MSc Thesis - Final Version

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Title:

'Firm Size and Investor Reactions to Earnings Announcements: Evidence for a Size Premium in Earnings Surprise Effects'

Abstract:

Inspired by a related investigation of the MB-ratio by Skinner and Sloan (2002), I look into the role of firm size in earnings surprise effects. By means of an event study of earnings announcements, this master's thesis most primarily finds strong evidence for the existence of a size premium around earnings announcements. That is, small firms on average have significantly better abnormal returns to earnings announcements than large firms. However, this *only* holds if we allow for the higher tendency of large firms to preannounce earnings information; announcements which predominantly comprise negative news. Furthermore, the superior abnormal returns of smaller firms prevail regardless of evidence indicating that large firms report fewer negatively surprising earnings. Notably, evidence indicates that investors drive the abnormal returns differential by more severely punishing large firms in case of negative surprises and rewarding them less for positive surprises. Moreover, this overpowers the - seemingly bounded rational - higher reward of large firms for unsurprising earnings reports. With regard to the behavioural source of this size premium, this research additionally includes an exploration to alternative drivers, which might share properties with firm size. The resulting evidence suggests that – amongst other investigated variables - only firm familiarity can partly account for the size premium in earnings surprise effects.

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1. Introduction

In a remarkable research, Skinner and Sloan (2002) show that stock price movements around earnings announcements largely explain the return differential between value and growth stock - also known as the 'MB-effect'[1]. Moreover, they show the effect to be asymmetric: it concentrates in negative earnings surprises of growth firms. Earnings surprises are instances where firms report earnings that deviate from earnings expected by investors. Numerous research has documented the price fluctuations that result from the reactions of surprised investors. Remarkably though, Skinner and Sloan (2002) reveal that earnings surprises can explain something as profound as the 'MB-effect'.

This notion forms the background to this research, which seeks to employ earnings announcements to shed light on the role of another significant firm characteristic: firm size. The underlying belief is that firm size will also have strong explanatory power over earnings surprise effects. On the one hand this belief stems from the presence of firm size - together with firm market-to-book-ratios - in the most widely used asset pricing models in economics[2]. On the other hand the significance of firm size may be obvious from consideration of differences in strongly firm size-related concepts like cash flow volatility, analyst coverage, information availability, trading volume and (their interaction with) beliefs and preferences of investors.

While it would be rewarding to explain something like the 'size-effect'[3] in the fashion of Skinner and Sloan (2002), it is not the primary purpose of this master's thesis. Two reasons for this are the absence of conclusive evidence on the existence of a 'size-effect' and lack of a specific governing hypothesis

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[1] The 'MB-effect' generally describes the widely documented outperformance of 'value' stock versus 'growth' stock. The abbreviation 'MB' stands for the market-to-book ratio, which is the ratio of the market capitalization to the book value of a firm. 'Value' stock have relatively low market-to-book ratios whereas 'growth' stock have high respective ratios. High ratios reflect high growth expectations regarding future cash flows by the market.

[2] Fama and French (1993) innovated asset pricing with their three-factor pricing model. This model includes – besides a market factor – a factor for size and a factor for market-to-book ratios. These factors were included to incorporate the price effects of firm size and of the book-to-market ratio.

[3] Similar to the 'MB-effect', the 'size effect' is a well-known - yet debatable in existence - phenomenon that reflects the general stock return outperformance of small firms versus large firms.

to explain it[4]. However, the more important reason is the deliberate choice for a more general exploration of the role of firm size in the context of earnings surprises. This choice results from the notion laid out in the previous paragraph, which practically assumes that firms of different sizes act markedly different around earnings announcements and induce considerably different reactions to these announcements by investors. Moreover, I presumed that a behavioural investigation of these differences, their drivers and implications is relevant; both to academia as to agents in the market. After introducing the research question, I will elaborate on that relevance along with a high-level overview of the results of this master's thesis.

The main research question reflects the general nature of the exploration:

'What role does firm size play in stock price reactions to earnings surprises?'

The main research question governs three sub research questions, which form the framework of this master's thesis. This framework foresees in consecutively investigating these three sub research questions. More specifically, for each sub research question the investigation tests a set of sub hypotheses with individual underlying theorization. Section 3 develops these sub hypotheses with use of insights from a review of relevant literature in Section 2. The three sub research questions are as follows:

1. *'Does firm size affect the occurrence, sign or magnitude of earnings surprises?'*
2. *'Does firm size affect* stock price *reactions to earnings surprises?'*
3. *'What drives differences in stock price reactions to earnings surprises based on firm size?'*

With respect to the outcomes of the associated investigation, the general nature of the exploration indeed seems to have merit in generating a number of distinct relevant findings. On the one hand this master's thesis produces findings that have academic relevance in filling a gap in literature or corroborating and/or complementing previous literature. One the other hand, this investigation provides insights of more practical nature – which should be relevant to firms and investors.

The most notable contribution of this master's thesis comprises the unravelling of strong evidence for the existence of a significant size premium in stock price reactions to earnings announcements. The aforementioned work on the MB-ratio by Skinner and Sloan (2002) laid bare an associated gap in literature, which pertains to investigation of a similarly important firm characteristic: firm size. While this master's thesis does not provide evidence that explains any 'size-effect', it does show that smaller firms have significantly superior abnormal returns to earnings announcements than larger firms. Moreover, the evidence substantiates the importance of incorporating preannouncements of earnings information: the superior abnormal returns only exist if we account for the higher tendency of large firms to preannounce negative earnings information. Both findings should be valuable to investors as well. They can theoretically earn excess returns on a firm size-based trading strategy around earnings

[4] Skinner and Sloan (2002) hypothesize and show that investors have expectational errors regarding the future performance of 'growth' firms. Earnings surprises disprove these expectations, which leads to the 'MB-effect'.

announcements. However, this only holds if they stretch the associated short position in larger firms to include the periods during which firms typically preannounce earnings information. Abstracting from any long-short trading strategy, investors should be wary of a long position in firms in the period preceding an earnings announcement: a holding period starting 43 days prior to the announcement results in a strong discount on average. This contrasts the earnings announcement premium using a 3-day holding period with one day on either end of the announcement date, as documented by studies which the Literature Review of Section 2 discusses.

Another set of findings results from including an extra research step, when compared to Skinner and Sloan (2002). This step is explicit from sub research question 1. Indeed, differences in firm size lead to different propensities to report earnings surprises. Corroborating previous work of Doyle et al (2006), I find that smaller firms report more extreme earnings surprises. More notably though, this master's thesis finds that larger firms report more unsurprising and more positively surprising earnings. Interestingly, by extending methods of Skinner and Sloan (2002) to include a 'zero' earnings surprise event, I document evidence suggesting that larger firms have a higher tendency to engage in earnings management and/or analyst guidance in order to meet the market expectation of earnings. Drawing on this novel approach, this research also documents evidence that suggests that investors do not appreciate the suggested higher tendency of large firms to inflate the market's reception of their earnings report. On the contrary: large firms are rewarded more for 'just-meet' earnings than smaller firms. Following work by Degeorge et al (1999), investors should probably reward large firms less for 'just-meet' reports since their evidence shows that artificial inflation of earnings report perception leads to worse long-term returns.

Furthermore, investigating differences in the propensity of firms to announce earnings surprises (by means of sub question 1) is also useful for building perspective on sub questions 2 and 3. With this knowledge, we can assess whether the aforementioned size premium results from differences in firm quarterly reporting behaviour or differences in investor reactions to earnings announcements. In this respect, evidence suggests the latter causes the better performance of smaller firm stock. Investors punish large firms more for negative earnings surprises and reward them less for positive earnings surprises. With sub question 3, this research additionally investigates potential drivers of these differences in investor reactions - other than plain firm size. This exercise suggests that firm fame partly accounts for the size premium by primarily driving larger punishment for negative surprises. This would contrast work by Pfarrer et al (2020), if the different proxies for firm fame are perceived as equally valid. The MB-ratio does not seem to account for the size premium; evidence suggests this in a way that corroborates work by Skinner and Sloan (2002). Finally, this master's thesis could not produce evidence that trading volume or an application of learning about profitability (as brought forward by Pastor and Veronesi, 2003) partly cause the size premium. As such – besides plain firm size in terms of revenue – correlated differences in contents of earnings announcements, general information dissemination or shorting restrictions are more likely to cause the size premium in earnings surprise effects.

2. Literature review

An extensive search in literature did not reveal academic papers that have investigated earnings surprises with a similarly specific focus on firm size. However much research has been conducted in the context of earnings announcements - but with a different focal point. The forthcoming discussion of that research should serve to provide basis for theorization of hypotheses and determination of empirical methodology.

2.1 Earnings announcements and behavioural economics in general

Much research has been conducted in the context of earnings announcements, especially research within the field of behavioural economics (Barberis and Thaler, 2003). The main reason seems that these information events represent unique instances where there is a direct interaction between firms and investors. On the one hand these instances confirm the need of a behavioural perspective as they defy axioms of standard rational economic theory like continuous information processing, market efficiency (Bernard et al, 1997) and evaluation based on fundamentals (Freeman, 1992). On the other hand the events function well as tools for empirical work since these regular moments of interaction have measurable parameters and price effects that can provide insight into market inefficiencies as well as into the beliefs and preferences of agents in the market (Barberis and Thaler, 2003). These outcomes are most pronounced when a company discloses information that the investor did not expect (Skinner and Sloan, 2002). In general, academic work agrees that this surprise occurs when there is a discrepancy between the consensus forecast of analysts and reported earnings (Doyle et al, 2006); and this often boils down to the metric earnings-per-share (Skinner and Sloan, 2002). The relation between this surprise and the effect on the stock price is the subject of several behavioural studies, which makes them of immediate relevance to this master's thesis. The following paragraphs discuss these papers.

2.2. Earnings announcements and the aggregate stock market

On the level of the aggregate stock market Frazzini and Lamont (2007) document an earnings announcement premium in the US. That is, US stock on aggregate earn higher stock returns in periods when earnings are announced, an increase which they show to exceed 7% on an annual basis. Barber et al (2013) extend this research globally and show the existence of earnings announcement premia in numerous other countries. By applying a cross-country analysis they conclude that uncertainty about the earnings information to be disclosed is a large driver of the magnitude of the premium since countries with smaller information efficiency have higher premia. This substantiates the thought that stock price reactions to earnings announcements increase in magnitude as an inverse function to information availability. Frazzini and Lamont (2007) also show that these premia are strongly related to (past) trading volume around announcements and suggest that smaller type investor trading activity is their common driver. To this type of investor, earnings announcements might be more valuable as they generally possess or develop less relevant information.

2.3 Earnings announcements from a temporal perspective

In another research, Cohen et al (2007) bring forward evidence that the premia around earnings announcements have declined over time. They argue this to remarkably contrast the widely documented declining *general* volatility of the stock market. For a part, they ascribe the decline in premia to an increase of voluntary information disclosures of firms. Another driver of a decrease in premia is brought forward by Drake et al (2012), who show that continuous information availability – as manifested by Internet searches – drives a decrease in earnings announcement premium and trading volume. With respect to an alternative explanation for this decrease, Landsman (2002) does not find evidence of declined information content in earnings announcements themselves; so changes in exogenous information availability and accessibility are more likely the cause.

2.4 Earnings announcements and firm behaviour

Extensive work has also been done on the interplay between firms, analysts and investors; these actors form the basis for research into forecasting, analyst guidance and earnings management[5]. Brown (2001) provides evidence of an increased tendency for managers to engage in earnings management to meet forecasts. Incentive for this 'just-meet' goal was also shown by Skinner and Sloan (2002). They show that the non-linear relation between prices and earnings surprises, first documented by Freeman and Tse (1992), is S-shaped with a highly steep relation around zero. Hence, investors favour a form of reliability in meeting the forecast rather than looking at fundamentals; and firm managers seem to cater to this. Notably, Degeorge et al (1999) show that 'just meet' firms have inferior long term performance. This suggests that their periodically reported performance may indeed be inflated or otherwise artificial. Brown and Caylor (2004) also showed that increased tendencies to meet thresholds resulted in a higher focus of managers on metrics, that are forecast by analysts, over other metrics (e.g. EPS over profit). The metrics, that are more prominently forecast, were shown to be increasingly influenced by means of analyst guidance (Anilowski, Feng and Skinner, 2007). They show the associated private interactions between firms and analysts to be over weighted in negative information. This serves to bring down earnings forecasts, which makes it easier to surpass the consensus forecast. Alternatively, negative information is also published in a public form that mostly serves to warn investors in case of underperformance; literature also refers to this as earnings preannouncements (Kasznik and Lev, 1995; Soffer et al, 2000). Skinner and Sloan (2002) also underline the importance of its inclusion in between-firm analyses around earnings announcements.

