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Equity Analysts' Role Following the Credit Crisis: Exploring the Incremental Value of Earnings Forecast Revisions

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ABSTRACT

In this paper, we provide an updated view on the incremental value conveyed in equity analysts' one-quarter-ahead earnings forecast revisions, following the financial crisis of 2008. We present statistical evidence of a greater analyst workload, stemming from an increased number of covered stocks and issued reports per analyst. We use the measure of relative forecast error to show that the incremental value each earnings forecast revision brings to the market has decreased. The value deterioration is most significant for revisions in periods when firms provide little or no new information, identified by periods preceding earnings announcements. This shows that the incremental value created from supplying the market with new information has decreased more than the value created from interpreting public information. Despite the greater decrease, we reconfirm findings on historical data and show that analysts' information discovery role is still superior to their interpretation role. Through a series of regressions, we document a statistically significant relationship between the increase in analysts' workload and the decrease in incremental value of forecast revisions preceding earnings announcements. However, as this relationship is of limited economic significance, most of the value deterioration post-crisis remains to be explained.

Keywords: Information discovery, information interpretation, relative forecast error, analyst workload, earnings forecast revisions

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1. Introduction

Equity researchers play an important role in financial markets. Through gathering and critically assessing market- and company specific information, they act as information intermediaries between publicly held corporations and investment professionals. The institution yearly engages great amounts of money and effort, and much attention has been devoted towards understanding its fundamentals.

Previous literature acknowledges two ways in which equity analysts gather information for their reports. Specifically, analyst may either rely on *interpretation* of public information, or *discovery* of information not readily available to the market (Ramnath et al. 2008; Chen et al., 2010). By studying when in time analysts issue reports, in relation to firms' own public announcements, scholars separate the two sources of analyst information. The mere timing of reports has shown that most analyst reports are issued shortly following firms' earnings announcements. This implies that analysts mainly rely on the interpretation role when providing forecasts (Kim et al., 2011; Livnat & Zhang, 2012). However, Ivković and Jegadeesh (2004), Asquith et al. (2005) and Chen et al. (2010) document that forecasts based on information discovery bring more valuable new information to the market. These findings provide insight to equity analysts' behavior and their role as information agents. The findings are further valuable for investors who seek to understand when in time, in relation to firms' public announcements, analyst reports contain the most incremental value[1].

However, the working climate for equity analysts has seen structural changes, particularly in the aftermath of the 2008 financial crisis. Studies document a great reduction in research budgets between the years of 2007 and 2013 (The Economist, 2013; Scarth & Shah, 2014) and subsequent reduction in headcount (Greenwich Associates, 2013). To the best of our knowledge, no previous study has investigated if these changes have affected analysts' workload, which type of information they rely on, or the incremental value conveyed in their reports. An updated view on these issues would provide valuable insights to current research as well as to brokerage houses and investors. With this in mind, we use a three-step approach to shed light on (i) post-crisis changes to equity analysts' workload and the type of information they rely on, (ii) post-crisis changes to incremental value provided by analysts' forecasts, and (iii) the relationship between (i) and (ii).

In the first part of our study, we provide new findings on whether the market-wide equity research overhaul has affected analysts' workload. By comparing pre- and post-crisis data, we

[1] Throughout the thesis, we use the term incremental value to define the amount of valuable new information an analyst's report bring to the market, i.e. excluding information provided by previous analyst reports.

document an increase in the number of covered stocks and issued reports per analyst. Analysts active in both time periods cover on average three additional stocks, and issue on average sixteen additional reports, per year. Increased workload implies less time per analysis, and consequently reduced ability for analysts to take on search costs. We hypothesize that this either leads to a shift towards production of less time consuming reports, or that more time-consuming reports will suffer from reduced information content. By nature, reports based on information discovery require more search costs than those based on information interpretation. Our hypothesis therefore implies that analysts either release fewer reports based on information discovery, or that the incremental value of these reports deteriorate, assuming constant analyst efficiency. Our results indicate that analysts only to a marginal extent compensate their increased workload by changing which of the two types of information they rely on when producing forecasts. Thus, reports based on information discovery should bring less amount of valuable new information to the market than historically observed. In the remainder of the paper, we examine if this logic holds, and consequently whether analysts' discovery role still proves superior to their interpretation role.

