- Reported quarterly earnings are collected from the two data sources described above. EPS_{GAAP} comes from the SIX database and EPS_{IBES} comes from the I/B/E/S database.
- The dates of the quarterly earnings announcement have been provided by SIX.
- Analyst forecasts on EPS have been provided by I/B/E/S. I use the median EPS forecast three days prior to the earnings announcement date.[114, 115] The forecast one day before the announcement date is not used in order to limit any effects on the forecast, in case the data on the announcement date is wrong.
- The Datastream Return Index has been used to measure the return to each firm. The Datastream Return Index is constructed out of capitalization-adjusted closing prices and gross dividends.
- The return on a Swedish 1-month treasury bill has been used as a proxy for the risk-free rate. This data has been obtained from the EcoWIN database.
- The Morgan Stanley Sweden Index (MSCI) from Datastream has been used as a proxy for the overall market return during the sample period.
- Information about the number of shares outstanding for each firm was found to be of low quality in the standard databases. I have therefore collected this information from the periodical Börsguiden which reports yearly facts about listed companies. As a consequence, I only have the number of shares for each firm as of December 31. Market capitalization (*market cap*) has been calculated as the number of shares times the price of the share. If a company has dual-class shares, each class of shares has been weighted with the price of that class of shares. Quarterly observations of *market cap* have been calculated as the number of shares (as of December 31) times the price of the share at the last day of the quarter. This procedure is not valid if there have been splits, new issues or share repurchases during the year. In order to avoid problems with

[113] Exchange rates have been obtained from the database EcoWIN.

[114] In this sample there is only a small difference between the mean and the median forecast, which is an effect of the small number of analysts following each firm.

[115] I have also studied forecasts from 40 days prior to the announcement date, but the mean of these forecasts is not significantly different from the one three days prior to the announcement. I conclude that there is in my sample no signs of the so-called "expectations path" where earnings forecasts tend to decrease (become more pessimistic) as the announcement day approaches (e.g., Bartov *et al*., 2002).

this assumption I have scanned the data and adjusted observations that obviously were affected by splits, new issues and repurchases during the year.

- All metrics of unexpected earnings (EPS minus forecast) have been scaled by the share price as of the last day of the quarter preceding the quarter which the announced earnings refer to.
- Data on the control variables; total assets, leverage and sales growth, have been collected from SIX.

2.4.4 Descriptive statistics

Table 2.4 reports descriptive statistics of the key variables in this study.

Table 2.4. Descriptive statistics of key variables.

Variable	N	Mean	Median	Std Dev	Pr > |t|
EPS_{GAAP}	734	1.987	1.450	2.702	<0.0001
EPS_{IBES}	466	1.910	1.655	1.817	<0.0001
UE_1	304	0.031	0.001	0.312	0.0878
UE_2	669	0.007	0.003	0.036	<0.0001
UE_3	219	-0.004	0.004	0.281	0.8360
CAR [-1,0]	790	0.000	0.001	0.048	0.8403
market cap	747	58528	17967	120828	<0.0001
size	814	43824	16802	71393	<0.0001
leverage	701	0.606	0.615	0.139	<0.0001
growth	760	0.174	0.058	2.257	0.0335

(i) EPS_{GAAP} is reported GAAP earnings per share collected from SIX. EPS_{IBES} is reported "core" earnings per share collected from I/B/E/S. *UE_1* is EPS_{IBES} minus the median analyst forecast from I/B/E/S. *UE_2* is EPS_{GAAP} minus EPS_{GAAP} four quarters ago, *UE_3* is EPS_{IBES} minus EPS_{IBES} four quarters ago. All UE measures are scaled with price at the last day of the quarter preceding the quarter which the announced earnings refer to. *CAR* is the cumulative 2-day market-adjusted return around firm *i*'s quarter *q* earnings announcement. *market cap* is measured as the stock price at the last day of the quarter preceding the announcement times the number of shares, *size* is measured as log of firm *i*'s total assets at the end of the quarter preceding the announcement, *leverage* is measured as firm *i*'s ratio of total debt to total assets at the end of the quarter preceding the announcement. *growth* is measured as firm *i*'s sales growth between quarters that are four quarters apart.

The first thing to note is that there is a substantial loss of observations for certain variables. This is caused by the limited coverage by both SIX and I/B/E/S, where it is obvious from the table that the coverage by I/B/E/S is lower. There are 734 observations on EPS_{GAAP} from the SIX database and 466 observations on EPS_{IBES} from the I/B/E/S database. Both the I/B/E/S signal (UE_1) and the GAAP signal (UE_2) have slightly positive means. This is in line with previous research on the distribution of analysts forecast errors, indicating that positive earnings surprises are more common than negative earnings surprises (e.g., Burgstahler and Dichev, 1997). Since the GAAP signal is based on a fairly crude forecasting method, it is a bit surprising that the standard deviation of the signal is lower than that of the I/B/E/S signal.

Table 2.5 displays the distribution of the number of observations over the sample period for the each of the three UE signals.

Table 2.5. Distribution of observations on unexpected earnings signals over the sample period

	UE_1	UE_2	UE_3
Q1 2004	2	50	0
Q2 2004	1	46	0
Q3 2004	0	46	0
Q4 2004	1	45	3
Q1 2005	11	46	2
Q2 2005	12	46	7
Q3 2005	26	45	3
Q4 2005	44	47	27
Q1 2006	37	45	15
Q2 2006	38	49	25
Q3 2006	39	49	39
Q4 2006	41	61	45
Q1 2007	25	47	25
Q2 2007	27	47	28
Total number of observations	304	669	219

(i) UE_1 is EPS_{IBES} minus the median analyst forecast from I/B/E/S. UE_2 is EPS_{GAAP} minus EPS_{GAAP} four quarters ago, UE_3 is EPS_{IBES} minus EPS_{IBES} four quarters ago. All UE measures are scaled with price at the last day of the quarter preceding the quarter which the announced earnings refer to.

The GAAP signal, UE_2, which contains only SIX data, has a stable number of observations for the whole sample period. The other two UE signals contain data from I/B/E/S and the table reveals that the cross-section of these observations is small in the beginning of the sample period. UE_3 has the lowest number of observations, since it also demands lagged I/B/E/S data for the time-series forecast. In Section 2.6.4, results keeping the sample of firms constant are reported. In general, these results are very similar to those of the main sample.

Table 2.6. Correlation matrix

Variable	UE_1	UE_2	UE_3
UE_1		0.115	0.0481**
UE_2	0.210		0.559***
UE_3	0.474**	0.738***	

(i) Pearson (Spearman) correlations are reported above (below) the diagonal.

(ii) UE_1 is EPS_{IBES} minus the median analyst forecast from I/B/E/S. UE_2 is EPS_{GAAP} minus EPS_{GAAP} four quarters ago, UE_3 is EPS_{IBES} minus EPS_{IBES} four quarters ago. All UE measures are scaled with price at the last day of the quarter preceding the quarter which the announced earnings refer to.

(iii) The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

In Table 2.6 Pearson and Spearman correlations between the three UE signals are presented. Correlations are calculated each quarter and the mean of these correlations is reported in Table 2.6. Since some UE signals by construction share data, the correlations are quite high. The lowest correlations, at about 20%, are between the two main earnings signals; UE_1 (I/B/E/S) and UE_2 (GAAP).

2.5 Test design

The aim of the empirical tests is to measure and compare the return reaction to the three different UE signals, with special focus on the I/B/E/S and GAAP earnings signals. The initial announcement reaction is measured through earnings response coefficients (ERCs) and the post-earnings announcement drift (PEAD) is measured by implementing a PEAD trading strategy. The test design is described in more detail below.

2.5.1 Earnings response coefficients

To measure the market's response to each of the three UE metrics, I examine the short-term ERC, which is the coefficient relating unexpected returns to unexpected earnings (γ_1 in regression (2.9) and (2.10) below). The unexpected returns are measured as the cumulative market–adjusted returns during the two days surrounding the announcement.[116] Unexpected earnings are measured with each of the three UE signals.

It has been shown in previous research that several factors are associated with the market's reaction to earnings news. Empirically it has been shown that the ERC can vary substantially both over time and between firms (e.g., Collins and Kothari,

[116] The daily return on the market index is subtracted from firm *i*'s daily return and then compounded over the two days surrounding the announcement date.

1989). Smaller firms, more highly leveraged firms, and firms with high growth opportunities have a higher market response to earnings news (e.g., Easton and Zmijewski, 1989; Collins and Kothari, 1989). In regression (2.10), the variables *size*, *leverage* and *growth* are included to control for these previous findings.

$$CAR[-1,0]_{i,q} = \gamma_0 + \gamma_1 UE_{i,q} + \varepsilon_{i,q} \quad (2.9)$$

$$CAR[-1,0]_{i,q} = \gamma_0 + \gamma_1 UE_{i,q} + \gamma_2 size_{i,q} + \gamma_3 leverage_{i,q} + \gamma_4 growth_{i,q} + \varepsilon_{i,q} \quad (2.10)$$

where:

$CAR[-1,0] =$	Cumulative 2-day market-adjusted returns around firm *i* 's quarter *q* earnings announcement,
$UE_{i,q} =$	Unexpected earnings signal revealed in firm *i* 's quarter *q* earnings announcement, scaled by firm *i* 's share price at the last day of the quarter preceding the quarter which the announced earnings refer to. Unexpected earnings are measured in three alternative ways: UE_1 is EPS_{IBES} minus the median analyst EPS forecast from I/B/E/S. UE_2 is EPS_{GAAP} minus EPS_{GAAP} four quarters ago, UE_3 is EPS_{IBES} minus EPS_{IBES} four quarters ago,
$size_{i,q} =$	log of firm *i* 's total assets at the end of the quarter preceding the announcement date,
$leverage_{i,q} =$	firm *i* 's ratio of total debt to total assets at the end of the quarter preceding the announcement date,
$growth_{i,q} =$	firm *i* 's sales growth between quarters that are four quarters apart, measured at the end of the quarter preceding the announcement date.

2.5.2 Post-earnings announcement drift

The second test is aimed at assessing whether there is a drift in stock prices after the announcement of quarterly earnings. I implement a trading strategy (following Chan *et al.*, 1996) where, at the first day of the quarter following the announcement, firms are ranked according to the magnitude of their UE signal.[117] For quarters where the cross-section is sufficiently large (in my main tests I demand twenty firms in the cross-section) I take a long position in the top 20% (most positive UE) and a short position in the bottom 20% (most negative UE) and hold these positions for twelve months.[118]

[117] I do not implement the strategy directly after the day of the announcement (i.e., in event time) in order to make sure that when I take the positions all earnings have been announced. This is done to ensure that the strategy is implementable. Also, taking the long and short positions simultaneously facilitates the construction of a self-financed hedge portfolio where the income from selling short finances the purchase of stocks for the long position.

[118] I choose a fairly long holding period of 12 months since it was shown in Paper 1 of the dissertation that the drift in the Swedish stock market continues up to 12 months.

The return to a portfolio is calculated as the equally-weighted return across the stocks included in that portfolio.[119, 120]

$$R_{p,t} = \frac{1}{N}\sum_{i=1}^{N} R_{i,t}$$

(2.11)

where:

$R_{i,t} =$	return of share i at month t,
$R_{p,t} =$	return of portfolio p at month t,
$p =$	type of portfolio, $p = 1$ (SHORT), 2, …, 5 (LONG),
$t =$	month after formation date. $t = 1, 2, …, 12$.

The combined position, labeled the PEAD position, is the long position minus the short position. A new PEAD position is taken every quarter, which means that – with a holding period of twelve months – there can at most be four parallel PEAD positions in any given month during the sample period.[121]

Following Chan *et al.* (1996) I use a calendar-time approach to evaluate the magnitude and statistical significance of the abnormal returns to the PEAD positions.[122] In these regressions I measure abnormal returns relative to two alternative models of expected returns; the capital asset pricing model – CAPM (Sharpe, 1964; Lintner, 1965) – and the Fama-French three-factor model (Fama and French, 1993). The two alternative models are specified in regressions (2.12) and (2.13).

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[119] Since the portfolio mean is calculated each month, this assumes that the portfolios are rebalanced every month to keep the weights equal.

[120] This calculation is done for both long and short positions, so that if there is an upward drift after good news the long position will generate positive portfolio returns and if there is a downward drift after bad news the short position will generate negative portfolio returns.

[121] This procedure of four parallel portfolios differs from Chan *et al.* (1996) which include all new positions into the existing portfolio.

[122] Calendar-time regressions are proposed by Fama (1998) as a more robust method than using buy-and-hold returns (BHARs). Mitchell and Stafford (2000) also point out the difficulties in testing the BHARs statistically due to the skewed distribution of firm-specific BHARs.

$$R_{PEAD,t,f} = \alpha^{capm} + \beta^{capm} RMRF_t + \varepsilon^{capm} \quad (2.12)$$

$$R_{PEAD,t,f} = \alpha^{3f} + b^{3f} RMRF_t + s^{3f} SMB_t + h^{3f} HML_t + \varepsilon^{3f} \quad (2.13)$$

where:

$R_{PEAD,t,f} =$	return to a PEAD position at month t and formation date f,
$RMRF_t =$	excess market return at month t: $R_m - Rf$ (market return – risk free rate),
$SMB_t =$	monthly return of a hedge portfolio based on size (*market cap*),
$HML_t =$	monthly return of a hedge portfolio based on book-to-market.

Following Fama and French (1993) I estimate the factors SMB and HML as follows. The SMB portfolios are based on firm size, measured as market capitalization (the share price times the number of shares outstanding). Firms are ranked on *market cap* by June 30 each year and divided into two portfolios; portfolio Big and portfolio Small. The SMB factor is the monthly value-weighted return of the Small portfolio minus the monthly return of the Big portfolio. Monthly returns are measured from July 1 and twelve months ahead.

The HML portfolios are based on book-to-market (book value of equity divided by market capitalization). Firms are ranked on book-to-market by December 31 each year and divided into three portfolios; portfolio Value (high book-to-market), portfolio Neutral and portfolio Growth (low book-to-market). The HML factor is the monthly value-weighted return of the Value portfolio minus the monthly return of the Growth portfolio. Monthly returns are measured from July 1 (six months after portfolio formation) and twelve months ahead.

The monthly returns to the PEAD positions are regressed on the risk factors as described by equations (2.12) and (2.13). The intercepts (α^{capm} and α^{3f}) are thus measures of the monthly abnormal returns to the trading strategy, and if positive they indicate a drift in returns subsequent to the announcement date. In these tests I refer to it as "abnormal" return, but by this I only mean abnormal in relation to the expected return as described by the two models of market equilibrium.[123]

Given that the return prediction for the short position is ambiguous, looking at the combined hedge position could be considered to be a limitation in the test design. In the empirical sections I therefore also report separately the returns to the long and the short positions.

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[123] One risk factor that might be omitted is information risk, which is the theme of this paper.

2.6 Empirical results

In this section I report the main empirical results (2.6.1), results from several robustness tests (2.6.2), results for varying holding periods in the PEAD strategy (2.6.3), as well as results using a within-firm design (2.6.4). I also report tests on buy-and-hold returns for both the announcement period and the post-announcement period (2.6.5), as well as how the returns differ between the long and the short positions (2.6.6). Lastly, I report some results on how the differences between I/B/E/S and GAAP earnings, i.e. the exclusions, are related to future returns (2.6.7).

2.6.1 Main empirical results

Table 2.7 presents the estimated coefficients from equation (2.9) (Panel A) and equation (2.10) (Panel B) for each of the three earnings signals. In general, the inclusion of control variables in Panel B has a very limited effect on the ERC estimates. The overall explanatory power, R^2, of the regressions is low but in line with previous research.[124]

The initial market response to the I/B/E/S earnings signal, UE_1, is more pronounced than for the GAAP earnings signal, UE_2. The ERC for the I/B/E/S signal is 0.57 (t-statistic 4.12) compared to an ERC of 0.12 (t-statistic 2.34) for the GAAP signal. This result is in line with previous research on US data showing that the immediate stock market reaction is greater for earnings numbers higher up in the income statement (e.g., Bradshaw and Sloan, 2002).[125]

[124] In an overview, Lev (1989) showed that the R^2s where on average 2-5% in ERC regressions with short event windows. However, extending the event window can result in much higher explanatory power. See Easton *et al.* (1992) for a study of a US sample, Strong and Walker (1993) for a study of a UK sample, and Runsten (1998) for a study of a Swedish sample.

[125] It is also in line with results from the Finnish stock market, where the unexpected returns at the announcement are higher for earnings higher up in the income statement (Booth *et al.*, 1997).

Table 2.7. The market's announcement response to different unexpected earnings signals. Sample period 2004 - 2008.

		UE_1	UE_2	UE_3
Panel A: ERC-regressions				
intercept		0.000	-0.002	-0.001
	t-Stat	*(-0.16)*	*(-0.81)*	*(-0.22)*
UE		0.566***	0.121**	0.244***
	t-Stat	*(4.12)*	*(2.34)*	*(2.94)*
N		244	596	172
Adj. R2		0.062	0.007	0.043
Panel B: ERC-regressions with control variables				
intercept		-0.015	0.007	-0.056
	t-Stat	*(-0.56)*	*(0.49)*	*(-1.78)*
UE		0.581***	0.120**	0.224***
	t-Stat	*(4.21)*	*(2.30)*	*(2.68)*
size		-0.001	0.000	0.002
	t-Stat	*(-0.33)*	*(-0.19)*	*(0.78)*
leverage		0.036	-0.011	0.057**
	t-Stat	*(1.54)*	*(-0.79)*	*(2.10)*
growth		-0.001	0.000	0.001
	t-Stat	*(-0.35)*	*(-0.05)*	*(0.22)*
N		244	568	172
Adj. R2		0.061	0.007	0.054

(i) UE_1 is EPS_{IBES} minus the median analyst forecast from I/B/E/S. UE_2 is EPS_{GAAP} minus EPS_{GAAP} four quarters ago, UE_3 is EPS_{IBES} minus EPS_{IBES} four quarters ago. All UE measures are scaled with price at the last day of the quarter preceding the quarter which the announced earnings refer to.

(ii) The dependent variable is the cumulative 2-day market-adjusted return around firm *i* 's quarter *q* earnings announcement.

(iii) In panel B control variables are added to the regression. *size* is measured as log of firm *i* 's total assets, *leverage* is measured as firm *i* 's ratio of total debt to total assets, *growth* is measured as firm *i* 's sales growth between quarters that are four quarters apart. All control variables are measured at the end of the quarter preceding the announcement date.

(iv) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

In Table 2.8 I report the results from implementing PEAD strategies based on the three different earnings signals. The table reports the monthly abnormal return to the hedge portfolio (long minus short) in excess of risk factors described by the Fama-French three-factor model (equation (2.13)). The results (not tabulated) are very similar when using CAPM to control for risk (equation (2.12)). Looking at the returns in the post-announcement period, there is (for a holding period of twelve months) a significant drift for the GAAP earnings signal, UE_2, but not for the I/B/E/S earnings signal, UE_1. The hedge portfolios that are based on the GAAP signal generate on average 0.9% risk-adjusted return each month.

Table 2.8. Average monthly abnormal returns PEAD positions.
Sample period 2004 - 2008.

Variable		UE_1	UE_2	UE_3
intercept		0.005	0.009***	-0.007
	t-Stat	*(0.93)*	*(2.71)*	*(-1.04)*
RMRF		0.060	0.162***	0.077
	t-Stat	*(0.72)*	*(2.77)*	*(0.80)*
SMB		0.185*	0.009	0.156
	t-Stat	*(1.84)*	*(0.12)*	*(1.34)*
HML		0.128	-0.006	-0.109
	t-Stat	*(1.08)*	*(-0.08)*	*(-0.81)*
N		96	168	72
Adj. R2		0.023	0.031	0.014

(i) The PEAD strategy is performed for three metrics of unexpected earnings. UE_1 is EPS_{IBES} minus the median analyst forecast from I/B/E/S. UE_2 is EPS_{GAAP} minus EPS_{GAAP} four quarters ago, UE_3 is EPS_{IBES} minus EPS_{IBES} four quarters ago. All UE measures are scaled with price at the last day of the quarter preceding the quarter which the announced earnings refer to.

(ii) The PEAD strategy requires twenty UE each quarter and takes long positions in the top 20% of ranked earnings surprises and short positions in the bottom 20% of ranked earnings surprises that are announced during the time period April 2004-September 2007. All positions are taken the first day of the quarter subsequent to the quarter when the earnings are announced.