2.5 Earnings announcements and the cross-section of returns: firm characteristics

Several studies have focused on the role of some firm characteristic other than firm size. Porta et al (1997) for example first sought to examine the hypothesis of expectational errors regarding growth stock by instrumenting earnings surprises, but could not provide conclusive evidence. Allowing for an

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[5] Analyst guidance describes the activity where firms have borderline private interactions with analysts to inform them to some extent on the firm's performance. Earnings management constitutes the broad set of activities that a manager of a firm can employ to manipulate an accounting form of earnings. This is often driven by externally forecasted earnings; for example the consensus analyst forecast. Both concepts can be imagined to have significant practical differences between smaller and larger firms.

asymmetric response and preannouncements, Skinner and Sloan (2002) did succeed in doing so. Brown (2001) also documented differences in reporting behaviours between growth and value stock firms: he finds that managers of growth firms are more likely to report positive surprises, especially marginal ones of the ‘just-meet’ variety. Pfarrer et al (2010) find significant results in a particularly behavioural investigation of earnings surprise effects: they find that investors reward firms more for positive earnings surprises and punish them less for negative surprises if they are perceived as reliable or famous. Pastor and Veronesi (2003) employ firm age - as proxied by years since public listing - to investigate the ability to learn about a firm’s profitability. Interestingly, they find that the evaluation ability of spectators (e.g. analysts), grows stronger as the evaluated firms are listed longer. This suggests that it might be easier to predict earnings of older firms.

Other studies have focused more on firm size. A reverse approach from Doyle et al (2006) isolates firms with extreme earnings surprises and finds that these tend to be stocks with high MB-ratios, low analyst coverage and high forecast dispersion. Moreover, the returns to a hedged trading strategy on this basis are highest in firms with high transaction costs and low institutional investor interest. Interestingly, these properties seem to correlate strongly with smaller firms. Another property of firms, information availability, was investigated in earnings surprise context by Atiase (1985). He argued that information dissemination is a decreasing function of firm size; so one might argue earnings reports by smaller firms thus have more significance. Bamber (1987) also documents evidence to support this; he operationalized firm size as a proxy for information availability and shows that it decreases the magnitude of trading volume around earnings announcements. Specifically investigating firm size as a result of this previous work, Freeman (1990) showed that for a given level of unexpected earnings, the cumulative abnormal returns of small firms exceed that of large firms. Contrasting this on a more general level, Horowitz et al (2000) deny the existence of a small firm premium based on an investigation of firms in the years 1980 until 1996. More generally noted, the mere existence of a small firm premium is debatable. While academic work on the issue seems ubiquitous before 2000, little can be found originating from after 2000. Thus, while not the main goal of the paper, it could be interesting to see whether a ‘size effect’ is at play in earnings surprise effects; and whether it may in some way manifest underlying behavioural drivers.

3. Hypotheses

This section defines the hypotheses of this research in accordance with the framework set out in the Introduction section: by sub research question. For each sub research question, I first define the several sub hypotheses after which I provide theoretical argumentation for each of them. After that, this section concludes by visualizing what the different hypotheses jointly entail. This should serve to bring across a more illustrative and comprehensive picture of what this master’s thesis investigates.

3.1 Definition and rationale of hypotheses underlying the first sub research question

The first sub research question is as follows:

1. Does firm size affect the occurrence, sign or magnitude of earnings surprises?'

From the above question, I derive the following hypotheses:

1a Smaller firms have a higher occurrence of earnings surprises
1b Smaller nor larger firms have more earnings surprises of a particular sign
1c Smaller firms have earnings surprises of a larger magnitude

First, 1a assesses whether there are any differences in the *occurrence* of earnings surprises between larger and smaller firms. The underlying reasoning for the assumption that smaller firms report more surprising earnings is twofold. First there might be lower consensus forecast accuracy for smaller firms because of higher earnings volatility, lower analyst coverage density and/or less analyst guidance. Secondly, larger firms might have a higher tendency to engage in earnings management to report 'just-meet' earnings. 1b tests whether there is any asymmetricity in the occurrence of earnings surprises. Knowledge of any asymmetricity differences based on firm size is worthwhile for establishing what rational expectations would prescribe in the context of stock price reactions to earnings surprises. Hypothesis 1c is inspired by aforementioned evidence of Doyle et al (2006) on the one hand, and on the other hand by assumed lower forecast accuracy caused by similar drivers as mentioned under 1a.

3.2 Definition and rationale of hypotheses underlying the second sub research question

The second sub research question is as follows:

2. 'Does firm size affect stock price reactions to earnings surprises?'

From the above question, I derive the following hypotheses:

2a Given a negative earnings surprise, larger firms have stronger negative price reactions – especially when allowing for preannouncements
2b Given a positive earnings surprise, there is no significant difference in stock price reactions between smaller and larger firms
2c In case there is no earnings surprise[6], smaller firms have stronger positive price reactions

Hypothesis 2a stems from the belief that investors might expect large firms to report less (negative) earnings surprises than smaller firms. Thus they respond more strongly when they do; and in particular punish larger firms severely when they disappoint. 2a is additionally driven by the familiarity of larger firms, which could drive a broader reach and stronger resonance of an earnings surprise with investors. The specification of preannouncements illustrates the assumption that larger firms have more preannouncements, which studies have shown to predominantly contain negative news. If we relate this to hypothesis 2b, one might similarly expect stronger reactions to large firms reporting positive surprises. But I hypothesize that smaller firms here also have strong positive price

[6] Naturally, reported earnings may also not be surprising to the market. This is the event that this sub hypothesis refers to. The formal definition of this 'no surprise' event is outlined in the Data section.

reactions for several reasons. First, smaller firms are expected to have more extreme surprises, leading to higher price jumps in accordance with revaluation based on fundamentals. Second, trading volume and shorting possibilities are relatively small and restricted, respectively. This might allow for higher and longer price jumps in positive direction than in the negative direction. Additionally, I found no documentation of a tendency to preannounce positive earnings in relevant literature; hence I assume this should not favour large firms. Hypothesis 2c is driven by two lines of reasoning, the first relates specifically to small firms and the second to large firms. With respect to small firms, investors might overestimate the volatility of their earnings[7]. This overestimation of small firm earnings volatility would lead to the hypothesis that investors will strongly reward smaller firms for reported earnings when they 'just meet' forecasts. Conversely regarding larger firms, investors might also reward large firms less for 'just-meet' earnings announcements. This is because they should expect larger firms to influence the reported earnings, as was discussed earlier.

3.3 Definition and rationale of hypotheses underlying the third sub research question

The third sub research question is as follows:

3. 'What drives differences in stock price reactions to earnings surprises based on firm size?'

From the above question, I derive the following hypotheses[8]:

3a Smaller firms have higher MB-ratios, which drives larger stock price reactions to earnings surprises
3b Larger firms allow more learning as have been publicly listed longer, which drives larger stock price reactions to earnings surprises
3c Larger firms are more famous, which drives larger stock price reactions to earnings surprises
3d Smaller firms have lower liquidity, which drives larger stock price reactions to earnings surprises

The reasoning behind hypotheses 2 already hints at the nature of hypotheses 3: they assume some property associated with size which forms the basis for the hypothesized effect. However, the set of hypotheses 3 will put emphasis on this relation with one specific property. This serves to see to what extent it actually is an inherent aspect of firm size that drives differences in stock price reaction, as opposed to another more standalone property and (behavioural) reasoning.
The origination of hypothesis 3a lies in the work of Skinner and Sloan (2002); it seeks to see whether it is the MB-ratio that drives differences. 3b is inspired by Pastor and Veronesi (2003) and assumes that market spectators expect to learn better evaluate the profitability of larger firms as they are generally listed longer on public stock exchanges. This would then lead to stronger reaction if these

[7] As I have not found basis for this argument in relevant research, it has not been discussed in the Literature Review. However, I imagine this overestimation to exist and to have significant impact. Investors might view smallcap companies as small, and therefore risky and/or with volatile earnings. But this might be due to comparison with largecap companies. These smaller publicly traded companies might be large in their own right; for example when compared to private SMEs. Hence their earnings volatility might be overestimated.
[8] The key content of the hypothesis is the investigated property, not necessarily the assumed correlation with firm size, the hypothesized effect on stock returns or a condition of surprise sign. The assumption of the latter relations is tentative until results of the research validate them and/or make them relevant to investigate.

firms report unexpected earnings. The theorization basis for 3c is broad, but generally boils down to the assumption of a higher resonance of famous firms' earnings surprises with investors, e.g. by means of press coverage, representativeness bias or the celebrity property laid out by Pfarrer et al (2010). Finally, by means of hypothesis 3d this research hopes to check whether relatively low liquidity can explain differences in price jumps resulting from earnings surprises.

3.4. Visualization of hypotheses

In order to help clarify the direction of this research, exhibits 1 and 2 are depicted below. Both exhibits are headed with a basic description of the contents and relation to hypothesis. To the extent possible, the description remains conceptual to leave discussion about the specifics of data and methodology to later sections of this document.

Exhibit 1: fabricated table with distribution and stock price reactions to earnings surprises
The table depicts the distribution of earnings surprises and hypothesized subsequent returns against firm size and the sign of the surprise. Horizontally, the different possibilities of surprise are depicted: negative, (virtually) zero and positive. Vertically, the firms are divided based on their respective size. The actual contents of the table (the inner 12 cells) depict the relative occurrence of the event and the stock price reaction to the event for the aforementioned horizontal and vertical stratifications. Distributions and stock price reactions are chosen randomly, but also with some diligence. They serve to bring across a number of points from the hypotheses. First, one observes a monotonic increase of severity of punishment to negative earnings surprises with firm size. Second, one sees a monotonic increase in reward to 'just-meet' earnings announcements inversely related to firm size. Third, a reward to positive earnings surprises is visible that is similar for all firm size classes. Fourth, we see that the distribution of earnings surprises of different firm size classes is generally symmetric. The only exception is that the largest class of firms have more 'zero' earnings surprises to illustrate the potential effect of earnings management. Naturally, these numbers are tentative and serve only to illustrate. Two more general features of the table are the following. (i) In accordance with literature the average of all events is positive at 0.81%, indicating the premium around earnings announcements documented by literature. (ii) The delta in the bottom cells indicates the return differential of largest vs. smallest stock, which would represent the potentially existent 'size premium'.

Firm size vs sign % mean CAR | (count)	*Earnings surprise sign*			
Firm size group	- (negative) (7/24)	0 (zero/small) (9/24)	+ (positive) (8/24)	All signs (24/24)
1. (Small firms)	-2% (2/24)	+2% (2/24)	+4% (2/24)	+1.33% (6/24)
2.	- 3% (2/24)	+1.5% (2/24)	+4% (2/24)	+0.83% (6/24)
3.	- 4% (2/24)	+1% (2/24)	+4% (2/24)	+0.33% (6/24)
4. (Large firms)	-5% (1/24)	+0.5% (3/24)	+4% (2/24)	+0.75% (6/24)
All firm size groups (4/4)	-3.29% Delta: -3%	+1.17% Delta: -1.5%	+4% Delta: 0%	+0.81% Delta: -0.58%

Exhibit 2: fabricated graph of stock price reactions to earnings surprises of different magnitudes
The below graph depicts the forecast error on the x-axis and the stock price reaction on the y-axis. It is complementary to exhibit 1 because it allows for a visualization of the elasticity of the stock price to different magnitudes of the earnings surprise as defined by the forecast error. Two lines are depicted, one for smaller firms and one for larger firms. In line with the hypotheses one can observe a more steep line in negative surprises for larger firms. Additionally, one can appreciate a flatter line for large firms just above zero, indicating more reward for small firms for 'just-meet' earnings. Generally, the S-shape, documented in literature, can be appreciated for both large and small firms. Finally, one may observe that the aggregate of positive reactions to positive earnings surprises is similar for larger and smaller firms.

4. Data

The coming paragraphs discuss the data according to the main concepts involved: the data sample, the operationalization of earnings surprises, firm size and other variables as well as summary statistics.

4.1. Sample

The sample consists of firm-quarter observations from 2005 up until 2017. The research question does not prescribe specific timing or geography. Similar to Skinner and Sloan (2002), I adopt a 13-year time period - which should include diverse economic states - and cover companies listed in the US.

Following Skinner and Sloan (2002) quarterly earnings data are obtained from the I/B/E/S historical database. This mainly comprises consensus forecasts by analysts and reported actual earnings with respect to Earnings-per-Share (EPS) of US firms. Furthermore, the data includes the number of analysts covering a company and the announcement date as well as the mean and median of the forecast as alternative proxies for the consensus forecast. This dataset is merged with COMPUSTAT Fundamentals database to include several quarterly firm characteristics required for further analysis. Finally, via EVENTUS I retrieve stock price data from CRSP to add the stock returns to their respective firm-quarter observations.

The resulting dataset includes 125,995 firm-quarter observations, which thus comprises firm-quarters with at least one analyst forecast. Several data requirements reduce the final sample to 100,031 observations. Most notably, firm-quarters were required to have quarterly revenue, non-missing price data, computable market-to-book ratios, non-OTC traded securities and reasonable forecasts as well as timing of earnings announcements[9].