In the second part of our study, we investigate whether the incremental value conveyed in analysts' forecasts has changed following the financial crisis. We follow the approach of Ivković and Jegadeesh (2004), and examine the *relative forecast errors* of one-quarter-ahead earnings forecasts revisions and their timing in relation to firms' own earnings announcements. By comparing pre- and post-crisis data, we identify a significant deterioration in the incremental value that the examined analyst reports bring to the market. On average, the value-add is reduced by approximately half. Since reports issued in the discovery period[2] historically provide the most incremental value, these experience a greater absolute reduction post-crisis. This implies that the relative superiority of analysts' information discovery role, compared to their information interpretation role, has decreased in magnitude. However, the value-add of discovery reports is still systematically larger than that of interpretation reports. The use of relative forecast error is well suited for examining the incremental value of an analyst's report. It compares the accuracy of the forecast at hand, to the accuracy of all previously issued forecasts, where the latter should reflect the information currently available to market participants. Relative forecast error further allows for comparison over time, as the value is measured between analysts and thereby isolates time-varying differences in analysts' forecast climate. Consequently, general changes to the market environment following the financial crisis should by definition, not lead to a general shift

[2] We refer to the period preceding an earnings announcement as the discovery period, and the period succeeding an earnings announcement as the interpretation period. This is in line with how previous scholars identify the two analyst roles.

in relative forecast errors. In addition, the use of forecast revisions, as opposed to all analyst forecasts, is favorable since it provides stronger evidence of which type of information analysts rely on when updating their view of the firm.[3]

We conclude our study by exploring whether the increase in equity analysts' workload post-crisis holds explanatory power to the decrease in incremental value of their forecasts. For reports that rely on information discovery, we document a statistically significant relationship between an increased number of covered stocks and a less favorable relative forecast error. A corresponding relationship does not prevail for reports based upon information interpretation. These findings support our hypothesis that an increased workload negatively affects reports that require more search costs. Hence, increased analyst workload seems to decrease the difference in incremental value attributable to the two analyst roles. The relationship between workload and value of analyst reports is, however, of limited economic significance.

The remainder of this paper is organized as follows. Section 2 discusses relevant literature on the subject. Section 3 outlines our research questions and empirical approach. Section 4 describes data gathering and key variables for our analysis. Section 5 displays our findings, and Section 6 concludes and discusses topics for future research.

2. Literature review

2.1 The financial crisis and change in analyst climate

In the aftermath of the financial crisis of 2008, the financial industry and investment banks in particular have been under strict scrutiny. Not only did the crisis raise awareness of the need of new banking reforms[4] (Chiarella et al., 2011) but also put pressure on profitability and cost savings, which affects research budgets. Further, an increase in passive investing and algorithmic trading has dampened the demand for analyst reports and also decreased trading margins (The Economist, 2013). According to a study by Scarth and Shah (2014), the budget of global sell-side research was cut by almost half between 2007 and 2013. Greenwich Associates (2012) confirms the reduced research budget and the consequent reduction in headcount.

Empirical evidence indicates that expectations on analyst performance remain even if their working conditions changes. For example, the U.S. Securities and Exchange Commission (SEC) introduced the Regulation Fair Disclosure[5] (Reg. FD) in the year of 2000, which changed the way

[3] According to Imhoff and Lobo (1984), a revision indicates that the analyst has received new information about the firm, which they deem important to share with the market.

[4] Such as for example Basel II.5, Basel III and the Dodd-Frank act.

[5] Reg. FD states that important information about a company has to be disclosed to all investors at the same time.

security analysts work. Despite the increased search cost associated,[6] Bowers et al. (2013) note that it did not result in any changes to the expectation of analysts' accuracy. The reductions in budgets and number of researchers impose another change to analysts' working conditions. Loh and Stulz (2014) suggest that increased career concerns in period of bad times may have two contradicting effects on analysts' work; first, the increased risk of getting fired may lead analysts' to work harder. On the other hand, the search for another job may reduce their efficiency along with less willingness to work hard due to reduced monetary incentives in bad times. Another possible effect of increased career concerns and increased risk aversion may be increased herding[7] behavior among security analysts (Hong et al., 2000). While accurate analysts indeed are rewarded, less accurate analysts may be forced to leave the profession (Hong et al., 2000; Hong & Kubik, 2003; Ramnath et al., 2008). As a consequence, analysts are given reason to conform to the general view rather than deviate from the predictions of the group (De Bondt & Forbes, 1999). On the same note, previous scholars raise experience (Hong & Kubik, 2003), confidence (Trueman, 1994) and reputation concerns (Gramham, 1999) as explanatory factors for why analysts' mimic previous forecasts.