(iii) The dependent variable is the monthly portfolio return of the long position minus the monthly portfolio return of the short position. The independent variables are defined as follows: *RMRF* is the excess market return measured as the return of the Morgan Stanley Sweden Index (MSCI) minus the return of a Swedish 1-month Treasury Bill; *SMB* is the monthly value-weighted return of the Small portfolio (low market cap) minus the monthly value-weighted return of the Big portfolio (high market cap), where firms are ranked on market cap by June 30 each year, positions taken on July 1 and held for twelve months; *HML* is the monthly value-weighted return of the Value portfolio (low market-to-book) minus the monthly value-weighted return of the Growth portfolio (high market-to-book), where firms are ranked on market-to-book by December 31 each year, positions taken on July 1 and held for twelve months.

(iv) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

Combined, I interpret the results in Table 2.7 and Table 2.8 as consistent with investors ascribing higher uncertainty to the GAAP earnings signal (lower immediate returns reaction, higher long-term drift) than to the I/B/E/S earnings signal (higher immediate returns reaction, lower long-term drift). This interpretation is based on the theoretical framework outlined in Section 2.2.

When looking at the price reactions to the control signal (UE_3), which uses the same earnings as the I/B/E/S signal but the same expectations model as the GAAP signal, this signal has a higher announcement reaction (ERC of 0.24, t-statistic 2.62) than the GAAP signal, but is not followed by a drift. In other words, the behavior of the control signal is more similar to that of the I/B/E/S signal, and I conclude that the differences between the I/B/E/S and the GAAP signals mainly are attributable to the different earnings levels, I/B/E/S earnings vs. GAAP earnings, rather than to different expectations models.

The difference in announcement reaction between the I/B/E/S signal (ERC of 0.57) and the control signal UE_3 (ERC of 0.24) must be attributable to the consensus forecast, in the I/B/E/S signal, being a better proxy for the market's expectations of earnings. This result thus confirms previous findings that point to the advantages of using analyst forecasts (e.g., Brown *et al.,* 1987).

To summarize the main empirical results, it seems like the two main earnings signals generate different reactions in the stock market. The difference between the I/B/E/S signal and the GAAP signal appears to be driven primarily by a difference in the perceived uncertainty in the earnings level (where I/B/E/S earnings introduce lower uncertainty than GAAP earnings) and to a much lesser extent by the choice of expectations model.

2.6.2 Various robustness tests

The results presented in Table 2.7 and Table 2.8 are robust to alternative specifications (results not tabulated). To check the possible impact of outliers I have estimated all regressions on alternative datasets that exclude observations that have studentized residuals that are larger than three in absolute magnitude. The results are unaffected. In addition, the results in the ERC regressions (equation (2.9) and (2.10)) are robust to using three-day announcement CAR, instead of two-day CAR, as well as using a market model to estimate the announcement CAR, instead of just adjusting for the market return.[126] Results in the ERC regressions are also robust to alternative control variables that are measured on an annual rather than quarterly basis. Using the median analyst forecast one day or seven days (instead of three days) prior to the announcement also gives quantitatively the same results. The ERC is somewhat smaller if the forecast one day before the announcement is used. This is in line with information leakage affecting the forecast, leading to a smaller surprise.

In the PEAD regressions (equation (2.12) and (2.13)) results are robust to a specification where I demand at least 25 firms, instead of 20 firms, in the cross-section in order to perform the PEAD strategy. Additionally, I control for returns momentum (e.g., Jegadeesh and Titman, 1993; Chan *et al.*, 1996) by including the returns to a momentum strategy as a fourth factor in the PEAD regressions.[127] The returns to the PEAD strategy (for any of the UE signals) do not change when regressed on a four-factor model that includes a factor-mimicking portfolio for returns momentum.

[126] When using the market model, CAR is equal to announcement return adjusted for the market return weighted with firm-specific betas. Firm-specific betas are estimated using all available data up until ten days before the announcement.

[127] The momentum factor is the monthly equal-weighted return to hedge portfolios, with a holding period of twelve months, taking a long position in the decile of firms with the highest past six months returns and a short position in the decile of firms with the lowest past six months return. This procedure follows Jegadeesh and Titman (1993).

2.6.3 Varying holding periods

Table 2.9 reports the monthly return to the PEAD strategy for varying holding periods: three, six, nine and twelve months (the returns for twelve months are thus identical to the ones reported in Table 2.8).

Table 2.9. Average monthly abnormal returns to PEAD positions - for holding periods of 3, 6, 9 and 12 months. Sample period 2004-2008.

Variable		UE_1	UE_2	UE_3
3 months		0.021**	0.009	0.000
	t-Stat	*(2.12)*	*(1.46)*	*(0.05)*
6 months		0.014*	0.008*	-0.002
	t-Stat	*(1.76)*	*(1.96)*	*(-0.17)*
9 months		0.008	0.007**	-0.001
	t-Stat	*(1.18)*	*(2.14)*	*(-0.18)*
12 months		0.005	0.009***	-0.007
	t-Stat	*(0.93)*	*(2.71)*	*(-1.04)*
	Q	8	14	6

(i) The PEAD strategy is performed for three metrics of unexpected earnings. UE_1 is EPS_{IBES} minus the median analyst forecast from I/B/E/S. UE_2 is EPS_{GAAP} minus EPS_{GAAP} four quarters ago, UE_3 is EPS_{IBES} minus EPS_{IBES} four quarters ago. All UE measures are scaled with price at the last day of the quarter preceding the quarter which the announced earnings refer to.

(ii) The PEAD strategy requires twenty UE each quarter and takes long positions in the top 20% of ranked earnings surprises and short positions in the bottom 20% of ranked earnings surprises that are announced during the time period April 2004-September 2007. All positions are taken the first day of the quarter subsequent to the quarter when the earnings are announced.

(iii) The dependent variable is the monthly portfolio return of the long position minus the monthly portfolio return of the short position. The independent variables are defined as follows: *RMRF* is the excess market return measured as the return of the Morgan Stanley Sweden Index (MSCI) minus the return of a Swedish 1-month Treasury Bill; *SMB* is the monthly value-weighted return of the Small portfolio (low market cap) minus the monthly value-weighted return of the Big portfolio (high market cap), where firms are ranked on market cap by June 30 each year, positions taken on July 1 and held for twelve months; *HML* is the monthly value-weighted return of the Value portfolio (low market-to-book) minus the monthly value-weighted return of the Growth portfolio (high market-to-book), where firms are ranked on market-to-book by December 31 each year, positions taken on July 1 and held for twelve months.

(iv) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

An interesting pattern emerges from Table 2.9. For the GAAP signal, UE_2, the drift is relatively stable for different holding periods. However, it should be noted that the PEAD return is not significant for a holding period of three months and only barely significant for six months. The magnitude of the drift is increasing with the length of the holding period. For the I/B/E/S signal, UE_1, the pattern in returns is reverse: the magnitude of the drift is decreasing with the length of the holding period. For a short holding period of three months this signal generates a large and significant return.[128] I interpret these results as consistent with information uncertainty and resolving risk. Even though the initial reaction to the I/B/E/S signal, UE_1, around the announcement is high, the reaction is not complete due to perceived information

[128] This result is in line with the findings of Livnat and Mendenhall (2006).

risk also in this signal. However, the remaining uncertainty in the I/B/E/S signal appears to resolve much quicker than the uncertainty of the GAAP signal. Given that the GAAP signal encompasses items that are hard to interpret or estimate, such as restructuring costs, it might take a longer time for investors to learn how these items map into the value creation of the firm. As much as three subsequent earnings announcements might be needed in order for the information risk in the original signal to resolve.[129]

2.6.4 Results using a within-firm design

The results reported so far have the limitations that the number of observations differs between the three earnings signals (in order to maximize the sample size). It can therefore not be ruled out that these results are driven, not by differences in introduced uncertainty, but rather by sample differences either in the cross-section or over time.

In order to control for the sample differences I perform further tests using a within-firm design. The dataset is here restricted to firms-quarters where observations of both the I/B/E/S and the GAAP signals are available (hereafter referred to as the restricted sample). So far, the results for the unrestricted sample have shown a high initial reaction and a short drift to the I/B/E/S earnings signal. In contrast, there is a muted initial reaction to the GAAP signal, followed by a more pronounced drift in returns. The results for the restricted sample (n = 208), are reported in Table 2.10 and Table 2.11.

[129] Some empirical findings in prior literature can also be interpreted as support for this argument. For example Easton *et al*. (1992) and Runsten (1998) show that the association between earnings and stock returns increases remarkably when the variables are measured over longer time-periods.

Table 2.10. The market's announcement response to different unexpected earnings signals - using a restricted sample requiring observations on UE_1 and UE_2. Sample period 2004 - 2008.

		UE_1	UE_2	Vuong's Z-statistic
Panel A: ERC-regressions				
intercept		-0.002	-0.001	
	t-Stat	*(-0.60)*	*(-0.16)*	
UE		0.537***	0.084	2.16
	t-Stat	*(3.96)*	*(0.57)*	*p-value: 0.032*
N		208	208	
Adj. R2		0.066	-0.003	
Panel B: ERC-regressions with control variables				
intercept		-0.028	-0.021	
	t-Stat	*(-1.03)*	*(-0.73)*	
UE		0.551***	0.086	
	t-Stat	*(4.07)*	*(0.58)*	
size		0.000	0.000	
	t-Stat	*(0.20)*	*(0.12)*	
leverage		0.040	0.032	
	t-Stat	*(1.58)*	*(1.24)*	
growth		-0.023	-0.024	
	t-Stat	*(-1.38)*	*(-1.39)*	
N		208	208	
Adj. R2		0.075	0.001	

(i) UE_1 is EPS_{IBES} minus the median analyst forecast from I/B/E/S. UE_2 is EPS_{GAAP} minus EPS_{GAAP} four quarters ago. Both UE measures are scaled with price at the last day of the quarter preceding the quarter which the announced earnings refer to.

(ii) The dependent variable is the cumulative 2-day market-adjusted return around firm *i* 's quarter *q* earnings announcement.

(iii) In panel B control variables are added to the regression. *size* is measured as log of firm *i* 's total assets, *leverage* is measured as firm *i* 's ratio of total debt to total assets, *growth* is measured as firm *i* 's sales growth between quarters that are four quarters apart. All control variables are measured at the end of the quarter preceding the announcement date.

(iv) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

The difference in ERC persists. The announcement reaction to the I/B/E/S signal is more than six times higher than the reaction to the GAAP signal. With a Vuong-test the two regressions (with either the I/B/E/S or the GAAP signal as the independent variable) are set up as competing models to explain the announcement return (Vuong, 1989).[130] This test provides a significant Z-statistic of 2.16 which makes it possible to statistically, on a 5%-level, verify that the model with I/B/E/S earnings has the lowest magnitude of residuals and thus is the model that best describes the announcement CAR.

[130] For an extensive description of the Vuong test see Dechow (1994). It is also used in for example Bradshaw and Sloan (2002).

Table 2.11. Average monthly abnormal returns to PEAD positions - using a restricted sample requiring observations on UE_1 and UE_2. Sample period 2004 - 2008.

		UE_1	UE_2
Panel A: Monthly abnormal returns to PEAD strategy			
intercept		0.006	0.011**
	t-Stat	*(1.06)*	*(2.09)*
RMRF		0.059	0.327***
	t-Stat	*(0.72)*	*(4.03)*
SMB		0.129	0.382***
	t-Stat	*(1.32)*	*(3.94)*
HML		0.138	-0.206
	t-Stat	*(1.20)*	*(-1.80)*
N		96	96
Adj. R2		0.009	0.303
Panel B: Characteristics of extreme portfolios			
median *market cap*		22937	24876
median *size*		9.89	10.11
median *leverage*		0.62	0.62
median *growth*		0.05	0.07

(i) The PEAD strategy is performed for three metrics of unexpected earnings. UE_1 is EPS_{IBES} minus the median analyst forecast from I/B/E/S. UE_2 is EPS_{GAAP} minus EPS_{GAAP} four quarters ago, UE_3 is EPS_{IBES} minus EPS_{IBES} four quarters ago. All UE measures are scaled with price at the last day of the quarter preceding the quarter which the announced earnings refer to.

(ii) The PEAD strategy requires twenty UE each quarter and takes long positions in the top 20% of ranked earnings surprises and short positions in the bottom 20% of ranked earnings surprises that are announced during the time period April 2004-September 2007. All positions are taken the first day of the quarter subsequent to the quarter when the earnings are announced.

(iii) The dependent variable is the monthly portfolio return of the long position minus the monthly portfolio return of the short position. The independent variables are defined as follows: *RMRF* is the excess market return measured as the return of the Morgan Stanley Sweden Index (MSCI) minus the return of a Swedish 1-month Treasury Bill; *SMB* is the monthly value-weighted return of the Small portfolio (low market cap) minus the monthly value-weighted return of the Big portfolio (high market cap), where firms are ranked on market cap by June 30 each year, positions taken on July 1 and held for twelve months; *HML* is the monthly value-weighted return of the Value portfolio (low market-to-book) minus the monthly value-weighted return of the Growth portfolio (high market-to-book), where firms are ranked on market-to-book by December 31 each year, positions taken on July 1 and held for twelve months.

(iv) In Panel B the median of some control variables are reported. *market cap* is measured as the stock price times the number of shares. *size* is measured as log of firm *i* 's total assets, *leverage* is measured as firm *i* 's ratio of total debt to total assets, *growth* is measured as firm *i* 's sales growth between quarters that are four quarters apart. All control variables are measured at the end of the quarter preceding the announcement date.

(v) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

Also evident in Table 2.11, Panel A, is that the difference in PEAD remains in the restricted sample. In this sample a PEAD strategy based on the GAAP signal (UE_2) generates an average monthly return of 1.1% (t-statistic 2.09) in excess of the three risk factors. The return to a strategy based on the I/B/E/S earnings signal is however not significant (a coefficient of 0.006, t-statistic 1.06).

In Panel B, some characteristics of the extreme portfolios are reported. The characteristics in terms of *market cap*, *size*, *leverage* and *growth* do not seem to differ very much whether the PEAD strategy is based on the I/B/E/S earnings signal or the GAAP earnings signal. I conclude that it is not differences in these factors that explain the difference in hedge return.

2.6.5 Buy-and-hold returns in event-time

The above results indicate that the returns reaction to the GAAP signal mostly is generated in the post-announcement period. However, it is hard to compare the ERC with the returns to the PEAD strategy in terms of magnitudes. First, the ERCs are estimated on the full cross-section of firms, whereas the post-announcement return only is estimated for stocks in the extreme portfolios. Second, the PEAD strategy is not implemented immediately after the announcement window, but rather a couple of months later. Further tests aim to see how, for the two earnings signals, the total returns for the twelve months period are distributed between the announcement period and the post-announcement period.

Alleviating the first problem above, I report in Panel A of Table 2.12 the announcement CAR for the extreme portfolios (excluding the middle portfolios) for the GAAP and I/B/E/S signals respectively. I can here verify that the return reaction at the announcement of extreme I/B/E/S signals is more pronounced (3.7%) than for the extreme GAAP signals (2.1%). For the good news portfolio the announcement reaction to the I/B/E/S signal (2.4%) is more than twice as large as the reaction to the GAAP signal (1.0%).

Table 2.12. Buy-and-hold returns in event-time for the long, short and hedge positions. Sample period 2004-2008.

	UE_1	UE_2
Panel A: BHAR for the announcement period		
Long position (good news)	0.024	0.010
Short position (bad news)	-0.013	-0.010
Hedge position (Long-Short)	0.037	0.021
Panel B: BHAR for the post-announcement period		
Long position (good news)	0.076	0.096
Short position (bad news)	0.018	0.008
Hedge position (Long-Short)	0.058	0.088

(i) UE_1 is EPS_{IBES} minus the median analyst forecast from I/B/E/S. UE_2 is EPS_{GAAP} minus EPS_{GAAP} four quarters ago. Both UE measures are scaled with price at the last day of the quarter preceding the quarter which the announced earnings refer to.

(ii) The announcement period starts one day before the announcement date and ends at the announcement date. The post announcement period starts the first day after the announcement date and ends 251 trading days after the announcement.

(iii) Buy-and-hold returns (BHARs) are firm-specific daily market-adjusted returns compounded over the period. Equal-weighted portfolio means are calculated for each formation period. Total sample means for the positions Short, Long and Hedge are reported in the table.

To be able to put these magnitudes of return in relation to the returns in the post-announcement period I need more than the average monthly return which was the outcome in the PEAD regressions. In addition, that measure suffered from the assumption that portfolios are rebalanced each month, which can be costly if transaction costs are considered. In Table 2.12 Panel B I therefore report the buy-and-hold abnormal returns (BHARs) for the post-announcement period. As pointed out by Barber and Lyon (1997) the advantage of this measure is that it mimics investor experience and does not assume monthly rebalancing of portfolios.[131] Here market-adjusted returns, for each firm, are compounded over one year (from one day after the announcement to 251 days after the announcement) and then portfolio means are calculated for firms that belong to the same portfolio. As a last step a sample mean for all portfolios (over the sample period) is calculated. Note that these BHARs are calculated in event-time and it is thus not an implementable trading strategy.[132] As an effect the returns are not directly comparable to the returns from the PEAD strategy, where positions are taken at the first day of the quarter subsequent to the announcements. The magnitude of the BHARs are however an indication of the effect of the assumption to rebalance the portfolios each months.

It can be noted in Table 2.12, Panel B, that the BHAR in the post-announcement period for the hedge position based on the I/B/E/S signal is 5.8% compared to that of the GAAP signal which is 8.8%. The drift for the GAAP signal is still larger, but the BHARs give a slightly different picture regarding the difference between the two signals. The magnitude of the drift is now more similar. Note however that the adjustment for expected return differs between the BHARs and the calendar-time regressions, where the BHAR measure only makes a crude adjustment for the market return. The results should therefore be compared with caution.

Relating the announcement return to the post-announcement return, I can confirm the previous findings in this paper. Out of a total BHAR of 9.5% (announcement return plus post-announcement return) for a hedge position based on the I/B/E/S signal, 39% (3.7% return) is generated during the announcement period. For the GAAP signal the return pattern is different, indicating a slower price drift. Here the total BHAR is similar (10.9%) but the distribution differs in the sense that 19% is generated during the announcement period and the rest in the post-announcement period. I interpret this result as confirming that there is a muted

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[131] I do not report t-statistics for the BHARs since they have been found in previous research to be misleading (e.g., Mitchell and Stafford, 2000). Using a bootstrapping procedure for statistical testing, proposed by Ikenberry *et al*. (1995), is outside the scope of this study.

[132] The strategy is not possible to implement since it is not possible to know the distribution of unexpected earnings (and thus which positions to take) until all firms have reported their earnings. The BHARs calculated in event-time (taking positions the day after the announcement) thus introduce hindsight bias. This problem is more severe if the earnings announcements of a quarter are spread over a long time period.

reaction to the GAAP signal due to investors perceiving this signal to be more uncertain and risky at the announcement date. As the risk resolves in the post-announcement period a price drift is generated.

2.6.6 Long and short positions

Table 2.12 reports separately the BHARs to the long and short positions. For the announcement period (Panel A), the BHAR for the bad news I/B/E/S earnings signals (-1.3%) is slightly more negative than for the GAAP earnings signals (-1.0%). For the good news portfolio the I/B/E/S signal has a mean announcement BHAR of 2.4% compared to 1.0% for the GAAP signal.[133]

As pointed out in the theoretical framework, two effects influence the announcement reaction to an uncertain bad news signal. First, the announcement reaction will be muted due to a less negative expected mean. Second, the reaction can be more pronounced due to a perceived higher risk. From the empirical observations on announcement reactions it is thus not possible to say anything regarding the perceived risk in the bad news signals. However, assuming that the GAAP signal indeed is perceived to be more risky, the lower announcement reaction to the bad news GAAP signal, compared to the reaction to the bad news I/B/E/S signal, might be an indication of the lower expected mean effect dominating the risk compensation effect. However, this is not tested explicitly.

I note that neither of the two earnings signals have negative BHARs for the short position in the post-announcement period (Panel B). It is rather slightly positive, but close to zero. This empirical pattern could be due to several reasons and is elaborated on more in Section 2.7.

Since the return on the short position is negligible, the return on the hedge positions is generated by the long positions. This is consistent with investors perceiving the good news signal to be risky and demanding a compensation for this risk, as predicted by the theoretical framework in Section 2.2.