4.2. Earnings surprises

An important aspect of this research is the definition and operationalization of earnings surprises. The research design foresees the use of a continuous variable indicating the magnitude of an earnings surprise as well as dummies/indices coding for the event of an earnings surprise of a particular sign.

I first derive the continuous variable. Following Skinner and Sloan (2002), the forecast error of a quarter is calculated by subtracting the median forecast of quarterly EPS from realized quarterly EPS[10]. The employed forecast pertains to the median analyst forecast reported in the final month of the respective quarter. In line with reasoning of Skinner and Sloan (2002) this ensures that the forecasts are not influenced by earnings preannouncements[11]. A negative result of the subtraction reflects that earnings were lower than forecast, and vice versa for positive results. This absolute forecast error is then scaled by the quarter-end share price to arrive at the relative forecast error, a continuous variable which I will label FE[12].

To create variables that indicate the event and sign of an earnings surprise, we need a definition of when we perceive reported earnings to be surprising. Here I alternate from Skinner & Sloan (2002) by allowing for events where expectations of earnings are met by the earnings announcement. Theoretically, this inclusion is important since I hypothesized dynamics where particular firms (i) have a higher propensity to report 'just-meet' earnings or (ii) induce different investor reactions to 'just-meet' earnings. Practically, one can also imagine that earnings can be unsurprising when the actual earnings deviate marginally from the consensus forecast (exactly meeting the forecast is not always probable). However, this induces the question of when we view earnings as surprising: what is the threshold? This definition is arbitrary by nature. The research design employs a definition for earnings surprises where sample firms - abstracting from their size - are actually equally likely to report negative surprises, positive surprises or unsurprising earnings. This is useful for answering the research questions as it entails an equal distribution and builds a view of what rational expectations would imply for investor reactions. And, as we shall see, the definition will make practical sense as well[13]. The consequential thresholds chosen for this research are the values -0.025% and +0.145% for the continuous variable FE.

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[9] The Appendix includes a breakdown of data requirements and associated data omissions.

[10] As does the vast majority of relevant literature: EPS is most widely used earnings measure while median seems the standard for consensus, arguably favoured above the mean as it is robust to extreme forecasts.

[11] I/B/E/S typically collects the forecasts throughout the first month of the quarter and reports the consensus halfway trough the month. Since Soffer et al (2000) show that preannouncements start occurring two weeks before the end of the respective quarter, we can be sure that the preannouncements do not influence the forecast data employed to construct measures for the earnings surprise.

[12] The research also foresees the use of the absolute value of the continuous variable FE. That is, all negative values are set to positive values. In this case, the variable is labelled FE-ABSOLUTE.

[13] An example might illustrate the practical sense of the thresholds. Say that a firm has a share price of 50 dollar and that the median forecast for earnings is 10.00 dollar earnings per share. In that case, the thresholds imply that earnings reports of ca. 9.99 dollar up to ca. 10.07 dollar earnings per share are not perceived as a surprise.

Based on this definition, the continuous variable FE forms the basis for creation of an indicator variable labelled EARNINGS SURPRISE INDEX with value 1 (if positive surprise), 0 (if no surprise), or -1 (if negative surprise). Besides this, EARNINGS SURPRISE DUMMY codes 1 (in case of an earnings surprise) and 0 (in case of no surprise). Finally, this research uses POSITIVE SURPRISE DUMMY, NEGATIVE SURPRISE DUMMY and NO SURPRISE DUMMY that code 1 and 0 for the occurrence of particular events that are evident from their labels. Following earlier reasoning we now have ca. 33.3% of firm-quarter observations for each of the event codes of EARNINGS SURPRISE INDEX. Logically, it follows that the other indicator variables have 1/3 vs 2/3 proportions in terms of firm-quarter observations.

4.3. Firm size

Firm size is the focal point of this research, hence its operationalization now follows as a standalone discussion. Simply put, this research sees two viable options to proxy for firm size: revenue or assets (e.g. book or market value of assets). For a number of reasons, revenue is chosen as measure. The two most important reasons are (i) that firm assets may vary more strongly across different industries in ways unrelated to their actual size, (ii) that assets may by definition correlate strongly with the MB-ratio, which would confound joint analysis if firm size is also defined based on assets.

The research design divides firms in quartiles based on their respective size in terms of revenue. They are classified in quartiles based on the 25^{th}, 50^{th} and 75^{th} percentile observation. The main function of the classification of size in this research is to allow panel data regressions with index digit predictor variables for size quartiles, or a dummy for membership of either one of the two highest quartiles or one of the lowest quartiles. Throughout the paper, larger firms are used as the positive side of the spectrum. This means that the associated variables increase with firm size (e.g. dummy code 1 for large firms and 0 for small firms). Similarly, the index increases with firm size from 0 to 3. As such, all index groups comprise 25% of the observations.

4.5. Other key variables

MB-ratio. The MB-ratio is calculated as the market value of equity divided by the book value of equity of firm-quarter events. The calculation employs the values at the end of the fiscal quarter. This respective variable is included in the regressions as an index number ranging 0 to 3 for quartile groups of firm-quarters based on the magnitude of the MB-ratio. The dummy codes 0 and 1 for membership of either of the two extreme quartiles. The index numbers and dummy increase with the MB-ratio.

Analyst coverage. The density of analyst coverage is proxied by deriving the number of analysts with a published forecast on I/B/E/S for a particular firm-quarter. The value is naturally strictly positive and will be included as a log-transformed variable. This seems sensible as the increases in analysts on the low end will likely have more impact than increases on the high end. The number of analysts may also be perceived as a proxy for the fame of a firm: the more famous the firm, the more it should be covered by analysts. In case I use this perspective, the associated regressions include the number of analysts as a dummy or index variable to do justice to far-end increases in analyst coverage numbers.

Trading volume. To proxy for the trading volume of a particular firm's stock, I use the trading of the respective quarter. Thus aggregate trading equals the number of common shares traded in the fiscal quarter. The variable is included as a log-transformed variable. One can also perceive trading volume as the liquidity of a security, where low liquidity could induce larger stock price reactions to earnings announcements. In that case, the research also uses a dummy to classify observations based on the number of common shares traded. This dummy increases with the number of shares traded.

Firm age. The age of a firm is approximated by the number of years since its initial public offering (IPO)[14]. This approximation makes sense since it involves the first moment that analysts would have a reason to forecast the earnings of a firm, especially since we are interested in the extent to which the market has learned about the firms profitability. This perspective is inspired by Pastor and Veronesi (2003). They show that learning increases most significantly in the first years since IPO. To reflect this, firm age is included as a log-transformed variable.

4.5. Summary statistics

Exhibit 3: table summarizing the statistics of key variables

The table gives number of observations reporting the value of the variable, as well as the mean, standard deviation, minimum and maximum of the value of the variable. In case the value is in millions as denominator, it is extended with (m); all monetary values are in dollars. FIRM OCCURENCE represents the number of observations of the same firm, NUMBER OF FORECASTS is the number of analyst forecasts per observation, MEDIAN FORECAST is the median forecast of EPS, ACTUAL REPORTED EARNINGS gives the actual reported EPS, ABSOLUTE FORECAST ERROR is the result of the subtraction of median forecast and actual reported earnings, SHARE PRICE indicates the share price at the end of the quarter, RELATIVE FORECAST ERROR gives the forecast error scaled by the share price, REVENUE is quarterly revenue in millions of dollars, COMMON SHARES TRADED give the number of shares traded during the respective fiscal quarter in millions, MARKET CAPITALIZATION represents the market capitalization at the end of the quarter in millions of dollars, BOOK VALUE ASSETS denotes the book value of assets in millions of dollars, MARKET-TO-BOOK RATIO is the ratio of the former two variables and finally FIRM AGE indicates the number of years since IPO of the respective company.

VARIABLE	OBS.	MEAN	ST. DEV.	MIN.	MAX.
FIRM OCCURRENCE	100,031	20.8	13.8	1	52
NUMBER OF FORECASTS	100,031	8.8	6.9	1	50
MEDIAN FORECAST	100,031	25.6	7,808	-360	2,469,600
ACTUAL REPORTED EARNINGS	100,031	25.6	7,808	-360	2,469,600
ABSOLUTE FORECAST ERROR	100,031	0.0	3.8	-314	300
SHARE PRICE	100,031	48.2	1,312	0.1	141,600
RELATIVE FORECAST ERROR	100,031	-0.24%	10%	-210%	90%
REVENUE (m)	100,031	1,223	4,684	0.001	131,565
COMMON SHARES TRADED (m)	100,031	96	270	0.021	12,000
MARKET CAPITALIZATION (m)	100,031	6,869	26,515	0.009	859,967
BOOK VALUE OF ASSETS (m)	100,031	6,389	25,927	2.9	846,988
MARKET-TO-BOOK RATIO	100,031	1.6	1.6	0.0	76.4
FIRM AGE: YEARS SINCE IPO	59,998	12.4	7.5	1	49

[14] Unfortunately the COMPUSTAT dataset on IPO dates is not complete. Hence, the sample only comprises an approximation of the firm age for ca. 60k of the total 100k firms. The omissions in the data did not show any consistent pattern that would suggest the reason for omission. Absence of a pattern reduces the danger of creation of sample bias, however to be safe firm age is primarily used for firm-age specific investigations and robustness checks.

5. Methodology

This section outlines the empirical methodology of this research. The following three subsections consecutively elaborate on (i) the specifics of the event study framework, (ii) the envisaged approach in visualizing illustrative evidence for analysis and finally (iii) the adopted empirical methodology for regression analysis.

5.1. Event study framework

Essentially, the event study framework revolves around quarterly earnings announcement events of US listed firms. These form firm-quarter observations in which this investigation analyses the effect of firm size on earnings surprise variables (sub research question 1) and the effect of firm size on stock price reactions to earnings surprises (sub research question 2 and 3). Having already defined the earnings surprise variables in Section 4, we now continue to establish the definition of stock price reactions.

To determine the stock price reactions to earnings announcements we first compute abnormal returns. These should isolate the effect of an earnings surprise event of a particular firm on its respective share price. To this end Skinner and Sloan (2002) use buy-hold with-dividend stock returns and compute abnormal returns by subtracting the return over that period by a size-matched portfolio. Employing buy-hold returns with inclusion of intermittent dividends seems undoubtedly prudent. Hence, I follow this approach. Their correction for market movement by means of a size-matched portfolio, however, will not work as we investigate the role of firm size itself. As such, this research needs another method. Pfarrer et al (2010) use a simple market model, a method which also seems common in other relevant literature. Another potential way for determining benchmark returns comprises the use of a multifactor model like the Fama-French three-factor model or the Carhart four-factor model. Both these models include a factor that is meant to capture the effect of firm size on stock returns. Since this research specifically investigates the effect of firm size, this effect needs to remain in the abnormal returns. Hence, it would be illogical to include a size factor in the benchmark model. Since this research foresees the explicit investigation of the impact of ‘growth’ or ‘value’ classification on firm stock returns, the same logic applies to the MB-ratio. Hence, the pricing model should also exclude a factor that captures effects of the MB-ratio on stock returns. The Carhart model additionally includes a momentum factor to capture price dynamics. In this regard, it seems unwise to include this factor. This is because apparent price dynamics are likely to appear excessively around earnings announcements. However, these apparent price dynamics might in fact result more from the information events itself than that they are driven by price movements alone. To avoid the risk of extracting earnings surprise event effects, the benchmark model should also exclude a momentum factor. In synthesis of the above considerations, it seems most prudent to adopt a simple market model. Again following Pfarrer et al (2010), this research also uses EVENTUS to retrieve the stock return data from the CRSP database. To compute the benchmark market returns, I use the equally-weighted CRSP market index. This is preferred over value-weighted computation as value-weighting could lead to a size-based bias in the construction of the benchmark returns; and thus in the abnormal returns. The quarterly firm alphas and betas are estimated using Ordinary-Least-Squares (OLS) regressions. The estimation window ends at least 100 days before the earnings announcements and ranges between 180 days minimum and 360 days maximum depending stock price data availability. In sum, the abnormal returns are thus calculated as depicted in the below specification:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i(R_{mt})) \quad (0)$$

where AR_{it} are the abnormal returns at for firm i at day t, R_{it} are the buy-and-hold with dividend returns of firm i at day t, α_i is the OLS-estimated intercept of returns of firm i, β_i is the covariance of firm *i* returns with the market return and R_{mt} is the benchmark market return at day t.