2.2 Measuring analysts' value creation

An area that has received great attention is research analysts' forecast ability; both in terms of stock recommendations and earnings forecasts. Barber et al. (2001), Womack (1996), Ramnath et al. (2008) among others has researched the subject, and the Wall Street Journal publishes annual analyst ratings based on forecast precision. Numerous studies have been devoted to the understanding of the drivers of analyst forecast errors; from the timing when they are produced (O'Brien, 1988), general market uncertainty (Brown & Mohd, 2003; Amiram et al., 2013; Arand & Kerl., 2012), analyst characteristics (Mikhail et al., 1997; Clement, 1999, Brown & Modh, 2003), past performance (Brown 2001) and stock coverage (Clement, 1999), to mention a few. While age of an analyst generally increases their accuracy (Brown & Modh, 2003), a higher number of covered stocks, and industries, decrease their correctness (Clement, 1999). Furthermore, security analysts tend to be overly optimistic in their forecasts (Klein, 1990; O'Brien, 1988), which forces them to revise their projections downward as the announcement day is approaching. Bartov et al. (2002) and Richardson et al. (2003) elaborate whether it is a deliberate move of managers to have analysts believe in lower earnings, in order to increase the firms' likelihood to beat, or meet, consensus forecast as actual earnings are reported. This would contribute to the relative

[6] Reg. FD aimed at removing the analysts' ability to receive an early peak on company material and hence imposed an increased demand on analysts' information gathering and data analysis (Mohanram & Sunder, 2006).

[7] Herding refers to analysts' tendency to release earnings forecasts that are not fully justified by their information but close to previous reports (Trueman, 1994).

dominance of the actual number of downward revisions to upward revisions, which both Ivković and Jegadeesh (2004) and Kim et al. (2011) report.

2.2.1 Relative forecast error

While accuracy of analysts' may be an important measure of analyst ability, both for employers and investors, it will not reflect whether an analyst, for instance, mainly mimics others (Ramnath et al., 2008). With this in mind, another measure to evaluate an analysts' contribution to the market is desired. The relative forecast error refers to the difference between analyst forecast error and the consensus forecast error from the previous day, and is a measure that has been used by several scholars in various research questions (Ivković & Jegadeesh, 2004; Song et al., 2009; Kim et al., 2011; Kim & Song, 2009). As noted by Kim et al. (2011), by taking current consensus into account, the relative forecast error measures analysts' accuracy adjusted for the timing of the published forecast. Furthermore, the measure is suitable for comparison across years as it isolates for differences in analysts' forecast climate (Song et al., 2009). The relative forecast error hence becomes a time-independent measure of the new information an analyst has obtained, in relation to the current information on the market which consensus seek to reflect (Kim et al., 2011). It makes it well suited for comparisons across forecasts, to determine which type of reports provide the most incremental value to the market.

2.3 The timing of forecasts and information role of financial analysts

Prior literature focuses on two sources of an analyst value-add; the analysts' information interpretation role and their information discovery role. The interpretation role conveys analysts' ability to process and provide insights about information disclosed in firms' public announcements. In contrast, the discovery role derives from analysts' ability to discover material not readily available to the market (Asquith et al., 2005; Chen et al., 2010; Ivković & Jegadeesh, 2004). In order to identify these two roles and their differences, previous researchers categorize forecasts by their timing relative to firms' public announcements, mainly focused on earnings announcements. By doing this, it is possible to observe trends in when analysts' issue reports, and how the reports add value to the market. This helps understanding which of the two sources of value-add an analyst mainly rely on, and which of the roles that provides most incremental value. As a way of further clarifying the two roles, previous research often focuses solely on forecast revisions, as opposed to all forecasts. The reason for this is that a revision indicates that the analyst has obtained new information about a stock, which they deem important to share with the market (Imhoff & Lobo, 1984). Thus, focusing on revisions further clarifies the information analysts' rely on when updating their view of a firm.

As for the mere timing of forecasts and forecast revisions, several factors have an influence. Earlier literature indicates that analysts strategically decide when to release their forecasts (Guttman, 2010; Kim et al., 2011). For instance they may try to time their reports to enhance their influence on investors to boost their professional development (Cooper et al., 2001; Irvine, 2003). In general, however, reports released later in time should be subject for greater reliability, as a result of access to more information along with the possibility to observe company peers and other analysts' projections (Kim et al., 2011). Scholars have found a majority of earnings forecasts to be released shortly following a firms' own earnings announcement. Ivković and Jegadeesh (2004) find the largest proportion of forecast revisions for a fiscal quarter to be published within two days following the previous earnings announcement, which is further supported by Kim et al. (2011). Hence, they show that analysts mainly rely on the information interpretation role when they update their forecasts.

In evaluating which of the analyst roles that provide most incremental value to the market, most literature finds the information discovery role to be premier to the interpretation role. Francis et al. (2002) and Frankel et al. (2006) argue that analyst reports are complements, rather than substitutes, to company reports and that the former are informative even if preceded by firms' own public announcements. However, Dempsey (1989), Ivković and Jegadeesh (2004) and Chen et al. (2010) among others, are able to demonstrate the analysts' relative superiority in the discovery role compared to the interpretation role. Chen et al. (2010) compare stock price response to earnings announcement and analysts' forecast reports, respectively, and conclude that analyst forecast prior to the announcement may preempt the firm's own corporate disclosure, and vice versa. They argue that both analyst roles are valuable, but conclude that the analysts' discovery role generally is of greater importance. They reflect upon the fact that the time and cost of an analyst to collect information differs among stocks, which is likely to have a larger impact in the discovery period. Further, they report that the interpretation role of an analyst is stronger for companies that generally feature more complex information. Altinkiliç et al. (2013) also study stock price responses. They argue that most analyst reports are released following some type of corporate news event, and show that the market integrates events into stock prices before analyst reports are released. Hence they question the value-add stemming from the information interpretation role. Dempsey (1989) shows that the analyst discovery role is substantial as these reports succeed in extracting important company information. More specifically, they find that the informative power of firms' own announcements decrease as the number of analysts following the stock increases.