2.6.7 Exclusions from GAAP earnings

It was argued in Section 2.3 that one potential source of uncertainty in the GAAP earnings level is the exclusions, for examples special items, that analysts make from GAAP earnings to derive core earnings. To test this further I construct a measure of this "non-core earnings" by taking the difference between GAAP and I/B/E/S

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[133] These results are for an unrestricted sample in order to maximize sample size. Since the sorting of firms differs for the I/B/E/S and GAAP signals, extreme portfolios will not entail the same set of firms even though the sample would have been restricted.

earnings.[134] These exclusions are positive if GAAP earnings are larger than I/B/E/S earnings. An example could be one-time gains that analysts consider not to be part of core operations. Negative exclusions could for example be restructuring costs.

In the tests below (results not tabulated) I study more thoroughly the relation between these exclusions and the ERC and drift respectively. I concentrate on the GAAP signal since I previously have shown that it is this signal that is associated with a muted ERC and a significant price drift for twelve months, interpreted as if this signal introduces the highest uncertainty to investors.

To draw conclusions on whether the muted reaction for firms with high absolute exclusions is due to higher uncertainty I also have to investigate if the firms with high absolute exclusions have a higher drift. Accordingly we would expect that these exclusions can explain future (twelve months) returns. In regression (2.15) market-adjusted firm-specific returns are regressed on the absolute exclusions.

$$|CAR|_{i,t+12} = \alpha_{i,t} + \beta_{i,t}|Exclusions|_{i,t-1} + \varepsilon_{i,t} \qquad (2.15)$$

where $|CAR|_{i,t+12}$ is the absolute market-adjusted return for firm *i* over the 12 months following portfolio formation. $|Exclusions|_{i,t-1}$ is the absolute exclusions (GAAP earnings minus I/B/E/S earnings) for firm *i* for the quarter prior to portfolio formation. When running regression (2.15) on the data, it turns out that the coefficient on the absolute exclusions is not significant.

There is in prior research indications of income-increasing items being more exposed to earnings management activities (e.g., McVay, 2006). Since these activities might introduce uncertainty to investors I study further only the exclusions that are positive (income-increasing). It could be argued that the market perceives earnings surprises with high income-increasing exclusions to have higher uncertainty. The problem here is that the sample becomes very limited. The tercile of firms with the highest income-increasing exclusions only comprise of 40 firm-quarter observations with non-missing observations. For none of the groups the ERC (-0.150 for High income-increasing exclusions and -0.348 for Low income-increasing exclusions) is significant.

Interestingly I find that in the regression on future market-adjusted returns, the coefficient on income-increasing exclusions is positive and significant (at the 10%-level). The market-adjusted return twelve months after the announcement increases by 0.9% for every income-increasing non-core EPS. But, when I control for additional

[134] Unfortunately there is no explicit data available on these “non-core earnings”.

risk factors and include *market cap* and *book-to-market* the coefficient is no longer significant (not tabulated here).

As a final test, in order to circumvent the problem of small numbers in the ERC regressions above, the sample is separated on the *signed* exclusions and ERC is compared for groups of firms with high/positive and low/negative exclusions. This separation yields 117-118 observations in each group. The ERC for the group with high signed exclusions (income-increasing) is -0.088 (t-value: -0.74) and the ERC for the group of low signed exclusions (income-decreasing) is 0.477 (t-value: 1.78).

I conclude that there are some indications in the data that income-increasing exclusions introduce uncertainty to investors. This uncertainty could thus be a potential explanation for the more muted reaction to the GAAP signal than to the I/B/E/S signal.

2.7 Critical assumptions of the theoretical framework

The results of this study are interpreted as if investors perceive the GAAP earnings measure to be more risky in the sense that it is less precise in its description of the underlying value creation of the firm. The theoretical framework in Section 2.2 thus postulates that it is the resolving information risk that drives the post-announcement drift. To infer the PEAD phenomenon to an omitted risk factor is intuitively appealing since the drift phenomenon has been so persistent over markets and time. If it has not been traded away, it really could have something to do with a systematic risk factor that researchers have not controlled for in empirical tests. One such factor could be information risk which is a risk factor that can be resolved over time, consistent with the drift pattern.

One should, however, be aware of that there are a number of empirical studies that thoroughly investigate risk as a potential explanation for the PEAD (e.g., Bernard and Thomas, 1989; Bernard *et al.*, 1997) and to my knowledge no study has been able to fully dismiss PEAD as a risk related phenomenon. In fact, it has been labeled the "grand-daddy of all anomalies" in Fama (1998).

Nonetheless, the null hypothesis of efficient markets is still a benchmark that any capital markets study has to relate to (e.g., Kothari, 2001; Richardson *et al.*, 2010). The framework in this study could therefore be considered an attempt to highlight under what assumptions information risk is consistent with the PEAD phenomenon. It is not proposed to be a full explanation of the drift, especially given the fact that the return predictions for the short position are ambiguous.

There are some critical assumptions in the theoretical framework that deserves some more attention. First, it is in this framework assumed that information risk is not possible to fully diversify away, i.e. it is systematic. This assumption might be problematic since there is no consensus in the empirical literature regarding this issue (e.g., Francis *et al.*, 2005; Aboody *et al.*, 2005). Nevertheless, in a Swedish sample of firms it has been found that firms with high information uncertainty (low earnings quality) appear to have a significantly larger cost of capital after controlling for other conventional risk factors such as *beta*, *book-to-market* and *size* (see Paper 3 in the dissertation). This suggests that Swedish investors perceive at least part of the information risk to be systematic.

A related issue regards whether this risk compensation is large enough to be able to explain the drift, which is implicitly assumed in the theoretical framework. The returns to the PEAD strategy, adjusted for expected returns measured by the three-factor model, is in most empirical studies approximately 8-10% a year.[135] By comparison, empirical studies on a US sample has found that the returns to a hedge portfolio strategy, taking a long position in stocks of high information uncertainty (low *accruals quality*) and a short position in stocks of low information uncertainty, generates on average 0.9-2.25% a year, after controlling for *beta*, *book-to-market* and *size* (e.g., Francis *et al.*, 2005). Assuming that these results capture returns to information risk, as defined in this study, and are possible to translate to the Swedish institutional setting, they indicate that the risk compensation investors get for bearing this risk is not high enough to be able to fully explain the observed PEAD return of about 1% a month.[136]

It has already been addressed in Section 2.2 that a critical issue with risk as an explanation for PEAD is that it predicts an upward drift on *both* the long position and the short position. This contradicts the empirical observation in most PEAD studies where the returns to the short position drift downwards in the post-announcement period.[137] Consequently it is not trivial to explain the classic PEAD results with an omitted risk factor. However, the theoretical framework assumes that the long and short positions are equally exposed to the information risk. In addition, it assumes that investors in the long and short positions have the same risk appetite. If relaxing these assumptions the risk explanation can, in addition to an upward drift, be consistent with both a zero drift and a downward drift on the short position.

First, it is not obvious that extreme good and bad earnings news are equally exposed to information risk. In light of research showing that firms have high incentives to manage earnings upwards, it could be argued that positive earnings surprises have higher uncertainty. Assuming that investors do not consider negative news to encompass the same information risk, this would yield a prediction of upward

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[135] An overview of PEAD studies can be found in the introductory chapter of the dissertation.

[136] Note though that the study by Francis *et al.* (2005) report realized returns, which is albeit a noisy estimate of expected returns (e.g., Elton, 1999).

[137] Recent studies of the PEAD do not always separately report the returns to the long and the short position, making it hard for the reader to assess the implications of risk on the short position. Doyle *et al.* (2006) is an exception. They report returns for the long and short position and find that the return on the long position is significantly larger. These results could be interpreted as if at least part of the return is due to an omitted factor in the expected return model, giving rise to an illusion of abnormal return.

drift after positive news but no drift after negative news. But, there is also empirical evidence indicating that extreme bad earnings news also can be considered to encompass uncertainty. Specifically, it has been shown that firms sometimes use earnings management to take so-called "big baths", depressing already low earnings in order to save reserves for the future. Francis *et al.* (2007) also show a U-shaped relationship between earnings signals and information uncertainty, suggesting that both the extreme positions (good and bad news) have high information uncertainty. To conclude, empirical evidence seems to point towards both good and bad earnings news encompassing high information uncertainty. The risk exposure should thus not differ too much in this respect.

Second, it is not obvious that investors holding the long and short positions have the same risk-appetite. It could be argued that the clientele of investors that hold short positions in general are less risk averse than investors holding long positions. The short position might in itself be considered to be more risky since there is no limit to the downside (in how much the stock price can increase), whereas the upside is limited (the stock price can only go down to zero). In addition the short-seller can be forced to close the position early, due to a margin call, when the stock price is not to his/her advantage. This characteristic of the short position might attract a certain kind of investors. If these investors indeed are risk neutral or even risk loving, the returns prediction for the short position will change from that proposed in the theoretical framework. In fact we would then expect to see either no drift (assuming risk neutral investors) or a downward drift (assuming risk loving investors) on the short position. To my knowledge there is no research explicitly investigating this potential clientele effect and its implications for risk as an explanation for the PEAD.[138]

2.8 Alternative interpretations

The PEAD literature is still struggling with the driving forces behind the drift. There is to date no consensus on what can explain this "underreaction" phenomenon. Since it is not without doubt that the PEAD is driven by the forces outlined in the theoretical framework, this study suffers from a problem of joint hypotheses. Acknowledging that the interpretation of the empirical results relies on debatable assumptions, it is important to consider alternative explanations for the empirical results. Below, I consider market frictions (Section 2.8.1), structural uncertainty and rational learning (Section 2.8.2) and mispricing due to behavioral biases (Section 2.8.3). These explanations all predict a downward drift on the short position.

[138] There are however some empirical papers that look at how institutional and local investors trade differently after earnings announcements. Booth *et al*. (2006) show that foreign institutional investors, that are assumed to be more sophisticated, trade on the drift pattern, whereas local investors are contrarian in their strategies, buying (selling) stocks with bad (good) news.

2.8.1 Market frictions

It is proposed in the literature that the initial underreaction and subsequent drift is generated by market frictions, for example that transaction costs related to performing a PEAD trading strategy are high enough to render it unprofitable.[139] Several empirical studies have tried to take into consideration these costs, but they have seldom been able to dismiss all of the PEAD return to these types of costs (e.g., Bernard and Thomas, 1989 and 1990; Bhushan, 1994). Some recent empirical studies have however tried to use a more comprehensive estimate of transaction costs, also taking into consideration more indirect costs such as price impact and opportunity costs (Chordia *et al*., 2007; Ng *et al*., 2008). Ng *et al.* (2008) find a more muted announcement reaction and a higher drift for firms with higher transaction costs. In addition they find that these costs are so high that they significantly drive down the profitability of the PEAD strategy. Consequently they propose that these costs provide an explanation for the existence of PEAD.

In addition to studies investigating market frictions as a possible explanation for the *existence* of the drift, a large literature also proposes market frictions as the reason for the *persistence* of the drift (for an overview see Barberis and Thaler, 2003). That is, given that the underreaction and drift occur for any reason (often argued to be behavioral), it is not traded away by rational investors due to these market frictions, also referred to as "limits to arbitrage". Arbitrageurs are here assumed to play an important role in capital markets, chasing "risk-free" returns by trading on observed returns patterns, such as the PEAD.[140] The "limits to arbitrage" literature argue however that trying to exploit these return patterns can be both risky and costly, rendering them unattractive for arbitrageurs. One example is that investors face the risk that prices in the short-run drift against his/her predictions. If the investor has a limited investment horizon, this might force him/her to liquidate the position at a loss. Shleifer and Vishny (1997) show that this risk is higher in an agency setting where the principal (who owns the invested funds) evaluates the agent (the portfolio manager) on returns. Seeing that returns in the short-run are negative, the principal might force an early liquidation. This risk might thus refrain rational agents from pursuing these investment strategies.[141] There might also be short-selling constraints hindering the investor to sell short. In many countries legal restrictions prevent pension funds and

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[139] A problem with explaining the drift with transaction costs is that several studies have documented that the drift is concentrated around following announcement dates, and it is not clear why costs should be higher at these times.

[140] The PEAD strategy is not really an arbitrage (risk-free) opportunity, which is exactly the point in the "limits to arbitrage" literature. According to Barberis and Thaler (2003) rational investors, trying to exploit mispricing, are referred to as "arbitrageurs".

[141] Premature liquidation might also be triggered by creditors.

mutual funds to engage in short selling.[142] If hindered to sell short, the investor will be more exposed to the fundamental risk on the long position, rendering it less attractive.

More specifically related to PEAD it has been shown empirically that stocks in the extreme portfolios of the PEAD strategy have very high idiosyncratic risk (measured as the volatility of the residuals from a three factor model). It has been proposed that this is the reason for why arbitrageurs avoid such positions and thus do not exploit the PEAD return pattern to the extent that it disappears (e.g., Mendenhall, 2004).

In relation to the results of this study, it is not obvious how market frictions could explain the difference between the announcement reaction and drift to the GAAP and core earning signals. In addition, it is really an empirical question whether Swedish investors face these restrictions in trying to exploit PEAD. To my knowledge there are no empirical studies investigating this and neither does this study.

2.8.2 Structural uncertainty and rational learning

Recent research relates *structural uncertainty* and *rational learning* to the return pattern of underreaction and drift. Brav and Heaton (2002) show in their "rational structural uncertainty model" that a returns pattern such as PEAD can arise even if investors are fully Bayesian-rational, assuming that they do not have full information. If investors face uncertainty about structural shifts in the value relevant parameter (for example earnings), they will appear to underweight a new signal that is announced just after a structural shift. This underweighting is due to investors mistakenly, but rationally, placing too much weight on old information because they are uncertain whether there has been a shift or not. As time passes and investors learn that there has been a structural shift, investors place more weight on the original signal, leading to a drift in security prices. Note, however, that this return prediction rely on the assumption that investors think the value relevant parameter is stable, when in fact there is a structural shift.[143]

This model is thus not consistent with the characteristics of an efficient market, where it is assumed that investors *both* have full information and are rational in how they process this information. However, as Brav and Heaton (2002) point out, it differs from the behavioral models where it is assumed that investors have full information but that this information is not processed in a rational manner. The

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[142] There might also be other restrictions hindering institutional investors to exploit these returns. In the US, institutional investors are not allowed to hold more than 5% of the shares outstanding for a specific firm (Ng *et al.*, 2008).

[143] Brav and Heaton (2002) also illustrate the opposite case where investors mistakenly incorporate a probability of a shift in their estimates, even though the parameter is stable (there is no shift). In that case, investors will mistakenly place too much weight on recent information and appear to overreact.

behavioral and the rational structural uncertainty models give rise to similar returns predictions, making them hard to distinguish empirically.

Francis *et al.* (2007) also propose that information uncertainty and learning by rational investors is related to the drift in security prices.[144] They show that stocks in the extreme unexpected earnings portfolios also exhibit higher information uncertainty. Information uncertainty is here defined as the extent to which the reported earnings map into cash flows, and is operationalized using the model specified in Dechow and Dichev (2002). Consistent with their predictions Francis *et al.* (2007) find that the stocks with the highest information uncertainty are followed by a muted announcement reaction and a drift in stock prices.[145]

There are two potential problems with this PEAD explanation. First, the framework proposed by Brav and Heaton (2002) is contingent on there being a shift in the underlying value relevant parameter, and it could be argued that this is not always descriptive of real-world earnings announcements. Second, the prediction in Francis *et al.* (2007) that rational learning drives the drift builds on the assumption that the initial uncertainty resolves over time. It is thus implicitly assumed that information in the post-announcement period *on average confirms* (and not contradicts) the original earnings signals. There is no theoretical motivation for this assumption.

2.8.3 Mispricing due to behavioral biases

The mispricing explanation has been proposed by several (e.g., Bernard and Thomas, 1990; Ball and Bartov, 1996). It is in this literature common to consider PEAD to be attributable to investors underestimating the persistence in unexpected earnings. Lately the field of behavioral finance also proposes some explanations based on human psychological limitations. First, Barberis *et al.* (1998) propose that investors suffer both from a *conservative bias* and a *representativeness bias*, where the first causes investors to underreact and the second, which comes into play after a while, leads investors to overreact in the longer term.[146] Second, Daniel *et al.* (1998) present a model where the initial underreaction and price drift is due to investors suffering from biases such as *overconfidence* and *self-attribution* which lead them to weight private information too high and public information too low. A third behavioral explanation is proposed in Hong

[144] Francis *et al*. (2007) are silent upon how the PEAD is related to the opposite returns prediction in Brav and Heaton (2002).

[145] Since the return following the announcement of high uncertainty signals in this sense is predictable, there has to be market limitations that can explain why rational investors with this information do not trade away the drift. An alternative interpretation is that mispricing arises for some reason (for example behavioral biases) at the release of new information and that rational learning describes the mechanism through which prices adjust towards a new equilibrium (see Francis *et al*., 2007, p. 409).

[146] *Conservatism* refers to the underweighting of recent information and *representativeness* refers to the overweighting of recent information.

and Stein (1999). According to their model, which distinguishes between informed traders and momentum traders, the initial underreaction is due to a slow diffusion of firm-specific information. As momentum traders can gain profits on this slow price adaption, more and more of these traders will enter the market, eventually leading to a long-term overreaction. It is important to note that all the behavioral explanations rely on two important building blocks; that investors on average are irrational (suffering from biases) and that there exist limitations in the stock market that refrain rational investors from trading away the observed returns (Barberis and Thaler, 2003).

A criticism raised against the behavioral models is that they potentially can explain both underreaction and overreaction. In addition, it is often argued that these behavioral predictions are "fitted" to explain a certain empirical pattern and might thus be sample specific (Fama, 1998). In line with this criticism, Forner and Sanabria (2010), in an out-of-sample test using data from the Spanish stock market, find no support for these behavioral explanations in relation to PEAD.

It cannot be ruled out that the results of the current study are driven by investors' cognitive biases which affect their processing of earning signals. Nevertheless, it is hard to see why investors would be more affected by for example the conservatism bias when processing the GAAP signal than when processing the I/B/E/S signal. Liang (2003), however, argues that when information uncertainty is higher there is more room for cognitive biases.

2.9 Concluding remarks

The theoretical framework proposed in this study links information uncertainty and risk to the empirical phenomenon labeled PEAD (post-earnings announcement drift). The purpose of this framework is to highlight under what assumptions information uncertainty as a priced risk factor is consistent with the return pattern of PEAD, i.e. an initial underreaction and subsequent drift in security prices. It was shown that for good news earnings signals, a signal perceived to be uncertain will be followed by a muted announcement reaction and a drift in prices as the risk resolves (assuming that investors are risk averse). The more uncertain the signal is perceived to be, the lower the initial reaction and the higher the drift. For bad news signals, it was shown that the return prediction, both at the earnings announcement and in the post-announcement period, is more ambiguous.

The return predictions from the theoretical framework were used to interpret the results of the empirical investigation. The question in focus was whether GAAP earnings and so-called core earnings introduce different levels of uncertainty to investors, in terms of how these accounting earnings measures depict the underlying value creation of the period, i.e. the economic earnings. It was found that the GAAP earnings signal had a more muted reaction and a higher post-announcement drift compared to the core earnings signal. These empirical results were interpreted as if the GAAP earnings signal introduces higher uncertainty to investors. It was argued that this higher uncertainty can be due to this earnings measure encompassing items, such as special items, that prior research has shown to be more likely to be manipulated and/or to encompass more estimation error.

Further empirical tests revealed that it is indeed the earnings level and not the expectations model that drives the returns difference between the GAAP and the core earning signals. There are also some indications that the income-increasing items, included in GAAP earnings but not in core earnings, might be the source of the perceived uncertainty. In addition, the drift in prices was in the main generated by the long position, i.e. after good earnings news, whereas the drift on the short position was close to zero. The drift on the short position was thus not in line with the theoretical framework, where an uncertain bad news signal should be followed by a positive drift in security prices. However, it was also pointed out that this return prediction can be considered to be quite uncertain, as discussed in depth in Section 2.7.

The results reported in this paper should be interpreted with caution, given that the theoretical framework rests upon a debatable assumption, namely that PEAD is related to information risk. To date, there is no consensus in the literature about the driving forces behind the drift. It can therefore not be ruled out that alternative explanations are driving the results reported in the paper.