To perform the envisaged investigation daily abnormal returns do not suffice, cumulative abnormal returns are required. This raises a question regarding the accumulation period of the returns. In this regard, this research design approximates methods employed by Skinner and Sloan (2002)[15]. I will adopt similar terminology and define FULLRET, POSTRET, PRERET and ARET. FULLRET begins 89 days before the earnings announcement date and ends 1 day afterwards to reflect the length of one quarter[16]. POSTRET and PRERET split this 91-day period into two with PRERET starting 43 days prior to announcement date and ending 1 day after. POSTRET covers the first half of the quarter. Finally, ARET captures the abnormal returns of the 3-day period around the earnings announcements, which starts 1 day prior to the event and ends 1 day afterwards. The extra day of ARET on both ends of the announcement date (and extra end-day in PRERET and FULLRET) reflects common research practice in the context of information events to include leakage prior to the event and slow reactions after the event. To summarize, exhibit 4 gives an overview of the periods over which the returns from CRSP are aggregated via EVENTUS to become cumulative abnormal returns (CAR):

Exhibit 4: table with time period names and composition in days

Time period name	Days as a function of the announcement date
ARET	(-1, +1)
PRERET	(-43, +1)
POSTRET	(-89, -44)
FULLRET	(-89, +1)

5.2. Illustrative evidence analysis

Besides regression analysis, the methodology also foresees analysis of several exhibits of illustrative evidence. This serves to provide background before engaging in discussion of the empirical analysis

[15] It is an approximation since there are minor differences. For better comprehensibility, we label PRERET the returns preceding the announcement and POSTRET the returns following the previous announcement. This is opposite from Skinner and Sloan (2002). Moreover, they condition the return periods on the dates of previous announcement, fiscal quarter-end and current announcement. However I use definitive values for the return period as a function of the announcement date.

[16]Please note that the concept 'quarter' must not be mistaken for an actual quarter. It reflects the time between two earnings announcements rather than the time between the fiscal quarters that the earnings announcements report on. As such it depends on the timing of announcements, which may vary.

by means of regressions. The exhibits of illustrative evidence include the table and graph used to illustrate the hypotheses in Section 3. Moreover, an additional exhibit tabulates the mean CAR per time period (e.g. ARET, PRERET etcetera) against groups of different firm sizes.

5.3. Regression analysis

On a general note with respect to the regression analysis in this master's thesis, this research chooses to adopt a generic validation method throughout the paper, which rejects the null-hypothesis at the 5% significance level, and illustrates significance levels with p-values. Besides this, coefficients indicate the sign and magnitude the effect of a variable which serves in validation of sign-specific hypothesis and determination of economic meaning. All regressions are linear and have standard errors robust to homoskedasticity. Furthermore, all regressions employ dummies to capture yearly time fixed effects and industry fixed effects at the two-digit industry sic code level. This should control for time-specific or industry-specific differences in firm propensity to report surprising earnings and/or in investor reactions to earnings surprises. The Appendix documents a consideration of approach and results of additional tests of parameter restrictions of the regression models.

Broadly speaking the regression analysis comprises three sets of regressions. Each set has a different general set-up and belongs to one of the three sub research questions. Further discussion of the empirical methodology is structured into the three sets of regressions, starting with the first set.

5.3.1. First set of regressions

The first set of regressions pertains to the hypotheses under sub research question 1. The goal of these regressions is to investigate whether firm size indeed has some significant impact on the occurrence, sign or magnitude of earnings surprises. The sub hypotheses were as follows:

1a Smaller firms have a higher occurrence of earnings surprises
1b Smaller nor larger firms have more earnings surprises of a particular sign
1c Smaller firms have earnings surprises of a larger magnitude

The general set-up of the first set of regressions is given by the below specification:

(1) $$Y_{it} = a + \beta_1 * D_{it} + \beta_j * {X^j}_{it} + \epsilon_{it}$$

Where *it* denotes the firm-quarter, *Y* denotes the value for the earnings surprise variable, α denotes the intercept, *D* denotes the dummy or index variable for firm size, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Testing each one of the above hypotheses requires a slight modification of specification (1). The modification predominantly relates to the earnings surprise variable that is used as independent variable. For 1a the regression employs the variable EARNINGS SURPRISE DUMMY. A significant loading on this coefficient indicates the percentage increase in the odds ratio resulting from an increase in the size group. Hence, a negative loading indicates that larger firms have less earnings surprises (or, alternatively formulated: smaller firms have more earnings surprises). Testing 1b comprises three types of variables: the two sign-specific surprise variables POSISTIVE SURPRISE DUMMY and NEGATIVE SURPRISE DUMMY as well as the bidirectional index EARNINGS SURPRISE INDEX to illustrate the aggregate effect on the direction of the surprise. Finally, for 1c the independent variable is based on the continuous variable FE, where the variable is included in absolute form. The variable serves to establish the aggregate effect on magnitude. The associated coefficient shows the average percentage change in FE resulting from an increase in firm size group, while making absolute - and thus aggregating - positive and negative surprises. All regression models use the MB-index, trading volume and the number of analyst forecasts as control variables.

5.3.2. Second set of regressions

The second set of regressions pertains to the hypotheses under sub research question 2. These are meant to assess whether firm size has an effect on the way stock prices respond to earnings announcements. As such, the required regressions use stock price returns as the dependent variable. The sub hypotheses under 2 were as follows:

2a Given a negative earnings surprise, larger firms have stronger negative price reactions – especially when allowing for preannouncements
2b Given a positive earnings surprise, there is no significant difference in stock price reactions between smaller and larger firms
2c In case there is no earnings surprise, smaller firms have stronger positive price reactions

The general set-up of the second set of regressions is given by the below specification:

(2a) $$CAR_{it} = \alpha + \beta_1 * (Y_{it} * D_{it}) + \beta_2 * Y_{it} + \beta_3 * D_{it} + \beta_j * X^j{}_{it} + \epsilon_{it}$$

Where *it* denotes the firm-quarter, *CAR* denotes the cumulative abnormal returns, *Y* denotes the value for the earnings surprise variable, *D* denotes the dummy or index variable for firm size, α denotes the intercept, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

The primary feature of specification (2a) is the variable that interacts the earnings surprise indicator with the firm size indicator. The individual earnings surprise variable and size variable serve to draw away the general effect of the earnings surprise and firm size on the stock returns. The interaction variable should thus isolate the effect of firm size *given a particular earnings surprise event.* Thus the coefficient shows the magnitude and direction of the effect, if this effect is indeed significant. The magnitude is expressed as the percentage change in cumulative abnormal returns caused by an increase in firm size group in the event of the earnings surprise. Importantly, the methodology actually foresees to use an extension of specification (2a) to account for asymmetricity. To this end, the regression models include an extra interaction variable per sign of the earnings surprise[17]. This effectively results in inclusion of one more interaction variable and one more individual earnings

[17] As Section 6 shows, only the extension with using positive surprises and negative surprises is relevant. Hence, the specification is not extended with the NO SURPRISE DUMMY variable.

surprise variable to draw away the general effect of the alternate earnings surprise event. The extension is given as specification (2b):

$$\text{(2b)} \quad CAR_{it} = a + \beta_1 * (Y^{-}{}_{it} * D_{it}) + \beta_2 * (Y^{+}{}_{it} * D_{it}) + \beta_3 * Y^{-}{}_{it} + \beta_4 * Y^{+}{}_{it} + \beta_5 * D_{it} + \beta_j * X^{j}{}_{it} + \epsilon_{it}$$

Where *it* denotes the firm-quarter, *CAR* denotes the cumulative abnormal returns, *Y* denotes the value for the earnings surprise variable with a superscript indicating the sign of surprise, *D* denotes the dummy or index variable for firm size, α denotes the intercept, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Additionally, the regressions are conducted using different time periods as accumulators for the CAR. This way we might be able to observe differences in general statistical significance differences and specific firm sign or magnitude-based differences like the hypothesized tendency for larger firms to preannounce negative earnings surprises. Together, the different regression models should grant the ability to test the hypotheses. The models employ the MB-index, trading volume, firm age and the number of analyst forecasts as control variables.

5.3.3. Third set of regressions

The third set of regressions pertains to the hypotheses under 3. Having established differences in stock price reactions to earnings announcements based on firm size, this set of regressions investigates the drivers of these differences. Similar to the second set, CAR are used as independent variable. However, the focus is different. The regressions assess the influence of some property – related with firm size – on the effects revealed in the second set of regressions. I formalized the hypothesized effects of these properties in the sub hypotheses under 3:

3a Smaller firms have higher MB-ratios, which drives larger stock price reactions to earnings surprises
3b Larger firms allow more learning about profitability as they are publicly listed longer, which drives larger stock price reactions to earnings surprises
3c Larger firms are more famous, which drives larger stock price reactions to earnings surprises
3d Smaller firms have lower liquidity, which drives larger stock price reactions to earnings surprises

The general set-up of the second set of regressions is given by the below specification:

$$\text{(3a)} \quad CAR_{it} = a + \beta_1 * (Y_{it} * D_{it}) + \beta_2 * (Y_{it} * C_{it}) + \beta_3 * Y_{it} + \beta_4 * D_{it} + \beta_5 * C_{it} + \beta_j * X^{j}{}_{it} + \epsilon_{it}$$

Where *it* denotes the firm-quarter, *CAR* denotes the abnormal returns, α denotes the intercept, *Y* denotes the value for the earnings surprise indicator, *D* denotes the dummy or index variable for firm size, C denotes the variable implied by the particular sub hypothesis, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

The primary feature of specification (3a) is the inclusion of an additional interaction variable of the earning surprise indicator with the variable that proxies for a particular hypothesized driver of earnings surprise effects. This interaction variable should capture the effect of the investigated property *in the event of an earnings surprise of a particular sign*. The general effect of the property should be captured by also including it as a standalone variable. The operationalization of this variable for the interaction variable may deserve specific attention[18]. The third set of regressions comprises several models that employ the different proxy variables explicit from the sub hypotheses. All models use the CAR time period that rendered the most significant results in the second set of regressions. The goal of the models is to see whether the property can draw away any of the effect that firm size had on the CAR. On the one hand it could be interesting in its own right to see if the property has influence, on the other hand it can reveal whether the property actually (partly) drove the effects that we may have attributed to firm size in the second set of regressions. Similar to specification (2b), the third set of regressions will also allow for asymmetricity. That is, they may also include additional interaction variables and earnings surprise indicators to capture effects in another direction[19]. The extension is made explicit by specification (3b).

(3b) $$CAR_{it} = a + \beta_1 * ({Y^-}_{it} * D_{it}) + \beta_2 * ({Y^+}_{it} * D_{it}) + \beta_3 * ({Y^-}_{it} * C_{it}) + \beta_4 * ({Y^+}_{it} * C_{it}) + \beta_5 * {Y^-}_{it} + \beta_6 * {Y^+}_{it} + \beta_7 * D_{it} + \beta_8 * C_{it} + \beta_j * {X^j}_{it} + \epsilon_{it}$$

Where *it* denotes the firm-quarter, *CAR* denotes the abnormal returns, α denotes the intercept, *Y* denotes the value for the earnings surprise indicator with a superscript indicating the sign of surprise, *D* denotes the dummy or index variable for firm size, C denotes the variable implied in the particular sub hypothesis, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

6. Results

This section first analyses several exhibits of illustrative evidence, after which the next subsection turns to the documentation and discussion of the empirical evidence from the regression analysis.

6.1. Illustrative evidence analysis

[18] Several of the hypothesized properties have already been included in the first two sets of regressions. However, there they were primarily used as general controls. The third set may require different operationalization. An example regarding the number of analyst forecasts might illustrate this. In the first and second set of regressions this number was included as a general control variable in log-transformation. However, for the third set an alternate use of dummy or index might suit the analysis better. This has two primary reasons. One reason is that this would make it an equal competitor of firm size as a driver of the effect. Another hypothesis-specific reasoning is that the number of analysts might proxy for the extent to which a firm is 'famous'. In that case, a log-transformation would decrease the variability at the far end of the continuum: 50 instead of 45 analysts is no less relevant than 10 instead of 5 for assessing fame. Thus, a dummy or index serves the investigation better. To contrast this, a reasoning that higher density of analyst forecasts leads to stronger market reaction in the event of an earnings surprise would require differently: it values beginning-end increases relatively more.

[19] As Section 6 shows, only the extension with using positive surprises and negative surprises is relevant. Hence, the specification is not extended with the NO SURPRISE DUMMY variable.

As mentioned in the Methodology section, the illustrative evidence comprises three types of exhibits. The first type is exhibit 5 with the matrix that stratifies mean CAR against surprise sign and firm size. This matrix is shown in two versions to illustrate differences in adopting the ARET window and the PRERET window. The second type is exhibit 6: a graph, which is similar to one in the Hypotheses section, plotting CAR against magnitudes of the forecast error. This graph is displayed in different versions: these allow for a view on both aforementioned CAR windows and two different scales of forecast error magnitude. The third type is exhibit 7, it indicates the mean returns of different CAR time windows for different size groups, as well as their respective forecast errors and quarterly nominal price increases. To structure the document and allow for brevity and synthesis, the analysis of the exhibits occurs with a comprehensive view of the three exhibits after all three have been displayed.