Ivković and Jegadeesh (2004) take on a slightly different approach to understand the

information role analysts possess and subsequently when they add the most value. By studying the relative forecast errors of revisions, depending on the time of issuance relative to firms' earnings announcements, they evaluate the relative value-add of the two analyst roles. Remember that this measure uses the consensus forecast as a proxy for the information available on the market at a certain point in time. Thus, their study of forecast revisions communicates the incremental information on which the analysts' revise their forecast. Ivković and Jegadeesh (2004) show that the relative forecast error is close to zero immediately following an earnings announcement, while it turns to negative numbers over the event time leading up the forthcoming earnings announcement. Following the definition of relative forecast error, their result implies that the analysts' value-add is greater in periods before an earnings announcement, than after.[8] Furthermore, they find that downward revisions systematically beat upward revisions in terms of relative accuracy, which is partly explained by analysts' optimism bias.

Recently, a couple of papers have discussed what type of information the discovery role conveys to the market, in order to further shed light on its superiority. While earlier scholars consider the discovery role to be the gathering of private information, it could rather imply gathering of information from less available public sources. Livnat and Zhang (2012) include a more comprehensive characterization of corporate announcements to better understand the informative role of security analysts. They find that most revisions are issued within a three-day period of any of these disclosures, and thus argue that most reports rely on interpretation of public information. However, Lo (2012) list a few considerations regarding their handling of revisions, and analysts' motive behind them. The paper argues that Livnat and Zhang's (2012) findings should be interpreted with caution. Kim and Song (2009) perform another study that includes additional corporate data, namely management earnings forecasts. They argue that these forecasts are a large driver behind the findings of Ivković and Jegadeesh (2004), which supports that the periods of most analyst value-add do not rely on gathering of private information.

3. Research questions and empirical approach

3.1 Definition of research questions

3.1.1 Change in analyst workload

Our first research question aims at understanding whether the analyst climate has changed following the financial crisis of 2008. Specifically, we examine whether analysts on average have a different workload post-crisis compared to pre-crisis. If so, we seek to explore if they chose to

[8] Note that a negative forecast error indicates the analysts' forecast error to be lower than the consensus forecast error.

release a smaller fraction of revisions that require more search cost, i.e. reports published in the discovery period.

Following previous findings of a decreased research budget after the financial crisis, and subsequent reduction in headcount, we expect to see a decreased number of analysts per brokerage house post-crisis. Assuming a brokerage house motivation to maintain a similar stock coverage, we expect each analyst to cover a greater amount of stocks. We further expect to find an increased number of reports released per analyst and year, mainly due to an increased stock coverage. If we observe an increased stock coverage, we may see a corresponding decrease in the share of reports issued in the discovery period. If we cannot observe any change in the distribution of reports, or if the change is small, this motivates the investigation of succeeding research questions.

3.1.2 Change in relative forecast error, discovery versus interpretation

Our second research question aims at understanding changes in the incremental value conveyed in analysts' earnings forecast revisions following the crisis. We seek to understand whether the single analyst contribution to the market has changed, following differences in the analyst climate. Further, we seek to understand if the historically superiority of the discovery role to the interpretation role still holds.

In our pre-crisis data, we expect to confirm findings of Chen et al. (2010) and Ivković and Jegadeesh (2004). In other words, we expect to see a relative forecast error close to zero immediately following the earnings announcement, but decreasing as the next-coming earnings announcement is approaching. We further expect to observe a superiority of individual analyst contribution in the discovery period, relative to the interpretation period, in the pre-crisis time period.

However, as literature show that the research climate is changing (Greenwich Associates, 2012; The Economist, 2013; Scarth & Shah, 2014), we question whether these findings are still valid following the crisis. For instance, higher career concerns in periods of bad times should impact analysts' willingness to deviate from the general view, i.e. consensus. Further, we expect an increased analyst workload to lower the relative superiority of the discovery role to the interpretation role. With less time available for information gathering on each individual stock, the information content of analysts forecast should be reduced, which should be reflected in reports that are built upon information discovery. Further, following Ivković and Jegadeesh (2004) and the information bias of managers (Bartov et al., 2002; Richardson et al., 2003), we expect to observe a difference in relative forecast error between up- and downward revisions.