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3 Earnings quality and the implied cost of equity capital – the Swedish case

Abstract

This paper reports results on the association between earnings quality and the implied cost of equity capital for a non-US sample of firms. In light of the ongoing debate in the empirical literature of whether earnings quality really is a priced risk factor, there is a need for out-of-sample evidence. I use a sample of firms listed in Sweden over the years 1994-2008, and argue that the association between earnings quality and implied cost of capital might be stronger in this market. I also propose a new approach to estimate the implied cost of capital. This approach differs from existing approaches since it is not restricted to firms with analyst following, positive earnings, positive earnings growth, and/or long time-series of accounting data. The benefits of an unrestricted sample are twofold; it enables a larger number of observations in the earnings quality tests, and it allows for a study of the full cross-sectional variation of the variables. The proposed cost of capital approach is a Residual Income Valuation application, using historical mean ROE as the ROE forecasts. In addition, firm-specific steady state ROE is modeled as a function of accounting conservatism, growth and cost of capital (following Skogsvik, 1998). In the main tests, I find that poor earnings quality seems to be associated with a higher implied cost of equity capital. On average, moving from the group with the highest earnings quality to the group with the lowest earnings quality, the cost of capital increases with about 1.6 percentage points after controlling for conventional risk factors. The results of the paper thus support the idea that information risk is a priced risk factor.

3.1 Introduction

Theoretical research suggests that information risk is a priced risk factor (e.g., Easley and O'Hara, 2004; Lambert *et al.*, 2011), i.e. investors demand a higher cost of equity capital for firms with high information risk.[147] In the empirical literature some papers report evidence supporting this view (e.g., Francis *et al.*, 2005; Gray *et al.*, 2009; Kim and Qi, 2010), whereas others are unable to find an association between cost of capital and information risk (e.g., Core *et al.*, 2008; McInnis, 2010). The empirical evidence is typically limited to samples of US firms, and there is hence a need for out-of-sample studies.

The objective of this paper is to examine the association between the cost of equity capital and information risk in a Swedish setting. If it can be confirmed that poor *earnings quality*, as a proxy for information risk, is associated with higher cost of capital also in this sample of firms, it supports the notion that information risk is a priced risk factor. In my view, this association is especially interesting to study in a Swedish capital market context. The Swedish stock market is well-developed, but analyst following has until recently been relatively limited (Doukas and McKnight, 2005).[148] Analysts act as information intermediaries in financial markets, and without these intermediaries one might assume that investors will demand a higher compensation for information risk. Hence, if there is an association between earnings quality and cost of capital, this association can potentially be stronger in Sweden.

Prior empirical studies use two alternative methods to determine whether earnings quality is a priced risk factor: either factor mimicking portfolio tests (e.g., Francis *et al.*, 2005; Nichols, 2006) or earnings quality regressions with implied cost of capital estimates as the dependent variable (e.g., Francis *et al.*, 2004; Gray *et al.*, 2009).[149] An advantage of factor mimicking portfolio tests is that there are few restrictions on data availability. However, the use of this method is also debated (e.g., Aboody *et al.*, 2005; Core *et al.*, 2008). The essence of the critique is that a significant loading on a factor proxying for information risk does not mean that it is priced by the market. Core *et al.* (2008) use a Fama and MacBeth (1974) approach and show that even though the loading on a factor that proxies for information risk is positive, the factor cannot explain the cross-sectional variation in returns.

Alternatively, the association between earnings quality and cost of capital is evaluated using *implied cost of capital* estimates. These estimates coincide with the

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[147] Cost of equity capital and cost of capital are used interchangeably in this report. Cost of debt is not considered.

[148] The Swedish stock market during the sample period is described in the introductory chapter of the dissertation.

[149] Gray *et al.* (2009) use a crude implied cost of capital proxy: the industry adjusted EP ratio. This proxy can only be considered to be valid under special conditions such as full payout ratio and no growth. In fact, in tests of robustness I do not find a significant relation between the EP ratio and earnings quality in my sample of firms. This might be an indication of the EP approach generating cost of capital estimates that are too noisy.

internal rate of return that equates a firm's current stock price with the discounted future expected (net) dividends. This research method avoids the critique raised against the factor mimicking portfolio tests. However, there are other disadvantages using this method. Existing approaches to estimate the implied cost of capital are constrained, as they can only be applied to firms with positive earnings, positive earnings growth, analyst following and/or long time-series of accounting data.[150] In many cases the loss of observations is substantial and it can be questioned whether inferences to the population of firms really can be drawn from observing these potentially non-representative samples.[151]

I choose to use implied cost of capital estimates to study whether earnings quality is a priced risk factor in a Swedish sample of firms. In order to mitigate the potential sample selection bias associated with such a methodology, I develop an implied cost of capital approach that does not restrict the sample in the dimensions previously mentioned.[152] It thus enables a study of the full cross-sectional variation in the variables of interest. For example, non-profitable firms and firms without analyst following might be viewed as overall more risky and potentially as having higher information risk. Including these types of firms in my sample is yet another reason for why a stronger association between earnings quality and cost of capital might be expected in this study.

The proposed implied cost of capital approach is an application of the residual income valuation model (RIV) and I choose to label it "the fundamental RIV approach". It uses firm-specific historical ROE (three-year mean) as forecasts of ROE for the first three years after the valuation point in time (e.g., Penman and Sougiannis, 1998).[153] The use of three year historical ROE has in previous research been found to be useful in forecasting (e.g., Skogsvik, 2008). From year 4 and onwards, both the ROE and the equity growth rate are assumed to fade linearly over a ten year period towards a steady state level. In the approach, firm-specific steady state ROE is modeled, assuming it is a function of the accounting conservatism in the industry, an

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150 Hou *et al*. (2010) propose a new approach to the implied cost of capital that is neither dependent on analyst forecasts, nor positive earnings, nor positive earnings growth. However, this approach hinges on a very elaborate earnings forecasting model that requires long time-series of accounting data. As such, the approach can also be used only on a limited sample of firms.

151 For example, in Easton and Monahan (2005) the majority of the Compustat firms is lost when implementing their implied cost of capital approach. Another example is Karamanou and Nishiotis (2009) in which they lose about 40% of their sample when testing the association between the announcement of IAS adoption and the change in implied cost of capital.

152 Not restricting the sample also enables a larger number of observations of the cost of capital. This is often crucial when doing statistical tests in samples, such as the Swedish one, where both the cross-section and time-series are limited.

153 ROE stands for "return on owners' equity" and is measured as earnings before extraordinary items divided by the book value of owners' equity in the beginning of the financial year.

assumed growth rate in the steady state and the firm's cost of capital (Runsten, 1998; Skogsvik, 1998; Skogsvik and Skogsvik, 2010).[154] The model is implemented quarterly in order to further enhance the number of observations.[155]

The fundamental RIV approach is evaluated by benchmarking it to more established models in the literature (e.g., Botosan *et al.*, 2010). I find that the mean cost of capital estimate derived from the fundamental RIV approach, is similar to the mean estimates derived from the established models. The standard deviation around the mean is however higher for the fundamental RIV approach.[156] The implied cost of capital estimates from different approaches are also evaluated in regressions on conventional risk factors (*beta*, *market cap* and *book-to-market*). In these regressions, the estimates derived from the fundamental RIV approach seem to be more associated with the risk factors than the other estimates. The adjusted R^2 is 23.3% when the implied cost of capital estimates are derived from the fundamental RIV approach, whereas it is only 1.9 - 15.3% when the implied cost of capital estimates are derived from the established models. However, when *book-to-market* is excluded as an explaining variable, the adjusted R^2 is reduced for the fundamental RIV approach. I conclude that my approach seems to generate cost of capital estimates that are (at least) at par with estimates from the more established approaches.

The estimates derived from the fundamental RIV approach are then used to answer the main question of the paper; whether *earnings quality* (EQ) is associated with the cost of capital for firms listed in Sweden. Over the time period 1994-2008, firms with the necessary data generate 940 firm-quarter observations of the implied cost of capital. Following prior research, I regress the cost of capital estimates on conventional risk factors and an EQ rank based variable, ranging from 1 to 5 (EQ is measured either as *value relevance* or *timeliness* and a high rank of EQ means that the firm has high earnings quality).[157] For both measures of EQ, the coefficients are positive and statistically significant, indicating that firms with a low EQ are associated with a higher cost of capital.[158] The magnitude of the coefficients on the EQ rank variables are in line with previous research (e.g., Francis *et al.*, 2004). On average, moving from the group with the highest earnings quality (measured as *value relevance*) to the group

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[154] As a proxy for accounting conservatism I use the industry based measure developed in Runsten (1998). The opportunity to use an existing empirical measure of accounting conservatism, in the estimation of cost of capital, is an additional benefit of using a Swedish sample of firms (see also Skogsvik and Skogsvik, 2010).

[155] Another example of implementation on shorter time-intervals is Daske (2006), who implements a cost of capital model using monthly observations on stock price.

[156] This higher standard deviation could be attributed to the firm-specific steady state ROE, which allows for more firm-specific variations in the determinants of cost of capital.

[157] With a sample of Czech firms, Hellström (2006) validates the value relevance methodology as indicative of accounting quality.

[158] In robustness tests I include year-dummies in the regressions and report statistical significance based on White's heteroskedasticity consistent t-values (White, 1980). The results remain, though slightly muted.

with the lowest earnings quality, the cost of capital increases with about 1.6 percentage points.[159]

There is scarce evidence on the association between *earnings quality* and the *implied cost of capital* for non-US samples of firms. Using a Swedish sample of firms, this study provides out-of-sample evidence of poor earnings quality being associated with a higher cost of capital. The paper thus corroborates prior research showing that information risk is a priced risk factor.

Another contribution of this paper is the development of the fundamental RIV approach to estimate the cost of capital. The approach seems to be, at least, at par with the more established implied cost of capital approaches in terms of its ability to explain variations in conventional risk factors. More importantly, the approach does not suffer from the same sample restrictions as more established approaches. In a robustness test it is indeed found that, when the sample is restricted to firms with positive earnings, positive earnings growth and analyst following, the association between earnings quality and cost of capital is no longer significant. This might be an indication of small, non-profitable firms (typically excluded from the sample) having a more pronounced association between earnings quality and cost of capital than other firms.

3.2 Previous research

In this section, I discuss previous research on the association between information uncertainty and cost of capital (3.2.1), the measurement of information uncertainty based on operationalizations of earnings quality (3.2.2), and the measurement of the cost of equity capital (3.2.3). This discussion serves as a foundation for the choices of empirical estimates of both cost of capital and information uncertainty that are done in the study. In subsequent tests, the estimates of the cost of capital are regressed on the measures of earnings quality.

3.2.1 Information uncertainty and the cost of equity capital

In a classic CAPM setting, information risk is typically ignored (e.g., Sharpe, 1964; Lintner, 1965). Beta captures *all* the risk, and expectations on beta are assumed to be exogenously given. As such, the quality of accounting information is not an issue. When relaxing these assumptions, however, information risk might become a concern. The theoretical literature proposes several factors why information risk indeed should be priced by investors. For example, when relaxing the assumption of homogenous

[159] The effect is somewhat smaller when EQ is measured as *timeliness* (1.3 percentage points). This difference in magnitude, between *timeliness* and *value relevance,* has also been found in previous research (e.g., Francis *et al*., 2004) and it is thus often argued that *value relevance* thus might be a better proxy for EQ.

beliefs among investors, Merton (1987) shows that a firm's cost of equity capital decreases when the uninformed investors receive more information about the firm. Diamond and Verrecchia (1991) also demonstrate how higher information risk can increase the cost of capital through liquidity risk. Easley and O'Hara (2004) argue that the cost of capital effect is mainly due to the asymmetry in the distribution of information among investors. Lambert *et al.* (2011), on the other hand, argue that it is not information asymmetry that gives rise to the effect on cost of capital, but rather the average level of information precision. The theoretical studies thus seem to agree on investors perceiving information uncertainty as a risk factor.

Prior empirical evidence is less clear-cut, however. Most of these studies use earnings quality (EQ) as a proxy for information uncertainty, where low earnings quality is a measure of high information uncertainty, and vice versa.[160] Francis *et al.* (2004) find that several earnings quality proxies are statistically associated with implied cost of capital estimates, indicating that earnings quality is perceived as a risk factor by investors. Similar conclusions are drawn by Bhattacharya *et al.* (2003), who look at a composite earnings quality measure. McInnis (2010) however finds that *earnings smoothness* as a measure of earnings quality is not associated with implied cost of capital estimates.

Using factor mimicking portfolio tests, several papers find a positive loading on the return of a portfolio based on earnings quality (e.g., Francis *et al.*, 2004; Nichols, 2006; Gray *et al.*, 2009).[161] These results indicate that firms with poor earnings quality have higher returns. Since the loading on this EQ factor is significant after controlling for other conventional risk factors, it is concluded that earnings quality indeed is a priced risk factor. However, this conclusion is disputed (e.g., Aboody *et al.*, 2005; Core *et al.*, 2008). Core *et al.* (2008) argue that, to be able to conclude that this factor is priced, one has to be able to show that the loading on the EQ factor can explain cross-sectional returns. Employing a methodology following Fama and MacBeth (1974), they show that the EQ factor has no explanatory power on the distribution of stock returns. Accordingly, they dismiss the idea that earnings quality is a priced risk factor.

Recent papers employ the same technique as Core *et al.* (2008), but report conflicting results (e.g., Ogneva, 2010; Kim and Qi, 2010). Ogneva (2010) points out that poor earnings quality is positively correlated with negative cash flow shocks, which in turn leads to negative returns. She proposes that the negative returns might

[160] I restrict the following discussion to results regarding the association between earnings quality and cost of capital and do not cover research that uses other proxies for information uncertainty.

[161] The portfolios are constructed so that a long position is taken in stocks with low earnings quality and a short position in stocks with high earnings quality. The return of the combined portfolio (long minus short) is added as a fourth factor, in addition to the excess market return, the return to the SMB portfolio and the return to the HML portfolio. The dependent variable is firm-specific return in excess of the risk free rate.

offset the higher expected returns required for firms with poor earnings quality. Failing to control for the negative cash flow shocks, it is hard to empirically find an association between earnings quality and realized returns. Ogneva (2010) finds that, after controlling for the negative cash flow shocks, the EQ factor is indeed associated with cross-sectional returns.

To summarize, the theoretical research seems to suggest that information uncertainty should be perceived by investors as a risk factor. The empirical research however provides mixed evidence. The return tests (using factor mimicking portfolios) are debated and, as mentioned in the introduction, the implied cost of capital approach has only been used in fairly restricted samples. Overall, this suggests a need for more empirical evidence.

3.2.2 Measuring information uncertainty

It is common in the literature to use *earnings quality* as a summary indicator of accounting information uncertainty.[162] Investors care about the future pay-offs of investments and poor earnings quality potentially obstructs the assessment of these pay-offs. The concept of earnings quality is however difficult to operationalize and measure empirically. Nevertheless, there is a vast literature suggesting different proxies for earnings quality (for an overview, see for example Dechow and Schrand, 2004; Francis *et al.*, 2006; Dechow *et al.*, 2010).

Francis *et al.* (2004) compare a number of earnings quality metrics with the aim of determining which dimensions of earnings quality that investors care most about. Four metrics are characterized as "accounting-based" and three are characterized as "market-based". The accounting-based metrics (*accruals quality*, *persistence*, *smoothness* and *predictability*) are measured using accounting data and look at the difference between cash flows and earnings (i.e. the accruals). The market-based metrics (*value relevance*, *timeliness* and *conservatism*) also use accounting data, but relate this data to market prices or returns. Francis *et al.* (2004) find that *accruals quality*, *persistence* and *value relevance* have the highest association with their cost of capital estimates, and conclude that these dimensions of earnings quality matter most to investors. *Accruals quality* has in subsequent studies been the predominant proxy for earnings quality (e.g., Francis *et al.*, 2005; Gray *et al.*, 2009; Kim and Qi, 2010).

The logic behind the earnings quality metrics is not always evident. One example is *smoothness*, where it is not obvious that smooth earnings really should be an indicator of low information uncertainty. If a firm has very smooth earnings, surely investors

[162] Some studies try to separate earnings quality into innate earnings quality and discretionary earnings quality, where the first arises from innate sources such as the firm's business model and the second arises from the financial reporting process (e.g., Francis *et al.,* 2005). However, this paper focuses on total earnings quality.

would suspect some kind of earnings management and consider the reported information to be uncertain.

In addition, some of the earnings quality metrics can be considered to be contradictory. In for example *total accruals*, earnings are considered to be of high quality if they are highly associated with cash flows. A different perspective, underlying for example the *value relevance* metric, is that earnings are of high quality if they are highly associated with stock market returns. It is not obvious that these two quality dimensions coincide.

I use *value relevance* and *timeliness* as proxies for earnings quality. A benefit of these measures is that the estimations do not require a long time-series of accounting data.[163] In addition, the measures are possible to implement with quarterly data, increasing the number of data points in the regressions with cost of capital.[164]

3.2.3 Measuring the cost of equity capital

Realized returns have been used as a proxy for the *expected* returns in prior research. This is problematic however, as pointed out by Elton (1999). Realized returns can be decomposed into *expected* returns and *unexpected* (or abnormal) returns. When using realized returns as a proxy for expected returns, it is presumed that unexpected returns has a zero mean, at least in sufficiently large samples. However, unexpected returns are large in magnitude and correlated across firms and time. Consequently, average realized returns are often a biased proxy of expected returns, even in large samples. In addition, Vuolteenaho (2002) finds empirically that the part of realized returns that corresponds to unexpected returns, has a much higher variation than the part that corresponds to expected returns. In fact it seems like the unexpected return component is the dominant factor driving firm-specific realized returns. These findings suggest that realized returns are problematic to use as a proxy for expected returns.

New approaches to find better estimates of the expected return have been a concern in the finance and accounting literature over the latest decade. Many of these use valuation models and calculate the implied discount rate that equates the modeling value of the share to the share price. Using the PVED model (Present Value of Expected Dividends) as an illustration, the implied cost of capital approach means solving for r in the following equation:

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[163] Other proxies of earnings quality, for example *accruals quality*, can be implemented in the cross-section. However, a large cross-section is then needed for each industry.

[164] Yet another motivation is that both these metrics use returns as their reference construct. It is assumed that earnings of good quality reflect economic earnings (which are represented in market returns). This concept of earnings quality (or information uncertainty) is also the theme of the second paper of the dissertation.

$$P_0 = \sum_{t=1}^{T} (1+r)^{-t} E_0(dps_t) + (1+r)^{-T} E_0(P_T)$$

(3.1)

where:

$P_0 =$	price of share at time $t = 0$,
$r =$	required (expected) cost of equity capital,
$dps_t =$	dividend per share at time t,
$E_0(\ldots) =$	expected value of (…) assessed at time $t = 0$,
$P_T =$	price of share at time $t = T$.

In PVED the value of a stock equals the discounted present value of future expected dividends up to the terminal date T and the discounted expected price of the stock at this terminal date. When applying the model to empirical data, one has to decide on the choice of T and how to assess the terminal price, P_T. A common way to calculate P_T is to apply Gordon's growth formula, where the expected value of the dividend in the first period after T is expected to grow at a constant rate (g_{ss}).

$$P_0 = \sum_{t=1}^{T} (1+r)^{-t} E_0(dps_t) + (1+r)^{-T} (r - g_{ss})^{-1} E_0(dps_{T+1})$$

(3.2)

where:

$g_{ss} =$	growth rate in the steady state, $t = T+1, T+2, \ldots$.

The growth rate in the steady state is either exogenously given or can be solved for simultaneously (e.g., Nekrasov and Ogneva, 2011).

Even though the underlying logic basically is the same for all implied cost of capital approaches, the implementations proposed in the literature differ regarding the timing of the steady state, growth up to the steady state, and growth in the steady state. The implementations also differ with respect to the forecasts which constitute input variables in the models. Depending on which valuation model that is used, data is needed on the market's beliefs about expected future dividends, earnings, book values of equity, and the growth rate in the steady state. Since the beliefs of the market are non-observable, analysts' forecasts of these variables have often been used in prior research.

Table 3.1 summarizes some commonly used implied cost of capital approaches,[165] which will serve as benchmarks to the fundamental RIV approach suggested in this paper.