Exhibit 5: matrices with mean CAR and distribution of earnings surprises against firm size
Two versions of the matrix are on display, the top one uses the ARET time window and the bottom one uses the PRERET time window. Two versions are given since they give strongly different results, which are relevant to discuss and further research. Similar in both is the distribution of observations, which are given per stratification. All cells have the mean CAR in percentage points. The standard deviation of the mean CAR per group decrease with size (far-right cells). The bottom cell gives indicates the difference (delta) between the extreme groups in percentage points.

ARET time window % mean CAR | (count)	*Earnings surprise sign*			
Firm size group	- (negative) 33.3k = 4/12	0 (zero/small) 33.3k = 4/12	+ (positive) 33.3k = 4/12	All signs % mean | std
1 (small) 25k = 3/12	-3.43% (10,150)	- 0.19% (4,951)	+2.96% (9,907)	-0.26% 0.110
2 25k = 3/12	- 3.48% (8,707)	+0.46% (7,637)	+5.91% (8,664)	0.47% 0.101
3 25k = 3/12	- 3.05% (7,790)	+0.42% (9,582)	+3.90% (7,639)	0.40% 0.089
4 (large) 25k = 3/12	-2.52% (6,864)	+0.21% (11,047)	+2.90% (7,093)	0.22% 0.071
All groups (100k firms) % mean | (% delta)	-3.17% (0.99%)	0.27% (0.40%)	3.55% (-0.06%)	0.20% (0.48%)

PRERET time window % mean CAR | (count)	*Earnings surprise sign*			
Firm size group	- (negative) 33.3k = 4/12	0 (zero/small) 33.3k = 4/12	+ (positive) 33.3k = 4/12	All signs % mean | std
1 (small) 25k = 3/12	-3.75% (10,150)	- 0.53% 4,951	+4.86% (9,907	-0.11% 0.260
2 25k = 3/12	- 5.88% (8,707)	+0.44% (7,637)	+5.91% (8,664)	-0.13% 0.199
3 25k = 3/12	- 5.72% (7,790)	+0.09% (9,582)	+4.88% (7,639)	-0.33% 0.171
4 (large) 25k = 3/12	-4.74% (6,864)	-0.40% (11,047)	+3.61% (7,093)	-0.45% 0.141
All groups (100k firms) % mean | (% delta)	-5.27% (-0.99%)	-0.34% (0.13%)	4.87% (-1.25%)	-0.37% (-0.24%)

Exhibit 6: graphs plotting mean CAR against mean forecast error

The below graphs show the mean CAR and FE of a group of large and small firms based on 16 portfolios (evenly distributed based on number of observations) per associated magnitude in FE. The resulting points are connected and smoothed using Excel functionality. The 'large' firms comprise firms in the top two size quartiles, and 'small' firms reside in the bottom two. Again multiple versions of the graph are shown. On the left we observe ARET CAR and on the right PRERET CAR. The top graphs exclude the extreme FE magnitude portfolios, while the below ones include them. Hence, the top ones serve to see elasticity around FE=0% and the bottom ones display the entire picture on grander scale. Notably, for display functionality the scaling differs per graph and within-graph per direction (hence for example the steepness of the S-curve can be under- or overstated).

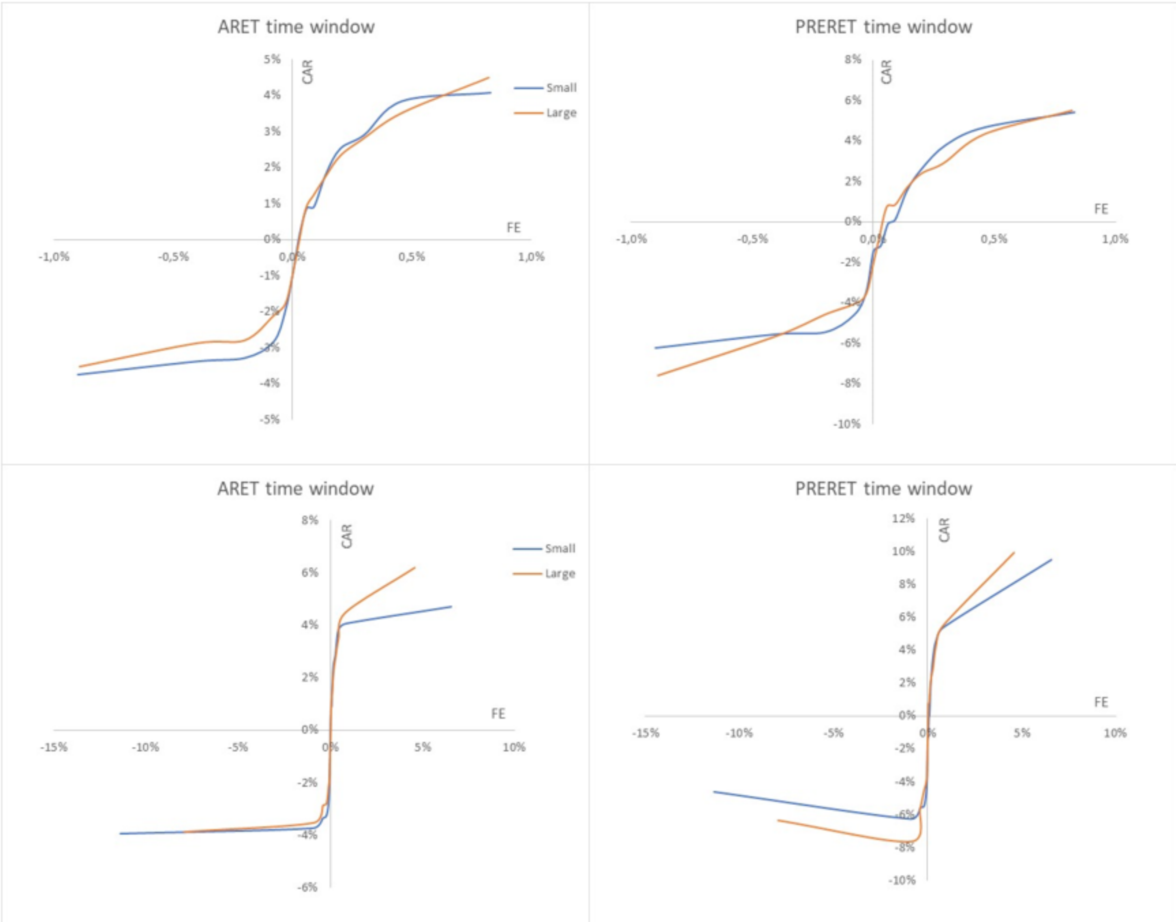

Exhibit 7: mean FE, mean CAR per time period and mean quarterly price increase by size

Mean percentage values and their standard deviations are given per firm size group as well as for all firm size groups. Mean forecast error and nominal quarterly price increase decrease with size, as do their standard deviations. Relations between mean CAR and firm size differ significantly per time window.

Metrics by firm size % mean | std	Forecast Error	ARET CAR	PRERET CAR	POSTRET CAR	FULLRET CAR	QoQ price increase
1 (small)	-0.58%	-0.25%	-0.11%	-0.05%	-0.16%	3.80%
25k = 3/12	0.110	0.110	0.260	0.253	0.382	0.501
2	-0.20%	0.46%	-0.13%	-0.14%	-0.27	3.76%
25k = 3/12	0.056	0.101	0.120	0.198	0.291	0.384
3	-0.09%	0.40%	-0.33%	0.24%	-0.09%	3.15%
25k = 3/12	0.043	0.089	0.171	0.171	0.253	0.233
4 (large) 25k = 3/12	-0.01% 0.036	0.22% 0.070	-0.45% 0.141	0.12% 0.141	-0.32% 0.209	2.39% 0.193
All groups (100k firms)	-0.24%	0.20%	-0.26%	0.04%	-0.21%	3.27%
% mean | std	0.067	0.094	0.120	0.195	0.291	0.348

In several ways the above exhibits show marked patterns that may be worth discussing. Naturally, the illustrative evidence does not provide conclusiveness on any relations. The evidence may, however, serve to illustrate the sample composition and guide the empirical investigation.

With regard of the occurrence of surprise events, we generally see a strongly higher tendency for large firms to report 'just-meet' earnings. As we can see in the matrices of exhibit 5, the number of observations increases monotonically with firm size group, and draws asymmetrically from negative earnings surprises. This hints at the alleged higher tendency of large firms to engage in earnings management and/or analyst guidance, which would be in line with the related hypothesis. The investor reactions to this 'zero' surprise event seem against expectations, larger firms generate higher abnormal returns in case of 'just-meet' earnings. Indeed in the top graphs of exhibit 6 we see a slight hint of a higher reward for larger firms for 'zero' surprise. Remarkably, firms do not seem to be immediately rewarded in case of a forecast error marginally above 0.00%. Generally, we do see highly steep S-shapes in the graphs. This strongly suggests that investors do not react in accordance with fundamentals (as per the reported EPS), but in fact are more elastic to forecast errors around 0%. Strikingly, for extreme negative forecast errors the *absolute* punishment actually decreases, which would corroborate the notion of bounded rationality of the market. On another general note, we see evidence in ARET of the earnings announcement premium documented in literature (0.20% in bottom right cell). This effect concentrates in larger firms, as the smallest size group actually seems to have a discount during this 3-day period.

Moving to the difference between ARET and PRERET, the matrices in exhibit 5 show that the relation of mean CAR with firm size changes drastically. In PRERET the aggregate of returns are actually negative. This is mainly driven by the stronger negative returns for 'zero' surprises and negative surprises. Especially negative surprises generate relatively more negative returns than in ARET. Interestingly, this change is again primarily caused by a sharp magnification of the negative returns of larger firms. Taking into account a larger time period before the earnings announcement seems to lead to far more severe punishment by the market in case of negative surprises. We also see this effect in the bottom graphs of exhibit 6. The PRERET graphs strikingly illustrate the increase in average punishment in case of negative forecast error for large firms. This strongly suggests large firms indeed more frequently preannounce negative earnings surprises. We should see this switch of sign of the relation in the regression analysis. With respect to positive surprises, the relative reward to positive surprises for larger firms seems to decrease slightly in the graphs - when accounting for a larger period prior to the earnings announcement.

The difference between PRERET and ARET is also apparent from the table in exhibit 7. This table actually adds perspective by indicating that POSTRET has an opposite relation to PRERET. The sum of these returns in FULLRET is actually decreasing with firm size because the negative relation in PRERET is stronger. The decreasing relation in PRERET and consequentially FULLRET contrasts the relation we observe in the average forecast error: its mean value increases with firm size. As could be expected the standard deviation of all table mean values decreases with firm size. Hence, we can not easily argue that we indeed observe some significant size premium. FULLRET returns and quarterly nominal price changes do decrease with firm size. But, as do their standard deviations. Moreover, the nominal price increase might be misleading if small firms generally have higher market betas.

Importantly, we thus not per se observe a size premium in general. Stronger evidence favours the thought that we might have a size premium in earnings surprises specifically, which should become apparent if we account for earnings preannouncements. Another important observation is that - also in PRERET - there are nevertheless no consistent monotonic decreases in returns across *all four size groups* and across *all surprise signs*. We do have consistence in relations if we average the returns of the two smaller and two larger groups. For this reason, it seems wise to primarily adopt that two-way distinction in firm size going forward (the graphs in exhibit 6 already incorporate this halfway split and illustrate the pattern well). This also better justifies the hypothesization, which did not imply a specific size classification. One might thus consider a halfway divide most true to the investigation.

The regression analysis will seek to establish whether the suggested relationships in occurrence of earnings surprises and their associated returns are actually attributable to firm size in case of a particular earnings surprise - as opposed to other effectors. In line with above argument, the halfway split size dummy will be the primarily instrumented variable in the regressions. As the results indicate, this dummy variable generally suffices in statistical significance to answer the research questions.

6.2. Regression analysis

The Methodology section introduced three sets of regressions, of which each one is associated with either three of the sub research questions. That structure governs the display and discussion of the results of the regressions: starting with the first set, and ending with the third set. Each set comprises multiple regressions models. The results of these regression models are compiled into one table per set[20]. For each set an exhibit tabulates the results with a brief description above. General text documents the investigation regarding their relation the hypotheses. The discussion, weighing more into the academic and/or economic implications of the results, is left for the Conclusions section.

6.2.1. First set of regressions

As one may observe the size variables generally load significantly as a predictor of the earnings surprise variables[21]. I discuss them in accordance with the different hypotheses. Regression model 1 and 2 pertain to hypothesis 1a. In this regard, we can accept the hypothesis that smaller firms have more earnings surprises. Since the independent variable is binary, the coefficient on the predictor may be interpreted as a change in the odds ratio. Hence an increase in the size index group on average leads

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[20] Considerations and results of tests of parameter restrictions are given in the Appendix. The results did not seem to threaten the significance of any of the regression models, as also visible from the F-statistics.