However, we see no reason for the increased workload to affect up- and downward revisions differently, which we confirm in unreported tests.

3.1.3 Explanatory value of analyst workload on relative forecast error

Our third, and last, research part makes a first attempt to clarify drivers behind the expected drop in analysts' value-add. In detail, we question whether changes in relative forecast error can be explained by changes in the number of stocks an analyst cover. Especially, we seek to understand whether this relationship is stronger for the analysts' discovery role.

If we are able to observe both an increase in analyst workload and a change in relative forecast error, we expect to find some relationship between the two. We further expect to be able to observe a relative larger explanatory power of a changed workload in the analyst discovery role versus interpretation role, with respect to the greater amount of information gathering the former suggest.

3.2 Empirical approach

3.2.1 Investigating changes in analyst workload

In order to answer our first research question, we initially study summary statistics on analyst coverage. In a second step we seek to statistically confirm found patterns. More specifically we regress the number of covered stocks, $StocksCovered$, for analyst i and year y on a post-crisis dummy variable, $PostCrisis$, according to the fixed effects regression model

$$StocksCovered_{i,y} = \alpha + \mu_i + \beta_1 PostCrisis_{i,y} + Control\ variables_{i,y} + \varepsilon_{i,y}, \qquad (3.1)$$

where μ_i indicates inter-analyst differences in number of covered stocks. The same regression is run for number of issued reports per analyst and year, $IssuedReports$, as dependent variable. Next, we examine whether analysts adjust their work by changing the number of reports issued per stock, $Reports/Stock$, by estimating the fixed effects regression model

$$Reports/Stock_{i,y} = \alpha + \mu_i + \beta_1 PostCrisis_{i,y} + \beta_2 StocksCovered_{i,y} + Control\ variables_{i,y} + \varepsilon_{i,y}. \qquad (3.2)$$

With the same logic, we also examine whether the analysts adjust their share of discovery reports, $\%DiscoveryReports$. It is done by running regression 3.2 but with $\%DiscoveryReports$ as dependent variable.

We include analyst id fixed effect to exploit the variation over time among individual analysts. We note that using fixed effects on this specific case may slightly bias the results, since analyst may cover more stocks as they become more experienced. However, we use this setup to match with regression in the third part of our study, where a fixed effects model is preferable to

a random effects model. Further we use robust standard errors in order to relax the assumption of identically distributed error terms. Throughout the thesis, we control that the choice of standard errors does not yield different results.

3.2.2 Investigating changes in relative forecast error, discovery versus interpretation

In the second part of the study, we provide and compare relative forecast errors given different points in time relative to an earnings announcement day (EAD). By categorizing observations according to the number of trading days to the closest EAD, we are able to study which trading days that provides the most incremental value to the market. To statistically confirm differences across trading day intervals, we use Welch's t-test of equality of means, for unequal sample sizes with unequal variances. More specifically, the mean relative forecast error of each trading day interval is compared to the mean relative forecast errors on all days, excluding day 0 and day 1. Further, to statistically confirm the changes to the relative forecast error, between discovery and interpretation periods and across years, we use a clustered simple regression. By regressing the relative forecast error, FE^{Rel}, for each observation j on $PostCrisis,$ a discovery period dummy variable, $DiscoveryPeriod,$ and an interaction term between the two, $PostCrisis * DiscoveryPeriod,$ we estimate the regression model

$$FE_{c,j}^{Rel} = \alpha + \beta_1 Post\ Crisis_{c,j} + \beta_2 Discovery\ period_{c,j} + \beta_3 (PostCrisis * DiscoveryPeriod)_{c,j} + Control\ variables_{c,j} + \varepsilon_{c,j}, \quad (3.3)$$

where each observation belongs to cluster, $c = 1, \dots, C$, based on stock id. Prior research suggests a certain degree of similarity across analysts' forecast accuracy of a given stock (O'Brien, 1990; Butler & Lang, 1991). Hence, clustering on stock id, we mitigate the assumption that all observations are independent and further allow for a certain degree of within-stock correlation of relative forecast errors (Petersen, 2008). Similar to all other regression in the paper, we control that the choice of cluster is not crucial for the results.[9]

The interaction term illustrates whether the post-crisis effect is different in the interpretation versus discovery period. β_1 represents the unique post-crisis effect if the report is published in interpretation period, while $\beta_1 + \beta_3$ represent the post-crisis effect for revisions published in the discovery period. Hence, β_3 show if the relative superiority of analysts' discovery role versus interpretation role differs pre- and post-crisis. The above regression is further run on up- and downward revisions separately, to control for differences between the two types.

[9] Specifically, we also cluster on brokerage house and analyst id. Clustering on stock yield the highest standard errors.