Table 3.1. Implied cost of capital formulas

Implied cost of capital	Formula
r_{ojn}	$r_{ojn} = A + \sqrt{A^2 + \frac{eps_1}{P_0} \times \left(\frac{eps_2 - eps_1}{eps_1}\right) - (\gamma - 1)}$ $A = \left((\gamma - 1) + \frac{dps_1}{P_0}\right)\frac{1}{2}$
r_{mpeg}	$r_{mpeg} = A + \sqrt{A^2 + \left(\frac{eps_2 - eps_1}{P_0}\right)}$ $A = dps_1/(2P_0)$
r_{peg}	$r_{peg} = \sqrt{\left(\frac{eps_2 - eps_1}{P_0}\right)}$
r_{gls}	$P_0 = bps_0 + \sum_{t=1}^{12}(1 + r_{gls})^{-t}\left[(ROE_t - r_{gls})bps_{t-1}\right] + (1 + r_{gls})^{-12}(r_{gls})^{-1}\left[(ROE_{ss} - r_{gls})bps_{12}\right]$

(i) P_0 is the price of the share at the first trading day of the calendar year. eps_t is the forecast of earnings per share, measured with the median of analysts' forecasts as of December 31 year t-1. dps_1 is the forecasted dividend per share for year 1, measured as dps_{-1} which is the actual dividend per share for the year preceding the valuation date, year -1. $(\gamma-1)$ is the growth in abnormal earnings beyond the forecast horizon and is set to the risk-free rate minus 3%. bps_0 is the book value per share at the end of year -1, i.e. at the valuation point in time. ROE_t for years 1-3 is in the r_{gls} approach measured as eps_1, eps_2 and eps_3 divided by beginning of period book value per share. From year 4 to year T, ROE_t fades linearly towards the steady state ROE, ROE_{ss}. ROE_{ss} is in the r_{gls} approach set equal to the historical median ROE for the industry in which the firm operates.

Gebhardt *et al.* (2001) use a RIV model to solve for the cost of capital. Estimates generated by this approach are referred to as r_{gls}.[166] Analyst forecasts of earnings are

[165] A more extensive overview can be found in Botosan *et al*. (2010), Table 2 and 3.

used for the first three years, and then it is assumed that the forecasted ROE_t of year 3 linearly fades towards the ROE in the steady state. Gebhardt *et al.* (2001) further assume that ROE in the steady state, ROE_{ss}, is equal to the historical median ROE of the industry in which the firm operates. The residual return in the steady state is thus the spread between the industry median ROE and the cost of capital.[167]

Ohlson (2005) points out that the RIV model might be sensitive to the assumption of the clean surplus relation (CSR). By rewriting PVED, Ohlson and Juettner-Nauroth (2005) derive the abnormal earnings growth (AEG) model, which does not rely on CSR. The AEG model anchors on capitalized forward earnings and has an "adjustment factor" for future growth in abnormal earnings, where abnormal earnings growth essentially is cum-dividend earnings minus earnings for the previous year. Gode and Monhanram (2003) use the AEG model to generate implied cost of capital estimates, here referred to as r_{ojn}.[168]

Easton (2004) uses the PEG model (Price to Earnings Growth) to derive an estimate of the cost of capital. The PEG model is the price to earnings ratio (PE) divided by the forecasted growth in earnings. Easton (2004) also shows that when there is no abnormal growth in earnings beyond the second forecast period, the AEG model coincides with the modified PEG ratio and the cost of capital estimate r_{mpeg}. If one additionally assumes that the forecasted dividend for year 1 is zero, r_{mpeg} coincides with r_{peg}.

The above cost of capital estimates have frequently been used in previous empirical research and will serve as benchmarks for the fundamental RIV approach developed in this study. Note that all of the approaches require data on analysts' forecasts of earnings. The r_{ojn}, r_{mpeg} and r_{peg} approaches can moreover only be implemented for firms with positive earnings and positive earnings growth.[169]

In addition to being sensitive to assumptions and forecasting methods, the estimates are inherently hard to validate. Nevertheless, several validation procedures have been proposed in the literature. A first validation procedure is to correlate the estimated cost of capital to realized returns. If the correlation is positive, the cost of

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166 In Table 3.1 the formula for r_{gls} does not define the cost of capital explicitly, since such an expression is cumbersome. The r_{gls} approach is in the literature commonly presented with a valuation model instead, where r_{gls} is solved for.

167 Claus and Thomas (2001) also use the RIV model to infer the cost of capital. The difference compared to the application by Gebhardt *et al.* (2001) is that Claus and Thomas (2001) assume a forecasting period of five years and use analysts' forecasts of earnings and book values during this period. In the steady state they assume a growth rate equal to the inflation rate, which they set to be equal to the nominal interest rate minus 3%. This growth rate is thus similar to all firms and industries. I do not report the specification by Claus and Thomas (2001) in Table 3.1, since it will not be considered in this paper.

168 OJN stands for Ohlson Juettner-Nauroth. In the estimation of r_{ojn}, I follow the implementation of Gode and Mohanram (2003) which is described more thoroughly in Section 3.5.1.1.

169 Positive values of earnings growth is required in order to restrict the solution to one value of the cost of capital.

capital estimates can be considered to be valid proxies of expected returns (e.g., Gode and Monhanram, 2003; Guay *et al.*, 2005). The procedure hinges upon realized returns being a good proxy for expected returns, which, as mentioned above, can be somewhat problematic. Some argue however, that for large portfolios the problem is less severe (e.g., Gode and Monhanram, 2003). The correlation between realized returns and cost of capital estimates are therefore usually done on a portfolio level.

Another validation procedure tries to control for cash flow news and expected return news when regressing realized returns on the implied cost of capital estimates (Campbell, 1991). Easton and Monahan (2005) set up a regression with firm-specific realized return as the dependent variable and the estimated implied cost of capital, a proxy variable for cash flow news and a proxy variable for expected return news, as independent variables (following Vuolteenaho, 2002). They recognize that there can be measurement errors in the control variables, which would affect the coefficient estimates. Hence, they try to control for this and isolate the measurement error that is attributable to the cost of capital estimate. Botosan *et al.* (2010) also use the regression proposed by Vuolteenaho (2002), but argue that Easton and Monahan's (2005) results are sensitive to the definition of the control variables and even subject to induced circularity.[170]

A third validation procedure is to investigate how the implied cost of capital estimates are correlated to factors that have been shown to be related to risk (e.g., Gebhardt *et al.*, 2001; Botosan and Plumlee, 2005; Botosan *et al.*, 2010). This procedure requires that the choice of risk factors is exhaustive and correct, which is unlikely. It is really only the market *beta* that is theoretically related to investment risk (e.g., Sharpe, 1964; Lintner, 1965), even though other factors such as *book-to-market* and *size* (market capitalization) have been proposed to be able to explain cross-sectional variations of risk (e.g., Fama and French, 1992 and 1993).[171] However, empirical investigations have typically focused on the association between these factors and *realized returns*, so we do not really know the relationship between these "risk factors" and expected return. Despite the shortcomings, regressions on risk factors are commonly used as a means of validation. The implied costs of capital estimates are then expected to have a

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[170] This circularity comes from Easton and Monahan's proxy for expected return news, where they use the change in implied cost of capital over the year. Since this variable is a function of the change in price (which is part of the dependent variable) and the change in cash flows (which is part of the other control variable), there is by construction correlation among the independent variables.

[171] Dividend yield has also been proposed as a risk factor (e.g., Rozeff, 1984). However, it is seldom used in validation tests of implied cost of capital estimates.

positive association with *beta* and *book-to-market*, and a negative association with *market cap*.[172]

A fourth validation procedure is proposed in Daske *et al.* (2010). They evaluate different estimates of the implied cost of capital by comparing the estimates to a "true" cost of capital derived from a simulated economy. The result of this type of validation procedure is dependent on the assumptions made in the simulation, regarding for example sales growth and EBITDA margins.

Results from the validation procedures are mixed. Guay *et al.* (2005) and Easton and Monahan (2005) find that all the established implied cost of capital approaches generate estimates that have very low validity. However, after refining the control variables in Easton and Monahan (2005), Botosan *et al.* (2010) find a significant association with realized returns for almost all cost of capital estimates. In particular, it is found that r_{peg} appears to be robustly associated with realized returns after controlling for cash flow and cost of capital news.

Botosan *et al.* (2010) also show that many implied cost of capital estimates have a robust relationship to risk factors. For example estimates of r_{peg} are in yearly regressions typically positively associated with *unlevered beta*, *leverage*, *book-to-market* and *growth*, and negatively associated with *market cap*.[173]

Using the simulated cost of capital as a benchmark, Daske *et al.* (2010) find that most of the established estimates appear to exaggerate the cost of capital. There seems to be a distortion effect so that the models tend to overestimate the cost of capital when the "true" cost of capital is high, and to underestimate it when it is low. Further analyses show that this distortion can be traced to the modeling of future pay-offs in the implied cost of capital approaches. Typically it is here assumed that most pay-offs accrue relatively early, whereas they accrue on average later in the simulated economy. Nevertheless, Daske *et al.* (2010) find that the implied cost of capital estimates capture up to 90% of the variation of the "true" cost of capital, and that RIV applications and approaches with long forecasting horizons do better than other models.

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[172] Regarding the expectations on *book-to-market* and *market cap*, Botosan and Plumlee (2005) refer to Berk (1995). He argues that if the model of expected returns is not complete, the market capitalization variable will by construction have a negative loading since higher risk will give a lower price and thus a lower market capitalization. Consequently, *book-to-market* (which has price in the denominator) will have a positive coefficient. This is also consistent with the empirical findings in Fama and French (1992), but not consistent with the findings of Dechow *et al.* (2004) who propose that *book-to-market* is a crude proxy for "equity duration" and thus should have a negative relationship with risk. Due to the ambiguity of the relationship between these variables and risk, Botosan and Plumlee (2005) include the variables step-wise in their regression on cost of capital estimates. When including both variables, the coefficient on *market cap* is not significant (Table 4 in Botosan and Plumlee, 2005).

[173] Referring to previous research, Botosan *et al.* (2010) unlever the *market beta* in order to be able to more easily interpret the coefficient on this variable. When using the levered market beta, it captures both leverage risk and the risk associated with co-movements with the market (e.g., Modigliani and Miller, 1958).

It is clear from the discussion above that estimating the cost of capital is quite complex.[174] In addition to being hard to validate, the established implied cost of capital approaches are constrained by the fact that they require positive earnings, positive earnings growth, analyst following and/or long time-series of accounting data.

3.3 The fundamental RIV approach

I propose a new implied cost of capital approach – "the fundamental RIV approach". Cost of capital estimates from this approach are labeled r_{riv}.

The fundamental RIV approach uses an explicit forecast period of three years and thereafter ten years of a fading pattern towards a steady state. The estimation approach differs from existing approaches in a number of ways. First, firm-specific historical means of ROE are used as forecasts for ROE_t for years 1 to 3. Previous research indicates that historical mean values of ROE are useful in forecasting (e.g., Penman and Sougiannis, 1998; Skogsvik, 2008). Second, dividend policy is defined as the ratio of dividends to owners' equity (dpf_t). I argue that this relation is more stable than relating dividends to earnings, and thus more suitable for forecasting. Third, both ROE_t and the growth in owners' equity are assumed to change linearly over time from year 4 to time T+1 (=13). The linear fading process for ROE_t is calculated as:

$$ROE_t = ROE_3 + \left(\frac{ROE_{ss} - ROE_3}{10}\right)(t-3) \tag{3.3}$$

for $4 \leq t \leq 12$.

where:

$ROE_t =$ return on owners' equity for period t,
$ROE_{ss} =$ return on owners' equity in the steady state.

Fourth, ROE in the steady state (ROE_{ss}) is modeled to be a function of *accounting conservatism*, the *steady state growth rate* and the *cost of capital* (cf. Skogsvik, 1998). ROE_{ss} can be written as a function of the other variables by rewriting the expression of the

[174] Additionally, the reported implied cost of capital approaches do not consider probabilities of bankruptcy failure (cf. Skogsvik, 2006). Consequently, the cost of capital estimates have more the character of a promised yield than of a required expected return. Skogsvik (2006) shows how probabilistic business failure predictions can be incorporated in bond and equity valuation models, and hence implicitly how an unbiased value of the expected cost of capital can be obtained.

terminal value in the RIV model. Conditional on the clean surplus relation, the terminal residual value is:

$$V_T - BV(E)_T = \frac{BV(E)_T(ROE_{ss} - r)}{r - g_{ss}} \tag{3.4}$$

where:

$V_T =$	value of owners' equity at time $t = T$,
$BV(E)_T =$	book value of owners' equity at time $t = T$,
$ROE_{ss} =$	return on owners' equity in the steady state,
$r =$	cost of equity capital,
$g_{ss} =$	growth rate in the steady state.

Rewriting (3.4) yields the following expression for ROE_{ss}:

$$ROE_{ss} = r + (V_T/BV(E)_T - 1)(r - g_{ss}) \tag{3.5}$$

Assuming that all business goodwill has evaporated at time *T*, a positive difference between V_T and $BV(E)_T$ is attributable to a conservative measurement of book values. Runsten (1998) refers to $(V_T/BV(E)_T - 1)$ as the permanent measurement bias (*PMB*).[175]

The accounting conservatism is presumed to be similar for firms within the same industry. For industries with conservatively measured assets the *PMB* will be positive, increasing the difference between ROE_{ss} and the cost of capital. This is in the main an effect of the book values of operating assets being conservatively assessed. The modeling of the conservative measurement bias allows for firm-specific estimates of the steady state ROE.

To summarize, in the fundamental RIV approach, the cost of capital is solved for in the following valuation formula:

[175] I describe the empirical measures of PMB in Section 3.5.1.1.

$$P_0 = bps_0 + \sum_{t=1}^{12}(1 + r_{riv})^{-t}\,[(ROE_t - r_{riv})bps_{t-1}]$$

$$+ (1 + r_{riv})^{-12}\left[\left(\frac{V_T}{BV(E)_T} - 1\right)bps_{12}\right]$$

(3.6)

where:

$P_0 =$	stock price at time $t = 0$,
$bps_t =$	book value of equity per share at time t,
$ROE_t =$	return on owners' equity for period t,
$\left(\frac{V_T}{BV(E)_T} - 1\right) =$	permanent measurement bias of owners' equity at time T,
$r_{riv} =$	cost of equity capital in the fundamental RIV approach.

Note that some forecasts are exogenously given, whereas ROE_{ss} has to be solved for simultaneously with r_{riv} in an iteration process.[176] This is described in Section 3.5.1.1.

The approach is further implemented on both yearly data (in order to benchmark it to other models) and quarterly data (to gain data points for the earnings quality tests). The application for quarterly data is described further in Section 3.5.2.1.

[176] ROE_{ss} is not an explicit variable in expression (3.6), but is needed to determine the forecasts of ROE_t from year 4 to year T in line with the fading process in expression (3.3).

3.4 Sample and data

The sample consists of firms listed on the Nasdaq OMX Stockholm Exchange (previously Stockholmsbörsen) during the period January 1994 to September 2008. In the beginning of the period only firms that were listed on the major list (the A-list) have been included in the sample. Subsequent to the list changes on October 2, 2006, firms listed on Large Cap have also been included in the sample. [177] As a consequence, 16 companies have been added to the sample as of October 2, 2006.

The sample firms make up a large portion of the total Swedish equity market. In 2005, 52 out of 269 listed firms were listed on the A-list and their total market value was approximately 80% of the total market capitalization this year. Financial companies have been excluded from the sample in order to increase the comparability with previous studies. Firms with a reporting year other than the calendar year have also been excluded, as a matter of convenience in the test design.

Three main data sources have been used in the study; I/B/E/S (Institutional Brokers' Estimate System), SIX (Scandinavian Information Exchange) and Datastream.[178] The analysts' forecasts have been collected from the I/B/E/S database provided by Thomson Reuters. I use the median of analysts' forecasts as of December 31 every year. Forecasts on earnings per share for the coming fiscal year (eps_1), two years ahead (eps_2) and three years ahead (eps_3) are used in the cost of capital estimates.

The accounting data has been provided by SIX, a Swedish company that sells financial information to market participants. SIX does not provide an established database for research purposes, but was at the start of this project the only source that could provide interim accounting reports for the sample firms over the period 1994-2008. The acquired data was in the form of 3-, 6-, 9- and 12-month reports and have been converted into quarterly accounting numbers.[179] Financial statements reported in foreign currencies have been converted to SEK with the exchange rate as of the last date of the reporting period.[180]

Stock market data – such as stock prices and returns, risk-free rates and return on the Morgan Stanley Sweden Index (MSCI) – have been collected from Datastream. Information about the number of shares outstanding for each firm has been collected from the periodical Börsguiden.[181]

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[177] These changes implied that the "A-list" and "O-list" were merged and divided into "Large Cap", "Medium Cap" and "Small Cap".

[178] For more information on data sources, see www.thomsonreuters.com and www.six-telekurs.com.

[179] For example, to get the income statement numbers for Q2, the numbers in the 3-month reports where deducted from the 6-month reports.

[180] Exchange rates have been obtained from the database EcoWIN.

[181] The number of shares is used to calculate market capitalization (*market cap*).

Sample firms with all the necessary data yields 940 firm-quarter observations in the main tests (61 firms have all the necessary data). Table 3.2 describes the distribution of observations over the sample period.[182]

Table 3.2. Number of observations over sample period

Year – quarter	# obs	Cum. Freq.
1996-Q4	4	4
1997-Q1	6	10
1997-Q2	9	19
1997-Q3	9	28
1997-Q4	20	48
1998-Q1	21	69
1998-Q3	24	93
1998-Q4	24	117
1999-Q1	27	144
1999-Q2	28	172
1999-Q3	26	198
1999-Q4	30	228
2001-Q1	28	256
2001-Q3	22	278
2001-Q4	21	299
2002-Q1	27	326
2002-Q2	27	353
2002-Q3	23	376
2002-Q4	24	400
2003-Q1	27	427
2003-Q3	28	455
2003-Q4	24	479
2004-Q1	28	507
2004-Q2	27	534
2004-Q3	25	559
2004-Q4	26	585
2005-Q1	28	613
2005-Q2	28	641
2005-Q3	29	670
2005-Q4	30	700
2006-Q1	27	727
2006-Q3	27	754
2006-Q4	28	782
2007-Q1	29	811
2007-Q3	29	840
2007-Q4	28	868
2008-Q1	24	892
2008-Q2	24	916
2008-Q3	24	940

[182] Since at least two yearly observations of ROE are needed to calculate historical mean ROE, the first observations of r_{riv} are for Q4 1996.

3.5 Estimation of variables and test design

The empirical tests are divided into two steps. Step 1 is concerned with the validation of implied cost of capital estimates from the fundamental RIV approach. Estimates from this approach are compared to four more established approaches (Section 3.2.3) in terms of regressions on established risk factors. These tests are based on yearly estimates of the implied cost of capital.

Step 2 is concerned with earnings quality and the cost of capital. I first implement the fundamental RIV approach with quarterly financial statements data, in order to increase the number of observations. Second, I run regressions with the cost of capital estimate as the dependent variable against an earnings quality rank variable, controlling for conventional risk factors. I test two alternative measures of earnings quality – *value relevance* and *timeliness*.

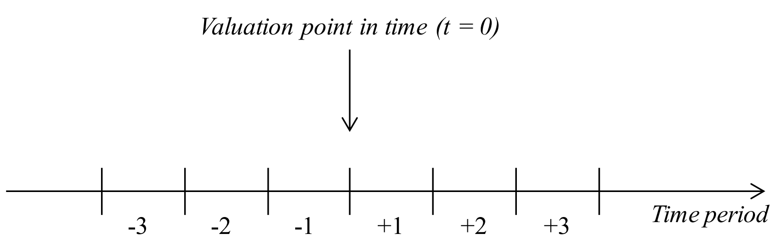
3.5.1 Validating the implied cost of capital estimates

3.5.1.1 Estimation of variables

In addition to the fundamental RIV approach, I implement four more established implied cost of capital approaches: r_{peg}, r_{mpeg}, r_{ojn} and r_{gls} (as specified in Table 3.1). In doing this, I try to follow the procedures of the original papers as much as possible. Below, the measurement of variables is described for each approach.

The valuation point in time is in all implementations the first trading day of period 1 (year 1 or quarter 1, depending on whether the model is implemented yearly or quarterly). At this point in time, the stock price (P_0) is set equal to the discounted forecasted accounting variables. The forecasts are made for periods 1, 2, 3 etc. and I refer to the periods preceding the valuation point in time as periods -1, -2, -3 etc. This is illustrated in Figure 3.1.

Figure 3.1. Illustration of valuation point in time



The r_{peg} approach:

- Forecasts of earnings per share (eps_1 and eps_2) are measured as of December 31 year -1, with the median of analysts' forecasts of eps_t for years 1 and 2, respectively.