[21] Firm age is excluded a control variable from this regression as it generates very similar results. Hence, the choice of exclusion is favoured for sake of employing the entire data sample instead of ca. 60% of the observations. Noted may be that inclusion of firm age log-transformed control variable leads to slightly decreases the magnitude of the coefficients and tilts the asymmetric effect of larger firms on the occurrence slightly to the positive side. Moreover, the size dummy in regression model 6 loads significantly with firm age. The alternate regressions that include firm age are given as a robustness check in the Appendix.

to a 10% decrease in the likelihood of an earnings surprise, while an increase from the smaller half to the larger half leads to a 15% decrease in the likelihood. Hence, in rude terms, smaller firms report more earnings surprises. Alternatively stated, large firms report more 'just-meet' earnings.

Exhibit 8: summary results of first set of regressions

The below table documents the results of the first set of regressions. All regression models incorporate dummies to capture yearly time fixed effects and dummies with 2-digit level sic codes to capture industry fixed effects. The I indicates the independent variable used in the model. An asterisk indicates whether coefficients are significant at the 5% level; p-values are given in brackets for further detail. F-statistics follow from the F-test of the restriction that all displayed coefficients equal zero. All models have the following basic form:

(1) $Y_{it} = a + \beta_1 * D_{it} + \beta_j * X^j{}_{it} + \epsilon_{it}$

Where *it* denotes the firm-quarter, *Y* denotes the value for the earnings surprise variable, α denotes the intercept, *D* denotes the dummy or index variable for firm size, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Regression model no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
EARNINGS SURPRISE DUMMY	I	I						
POSITIVE SURPRISE DUMMY			I					
NEGATIVE SURPRISE DUMMY				I				
EARNINGS SURPRISE INDEX					I	I		
FE-ABSOLUTE							I	I
FIRM SIZE INDEX	-0.100* (0.000)				0.011* (0.002)		-0.008* (0.000)	
FIRM SIZE DUMMY		-0.151* (0.000)	-0.070* (0.000)	-0.080* (0.000)		0.010 (0.135)		-0.011* (0.000)
MB-RATIO INDEX	-0.116* (0.000)	-0.106* (0.000)	-0.055* (0.000)	-0.051* (0.000)	-0.003 (0.291)	-0.004 (0.092)	-0.007* (0.000)	-0.006* (0.000)
LOG OF TRADING VOLUME	0.031* (0.000)	0.019* (0.000)	0.023* (0.000)	-0.004* (0.000	0.025* (0.000)	0.027* (0.000)	0.007* (0.000)	0.005* (0.000)
LOG OF NUMBER OF FORECASTS	-0.093* (0.000)	-0.108* (0.000)	-0.056* (0.000)	-0.052* (0.000)	-0.007* (0.000)	-0.004 (0.374)	-0.121* (0.000)	-0.014* (0.000)
F-statistic (p-value)	4420 (0.000)	4090 (0.000)	772 (0.000)	1078 (0.000)	66 (0.000)	64 (0.000)	378 (0.000)	367 (0.000)
R-squared	0.165	0.155	0.050	0.061	0.023	0.023	0.053	0.049
Observations	100k	100k	100k	100k	100k	100k	100k	100k

Regression models 3 to 6 pertain to hypothesis 1b. The results contrast the hypothesis by suggesting an asymmetric pattern. In line with 1a, larger firms report less surprises on aggregate. Interestingly though, the odds ratio is slightly higher for negative surprises (8% vs 7% for positive surprises). Regressions 5 and 6 employ the bidirectional index to corroborate the suggestion that the occurrence of earnings surprises is asymmetric in the direction of larger firms reporting a larger share of positive (or zero) surprises than small firms do. The size index variable loads significant and positive. Hence, large firms seem to report less negative earnings surprises and we should reject hypothesis 1b. Finally, regression models 7 and 8 allow us to accept hypothesis 1c, which presumed that smaller firms have earnings surprises of a larger magnitude. Aggregating both signs of surprises, the smaller half of firms on average have forecast errors of 1.1% higher in terms of their share price (model 8).

6.2.2. Second set of regressions

Exhibit 9: summary results of second set of regressions
The table below documents results of the second set of regressions. The I indicates the time period CAR used as independent variable. All regression models incorporate dummies to capture yearly time fixed effects and dummies with 2-digit level sic codes to capture industry fixed effects. An asterisk indicates whether coefficients are significant at the 5% level; p-values are given in brackets for further detail. F-statistics follow from the F-test of the restriction that all displayed coefficients equal zero. Regression models 7 to 9 have the following basic form:

(2a) $$CAR_{it} = a + \beta_1 * (Y_{it} * D_{it}) + \beta_2 * Y_{it} + \beta_3 * D_{it} + \beta_j * X^j{}_{it} + \epsilon_{it}$$

Where *it* denotes the firm-quarter, *CAR* denotes the cumulative abnormal returns, *Y* denotes the value for the earnings surprise variable, *D* denotes the dummy or index variable for firm size, α denotes the intercept, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Regression models 1 to 6 allow for asymmetry and have the following basic form:

(2b) $$CAR_{it} = a + \beta_1 * (Y^-{}_{it} * D_{it}) + \beta_2 * (Y^+{}_{it} * D_{it}) + \beta_3 * Y^-{}_{it} + \beta_4 * Y^+{}_{it} + \beta_5 * D_{it} + \beta_j * X^j{}_{it} + \epsilon_{it}$$

Where *it* denotes the firm-quarter, *CAR* denotes the cumulative abnormal returns, *Y* denotes the value for the earnings surprise variable with a superscript indicating the sign of surprise, *D* denotes the dummy or index variable for firm size, α denotes the intercept, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Regression model no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
ARET CAR	I			I			I		
PRERET CAR		I			I			I	
FULLRET CAR			I			I			I
IV: NEGATIVE SURPRISE * FIRM SIZE DUMMY	0.005* (0.000)	-0.004 (0.176)	-0.010* (0.019)	0.003 (0.167)	-0.007 (0.065)	-0.020* (0.001)			
IV: POSITIVE SURPRISE * FIRM SIZE DUMMY	-0.004* (0.008)	-0.015* (0.000)	-0.018* (0.000)	-0.001 (0.660)	-0.011* (0.004)	-0.016* (0.004)			
IV: NO SURPRISE * FIRM SIZE DUMMY							-0.001 (0.298)	0.008* (0.001)	0.013* (0.000)
NEGATIVE SURPRISE DUMMY	-0.039* (0.000)	-0.039* (0.000)	-0.068* (0.000)	-0.039* (0.000)	-0.059* (0.000)	-0.068 (0.000)			
POSITIVE SURPRISE DUMMY	0.033* (0.000)	0.033* (0.000)	0.067* (0.000)	0.034* (0.000)	0.053* (0.000)	0.070* (0.000)			
NO SURPRISE DUMMY							0.003* (0.009)	0.002 (0.475)	0001 (0.871)
FIRM SIZE DUMMY	0.003* (0.000)	0.003* (0.019)	0.022* (0.000)	0.003 (0.080)	0.006* (0.036)	0.024* (0.000)	0.004* (0.000)	-0.001 (0.684)	0.009* (0.003)
MB-RATIO INDEX	-0.002* (0.000)	-0.003* (0.000)	-0.004* (0.000)	-0.003* (0.000)	-0.013* (0.000)	-0.005* (0.001)	-0.003* (0.000)	-0.012* (0.000)	-0.005* (0.000)
LOG OF FIRM AGE				0.001* (0.015)	0.002 (0.132)	0.002 (0.267)			
LOG OF TRADING VOLUME	-0.002* (0.000)	-0.002* (0.000)	-0.002* (0.033)	-0.002* (0.000)	-0.005* (0.000)	-0.002 (0.127)	-0.002* (0.000)	-0.003* (0.000)	-0.000 (0.648)
LOG OF NUMBER OF FORECASTS	0.001 (0.064)	0.001 (0.064)	-0.016* (0.000)	0.001 (0.138)	-0.004* (0.017)	-0.020* (0.000)	0.001 (0.111)	-0.003* (0.009)	-0.016* (0.000)
F-statistic (p-value)	1063 (0.000)	577 (0.000)	405 (0.000)	584 (0.000)	316 (0.000)	226 (0.000)	19 (0.000)	71 (0.000)	35 (0.000)
R-squared	0.090	0.054	0.042	0.088	0.055	0.042	0.003	0.009	0.009
Observations	100k	100k	100k	60k	60k	60k	100k	100k	100k

For predictor variables the second set of regressions primarily comprises the earnings surprise indicator, the firm size dummy and their interacted variable. In the variety of models they load sufficiently significant for us to be conclusive on the several sub hypotheses of the second category. Coefficients of the predictor variables may be interpreted as incremental changes in percentage points to the abnormal returns as a result of the condition that the predictor variable represents. The set of regressions includes models 1 to 6 with bidirectional surprise sign interactions and standalone variables. These allow for asymmetric effects. The models 7 to 9 include the models that test the 'no surprise'-related hypothesis. These could not be incorporated in the first six models due to multicollinearity. Furthermore, regressions 1 to 6 include the use of firm age as log-transformed variable in 4 to 6. These models with firm age are complementary to the models without firm age in terms of relevance for testing the hypotheses. Models 7 to 9 are not extended with a version that includes firm age since that version is very similar and the models without firm age explain the variability in the returns better. Finally, the models differ in their use of CAR time window. This serves to illustrate the effect of including the abnormal returns of different time periods.

Turning to hypothesis 2a, one can appreciate the marked differences between regression models that use a different CAR time window. We need them so that we can accept hypothesis 2a, albeit with a slight alteration: larger firms have stronger negative stock price reactions to negative surprises – but *only* if we allow for preannouncements. This is apparent from switch of the sign of the negative interaction variable between model 1 and model 2 (or alternatively model 4 and 5 with inclusion of firm age). In the model with ARET, larger firms actually seem to have significantly weaker negative price reactions to negative earnings surprises. However, when we extend the time period to include 43 days before announcement date (thus theoretically allowing for preannouncements), the effect takes the opposite direction. The significance levels in the PRERET models are not sufficient for us to be conclusive, but extending it to the FULLRET period allows us to establish that larger firms have larger negative stock price reactions in the event of a negative surprises[22]. Quantified, the evidence shows that smaller firms on average have returns that are 1-2% higher (dependent on inclusion of firm age) than larger firms in the event of a negative earnings surprise during the FULLRET period. During this period, the general effect of negative surprises is negative 6.8% while larger firms have a general premium of ca. 2.3%[23].

With regard to hypothesis 2b, I assumed there was no significant differential effect in the event of a positive surprise due to firm size. Based on the results we must reject this hypothesis to establish that larger firms are rewarded significantly less on average in the event of a positive earnings surprise. The effect seems significant across all time windows. Remarkably, the magnitude of the effect increases strongly when including the PRERET and FULLRET period CAR. While the increase seems normal if we look at the proportion of days that the time window includes, it might not be as the market would

[22] Thus, possibly, preannouncements might also occur before the defined start of PRERET. This is still in line with evidence of Soffer et al (2002) indicating they commence two weeks before quarter-end. In this data sample, the average number of days between quarter-end and the earnings announcement date is 35 days.
[23] Since the coefficients of models with and without firm age are close, their average is taken for simplicity.

theoretically be unaware of the forthcoming positive earnings surprise. Hence, some information dissemination might take place earlier which favours smaller firms. Quantified, smaller firms on average have returns that are ca. 1.7% higher in the event of an earnings surprise over the FULLRET period. In same time span, the general effect of a positive surprise is ca. 6.9%.

For hypothesis 2c, we need to look at regression models 6 to 9. Based on the results, it seems we need to reject the hypothesis that smaller firms have better abnormal returns in case there is no earnings surprise. Contrary to the theorization, large firms on average generate better returns in case there is no earnings surprise. Thus investors do not seem to reward small firms more for 'just-meet' earnings, but rather reward larger firms more. For statistical significance, this verdict requires the extension to longer periods than ARET, while the *general* effect of 'no surprise' only loads significant and positive for ARET. The FULLRET period average effect of larger size on abnormal returns in case of unsurprising earnings is an increase by 1.3%.

Jointly, the tests regarding the hypotheses 2a-c illustrate that there are significant firm size-based differences in earnings surprise effects. On aggregate, one can see how the effects lead to a 'size premium' where smaller firms do better on average in in the context of earnings surprises. The superior returns exist specifically, in case – as defined in this research design – investors are surprised. The third set of regressions proceeds to investigate whether other factors, that share properties with firm size, might actually account for this particular size premium in earnings surprise effects.