3.2.3 Investigating the explanatory value of workload on relative forecast error

In the third part, we examine the explanatory power of an increased analyst workload on the relative forecast error. We run a series of analyst fixed effects regressions, similar to equation 3.1 and 3.2, including yearly averages of specified variables. Specifically, the methodology facilitates analysis of the effect that an additional covered stock has on an analyst's yearly relative forecast error. Hence, we estimate

$$Avg.FE_{i,y}^{Rel} = \alpha + \mu_i + \beta_1 PostCrisis_{i,y} + \beta_2 StocksCovered_{i,y} + \beta_3 \%DiscoveryReports_{i,y} + Control\ variables_{i,y} + \varepsilon_{i,y}, \quad (3.4)$$

$\%DiscoveryReports_{i,y}$ is included to control for an analyst's ability to adjust their workload by issuing a different set of reports, and sort out the effect this would have on an analyst's yearly average forecast error. We also run regression 3.4 using average relative forecast errors for forecasts issued in the discovery period and interpretation period, respectively.

If analysts become more skilled over the years it may imply greater efficiency in gathering information, and consequently capacity to cover more stocks without negatively affecting their relative forecast error. It suggests that the true effect of greater workload may be larger than β_2 in equation 3.4 suggests. However, using a random effects model would not show the impact of increased coverage, but rather the general relationship between relative forecast error and number of covered stocks. This is since superior analysts potentially cover more stocks. In unreported regressions, we control that the choice of model is not of crucial importance for our results.

4. Data and key variables

4.1 Gathering and handling of data

Data on sell-side analysts' quarterly and yearly earnings forecasts, and stock recommendations, is retrieved from the Thomson Reuters International Brokerage Estimate System (henceforth referred to as I/B/E/S). Specifically, we use the I/B/E/S detail files, which adjusts for stock splits and other capitalization changes. The database contains global information dating back to 1982[10], and encompasses a range of company metrics, including security identification, industry code, analyst identity and the brokerage house they belong to, actual earnings outcome, and stock price. It is extensively used among researchers who seek to study earnings and forecast data of stocks, globally (see e.g. De Bondt & Forbes, 1999; Barron et al., 2002; Ivković & Jegadeesh, 2004; Livnat & Zhang 2012). We note that analyst contribution is voluntary, which

[10] I/B/E/S contains company information dating back to 1982 for US firms and 1987 for non-US firms.

may create some selection bias in the data. However, the extensive reliance on I/B/E/S among previous literature supports that our results will be reliable and comparable to previous studies. Further, through correspondence with Thomson Reuters we understand that the database includes all stocks a certain analyst follows, given that the analyst is a contributor. This should ensure an accurate estimation of analyst workload.

In accordance to previous literature, we focus on one-quarter-ahead earning forecast revisions. When illustrating analysts' workload we include one-year-ahead forecasts along with stock recommendations, to ensure a solid estimation. Further, two-quarter-ahead earnings forecasts are used to identify revisions of one-quarter-ahead forecasts. Both US and non-US data is used as our analyses encompass analyst workload, likely not limited to country specific coverage. As a robustness check, unreported tests confirm that only considering US stocks in latter parts of the paper yields no difference in conclusions. Further, we using data from 2004 to 2012, which allows us to examine differences between analyst performance before and after the credit crisis, and thus show effects from changes in the analyst coverage climate following this event. Excluding data prior to 2004 will further allow us to disregard from big structural changes in the information gathering the improved technology suggest, and regulations such as Reg. FD. To discern the period of the credit crisis we divide our data into three time periods; January 2004 to June 2007, July 2007 to June 2009, and July 2009 to December 2012.[11] This allows us to observe 42 months preceding and succeeding the credit crisis, which is suitable for statistical comparison between the periods. It also sorts out the years with highest market volatility, which is favorable in our descriptive analysis where control variables are not applicable. To check the robustness of our results, we vary the chosen time periods. Specifically, we redefine our post-crisis period to the years of 2011 and 2012, due to the potential time lag before brokerage houses experience the consequences of the financial crises. This yield very similar results to those presented in the paper, or show a slightly stronger post-crisis effect. Hence, varying the post-crisis period does not affect our conclusions.

In order to minimize potential errors in the data, we follow the work of Hirshleifer et al. (2009) and exclude observations where actual or forecasted earnings exceed the firms' stock price or where the stock price is less than 1 US Dollar. The stock prices relate to the last trading day of the fiscal period the forecast pertains to and are converted to USD using daily exchange rates provided by I/B/E/S. In addition, all forecasts released after the actual earnings are publicly announced are removed from the dataset, as these observations could hardly be viewed as predictions of the future.

[11] As a reference, e.g. Loh and Stulz (2014) define the credit crisis as the period of June 2007 to March 2009.