The r_{mpeg} approach:

- Forecasts of earnings per share (eps_1 and eps_2) are measured as of December 31 year -1, with the median of analysts' forecasts of eps_t for years 1 and 2, respectively.
- dps_1 is the forecasted dividend per share for year 1. Analysts' forecasts of dividends are limited for Swedish firms, and as a proxy for dps_1 I use dps_{-1} (the dividend for the year -1).[183]

The r_{ojn} approach:

- Forecasts of earnings per share (eps_1 and eps_2) are measured as of December 31 year -1, with the median of analysts' forecasts of eps_t for years 1 and 2, respectively.
- As a proxy for dps_1, I use the dividend per share for the year preceding the valuation date, dps_{-1}.
- (y-1) is the growth in abnormal earnings beyond the forecast horizon. It is set equal to the risk-free rate minus 3% (following Gode and Mohanram, 2003). I use the return on a Swedish 1-year T-bill as the proxy for the risk-free rate.[184]

Note that the above approaches require data on analysts' forecasts of eps_t. In addition, the difference between eps_2 and eps_1 is used as an earnings growth measure when solving for r_{ojn}, r_{mpeg} and r_{peg}.[185] In order to restrict the solution to one value of the cost of capital, growth can only take on positive values, i.e. eps_2 is required to be larger than eps_1. Consequently, the three approaches can only be implemented for firms that are followed by financial analysts, have positive earnings and a positive trend in earnings.

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[183] By using dps_t of year -1 I introduce a possible look-ahead bias. Typically information on the dps_t of year -1 is not publicly known at the first day of year 1.

[184] Gode and Mohanram (2003) use the return on a 10-year T-bill as a proxy for the risk-free interest rate. During the sample period, the Swedish 10-year interest rate was on average 1% higher than the 1-year rate. As a consequence, using the 1-year rate implies a lower assumed growth in abnormal earnings.

[185] When estimating r_{mpeg} and r_{peg} it is common to assume that the short-term growth between eps_1 and eps_2 is not appropriate to explain price (e.g., Botosan *et al.,* 2010). Instead a more long-term growth in earnings, as expressed by the difference between eps_5 and eps_4, is used. Unfortunately, such long-term forecasts are not available for my sample of firms.

The r_{gls} approach:

- bps_0 is the book value per share (ex-dividend) at the end of year -1, i.e. at the valuation point in time.[186]
- ROE_t for years 1-3 are measured as eps_1, eps_2 and eps_3 divided by the beginning of period book value per share. eps_1, eps_2 and eps_3 are measured as of December 31 year -1, with the median of analysts' forecasts of *eps* for the financial years 1, 2 and 3 respectively. From year 4 to year $T = 12$, ROE_t is assumed to fade linearly towards the steady state ROE (cf. Gebhardt *et al.*, 2001).
- ROE_{ss} is the steady state ROE and it is set to the historical median ROE for the industry in which the firm operates. Median industry ROE is calculated using rolling three-year windows, requiring at least three observations to calculate the median. When implementing the r_{gls} approach, Botosan and Plumlee (2005) include firms with negative earnings in the estimation of industry median ROE. I follow this procedure.
- The payout ratio *pr* is estimated as dps_{-1} divided by eps_{-1}, i.e. the dividend per share for the year preceding the valuation date divided by the earnings per share for the year preceding the valuation date. The payout ratio is used to forecast future book values of equity and is assumed to be constant up to the steady state. Negative values of *pr* are set equal to zero and values of *pr* above one are set equal to one (following Gebhardt *et al.*, 2001).
- bps_t from year 1 to year T is forecasted presuming that the clean surplus relation holds, i.e. $bps_t = bps_{t-1} + eps_t \times (1-pr)$.

The fundamental RIV approach (r_{riv}):

- bps_0 is the book value per share (ex-dividend) at the end of year -1, i.e. at the valuation point in time.[187]
- For years 1 to 3, ROE_t is set to the firm-specific historical mean ROE. This historical mean is calculated using rolling three-year windows (years -3 to -1), requiring at least two firm-year ROE observations. From year 4 to year $T = 12$, ROE_t is assumed to fade linearly towards the steady state ROE.[188]

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[186] The look-ahead bias previously described also concerns the use of bps_0.

[187] Hence, the approach also suffers from the look-ahead bias previously described.

[188] There are many studies on the time-series behavior of ROE (e.g., Freeman *et al.*, 1982; Nissim and Penman, 2001; Skogsvik, 2008), all indicating that there is a mean reversion process in ROE. These results motivate the use of a linear fading pattern towards the steady state level of ROE (cf. Skogsvik, 1999).

- *dpf*, the dividend payout fraction, is measured as dps_{-1} divided by bps_{-2}, i.e. the dividend per share for year -1 divided by the equity book value per share at the end of year -2. The value of *dpf* is assumed to be constant for years 1-3.
- bps_t for years 1 to 3 is calculated using the following expression: $bps_t = bps_{t-1} + bps_{t-1} \times (ROE_t - dpf)$. From year 4 to year T, bps_t is forecasted assuming that the growth rate in owners' equity in year 3 fades linearly towards the steady state value, g_{ss}.
- g_{ss}, is assumed to be 2%.
- $(V_T/BV(E)_T - 1)$ is measured using industry estimates of permanent measurement bias (*PMB*) from Runsten (1998).[189] *PMB* values are collected from Runsten's 15 industries (cf. Table 5.2, p 151 in Runsten, 1998) and matched to the Datastream industry classification used in this study. If the industry classification includes more than one of Runsten's industries, the average of those *PMB* values are used. Each firm is attributed the *PMB* of the industry in which it operates.
- ROE_{ss} is assumed to be a function of the cost of equity capital, the steady state growth and the accounting measurement bias for the firm as described in expression (3.5).

The fundamental RIV approach and the r_{gls} approach both use the RIV model to solve for the cost of capital. However, the two estimation approaches differ in a few aspects. First, my approach does not require analyst forecasts and can thus be implemented on a larger number of firms. Second, the dividend policy is in my approach defined as dividends divided by the book value of owners' equity, whereas Gebhardt *et al.* (2001) relate dividends to earnings. I argue that dividends in relation to the book value of owners' equity is more stable and thus more suitable for forecasting. Third, in the r_{gls} approach, the payout ratio is a constant up to the steady state, whereas my approach allows for the growth in owner's equity to fade towards the growth rate in steady state. The fundamental RIV approach hence avoids a large jump in dividends prior to entering the steady state. The final difference is that the fundamental RIV approach models steady state ROE differently, assuming that it is a function of the permanent measurement bias, the cost of capital and the growth rate in steady state. As such, the approach models firm-specific estimates of steady state ROE, whereas the r_{gls} approach models industry-specific steady state ROE.

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[189] With a sample of 252 firms listed on the Stockholm Stock Exchange for the period 1966-1993, Runsten (1998) estimated PMB values for 15 industries. He calculated a marginal PMB for machinery, equipment, ships, buildings, trading property, land, investments in shares, R&D assets, human capital assets, marketing and advertising values, and deferred taxes. The median PMB for each asset class was then weighted by its relative importance in the industry. Finally, a time-series median of the total PMB for each industry was calculated.

In the r_{gls} approach and the fundamental RIV approach, iterations are needed in order to solve for the cost of capital. For each firm, I set the cost of capital to a starting value of 7%. In the fundamental RIV approach, this starting value is then used to first calculate ROE_{ss} (expression (3.5)). Subsequently, ROE_t for years 4 to T can be calculated (expression (3.3)) and forecasts of book values of equity can be calculated given the clean surplus relation of accounting. The solution of the cost of capital can be either higher or lower than the starting value of 7% and in a second step this new value is used as a starting point. This iteration process is done for each firm-year or firm-quarter until the solution to the cost of capital equals the starting value. The iteration procedure is restricted to only accept solutions that belong to the range [0.000001%, 30%].

3.5.1.2 Validity tests

I follow previous research and regress each cost of capital estimate on risk factors (e.g., Botosan and Plumlee, 2005; Francis *et al.,* 2004). The aim is to see if the cost of capital generated by the fundamental RIV approach are in line with estimates generated by more conventional models, before using these estimates to test for the association with earnings quality.

In the validity tests of the estimated cost of capital the following statistical model is used:

$$\hat{r}_{i,t} = \gamma_{0,i} + \gamma_{1,i} beta_{i,t} + \gamma_{2,i} MC_{i,t} + \gamma_{3,i} BM_{i,t} + \vartheta_{i,t} \qquad (3.7)$$

where:

$\hat{r}_{i,t} =$	implied cost of capital for firm *i* at the first trading day of year *t*, estimated from one of the approaches r_{gls}, r_{ojn}, r_{mpeg}, r_{peg} or r_{riv},
$beta_{i,t} =$	firm-specific CAPM beta, estimated with monthly data for 36 months preceding year *t* (minimum requirement of 18 monthly returns),
$MC_{i,t} =$	natural log of firm *i* 's market capitalization year *t*, measured at the last trading day of year *t*-1,
$BM_{i,t} =$	natural log of firm *i* 's book-to-market year *t*, measured as book value of owners' equity divided by market capitalization at the last trading day of year *t*-1.

As discussed in Section 3.2.3, $beta_{i,t}$ and $BM_{i,t}$ are expected to have positive coefficients, whereas $MC_{i,t}$ is expected to have a negative coefficient in regression (3.7). I choose to assess the validity of the cost of capital estimates both in terms of the sign of the estimated coefficients and in terms of the explained variation, R^2.[190, 191]

As a validation procedure, regression (3.7) has limitations. One problem is obviously which risk factors that should be included. Despite this limitation, a regression including the conventional risk factors seems to be the most common validation test in the literature.

3.5.2 Earnings quality and cost of capital regressions

The second step of the empirical tests concerns the question of whether investors perceive earnings quality to be a priced risk factor. In order to increase the number of observations, these tests are performed using firm-quarter observations. It is below described how the fundamental RIV approach is implemented using quarterly data, and how the two alternative proxies for earnings quality are estimated.

3.5.2.1 Quarterly estimates of r_{riv}

The main assumptions of the fundamental RIV approach were specified in Section 3.5.1.1 above. When applied to quarterly data, the discounted value of the forecasts is set to be equal to the stock price on the first trading day of each quarter. Another difference in relation to the yearly application is that some seasonality is built into the ROE_t forecasts. The forecasted ROE_t for Q1 in years 1-3 is set to the firm-specific historical mean ROE_t in Q1 during the three previous years (-3 to -1), the forecasted ROE_t for Q2 in years 1-3 is set equal to the ROE_t mean in Q2 during the three previous years, and so on. From year 4 and onwards, each quarter's ROE_t fades towards the steady state ROE. ROE in the steady state is still a function of the estimated cost of capital, industry-specific values of *PMB*, and a yearly growth rate of 2%, and all other assumptions are the same as in the yearly application.[192] The solutions for quarterly cost of capital are transformed to annual cost of capital values.[193]

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[190] Botosan *et al.* (2010) argue that to be able to judge which of the cost of capital estimates that is most related to risk factors, it is preferable to test the regression yearly. However, with the small number of observations in my sample, this is not possible.

[191] The alternative of using the returns decomposition approach (e.g., Easton and Monahan, 2005), i.e. regressing realized returns on the cost of capital estimate and control for cash flow news and expected returns news, is not feasible due to data limitations.

[192] Note that the starting value of quarterly cost of capital is set to 0.017059% $[(1+0.07)^{0.25} -1]$ and the quarterly growth rate is set to 0.004963% $[(1+0.02)^{0.25} -1]$.

[193] Annual cost of capital is equal to $(1+\text{quarterly cost of capital})^4 - 1$.

3.5.2.2 Quarterly earnings quality

I use *value relevance* and *timeliness* as proxies for earnings quality. The measure of *value relevance* tries to capture the ability of accounting earnings to explain variations in stock returns (e.g., Francis *et al.*, 2004). Following previous research, *value relevance* is measured as follows:

$$RET_{i,q} = \delta_{0,i} + \delta_{1,i}\frac{EAR_{i,q}}{MarketCap_{i,q-1}} + \delta_{2,i}\frac{\Delta EAR_{i,q}}{MarketCap_{i,q-1}} + \varepsilon_{i,q} \tag{3.8}$$

where:

$RET_{i,q} =$ firm *i*'s stock return during quarter *q*,
$EAR_{i,q} =$ firm *i*'s net earnings before extraordinary items in quarter *q*,
$\Delta EAR_{i,q} =$ change in firm *i*'s net earnings before extraordinary items between quarter *q* and quarter *q*-4,
$MarketCap_{i,q-1} =$ firm *i*'s market capitalization at the end of quarter *q*-1.

Regression (3.8) is estimated for each firm and quarter using data from rolling three-year windows (twelve quarters).[194, 195] To maintain comparability with previous research, I take the negative value of the adjusted R^2 from regression (3.8) as the measure of *value relevance*, meaning that higher values of the measure imply lower earnings quality.[196]

As an alternative measure of earnings quality, I use a measure of *timeliness* which captures the ability of earnings to reflect good/bad news that are impounded in returns (e.g., Francis *et al.*, 2004). Following previous research, *timeliness* is measured in the following regression:

$$\frac{EAR_{i,q}}{MarketCap_{i,q-1}} = \alpha_{0,i} + \alpha_{1,i}NEG_{i,q} + \alpha_{2,i}RET_{i,q} + \alpha_{3,i}NEG_{i,q} \times RET_{i,q} + \omega_{i,q} \tag{3.9}$$

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[194] The variables *RET*, *EAR* and *ΔEAR* are winsorized, setting the observations in the 1st and 99th percentiles to the cut-off values of these percentiles.

[195] I require data from at least six quarters in the estimation.

[196] Taking the negative value of R^2 simplifies the interpretation of the coefficients in the cost of capital regression, so that a positive coefficient is to be expected on the earnings quality variable.

where:

$NEG_{i,q} =$ 1 if $RET_{i,q} < 0$ and 0 otherwise.

Similar to the relevance measure, the measure of timeliness is here the negative value of the adjusted R^2 from regression (3.9). The regression is estimated using three-year (twelve quarters) rolling windows (at least six quarters are required).

Firms are ranked each quarter based on $-R^2$ for either regression (3.8) or regression (3.9) and divided into five groups, where firms with the highest (least negative) estimates on *value relevance* and *timeliness* are allocated to Group 5 (lowest EQ) and firms with the lowest (most negative) values are allocated to Group 1 (highest EQ). The firms' EQ rank is then used as an independent variable in the quarterly regression described in the following subsection.

3.5.2.3 Quarterly regressions

If earnings quality is perceived by investors as a priced risk factor and this can be captured with the chosen variables, I expect a positive coefficient on the variable *EQrank* in regression (3.10) below. Following previous research I include conventional proxies for risk as control variables in these regressions (e.g., Francis *et al.*, 2005; Gray *et al.*, 2009).

$$\hat{r}_{i,q} = \varphi_{0,i} + \varphi_{1,i}beta_{i,q} + \varphi_{2,i}MC_{i,q} + \varphi_{3,i}BM_{i,q} + \varphi_{4,i}EQrank_{i,q} + \vartheta_{i,q} \quad (3.10)$$

where:

$\hat{r}_{i,q} =$ implied cost of capital estimate for firm *i* according to the r_{riv} approach, at the first trading day of quarter *q*,

$beta_{i,q} =$ firm-specific CAPM beta (estimated with monthly data for the 36 months preceding quarter *q* and a minimum requirement of 18 monthly returns),

$MC_{i,q} =$ natural log of firm *i*'s market capitalization at the last trading day of quarter *q*-1,

$BM_{i,q} =$ natural log of firm *i*'s book-to-market, measured as book value of owners' equity divided by market capitalization at the last trading day of quarter *q*-1,

$EQrank_{i,q} =$ firm *i*'s rank on EQ, where EQ is either *value relevance* or *timeliness*. Firms are ranked and allocated to five groups. The group of firms with rank 1 has the highest EQ and the group of firms with rank 5 has the lowest EQ.

Regression (3.10) is estimated using all firm-quarter observations with data on all regression variables.

3.6 Descriptive statistics

Table 3.3 reports descriptive statistics of the key variables. The fundamental RIV approach (r_{riv}) generates median estimates of 9.4% and 10.3% for the yearly and quarterly applications, respectively.[197]

Table 3.3. Descriptive statistics of key variables. Sample period 1994 - 2008.

Variable	Mean	Median	Std Dev	N
quarterly r_{riv}	0.113	0.103	0.062	940
yearly r_{riv}	0.105	0.094	0.073	267
PMB	0.490	0.418	0.113	940
3-year historical mean ROE	0.154	0.149	0.109	456
beta	1.040	1.079	0.435	940
monthly stock return	0.010	0.008	0.101	7190
monthly market return	0.004	0.007	0.074	146
monthly risk free rate	0.003	0.003	0.001	146
book-to-market	0.536	0.506	0.287	940
market cap	44165	16681	117455	940

(i) r_{riv}, is the firm's cost of capital from the implied cost of capital approach described in Section 3.3 and Section 3.5. *PMB* is the permanent measurement bias per industry. *ROE* is the return on owners' equity, measured as earnings before extraordinary items (and after taxes) for year *t* divided by the beginning of the year book value of equity. The *3-year historical mean ROE* is calculated using data from the three years preceding year *t, beta* is the firm-specific CAPM beta estimated using monthly data for the 36 months preceding the quarter *q* (minimum requirement of 18 monthly returns), *monthly stock return* is firm *i* 's stock return during month *m*, *monthly market return* is the return in month *m* for stocks quoted on the "A-list", *monthly risk free rate* is the monthly return in month *m* on a Swedish 1-year T-bill, *book-to-market* is firm *i* 's book-to-market, measured as book value of owners' equity divided by market capitalization at the end of quarter *q*, *market cap* is firm *i* 's market capitalization, measured at the last trading day of quarter *q*.

The *PMB* has a mean value of 0.49 which implies that the average sample firm has "hidden" net asset values equal to about half the equity book value.[198] The three-year historical mean *ROE* has a mean of 15.4%, indicating that the average sample firm is quite profitable during the period 1994-2008.

The average estimated *beta* is 1.04 and its median value is 1.08. These estimations are based on monthly firm-specific returns, market returns and risk free rates. The mean monthly return is 1%, but a standard deviation of 10% indicates a very high variation in this return measure. The mean market return is 0.4%, with a standard deviation of 7.4%. Market return is here measured as the equally-weighted return for all stocks quoted at the main list (the A-list) during the sample-period.[199] The mean monthly risk free rate is 0.3%, implying an average market premium (difference between market return and risk free rate) of only 0.1%.

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[197] Differences are due to the sample not being exactly the same in the quarterly and yearly applications, i.e. for a certain year it might not be possible to estimate r_{riv} all four quarters.

[198] Details about the variation of *PMB* over industries are reported in Table 3.4.

[199] In Table 3.9 I report results where the beta estimations are based on the Morgan Stanley Sweden Index (MSCI) as a measure of market return. This measure of market return gives an average *beta* of 0.77. Table 3.9 shows that the *EQrank* variable is significant also in the regressions using the alternative measure of *beta*.

The mean *book-to-market* is 0.536, or equivalently the average sample firm has a market-to-book of about 2. The mean *market cap* is 44 165 MSEK, but the median is only 16 681 MSEK, indicating a skewed sample distribution including some very large firms. Due to this skewed distribution, I use the natural log of *market cap* in the regressions.[200]

Table 3.4 reports the *PMB*, *market-to-book,* and historical median *ROE* for all industries in the sample (yearly observations only).[201] Health Care is the industry with the highest *PMB* of 1.740. This is to be expected since pharmaceutical firms typically have large hidden assets in terms of non-capitalized R&D activities. Industrial firms have the lowest *PMB* of 0.418.

Table 3.4. Conservatism, market-to-book, historical industry ROE and ROE_{ss}

Industry	*PMB*	*M/B*	*ROE*	*ROEss*	*N*
Oil and Gas	-	1.252	0.112	-	5
Basic Materials	0.555	1.589	0.127	0.159	71
Industrials	0.418	2.116	0.135	0.112	186
Consumer Goods	0.595	1.950	0.143	0.178	48
Health Care	1.740	2.720	0.228	0.266	18
Consumer Services	0.620	2.211	0.126	0.155	31
Telecommunications	0.760	2.119	0.116	0.077	5
Utilities	0.760	1.827	0.104	0.107	5
Real Estate	0.555	1.378	0.099	0.251	23
Technolgy	0.590	3.889	0.184	0.092	34

(i) *PMB* is the Permanent Measurement Bias collected from Runsten (1998). It expresses the difference between value of equity and book value of equity in relation to the book value of equity. The value of equity is estimated using accounting principles that are not conservative (cf. Table 5.2, p 151 in Runsten, 1998). *M/B* is the market-to-book defined as market capitalization divided by the book value of equity. *ROE* is the time-series mean of the historical median ROE for the industry, calculated using three year rolling windows and demanding at least three observations to calculate an industry mean. ROE_{ss} is the steady state ROE that is solved for simultaneously with r_{riv} in the fundamental RIV approach. It is a function of PMB, cost of equity capital and steady state growth as specified in expression (3.5). *N* is the number of observations.