6.2.3. Third set of regressions

The main feature of the models in the third set of regressions is the extension with an extra interaction variable. This variable interacts a proxy variable for the property, that was implicated by the sub hypothesis, with the earnings surprise event indicator. This serves to capture the effect of this property in the event of an earnings surprise. As such, we might deduce the event-specific effect of the property and its relation to the effect of firm size. To judge the latter relation, the results include a baseline regression that excludes any of the extra interaction variables. To this end, regression model 6 from the second set of regressions is used (exhibit 9). This is mainly because the associated results provided the most convincing evidence for the existence of a size premium in earnings surprise effects. Moreover, model 6 includes firm age as a control variable, which we also need when assessing the influence of firm age in the event of an earnings surprise under hypothesis 3b. Furthermore, the analysis in the third set of regression only pertains to the bidirectional models that allow for asymmetry as opposed to a study of influences in the event of 'no surprise' (model 7 to 9 in exhibit 9). The main reason is that - as opposed to 'zero' surprise events - positive and negative surprises cause the size premium; hence, it should be interesting to see whether other properties may (partly) account for this effect. Exhibit 10 refers to the baseline model as regression model 0; and regression models 1 to 4 each test one of sub hypothesis under 3.

Exhibit 10: summary results of third set of regressions

The table below documents results of the third set of regressions. All regression models use FULLRET CAR as independent variable; and they all incorporate dummies to capture yearly time fixed effects and dummies with 2-digit level sic codes to capture industry fixed effects. An asterisk indicates whether coefficients are significant at the 5% level; p-values are given in brackets for further detail. F-statistics follow from the F-test of the restriction that all displayed coefficients equal zero. Regression base model 0 has the following basic form:

(2b) $CAR_{it} = a + \beta_1 * (Y_{it} * D_{it}) + \beta_2 * (Y_{it} * D_{it}) + \beta_3 * Y_{it} + \beta_4 * Y_{it} + \beta_5 * D_{it} + \beta_j * X^j{}_{it} + \epsilon_{it}$

Where *it* denotes the firm-quarter, *CAR* denotes the cumulative abnormal returns, *Y* denotes the value for the earnings surprise variable, *D* denotes the dummy or index variable for firm size, α denotes the intercept, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Regression model 1 to 4 have the following basic form:

(3b) $CAR_{it} = a + \beta_1 * (Y^-{}_{it} * D_{it}) + \beta_2 * (Y^+{}_{it} * D_{it}) + \beta_3 * (Y^-{}_{it} * C_{it}) + \beta_4 * (Y^+{}_{it} * C_{it}) + \beta_5 * Y^-{}_{it} + \beta_6 * Y^+{}_{it} + \beta_7 * D_{it} + \beta_8 * C_{it} + \beta_j * X^j{}_{it} + \epsilon_{it}$

Where *it* denotes the firm-quarter, *CAR* denotes the abnormal returns, α denotes the intercept, *Y* denotes the value for the earnings surprise indicator with a superscript indicating the surprise sign, *D* denotes the dummy or index variable for firm size, C denotes the variable implied in the particular sub hypothesis, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Regression model no.	**0**	**1**	**2**	**3**	**4**
IV: NEGATIVE SURPRISE * FIRM SIZE DUMMY	-0.020* (0.001)	-0.021* (0.000)	-0.021* (0.000)	-0.014* (0.027)	-0.018* (0.003)
IV: POSITIVE SURPRISE * FIRM SIZE DUMMY	-0.016* (0.004)	-0.021* (0.000)	-0.019* (0.001)	-0.013* (0.027)	-0.016* (0.008)
IV: NEGATIVE SURPRISE * MB-RATIO DUMMY		-0.005 (0.082)			
IV: POSITIVE SURPRISE * MB-RATIO DUMMY		-0.026* (0.000)			
IV: NEGATIVE SURPRISE * LOG OF FIRM AGE			0.004 (0.362)		
IV: POSITIVE SURPRISE * LOG OF FIRM AGE			0.006 (0.122)		
IV: NEGATIVE SURPRISE * FIRM FAME DUMMY				-0.016* (0.005)	
IV: POSITIVE SURPRISE * FIRM FAME DUMMY				-0.008 (0.129)	
IV: NEGATIVE SURPRISE * LIQUIDITY DUMMY					-0.004 (0.557)
IV: POSITIVE SURPRISE * LIQUIDITY DUMMY					0.000 (0.968)
NEGATIVE SURPRISE DUMMY	-0.068* (0.000)	-0.057* (0.000)	-0.076* (0.000)	-0.061* (0.000)	-0.067* (0.000)
POSITIVE SURPRISE DUMMY	0.070* (0.000)	0.088* (0.000)	0.058* (0.000)	0.074* (0.000)	0.071* (0.000)
FIRM SIZE FUMMY	0.024* (0.000)	0.026* (0.000)	0.026* (0.000)	0.021* (0.000)	0.024* (0.000)
MB-RATIO INDEX	-0.005* (0.001)	0.001* (0.000)	-0.005* (0.001)	-0.005* (0.001)	-0.046* (0.001)
LOG OF FIRM AGE	0.002 (0.267)	0.002* (0.000)	0.001 (0.571)	0.002 (0.257)	0.002 (0.264)
LOG OF TRADING VOLUME	-0.002 (0.127)	-0.002 (0.144)	-0.002 (0.114)	-0.002 (0.132)	-0.004 (0.224)
LOG OF NUMBER OF FORECASTS	-0.020* (0.000)	-0.020* (0.000)	-0.020* (0.000)	-0.016* (0.000)	0.020 (0.000)
F-statistic (p-value)	226 (0.000)	186 (0.000)	189 (0.000)	188 (0.000)	190 (0.000)
R-squared	0.042	0.043	0.042	0.042	0.042
Observations	60k	60k	60k	60k	60k

To asses hypothesis 3a, regression model 1 includes an interaction variable that incorporates a dummy that provides for an equal divide of firm-quarter observations based on the MB-ratio. As evident from the results, inclusion of the MB-ratio dummy interaction variable increases the significance and magnitude of the effect attributed to firm size. The coefficients of the interaction variable itself indicate that firms with higher MB-rations have inferior returns in case of earnings surprises. Since the correlation between firm size (as manifest by revenue) and the MB-ratio is negative (-6.33%), smaller firms generally have higher MB-ratios. Thus, the effect of the MB-ratio, previously included in the firm size effect, decreased the apparent return differential between smaller firms and larger firms. Hence, when controlling for the event-specific effect of the MB-ratio, we could conjecture that the size premium in earnings surprise effects is actually slightly larger. Summarizing, in a similar way to how Skinner and Sloan (2002) showed, the MB-ratio does effect abnormal returns to earnings surprises; but it does not partially drive the associated size premium.

Hypothesis 3b pertains to effect of firm age; specifically the effect of firm age, when the proxy of years since IPO is perceived as a driver of the ability of the market to learn about the profitability of a firm. More learning potential should lead to stronger capability to assess the profitability of a firm. As Pastor and Veronesi (2003) showed this capability should increase most rapidly in the first years after an IPO. This is why the interaction variable of key interest incorporates firm age as a log-transformed variable. As we can see in exhibit 10, this interaction variable does not load significantly itself; if anything, higher firm age results in better rewards for positive earnings surprises. Its inclusion does slightly increase the negative effect of larger firm size in case of positive earnings surprises. Since the correlation with firm size is positive (13.2%) and higher firm age seems to increase rewards for positive surprises, the inclusion of the interaction variable suggests that increasing firm size might actually result in more inferior returns in the event of a positive earnings surprise. In sum, higher learning about profitability as proxied by firm age does not seem to have strongly significant influence on earnings surprise effects.

To test hypothesis 3c, the regression includes a proxy for the relative fame of firms. As outlined in the Methodology section, to this end we use a dummy that codes for the number of analysts covering a company, which is incorporated in the interaction variable in regression model 3. The correlation between firm size and the proxy for fame is positive (28.5%). As we can see, this interaction variable loads significantly negative in earnings surprises in both signs. Following the underlying theorization of the approximation of the 'fame' property, we could say that well-known firms do worse in case of negative and positive earnings surprises. Relating this to the effect of plain firm size, we can see that the effect of fame seems to partly account for the size premium in earnings surprise effects established in the second set of regressions. In synthesis, we find evidence that larger firms are more famous, which significantly drives abnormal returns to earnings surprises and partly accounts for the previously established size premium.

Finally, hypothesis 3d represents an investigation to the effect of the liquidity of a firm's securities. To this end a dummy, indicating a divide based on trading volume (common shares traded in the previous quarter), is incorporated in the interaction variable in model 4. The dummy codes 1 for higher liquidity and 0 for lower liquidity, and the correlation of the proxy with firm size is 41.8%. According to theory, lower liquidity would amplify the earnings surprise effects of smaller firm's securities. Regarding any asymmetry in the effect, there is no specific expectation. From the regression, we find no evidence of a significant impact on stock returns in the event of an earnings surprise. Hence, we cannot arrive at any argument-driven conclusion to hypothesis 3d and find no evidence that liquidity has significant effect.

To synthesize, earnings surprise event-specific inclusion of the effect of the MB-ratio and firm age only exacerbate the apparent size premium in earnings surprise effects, while differences in liquidity seem to have no bearing on this. The generally higher degree of fame of larger firms does seem to partly account for the size premium. However, the remaining effect of firm size itself in abnormal returns to earnings announcements remains significant and large in magnitude.

8. Conclusions

This research demonstrates that firm size significantly affects the occurrence of earnings surprises as well the stock price reactions to earnings surprises. Most interestingly, the investigation shows there is a substantial size premium in stock price reactions to earnings announcements; but *only* if we allow for the tendency to preannounce earnings information. The size premium in earnings surprise effects represents the major contribution of this paper to academic literature, while the required condition on preannouncements underscores the importance of its inclusion in empirical analysis as also found in previous work by Skinner and Sloan (2002). The following paragraphs more comprehensively summarize and discuss the findings of this master's thesis.

As per the first sub research question, we should now have the ability to draw several conclusions. As could be expected by their higher earnings volatility, smaller firms have more extreme earnings surprises than large firms. Additionally, larger firms report more positive surprises as well as significantly more earnings that 'just-meet' market expectations. While not ambiguously evident, I would argue that these three findings should jointly improve the aggregate of abnormal returns of large firms as driven by earnings announcements. More positive surprises should generate more positive returns, and reports that meet expectations should not result in more negative abnormal returns. With respect to the larger magnitude of the earnings surprises of small firms, no asymmetric effect to favour positive returns arises. Moreover, a risk-averse investor should not like to consecutively surprised by earnings reports, especially if these are more often negative than positive. In general though, I would say that the effect of the extreme surprises should not be overestimated. As we can see in the graphs in the descriptive evidence the mean CAR follow a very steep S-shape around zero, which implies high relative rewards to minor surprises. More strikingly, the mean CAR actually decrease as the forecast error decreases below ca. -2% and the mean CAR of small firms for positive forecast errors do not surpass the magnitude of the mean CAR of large firms in extreme forecast error magnitudes.

Contrary to the expectation which these findings might generate, investigation of the second research question shows that smaller firms generate significantly superior abnormal returns as driven by earnings announcements. Against hypothesis, unsurprising earnings represent the only event where large firms do better. But more severe punishments for negative surprises and smaller rewards for positive surprises drive the aggregate effect on abnormal returns downwards. The higher reward for 'just-meet' earnings contrasts studies which show that investors are aware of potential manipulation by managers (e.g. via earnings management or analyst guidance) and incorporate this into their reaction. Additionally, investors do not seem to more strongly value a smaller firm meeting the benchmark. Hence, investigation of my conjecture that the market might overestimate small firm earnings volatility was not relevant. Abstracting from size-based differences in reward to 'just-meet' earnings announcements, the top graphs in exhibit 6 show that matching the consensus forecast is not strictly sufficient for generating positive abnormal returns, firms need to surpass the target to achieve this. This could mean that investors are aware that exactly meeting the benchmark is a bad sign, but that they do not appreciate firm-sized differences since large firms are still rewarded more for 'just-meet' earning announcements.

Nevertheless, evidence shows the superior returns of smaller firms - in case investors are surprised - drive the aggregate return differential to the advantage of smaller firms. Similar to what Skinner and Sloan (2002) found, it is key to allow for preannouncements to draw this conclusion. When only cumulating returns over a 3-day window around earnings announcements, we only see that larger firms are rewarded less and punished less. However, large firms seem to engage more in preannouncements, which would predominantly contain negative news. Apart from changing the effect in the event of a negative surprise, allowing for preannouncements also significantly raises the relative reward for smaller firms in case of positive surprises. This is puzzling, both classes of firms would have positive news to share, but the rewards only increase strongly for small firms.