4.2 Definition and creation of key variables

4.2.1 Analyst workload

We use the number of stocks covered by an analyst as a proxy for the analyst workload, given that the number of reports per stock is fairly constant. An analyst is considered to cover a stock if they release a minimum of one next-quarter earnings forecast, one next-year earnings forecasts or one stock price recommendations for the given stock and year. By including all these forecast measures, we expect to create a reliable estimation of how many companies a certain analyst follows during the course of a year. To avoid double counting of reports that includes several forecast measures, we limit the number of issued reports to a maximum of one per stock and day, per analyst.

4.2.2 Interpretation and discovery period

Following Ivković and Jegadeesh's (2004) and Kim and Song (2009), all observations are assigned a number from -30 to +32 based on the number of trading days to its closest earning announcement day (EAD). We define our timeline in relation to the closest EAD as

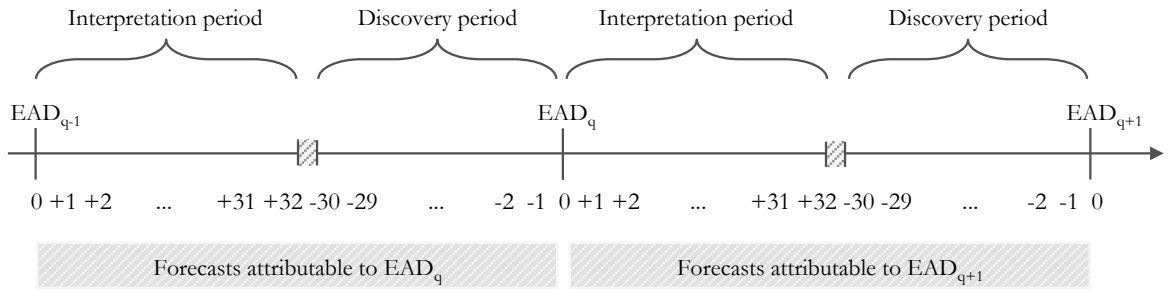
$$t = -30, -29, \dots, -1, 0, +1, \dots, +31, +32, \tag{4.1}$$

where t represents a certain trading day, and $t = 0$ translates to an EAD. A revision published at most thirty trading days prior to an EAD ($t = -30\ to\ -1$) reflects a forecast for which earnings are being announced at day 0, EAD_q. Revisions published on, or at most thirty-two trading days after, the EAD ($t = 0\ to\ +32$) refer to the succeeding fiscal quarter, for which earnings are announced at EAD_{q+1}. This time-horizon is chosen in accordance to Ivković and Jegadeesh's (2004), who report that sixty-three trading days usually span between two earnings announcements.[12] Further, we follow their approach and exclude observations outside of the timeline when the timing of reports is considered in the analysis.

The timeline is used to assess when in time, and thus in what way, analysts' provide the market with incremental value. We follow previous literature (Ivković & Jegadeesh, 2004; Kim & Song, 2009; Kim et al., 2011) and define the period immediately following an earnings announcement ($t = 0\ to\ +32$) as interpretation period, and the remaining ($t = -30\ to\ -1$) as discovery period, as illustrated in Figure I. Further, day 0 and $+1$ is considered the announcement period of the quarterly earnings.

[12] This figure is further supported through an analysis of our data, showing an average of 65 trading days.

FIGURE I. THE TIMELINE RELATIVE TO FIRMS' PUBLIC EARNINGS ANNOUNCEMENTS



The figure illustrates the timeline used in our study, indicating when in time reports are released in relation to the closest earnings announcement day (EAD). t=0 reflects the day the actual earnings is announced. Each report is in turn assigned a number between -30 and +32 based on the number of trading days to its closest EAD. A report assigned a number from t=0 and t=32 indicate a forecast pertaining to the *next* fiscal quarter (EAD(q+1)). A report release on day t=-30 to t=-1 reflects a projection on the next reported earnings (EAD(q)), i.e. where actual earnings are released at day 0.

Using this concept, all observations on day 0 should represent forecasts for the forthcoming fiscal quarter. Therefore, we remove all forecasts issued on the day of the earnings announcement EAD_q that pertains earnings released on that same day. In a similar matter, reports released prior to EAD_{q-1} that pertains to the earnings announcement released at EAD_q is removed from the dataset.

4.2.3 Forecast revisions

In the part of our study that concentrates on relative forecast error, we focus our analysis on earnings forecast *revisions* in order to isolate analysts' ability to find and process new information. A forecast is considered a revision if the analyst has previously produced a forecast for the corresponding stock and fiscal quarter. To not include stale forecasts, we impose a limit to the number of public announcements between the two reports. More specifically, a forecast produced between EAD_{q-1} and EAD_q is considered a revision if it is preceded by a forecast for the same stock and fiscal quarter, produced between EAD_{q-2} and EAD_q. We denote all revisions as a reiteration, upward revision or downward revisions based on the difference between the earnings estimate of the newly revised forecast and the analysts' previous forecast of the stock. A reiteration refers to an identical forecast of the up-coming earnings, while upward notation reflects a higher value than previously estimated, and vice versa for downward notation.