It is interesting to compare the *PMB* values to the *market-to-book*, which is the market capitalization divided by the book value of equity. If the industry is in a competitive equilibrium, the *market-to-book* would on average be equal to (1+*PMB*). Table 3.4 shows that for many industries the *market-to-book* substantially exceeds (1+*PMB*). Examples of such industries are Industrials, Consumer Services, Telecommunications and Technology. However, for some industries, for example Basic Materials and Utilities, there is only a slight difference.

In the RIV application by Gebhardt *et al.* (2001), it is assumed that the firm-specific *ROE* in the steady state is equal to the three-year historical industry median *ROE*, which is reported in the third column of Table 3.4. In this sample the

[200] This variable is referred to as *MC* in the tables.

[201] *PMB* is missing for the Oil&Gas industry, which is due to this industry not being included in Runsten (1998).

technology industry has a fairly high historical median *ROE* of 18.4% (the time-series mean of the estimated medians). Judging from the moderate value of the *PMB* for this industry, the high *ROE* is more due to high excess profitability than to the impact of accounting conservatism. For the health care industry however, the high *ROE* seems rather to be due to accounting conservatism.

Since the historical *ROE* encompasses effects of both accounting conservatism and excess profitability, it is potentially a biased proxy for the steady state *ROE*. Table 3.4 reports the steady state ROE (ROE_{ss}) that is solved for simultaneously with r_{riv} in the fundamental RIV approach. This ROE_{ss} is a function of the *PMB*, an assumed steady state annual growth rate of 2% and the implied cost of capital, as described in expression (3.5). Note that in cases where the *market-to-book* is considerably larger than 1+*PMB* (indicating excess profitability), the historical ROE is also higher than the calculated ROE_{ss}. This indicates that the ROE_{ss} used in the r_{riv} approach might be a better proxy, possibly not encompassing this excess profitability. Also lending support to the ROE_{ss} proxy in the fundamental RIV approach, is the fact that in the utilities industry, where the market-to-book indicates no excess profitability, the calculated ROE_{ss} is very similar to the historical ROE. In the real estate industry, the market-to-book compared to (1+*PMB*) indicates "under-profitability". In a technical sense, it is therefore reasonable that the calculated ROE_{ss} is higher than the historical ROE. The reverse can be noted for the technology industry. Here the market-to-book indicates excess profitability and the historical *ROE* is higher than the ROE_{ss}.

The robustness of the fundamental RIV approach can be questioned if one uses the numbers in Table 3.4 to calculate an industry average cost of capital using expression (3.5). Especially two industries have average costs of capital that are not in line with expectations. The telecom industry has an average cost of capital of 6%, which seems to be low for this industry. This indicates that the stock market had higher expectations on excess profitability (which is reflected in the stock price) than the forecasts built into the fundamental RIV approach. The higher expectations might concern the level and extension of *ROE* compared to the cost of capital (believing in a larger and/or more prolonged difference), the timing of the residual profitability (not believing in the linear fading pattern) and/or the beliefs about the accounting measurement bias in the industry (believing that *PMB* is higher). Real Estate has an average cost of capital of almost 24%, which on the contrary seems too high. Following the same logic as above, this would indicate that the stock market had less prosperous expectations for this industry than those built into the fundamental RIV approach.

Overall, the fundamental RIV approach might not be working equally well for all industries in the sample. I have nevertheless decided to include all industries.

3.7 Empirical results

3.7.1 Implied cost of capital estimates

Table 3.5 and 3.6 report the results from Step 1 of the empirical tests, evaluating the proposed implied cost of capital approach. In Panel A, Table 3.5, descriptive statistics are reported for the four established cost of capital approaches, as well as for the fundamental RIV approach.

r_{gls} has the highest mean value of about 12.9% and r_{riv} the lowest mean of about 10.5%.[202] All approaches thus seem to generate fairly similar estimates of the cost of capital, at least in terms of mean values. Note however that the standard deviation of the r_{riv} estimate is substantially larger than for the other approaches, presumably due to the fact that this approach models firm-specific steady state ROE. This approach might hence allow for more firm-specific variations in the determinants of the firm's cost of capital. It is also worth noting that the number of observations is the largest for the r_{riv} approach, in line with this approach requiring a less restricted sample.

In Panel B, Spearman and Pearson correlations are reported. Consistent with previous research, I find that the r_{ojn}, r_{peg} and r_{mpeg} are all strongly correlated, with an average Pearson correlation of more than 0.90. r_{gls} stands out with a modest Pearson correlation of about 0.10 with r_{ojn}, r_{peg} and r_{mpeg}. The estimates from the r_{riv} approach appear to be more correlated with the latter cost of capital estimates, with Pearson correlations of about 0.35-0.40. The r_{riv} approach thus seems to generate estimates that, at least at a first glance, appear to be reasonable.

[202] Botosan *et al*. (2010) report mean estimates for r_{ojn}, $r_{peg,}$ r_{mpeg} and r_{gls} of 11.69%, 11.70%, 12.50% and 7.47% respectively. The high mean value of r_{gls} (12.9%) in the present study is thus not in line with the results of Botosan *et al*. (2010).

Table 3.5. Descriptive statistics and correlations for estimated implied cost of capital proxies (annual observations). Sample period 1994 - 2008.

Panel A: Descriptive statistics of implied cost of capital proxies

	Mean (%)	Median (%)	Std Dev (%)	N
r_{gls}	12.91	12.31	4.28	256
r_{ojn}	10.89	10.37	3.93	177
r_{mpeg}	12.32	11.48	4.80	240
r_{peg}	10.88	10.28	4.43	240
r_{riv}	10.52	9.40	7.34	267

Panel B: Correlations

	r_{gls}	r_{ojn}	r_{mpeg}	r_{peg}	r_{riv}
r_{gls}		0.134*	0.081	0.099	0.214***
r_{ojn}	0.254***		0.936***	0.907***	0.362***
r_{mpeg}	0.133**	0.928***		0.980***	0.413***
r_{peg}	0.156**	0.898***	0.980***		0.3499***
r_{riv}	0.278***	0.345***	0.359***	0.311***	

(i) r_{gls} is the implied cost of capital estimated from a residual income model following Gebhardt et al. (2001). r_{ojn} is the implied cost of capital estimated from an abnormal earnings growth model (Ohlson-Juettner-Nauroth) following the application in Gode and Mohanram (2003). r_{peg} and r_{mpeg} are the implied cost of capital estimates from the PEG model and the modified PEG model respectively, following Easton (2004). r_{riv}, is the firm's implied cost of capital from a residual income model that is set equal to price at the first day of every calendar year. The model assumes firm-specific historical mean ROE as the forecasts of the first three years, whereafter ROE fades linearly ten years towards a steady state level. ROE in steady state is a function of industry-specific accounting conservatism (*PMB*), cost of capital and growth in steady state. Growth is assumed to be 2 % and measures of *PMB* are collected from Runsten (1998).

(ii) In panel B, Pearson (Spearman) correlations are reported above (below) the diagonal. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

In Table 3.6, Panel A, the results from regressing the cost of capital estimates on risk factors are reported. For all cost of capital estimates, the intercept is large and significant.[203] The adjusted R^2 values are in the range of 1.9% - 23.3%, with the highest explained variation for the r_{riv} approach. This is an indication of the approach being

[203] This might be partly due to the risk-free rate not being included. An alternative could have been to use excess return (cost of capital estimate minus the risk free rate) as the dependent variable. In order to maintain comparability with previous research, this has not been done.

more associated with the variation in the conventional risk factors than the other approaches.

Table 3.6. Implied cost of capital proxies against risk factors. Sample period 1994 - 2008.

		r_{gls}	r_{ojn}	r_{mpeg}	r_{peg}	r_{riv}
Panel A: Cost of capital estimates regressed on *beta*, *MC* and *BM*						
intercept		10.524***	14.237***	19.705***	17.075***	15.157***
	t-Stat	*(5.44)*	*(6.10)*	*(7.62)*	*(7.11)*	*(6.58)*
beta		-1.043*	0.386	0.859	1.265**	-0.437
	t-Stat	*(-2.19)*	*(0.77)*	*(1.41)*	*(2.23)*	*(-0.46)*
MC		0.340	-0.237	-0.616**	-0.59**	0.017
	t-Stat	*(1.61)*	*(-0.97)*	*(-2.21)*	*(-2.30)*	*(0.06)*
BM		0.717	1.796***	2.550***	1.936***	6.118***
	t-Stat	*(1.43)*	*(3.42)*	*(4.03)*	*(3.30)*	*(7.66)*
N		181	146	165	165	241
Adj. R2		0.019	0.088	0.153	0.137	0.233
Panel B: Cost of capital estimates regressed on *beta* and *MC*						
intercept		10.971***	14.947***	20.845***	17.941***	18.732***
	t-Stat	*(5.73)*	*(6.21)*	*(7.75)*	*(7.30)*	*(7.45)*
beta		-0.915	0.680	1.367**	1.651***	1.128
	t-Stat	*(-1.95)*	*(1.33)*	*(2.18)*	*(2.89)*	*(1.09)*
MC		0.225	-0.486**	-0.98***	-0.87***	-1.001***
	t-Stat	*(1.15)*	*(-2.00)*	*(-3.59)*	*(-3.49)*	*(-3.71)*
N		181	146	165	165	241
Adj. R2		0.013	0.020	0.074	0.084	0.047

(i) Regression in Panel A: $\hat{r}_{i,q} = \gamma_{0,i} + \gamma_{1,i}beta_{i,q} + \gamma_{2,i}MC_{i,q} + \gamma_{3,i}BM_{i,q} + \vartheta_{i,q}$

(ii) Regression in Panel B: $\hat{r}_{i,q} = \gamma_{0,i} + \gamma_{1,i}beta_{i,q} + \gamma_{2,i}MC_{i,q} + \vartheta_{i,q}$

(iii) r_{gls} is the implied cost of capital estimated from a residual income following Gebhardt et al. (2001). r_{ojn} is the implied cost of capital estimated from an abnormal earnings growth model (Ohlson-Juettner-Nauroth) following the application in Gode and Mohanram (2003). r_{peg} and r_{mpeg} are the implied cost of capital estimates from the PEG model and the modified PEG model respectively, following Easton (2004). r_{riv}, is the firm's implied cost of capital from a residual income model that is set equal to price at the first day of every calendar year. The model assumes firm-specific historical mean ROE as the forecasts of the first three years, whereafter ROE fades linearly ten years towards a steady state level. ROE in steady state is a function of industry-specific accounting conservatism (*PMB*), cost of capital and growth in steady state. Growth is assumed to be 2 % and measures of *PMB* are collected from Runsten (1998).

(iv) *Beta* is the firm-specific CAPM beta estimated using monthly data for the 36 months preceding the quarter *q* (minimum requirement of 18 monthly returns), *MC* is the natural log of firm *i*'s market capitalization, measured at the last trading day of quarter *q*-1, *BM* is the natural log of firm i's book-to-market, measured as book value of owners' equity divided by market capitalization at the last trading day of quarter *q*-1.

(v) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

However, it is only r_{peg} that has a positive coefficient on *beta* and *BM,* and a negative coefficient on *MC*. The r_{riv} estimate generates a negative coefficient on *beta* and a positive coefficient on *MC*, though none is significant. However, these coefficients might be affected by multicollinearity. Following Botosan and Plumlee (2005), I therefore exclude *BM* from the regressions and report the results in Panel B of Table

3.6. Except for the r_{gls} approach, the coefficient on *beta* is now positive and the coefficient on *MC* is negative for all the cost of capital estimates. However, the adjusted R^2 is now lower, in particular for the regressions for r_{ojn} and r_{riv}.

In the main, the results are in line with previous research, showing that r_{peg} appear to be consistently related to conventional risk proxies. The rather bad performance of r_{gls} has also been documented previously (Botosan *et al.*, 2010).[204] Regarding the performance of the fundamental RIV approach, it seems to be at par with the conventional models.

3.7.2 Earnings quality and cost of capital regressions

Tables 3.7 and 3.8 report the main results of the study, concerning the relationship between the implied cost of capital estimates and earnings quality.

Table 3.7. Mean values of r_{riv} and control variables over groups sorted on either *value relevance* or *timeliness*. Sample period 1994 - 2008.

	Group 1 (high EQ)	Group 2	Group 3	Group 4	Group 5 (low EQ)
Panel A: Mean values over groups sorted on *value relevance*					
r_{riv}	10.79	10.71	10.99	12.04	11.70
beta	1.06	1.03	1.05	1.04	1.03
market cap	38005	41511	36167	50495	51950
book-to-market	0.57	0.53	0.55	0.54	0.50
Panel B: Mean values over groups sorted on *timeliness*					
r_{riv}	10.69	11.25	11.79	10.78	11.75
beta	1.08	1.07	1.07	1.00	1.00
market cap	42246	41618	57415	49384	30332
book-to-market	0.59	0.56	0.55	0.51	0.49

(i) r_{riv}, is the firm's implied cost of capital from a residual income model that is set equal to price at the first day of every calendar quarter. The model assumes firm-specific historical mean ROE as the forecasts of the first three years, whereafter ROE fades linearly ten years towards a steady state level. ROE in steady state is a function of industry-specific accounting conservatism (*PMB*), cost of capital and growth in steady state. Growth is assumed to be 2 % and measures of *PMB* are collected from Runsten (1998).

(ii) *beta* is the firm-specific CAPM beta estimated using monthly data for the 36 months preceding the quarter *q* (minimum requirement of 18 monthly returns), *market cap* is firm *i* 's market capitalization, measured at the last trading day of quarter *q*-1, *book-to-market* is firm *i* 's book-to-market, measured as book value of owners' equity divided by market capitalization at the last trading day of quarter *q*-1.

(iii) In Panel A firms are sorted in groups based on *value relevance*. *Value relevance* is the negative of the adjusted R^2 from rolling 12-quarter regressions, with quarterly returns as the dependent variable and quarterly earnings and earnings changes (both scaled with *market cap*) as independent variables.

(iv) In Panel B firms are sorted in groups based on *timeliness*. *Timeliness* is the negative of the adjusted R^2 from rolling 12-quarter regressions with quarterly earnings as the dependent variable and independent variables capturing positive and negative quarterly returns.

[204] Botosan *et al*. (2010) also find a negative association between r_{gls} estimates and *beta*.

Table 3.7 reports the mean values of the implied cost of capital and some control variables for five groups of firms, where Group 1 is characterized by high earnings quality and Group 5 is characterized by low earnings quality. In panel A, the basis for the grouping is *value relevance* as a measure of earnings quality, and in panel B the basis for the grouping is *timeliness*.

In Panel A, r_{riv} is increasing when the earnings quality goes down, even if the increase is non-monotonic. The difference between Group 1 and Group 5 is about one percentage point. The difference between Group 1 and Group 5 is about the same when sorted on *timeliness* (Panel B). Both the *book-to-market* and *beta* are fairly stable over the groups (both in Panel A and Panel B). Hence, I cannot from these tables confirm previous findings that firms with poor earnings quality also have higher *betas* (e.g., Francis *et al.*, 2004).

The *market cap* varies over the groups and the table provides mixed evidence on whether earnings quality is related to size. In Panel A, larger firms are present in Group 4 and 5 and are thus associated with lower earnings quality. In panel B, Group 5 has the lowest mean *market cap*. However, one should in this context bear in mind that there are overall large size differences in the sample and that the mean values can be affected by a few large observations.

I conclude from Table 3.7 that earnings quality appears to be related to the cost of capital. This is tested more rigorously in regression (3.10) in Table 3.8, where Panel A reports results based on *value relevance* and Panel B reports results based on *timeliness*.

Table 3.8. Quarterly cost of capital regressions with alternative measures of earnings quality. Sample period 1994 - 2008.

			Model 1	Model 2	Model 3
Panel A. *EQrank* measured as *value relevance*					
		Pred. Sign			
intercept			10.357***	15.872***	15.048***
	t-Stat		*(14.77)*	*(13.05)*	*(13.11)*
beta		+	-0.078	0.261	-1.329***
	t-Stat		*(-0.17)*	*(0.54)*	*(-2.76)*
MC		-		-0.686***	-0.078
	t-Stat			*(-5.61)*	*(-0.61)*
BM		+			3.848***
	t-Stat				*(10.66)*
EQrank		+	0.322**	0.479***	0.411***
	t-Stat		*(2.19)*	*(3.20)*	*(2.92)*
N			940	884	884
Adj. R2			0.003	0.037	0.146
Panel B. *EQrank* measured as *timeliness*					
		Pred. Sign			
intercept			10.864***	16.139***	14.663***
	t-Stat		*(14.95)*	*(12.51)*	*(12.04)*
beta		+	-0.051	0.273	-1.329***
	t-Stat		*(-0.11)*	*(0.56)*	*(-2.76)*
MC		-		-0.620***	-0.002
	t-Stat			*(-5.12)*	*(-0.001)*
BM		+			3.978***
	t-Stat				*(10.97)*
EQrank		+	0.150	0.191	0.336**
	t-Stat		*(1.02)*	*(1.29)*	*(2.40)*
N			940	884	884
Adj. R2			-0.001	0.028	0.144

(i) Model 1: $\hat{r}_{i,q} = \varphi_{0,i} + \varphi_{1,i} beta_{i,q} + \varphi_{2,i} EQrank_{i,q} + \vartheta_{i,q}$

(ii) Model 2: $\hat{r}_{i,q} = \varphi_{0,i} + \varphi_{1,i} beta_{i,q} + \varphi_{2,i} MC_{i,q} + \varphi_{3,i} EQrank_{i,q} + \vartheta_{i,q}$

(iii) Model 3: $\hat{r}_{i,q} = \varphi_{0,i} + \varphi_{1,i} beta_{i,q} + \varphi_{2,i} MC_{i,q} + \varphi_{3,i} BM_{i,q} + \varphi_{4,i} EQrank_{i,q} + \vartheta_{i,q}$

(iv) The dependent variable is estimates of r_{riv}, the firm's implied cost of capital from a residual income model that is set equal to price at the first day of every calendar quarter. The model assumes firm-specific historical mean ROE as the forecasts of the first three years, whereafter ROE fades linearly ten years towards a steady state level. ROE in steady state is a function of industry-specific accounting conservatism (PMB), cost of capital and growth in steady state. Growth is assumed to be 2 % and measures of PMB are collected from Runsten (1998).

(v) *beta* is the firm-specific CAPM beta estimated using monthly data for the 36 months preceding the quarter *q* (minimum requirement of 18 monthly returns) measuring market return as the equal-weighted mean return of all stocks listed on the "A-list", *MC* is the natural log of firm *i* 's market capitalization, measured at the last trading day of quarter *q*-1, *BM* is the natural log of firm *i* 's book-to-market, measured as book value of owners' equity divided by market capitalization at the last trading day of quarter *q*-1.

(vi) *EQrank* is measured either with the rank of *value relevance* or *timeliness*. *Value relevance* is the negative of the adjusted R^2 from regressions using data from the 12 quarters preceding quarter *q*, with quarterly returns as the dependent variable and quarterly earnings and earnings changes (both scaled with *market cap*) as independent variables. *Timeliness* is the negative of the adjusted R^2 from rolling 12-quarter regressions with quarterly earnings as the dependent variable and independent variables capturing positive and negative quarterly returns. Firms are ranked and allocated to five groups, where the group of firms with rank 1 has the highest earnings quality and the group of firms with rank 5 has the lowest earnings quality.

(vii) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

Models 1, 2 and 3 include *beta*, *market cap* and *book-to-market* in a stepwise manner.[205] When the variable *EQrank* is based on *value relevance*, the variable has a positive and statistically significant (1%-level) coefficient in all three models. The size of the coefficient in Model 3 (0.411) indicates that going from the group with the highest earnings quality (Group 1) to the group with the lowest earnings quality (Group 5), the cost of capital on average increases by about 1.6 percentage points. The results when using *timeliness* as the measure of earnings quality is somewhat weaker (Panel B), with a positive and significant coefficient only when all three risk proxies are included in Model 3. The coefficient indicates an average increase in the cost of capital of 1.3 percentage points, going from firms with the highest earnings quality to the lowest earnings quality.