After having established the size premium in stock price reactions to quarterly earnings reports, the third sub research question was mainly employed to see if other factors could account for it. Including the event-specific effect of the MB-ratio and firm age would only increase the apparent magnitude of the size premium. Evidence indicate especially the effect of the MB-ratio contributes to this, in a way that corroborates the work of Skinner and Sloan (2002). The liquidity of the firm stock did not seem to have a bearing on the return differential. The extent to which a firm can be considered famous – or well known – did seem to partly drive the previously established size premium. Regardless, the greater part of the premium remained with firm size though. This suggests that there are other factors, possibly more intrinsic to firm size, that drive the inferior abnormal returns. Other important properties may for example include shorting restrictions or differences in information availability. Other research showed information availability decreases with firm size, and that lower general information availability increases earnings announcement premia. Thus smaller firms could benefit from an asymmetric relation with information availability. Moreover, higher shorting restrictions and differences in investor types of smaller firms could drive the abnormal return differential.

Though the research succeeded in providing sufficient evidence to be conclusive on the research questions, there are several limitations to note. For one, the research lays a lot of weight on the importance of EPS as the metric to judge the value of a firm. As most widely used in literature and most frequently forecast by analysts, the use of EPS makes academic and practical sense while also generating strong statistical significance. However, we cannot ascertain what is the most important subject of assessment by the market in an earnings announcement. It could be other financial metrics. Especially since EPS is notoriously easy to manipulate, the market could pay more attention to profit indicators that are less artificial and more comparable across industries. Another perspective on the value of the content of the announcement could highlight the difference between ‘hard’ financial information and more ‘soft’ information. Earnings announcements may comprise much more news than the financial performance of a firm, which could overshadow ‘hard’ financial information. Importantly, one can imagine firms of different sizes to report earnings in a different way; and this could also influence earnings surprise effects.

These limitations could also provide a basis for suggesting future research. An analysis inclusive of other financial metrics besides EPS could for example provide interesting insights on the actual occurrence and impact of earnings management. Moreover, incorporation of soft news contents of earnings announcements might provide for a more comprehensive investigation. Additionally, related research might behaviourally investigate the *per unit of forecast error* increase of abnormal returns based on firm size as opposed to the average effect in case of the event. Or for a more practical exercise, one might seek to develop a profitable trading strategy long in small stock and short in large stock around earnings announcements in a manner that allows for preannouncements. As a final suggestion, future studies could also investigate the effect of differences in information dissemination, investor type and/or shorting restrictions in their relation with firm size.

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9. Appendix

9.1. Additional exhibits

Exhibit 11: breakdown of data requirements and associated omissions

Reasoning behind the requirements with impact on sample size is as follows. First off, the shares must be actively traded, that is non-OTC (over-the-counter). To that end all shares that are not traded on NYSE or NASDAQ were omitted. Next, only observations with reasonable time periods around quarter-end and earnings announcements were included. That means exclusion of earnings announcements before end-of-quarter (and same percentile 0.03% cut-off at the far end of days after the quarter) and earnings announcements following within 55 days after the previous earnings announcement (and same 0.5% percentile cut-off at the other end of the spectrum). Moreover, observations with missing data on stock returns throughout the quarter, end-of-quarter stock prices, revenue, market valuation and book value of assets were omitted. Revenue (non-positive also excluded) is necessary as main proxy for firm size, end-of-quarter prices are needed to scale the forecast error by the share price while book value and market value are required to determine the MB-ratio. Finally, the data included several extremely unrealistic forecast and reported EPS. Thus these needed to be excluded as well. With close inspection of the data, 0.2% cut-off points were chosen for the variable which represents the absolute forecast error scaled by the share price.

Initial merged sample	**125,995 observations**
Not listed on NASDAQ or NYSE	(9,706 observations)
Unreasonable days around earnings report	(1,085 observations)
Missing stock return data	(10 observations)
Missing end-of-quarter stock prices	(36 observations)
Missing or non-positive revenue	(1,779 observations)
Missing book value or market value	(12,947 observations)
Unrealistic earnings report and/or forecast	(401 observations)
Final sample	**100,031 observations**

Exhibit 12: summary results of first set of regressions including firm age as control variable
The table below documents the results of regression models that have the following basic form:

(1) $Y_{it} = a + \beta_1 * D_{it} + \beta_j * X^j{}_{it} + \epsilon_{it}$

Where *it* denotes the firm-quarter, *Y* denotes the value for the earnings surprise variable, *D* denotes the dummy or index variable for firm size, α denotes the intercept, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Regression model no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
EARNINGS SURPRISE DUMMY	I	I						
POSITIVE SURPRISE DUMMY			I					
NEGATIVE SURPRISE DUMMY				I				
EARNINGS SURPRISE INDEX					I	I		
FE-ABSOLUTE							I	I
FIRM SIZE INDEX	-0.088* (0.000)				0.018* (0.002)		-0.007* (0.000)	
FIRM SIZE DUMMY		-0.118* (0.000)	-0.045* (0.000)	-0.072* (0.000)		0.028* (0.002)		-0.008* (0.000)
MB-RATIO INDEX	-0.113* (0.000)	-0.104* (0.000)	-0.053* (0.000)	-0.051* (0.000)	-0.001 (0.804)	-0.003 (0.449)	-0.008* (0.000)	-0.007* (0.000)
LOG OF FIRM AGE	-0.030* (0.000)	-0.036* (0.000)	-0.032* (0.000)	-0.004 (0.063)	-0.285* (0.000)	-0.027* (0.000)	-0.003* (0.000)	-0.004* (0.000)
LOG OF TRADING VOLUME	0.032* (0.000)	0.023* (0.000)	0.022* (0.000)	-0.001 (0.663)	0.020* (0.000)	0.021* (0.000)	0.008* (0.000)	0.007* (0.000)
LOG OF NUMBER OF FORECASTS	-0.103* (0.000)	-0.119* (0.000)	-0.063* (0.000)	-0.056* (0.000)	-0.010 (0.123)	-0.007 (0.277)	-0.015* (0.000)	-0.017* (0.000)
F-statistic (p-value)	2144 (0.000)	2003 (0.000)	368 (0.000)	484 (0.000)	26 (0.000)	25 (0.000)	213 (0.000)	207 (0.000)
R-squared	0.174	0.174	0.055	0.064	0.026	0.026	0.059	0.060
Observations	60k	60k	60k	60k	60k	60k	60k	60k

9.2. Tests of parameter restrictions on regression models

The individual significance of the variables in the regression models is given by the p-values that associate the coefficients of the predictor variables. In the main body text investigation has judged them to assess the significance of the effect of a predictor variable on the independent variable. The p-values reflect the implied significance levels computed by t-tests of a single hypothesis per variable: the null-hypothesis that the variable has no effect (coefficient = 0). Rejecting this hypothesis would lead to accepting the implied alternative hypothesis that the variable does have a significant effect on the independent variable (coefficient ≠ 0). This manner of assessing the significance of an effect, however, bears a risk with it. The risk is caused by the fact that these t-tests assess the significance of variables individually. In joint consideration of their associated hypotheses, one or more variables might actually not have a significant effect. This might especially be true if the data variables are collinear. Hence, we cannot ascertain the entire model has any significance at all. To assess this we have the option to test the joint null-hypothesis that all coefficients of the model are zero. Rejecting this hypothesis would mean that at least one of the variables is non-zero; and thus has some significant effect on the independent variable. This, again, in rude terms would mean that the model is significant. To test this joint hypothesis, one can use the F-test. This test is based on comparison of the sum of squared errors of the original unrestricted model with the sum of squared errors of a restricted model, which assumes the null-hypothesis to be true. If these sum of squares are substantially different – as indicated by the F-statistic, then we can reject the joint null-hypothesis and establish the significance of the model.

The above inspires the main approach that I take to support the significance of the regression models. For every set of regressions, I adopt a F-test to test the joint hypothesis that the coefficients of all predictor variables and control variables are equal to zero (thus excluding industry and year dummies). The resulting F-statistics are reported in exhibit 8, 9 and 10. Based on them there seems to be no immediate threat to the significance of the models. However, these F-tests also included the null-hypotheses regarding the control variables. Statistically there might be no difference between control variables and predictor variables. However, to ascertain the significance of the model for the investigation, I would be primarily interested in the significance of the predictor variables. Hence, I also mean to test their significance specifically by means of a parameter restriction tests. To jointly assess the significance of the variables that are key to the investigation of the hypotheses, I also include the below exhibit 13 as a robustness check for the second set of regressions. This should provide comfort on accepting the evidence for a size premium in earnings surprise effects. The restricted variables are indicated in the description in the exhibit. The resulting F-statistics are generally higher in this configuration of the F-test than in exhibit 9, hence the key predictor variables seem significant in joint consideration when excluding control variables as well.

Exhibit 13: summary results of second set of regressions with alternate F-test

The table below documents results of the second set of regressions. The I indicates the time period CAR used as independent variable. All regression models incorporate dummies to capture yearly time fixed effects and dummies with 2-digit level sic codes to capture industry fixed effects. An asterisk indicates whether coefficients are significant at the 5% level; p-values are given in brackets for further detail. F-statistics follow from the F-test of the restriction that $\beta_1 = \beta_2 = \beta_3 = 0$ for specification (2a) and the restriction $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ for specification (2b). Regression models 7 to 9 have the following basic form:

(2a) $CAR_{it} = a + \beta_1 * (Y_{it} * D_{it}) + \beta_2 * Y_{it} + \beta_3 * D_{it} + \beta_j * X^j{}_{it} + \epsilon_{it}$

Where *it* denotes the firm-quarter, *CAR* denotes the cumulative abnormal returns, *Y* denotes the value for the earnings surprise variable, *D* denotes the dummy or index variable for firm size, α denotes the intercept, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Regression models 1 to 6 allow for asymmetry and have the following basic form:

(2b) $CAR_{it} = a + \beta_1 * (Y^-{}_{it} * D_{it}) + \beta_2 * (Y^+{}_{it} * D_{it}) + \beta_3 * Y^-{}_{it} + \beta_4 * Y^+{}_{it} + \beta_5 * D_{it} + \beta_j * X^j{}_{it} + \epsilon_{it}$

Where *it* denotes the firm-quarter, *CAR* denotes the cumulative abnormal returns, *Y* denotes the value for the earnings surprise variable with a superscript indicating the sign of surprise, *D* denotes the dummy or index variable for firm size, α denotes the intercept, *X* denotes the set of *j* control variables used and ϵ denotes the error term.

Regression model no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
ARET CAR	I			I			I		
PRERET CAR		I			I			I	
FULLRET CAR			I			I			I
IV: NEGATIVE SURPRISE * FIRM SIZE DUMMY	0.005* (0.000)	-0.004 (0.176)	-0.010* (0.019)	0.003 (0.167)	-0.007 (0.065)	-0.020* (0.001)			
IV: POSITIVE SURPRISE * FIRM SIZE DUMMY	-0.004* (0.008)	-0.015* (0.000)	-0.018* (0.000)	-0.001 (0.660)	-0.011* (0.004)	-0.016* (0.004)			
IV: NO SURPRISE * FIRM SIZE DUMMY							-0.001 (0.298)	0.008* (0.001)	0.013* (0.000)
NEGATIVE SURPRISE DUMMY	-0.039* (0.000)	-0.039* (0.000)	-0.068* (0.000)	-0.039* (0.000)	-0.059* (0.000)	-0.068 (0.000)			
POSITIVE SURPRISE DUMMY	0.033* (0.000)	0.033* (0.000)	0.067* (0.000)	0.034* (0.000)	0.053* (0.000)	0.070* (0.000)			
NO SURPRISE DUMMY							0.003* (0.009)	0.002 (0.475)	0001 (0.871)
FIRM SIZE DUMMY	0.003* (0.000)	0.003* (0.019)	0.022* (0.000)	0.003 (0.080)	0.006* (0.036)	0.024* (0.000)	0.004* (0.000)	-0.001 (0.684)	0.009* (0.003)
MB-RATIO INDEX	-0.002* (0.000)	-0.003* (0.000)	-0.004* (0.000)	-0.003* (0.000)	-0.013* (0.000)	-0.005* (0.001)	-0.003* (0.000)	-0.012* (0.000)	-0.005* (0.000)
LOG OF FIRM AGE				0.001* (0.015)	0.002 (0.132)	0.002 (0.267)			
LOG OF TRADING VOLUME	-0.002* (0.000)	-0.002* (0.000)	-0.002* (0.033)	-0.002* (0.000)	-0.005* (0.000)	-0.002 (0.127)	-0.002* (0.000)	-0.003* (0.000)	-0.000 (0.648)
LOG OF NUMBER OF FORECASTS	0.001 (0.064)	0.001 (0.064)	-0.016* (0.000)	0.001 (0.138)	-0.004* (0.017)	-0.020* (0.000)	0.001 (0.111)	-0.003* (0.009)	-0.016* (0.000)
F-statistic (p-value)	1675 (0.000)	843 (0.000)	623 (0.000)	1035 (0.000)	513 (0.000)	384 (0.000)	10 (0.000)	20 (0.000)	31 (0.000)
R-squared	0.090	0.054	0.042	0.088	0.055	0.042	0.003	0.009	0.009
Observations	100k	100k	100k	60k	60k	60k	100k	100k	100k