3.7.3 Additional tests

The results in Table 3.8 confirm previously reported results, showing that poor earnings quality appears to be associated with a higher cost of capital (e.g., Francis *et al.*, 2005; Gray *et al.*, 2009; Kim and Qi, 2010). In Tables 3.9, 3.10, 3.11 and 3.12, I report results from some additional tests.

First, I test whether the results are sensitive to how the market return is measured in the estimations of *beta*. In Table 3.9, the return to the Morgan Stanley Sweden Index (MSCI) is used as a measure of market return, thus yielding a somewhat larger definition of "the market". The table reveals that the coefficient on *beta* is negative in all three models. However, the coefficients on *EQrank* are still positive and significant, though slightly smaller in magnitude.

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[205] Note also that, as in the validation tests (Table 3.6), the coefficient on beta turns negative when book-to-market is included.

Table 3.9. Robustness test with alternative estimation of *beta*. Sample period 1994 - 2008.

			Model 1	Model 2	Model 3
Panel A. *EQrank* measured as *value relevance*					
		Pred. Sign			
intercept			11.460***	16.098***	13.963***
	t-Stat		*(18.48)*	*(13.73)*	*(11.77)*
beta		+	-1.729***	-1.115*	-1.653***
	t-Stat		*(-3.22)*	*(-1.93)*	*(-3.02)*
MC		-		-0.594***	0.029
	t-Stat			*(-4.66)*	*(0.22)*
BM		+			3.759***
	t-Stat				*(10.85)*
EQrank		+	0.322**	0.461***	0.331**
	t-Stat		*(2.20)*	*(3.09)*	*(2.36)*
N			940	884	884
Adj. R2			0.014	0.041	0.145
Panel B. *EQrank* measured as *timeliness*					
		Pred. Sign			
intercept			12.050***	16.409***	13.963***
	t-Stat		*(18.90)*	*(13.24)*	*(11.77)*
beta		+	-1.706***	-1.172*	-1.653***
	t-Stat		*(-3.16)*	*(-2.02)*	*(-3.02)*
MC		-		-0.526***	0.029
	t-Stat			*(-4.18)*	*(0.22)*
BM		+			3.759***
	t-Stat				*(10.85)*
EQrank		+	0.128	0.167	0.331**
	t-Stat		*(0.87)*	*(1.13)*	*(2.36)*
N			940	884	884
Adj. R2			0.010	0.032	0.144

(i) Model 1: $\hat{r}_{i,q} = \varphi_{0,i} + \varphi_{1,i}beta_{i,q} + \varphi_{2,i}EQrank_{i,q} + \vartheta_{i,q}$

(ii) Model 2: $\hat{r}_{i,q} = \varphi_{0,i} + \varphi_{1,i}beta_{i,q} + \varphi_{2,i}MC_{i,q} + \varphi_{3,i}EQrank_{i,q} + \vartheta_{i,q}$

(iii) Model 3: $\hat{r}_{i,q} = \varphi_{0,i} + \varphi_{1,i}beta_{i,q} + \varphi_{2,i}MC_{i,q} + \varphi_{3,i}BM_{i,q} + \varphi_{4,i}EQrank_{i,q} + \vartheta_{i,q}$

(iv) The dependent variable is estimates of r_{riv}, the firm's implied cost of capital from a residual income model that is set equal to price at the first day of every calendar quarter. The model assumes firm-specific historical mean ROE as the forecasts of the first three years, whereafter ROE fades linearly 10 years towards a steady state level. ROE in steady state is a function of industry-specific accounting conservatism (PMB), cost of capital and growth in steady state. Growth is assumed to be 2 % and measures of PMB are collected from Runsten (1998).

(v) *beta* is the firm-specific CAPM beta estimated using monthly data for the 36 months preceding the quarter *q* (minimum requirement of 18 monthly returns) measuring market return as the return to the Morgan Stanley Sweden Index (MSCI), *MC* is the natural log of firm *i* 's market capitalization, measured at the last trading day of quarter *q*-1, *BM* is the natural log of firm *i* 's book-to-market, measured as book value of owners' equity divided by market capitalization at the last trading day of quarter *q*-1.

(vi) *EQrank* is measured either with the rank of *value relevance* or *timeliness*. *Value relevance* is the negative of the adjusted R2 from regressions using data from the 12 quarters preceding quarter *q*, with quarterly returns as the dependent variable and quarterly earnings and earnings changes (both scaled with *market cap*) as independent variables. *Timeliness* is the negative of the adjusted R2 from rolling 12-quarter regressions with quarterly earnings as the dependent variable and independent variables capturing positive and negative quarterly returns. Firms are ranked and allocated to five groups, where the group of firms with rank 1 has the highest earnings quality and the group of firms with rank 5 has the lowest earnings quality.

(vii) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

In Table 3.10 results are reported where year-dummies are included in the regressions. The t-statistics are also adjusted for heteroskedasticity (cf. White, 1980). In general, the results in Table 3.8 seem to be robust to these adjustments. The cost of capital effect from earnings quality is slightly subdued, but still significant, at the 5%- or 10%-level, depending on how *EQrank* is measured.

Table 3.10. Robustness test including year dummies. Sample period 1994 - 2008.

			EQrank = value relevance	*EQrank = timeliness*
		Pred. Sign		
intercept			19.298***	19.007***
	t-Stat		*(14.55)*	*(13.79)*
beta		+	-3.318***	-3.372***
	t-Stat		*(-5.47)*	*(-5.57)*
MC		-	0.048	0.106
	t-Stat		*(0.38)*	*(0.86)*
BM		+	3.898***	3.996***
	t-Stat		*(11.29)*	*(11.53)*
EQrank		+	0.290**	0.239*
	t-Stat		*(2.14)*	*(1.80)*
Year dummy included			*Yes*	*Yes*
N			884	884
Adj. R2			0.233	0.232

(i) The dependent variable is estimates of r_{riv}, the firm's implied cost of capital from a residual income model that is set equal to price at the first day of every calendar quarter. The model assumes firm-specific historical mean ROE as the forecasts of the first three years, whereafter ROE fades linearly ten years towards a steady state level. ROE in steady state is a function of industry-specific accounting conservatism (PMB), cost of capital and growth in steady state. Growth is assumed to be 2 % and measures of PMB are collected from Runsten (1998).

(ii) *beta* is the firm-specific CAPM beta estimated using monthly data for the 36 months preceding the quarter *q* (minimum requirement of 18 monthly returns) measuring market return as the return to the equal-weighted mean return of all stocks listed on the "A-list", *MC* is the natural log of firm *i* 's market capitalization, measured at the last trading day of quarter *q*-1, *BM* is the natural log of firm *i* 's book-to-market, measured as book value of owners' equity divided by market capitalization at the last trading day of quarter *q*-1.

(iii) *EQrank* is measured either with the rank of *value relevance* or *timeliness*. *Value relevance* is the negative of the adjusted R^2 from regressions using data from the twelve quarters preceding quarter *q*, with quarterly returns as the dependent variable and quarterly earnings and earnings changes (both scaled with *market cap*) as independent variables. *Timeliness* is the negative of the adjusted R^2 from rolling 12-quarter regressions with quarterly earnings as the dependent variable and independent variables capturing positive and negative quarterly returns. Firms are ranked and allocated to five groups, where the group of firms with rank 1 has the highest earnings quality and the group of firms with rank 5 has the lowest earnings quality.

(iv) Two-sided heteroskedasticity consistent t-statistics (White, 1980) are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

As an additional test, the cost of capital is measured using the earnings-price (EP) ratio as an alternative approach. The earnings-price (EP) ratio has been used as a cost of capital estimate in previous research to study the association with EQ (e.g., Francis *et al.*, 2005; Gray *et al.*, 2009).[206]

The EP ratio, *EP*, for each firm-quarter is defined as:

$$EP_{i,q} = \frac{EPS_{i,q}}{P_{i,q}} \tag{3.11}$$

where:

$EPS_{i,q} =$ firm *i*'s earnings per share for quarter *q*,
$P_{i,q} =$ stock price of firm *i* at the last day of quarter *q*.

This EP ratio approach has, similar to the fundamental RIV approach, the benefit of not being dependent on analysts' forecasts.[207] It does not require lagged data to estimate ROE forecasts, as in the fundamental RIV approach and the EP ratio approach is hence possible to implement for a large number of firms. There are however some disadvantages. First, the approach is restricted to firms with positive earnings, potentially introducing a sample selection bias. Second, it is based on a very simplified model of firm value, assuming that only one period of earnings can explain price and that all firms have a full payout ratio and no growth. It can therefore be argued that the EP ratio, as a proxy for cost of capital, is affected by more noise than proxies derived from valuation models, such as the r_{riv}. Below, I test if the EP ratio is positively associated with earnings quality, measured either as *value relevance* or *timeliness*. Following previous research (e.g., Gray *et al.*, 2009), control variables such as *growth*, *leverage*, *beta* and *size* are included.

$$EP_{i,q} = \gamma_{0,i} + \gamma_{1,i} growth_{i,q} + \gamma_{2,i} leverage_{i,q} + \gamma_{3,i} beta_{i,q} + \gamma_{4,i} size_{i,q} + \gamma_{5,i} EQrank_{i,q} + \vartheta_{i,q} \tag{3.12}$$

where:

$EP_{i,q} =$ EP ratio for firm *i*, measured at the last day of quarter *q*,

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[206] These studies use an industry-adjusted EP ratio, where the median EP for the industry is deducted from the firm's EP ratio. This is done in order to control for industry effects and gives a cost of capital measure that is the cost of capital *deviation* from the industry median. In Gray *et al*. (2009) and Francis *et al*. (2005) it is tested whether a firm's abnormal accruals (in relation to the industry) can explain the firm's deviation from the industry cost of capital. Since my EQ measures are not related to the industry, I do not make the industry adjustment in the EP ratio.

[207] It is thus not equal to a forward EP ratio, where typically analyst forecasts of forward earnings are used.

$growth_{i,q} =$	natural log of one plus the firm's growth in owners' equity, measured as the change in owners' equity between the end of quarter *t* and the end of quarter *t*-4,
$leverage_{i,q} =$	firm *i* 's ratio of total debt to total assets measured at the end of quarter *q,*
$beta_{i,q} =$	firm-specific CAPM beta (estimated using monthly data for the 36 months preceding the quarter *q* and a minimum requirement of 18 monthly returns),
$size_{i,q} =$	natural log of firm *i* 's total assets measured at the end of quarter *q*,
$EQrank_{i,q} =$	firm *i* 's rank on EQ, where EQ is either *Value Relevance* or *Timeliness*. Firms are ranked and allocated to five groups. The group of firms with rank 1 has the highest EQ and the group of firms with rank 5 has the lowest EQ.

Table 3.11. Quarterly cost of capital regressions with EP as proxy for cost of capital. Sample period 1994 - 2008.

			EQrank = value relevance	*EQrank = timeliness*
Panel A		*Pred. Sign*		
intercept			0.016***	0.018***
	t-Stat		*(4.25)*	*(4.78)*
growth		-	0.013***	0.013***
	t-Stat		*(4.49)*	*(4.48)*
leverage		+	0.003	0.003
	t-Stat		*(0.92)*	*(0.79)*
beta		+	0.001	0.001
	t-Stat		*(0.82)*	*(0.68)*
size		-	0.000	0.000
	t-Stat		*(0.28)*	*(0.39)*
EQrank		+	0.001	-0.000
	t-Stat		*(1.32)*	*(-0.46)*
N			1270	1270
Adj. R2			0.015	0.013

(i) The dependent variable, *EP*, is the firm's earnings-price ratio, *growth* is the log of one plus the firm's growth in book value of equity over the past four quarters, *leverage* is the ratio of total debt to total assets, *beta* is the firm-specific CAPM beta estimated using monthly data for the 36 months preceding the quarter *q* (minimum requirement of 18 monthly returns) measuring market return as the return to the equal-weighted mean return of all stocks listed on the "A-list", *size* is the log of total assets.

(ii) *EQrank* is measured either with the rank of *value relevance* or *timeliness*. *value relevance* is the negative of the adjusted R^2 from regressions using data from the twelve quarters preceding quarter *q*, with quarterly returns as the dependent variable and quarterly earnings and earnings changes (both scaled with market cap) as independent variables. *timeliness* is the negative of the adjusted R^2 from rolling 12-quarter regressions with quarterly earnings as the dependent variable and independent variables capturing positive and negative quarterly returns. Firms are ranked and allocated to five groups, where the group of firms with rank 1 has the highest earnings quality and the group of firms with rank 5 has the lowest earnings quality.

(iii) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

Table 3.11 reveals that the estimated coefficients on the *EQrank* variable (either measured as *value relevance* or *timeliness*) are not significant. This might be attributed to the EP ratio being a less valid proxy for the cost of capital, as compared to the estimates derived from the fundamental RIV approach.[208] It should also be noted that the EP ratio approach, even though restricted to firms with positive earnings, generate more observations than the fundamental RIV approach (cf. Table 3.8). This is probably due to the EP ratio approach not requiring any historical observations of ROE. Conclusively, I find that when benchmarked against the EP ratio, the fundamental RIV approach seems to generate better estimates of the cost of capital.[209]

It is in this paper argued that it is important to include the full cross-sectional variation of earnings quality and cost of capital, and that the fundamental RIV approach enables such a study. As a final test, I therefore replicate the results in Table 3.8 (Model 3), but restrict the sample to only include firms that have analyst following, positive earnings and positive earnings growth (n = 507). Table 3.12 reveals that the association between earnings quality and cost of capital is no longer significant in this more circumscribed sample. This indicates that the association between earnings quality and the cost of capital might be more pronounced among the excluded firms.

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[208] Previous studies, that use this proxy of cost of capital, use much larger samples of firms. This might explain why they are able to find a significant association with earnings quality.

[209] The EP ratio is also used as a dependent variable in regression (3.10) in order to use exactly the same control variables as in the regressions with r_{riv}. Results from these tests (not tabulated) are very similar to those in Table 3.11.

Table 3.12. Robustness test restricting the sample to firms with analyst following, positive earnings and positive earnings growth. Sample period 1994 - 2008.

			EQrank = value relevance	*EQrank = timeliness*
Panel A		*Pred. Sign*		
intercept			10.792***	11.401***
	t-Stat		*(8.48)*	*(8.53)*
beta		+	-1.055	-1.120
	t-Stat		*(-1.44)*	*(-1.53)*
MC		-	0.510***	0.524***
	t-Stat		*(3.47)*	*(3.57)*
BM		+	3.495***	3.460***
	t-Stat		*(7.24)*	*(7.12)*
EQrank		+	0.189	-0.038
	t-Stat		*(1.00)*	*(-0.20)*
N			507	507
Adj. R2			0.095	0.093

(i) The dependent variable is estimates of r_{riv}, the firm's implied cost of capital from a residual income model that is set equal to price at the first day of every calendar quarter. The model assumes firm-specific historical mean ROE as the forecasts of the first three years, whereafter ROE fades linearly ten years towards a steady state level. ROE in steady state is a function of industry-specific accounting conservatism (PMB), cost of capital and growth in steady state. Growth is assumed to be 2 % and measures of PMB are collected from Runsten (1998).

(ii) *beta* is the firm-specific CAPM beta estimated using monthly data for the 36 months preceding the quarter *q* (minimum requirement of 18 monthly returns) measuring market return as the equal-weighted mean return of all stocks listed on the "A-list", *MC* is the natural log of firm *i* 's market capitalization, measured at the last trading day of quarter *q*-1, *BM* is the natural log of firm *i* 's book-to-market, measured as book value of owners' equity divided by market capitalization at the last trading day of quarter *q*-1.

(iii) *EQrank* is measured either with the rank of *value relevance* or *timeliness*. *Value relevance* is the negative of the adjusted R^2 from regressions using data from the twelve quarters preceding quarter *q*, with quarterly returns as the dependent variable and quarterly earnings and earnings changes (both scaled with *market cap*) as independent variables. *Timeliness* is the negative of the adjusted R^2 from rolling 12-quarter regressions with quarterly earnings as the dependent variable and independent variables capturing positive and negative quarterly returns. Firms are ranked and allocated to five groups, where the group of firms with rank 1 has the highest earnings quality and the group of firms with rank 5 has the lowest earnings quality.

(iv) Two-sided t-statistics are reported in parentheses. The symbols ***, **, and * show statistical significance at the 1%-, 5%- and 10%-level, respectively.

3.8 Concluding remarks

This paper reports results on the association between earnings quality and implied cost of capital estimates for a sample of firms listed on the Stockholm Stock Exchange during the period 1994-2008. I find that poor earnings quality, measured either as low *value relevance* or low *timeliness*, is associated with a higher implied cost of capital. Going from the group with the highest earnings quality to the group with the lowest earnings quality, the implied cost of capital increases by 1.3 - 1.6 percentage points, after controlling for conventional risk factors. This is in line with theoretical research predicting a positive association between information uncertainty and risk. It is also in line with previous empirical studies showing that earnings quality is a priced risk factor. The results remain when using an alternative procedure for estimating beta, as well as when including year-dummies and controlling for heteroskedasticity.

A new approach to estimate the implied cost of capital is proposed in the paper: the fundamental RIV approach. It is based on the RIV model and uses firm-specific historical mean ROE as forecasts for the first three years. Firm-specific steady state ROE is modeled, assuming it is a function of accounting conservatism, steady state growth and cost of equity capital. The approach seems to generate cost of capital estimates that are reasonable, in the sense that calculated mean values are similar to those generated by more established models. Additionally, when regressing the cost of capital estimates on conventional risk factors, it seems like the estimates generated by the fundamental RIV approach are more associated with these risk factors. The adjusted R^2 from this regression is 23.3%, as compared to 1.9% - 15.3% when using estimates from the more established approaches. Also, further tests show that my RIV approach appears to generate estimates that are better proxies for the cost of capital, than estimates derived from the EP ratio approach.

The fundamental RIV approach is a methodological contribution to the implied cost of capital literature. The approach can be implemented in a sample that is not restricted to firms with positive earnings, positive earnings growth, analyst following and/or long time-series of accounting data. The benefits are twofold. First, it increases the number of observations. This can be crucial in empirical tests where both the cross-section and the time-series are limited. Second, it enables a study of the full cross-sectional variation in the variables of interest. For example, non-profitable firms and firms without analyst following (often smaller firms) are potentially more associated with higher information risk than other firms. Indeed, in a robustness test I find that, when the sample is restricted to firms with analyst following, positive earnings and positive earnings growth, the association between earnings quality and cost of capital is no longer significant.

A limitation of the proposed approach is its dependence on the empirical estimates of accounting conservatism from Runsten (1998). These values were estimated for Swedish industries using data from 1966-1993, but are in the paper assumed to be valid also for later time periods.[210] There are some empirical indications that lend support to this assumption. For example, Bergman and Tegnér (2008) show that the PMB values are relatively stable over time, even after the introduction of IFRS in 2005. Given that the underlying factors driving the *PMB* - asset composition, depreciation time, economic life and interest rates - are relatively stable over time, this is an expected result. To my knowledge there are no existing studies on how specific the PMB: s are for Swedish industries. This is an important issue if one would like to use the fundamental RIV approach outside the Swedish setting.

[210] It is also assumed that the *PMB* values are representative for each industry when entering the steady state period.

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4 List of abbreviations

AEG	Abnormal Earnings Growth model
AR	Auto Regressive
BHAR	Buy-and-Hold Abnormal Return
CAPM	Capital Asset Pricing Model
CAR	Cumulative Abnormal Return
CSR	Clean Surplus Relation
EBIT	Earnings Before Interest and Taxes
EBITDA	Earnings Before Interest Taxes Depreciation and Amortization
EP	Earnings Price ratio
EPS	Earnings Per Share
ERC	Earnings Response Coefficient
EQ	Earnings Quality
GAAP	Generally Accepted Accounting Principles
GDP	Gross Domestic Product
HML	High Minus Low portfolio
IAS	International Accounting Standards
I/B/E/S	Institutional Broker's Estimates System
IFRS	International Financial Reporting Standards
Market Cap	Market Capitalization
MSCI	Morgan Stanley Sweden Index
PE	Price Earnings ratio
PEAD	Post-Earnings Announcement Drift
PEG	Price Earnings Growth ratio
PMB	Permanent Measurement Bias
PVED	Present Value of Expected Dividends
R&D	Research and Development
RIV	Residual Income Valuation
RMRF	Excess market return
ROE	Return on Owners' Equity
SAX	Stockholm Automated Exchange
SIX	Scandinavian Information Exchange
SMB	Small Minus Big portfolio
SUE	Standardized Unexpected Earnings
UE	Unexpected Earnings

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