4.2.4 Relative forecast error

By comparing forecast errors of a certain analyst revision and that of consensus from the preceding day, we measure the relative forecast error, i.e. the amount of incremental value the revision brings to the market. The forecast errors are expressed as the absolute percentage

deviation of the forecasts compared to the actual earnings outcome. Hence, for analyst i, stock h, and trading day t, we define relative forecast error as

$$FE_{i,h,t}^{Rel} \equiv FE_{i,h,t}^{Analyst} - FE_{h,t-1}^{Consensus}, \tag{4.1}$$

where analyst forecast error is measured as

$$FE_{i,h,t}^{Analyst} = 100 * \left| \frac{AnalystForecast_{i,h,t} - QuarterlyEarnings_h}{QuarterlyEarnings_h} \right|, \tag{4.2}$$

and consensus forecast error as

$$FE_{h,t-1}^{Consensus} = 100 * \left| \frac{ConsensusForecast_{h,t-1} - QuarterlyEarnings_h}{QuarterlyEarnings_h} \right|. \tag{4.3}$$

As illustrated, a negative relative forecast error indicates that the individual analysts' revision is more precise than prevailing consensus. On the contrary, a positive relative forecast error indicates the reverse, i.e. that the consensus is more accurate.

Both analyst- and consensus forecast errors are truncated at 100 percent following the work of Ivković and Jegadeesh's (2004). Further, we adapt their definition of the consensus forecast, as the arithmetic average of all outstanding earnings forecasts made since the last earnings announcement, one day prior to the analysts' revision. Hence, a forecast revision published on trading day t, attributable to the earnings announcement on EAD_q is compared to the average of all forecasts published between EAD_{q-1} and $t-1$. As forecasts on trading day 0 are the first ones pertaining to the next-coming EAD, they cannot be compared to consensus from a previous day. Hence, there is no relative forecast error on trading day 0. Further, following Kim et al. (2011), for the consensus to be valid, a minimum number of two individual contributing analysts are required. When analyzing levels of relative forecast errors, we use one-quarter-ahead earnings forecasts.

4.2.5 Dummy variables

In order to distinguish categorical effects in our analysis, we construct a number of dummy variables.

PostCrisis. The post-crisis dummy distinguishes the years preceding and succeeding the credit crisis, in line with earlier definition. Thus, it equals one if the revision is published between July 2009 and December 2012 and zero if published between January 2004 and June 2007. July 2007 to June 2009 is set to missing.

DiscoveryPeriod. The period following an EAD ($t = 0\ to + 32$) is defined as the interpretation period, while the period preceding an EAD ($t = -30\ to - 1$) is defined as discovery period. Naturally, the discovery period dummy equals one if the revision is published

in the discovery period, and zero for the interpretation period. Potential observations outside our timeline are set to missing.

4.2.6 Control variables

We control for environmental specific factors that may affect analysts' forecast error and their relative forecast error.

*MarketUncertainty***.** Similar to Amiram et al. (2013), we measure market uncertainty using VIX. The VIX is a measure of the implied volatility of the Chicago Board Options Exchange's (CBOE) index of S&P500 index options. It is used as a control variable as increased market uncertainty could lead to increased forecast dispersion, which in turn could affect relative forecast errors. We construct a six-month simple moving average of the VIX, which we log and link to each forecast using issuance date. Data is obtained from CBOE (2014).

FirmSize. We follow previous literature and control for firm size, measured as the log of market value of equity at the end of the fiscal quarter the forecast pertains to (Kim et al., 2011; Clement & Tse, 2005). It is included since different firm sizes may imply different reporting standards and media coverage; both which should affect analysts' research efforts. All stock prices are converted to USD using daily exchange rates obtained from I/B/E/S.

*Industry***.** We include an industry code to control for if different industries provide different research conditions. The codes refer to the I/B/E/S classified industry code of each stock respectively.

5. Empirical results

5.1 Summary of findings

In the first part of our results, we show that analysts cover more stocks post-crisis than pre-crisis. Analysts active in both time periods cover on average three additional stocks, while the general trend in our full data set implies that every second analyst covers an additional stock. By studying analysts that are active in both time periods, we see that the increase has no economically significant impact on the number of issued reports per stock, but is partly compensated by a slight shift towards issuance of reports in interpretation periods. The latter change is however small. Hence, analysts' workload has increased post-crisis, and we expect them to have less time for each analysis.

In the second part of our results, we study relative forecast errors and find a negative shift in the precision of forecast revisions relative to consensus. For the pre-crisis and crisis time periods, the magnitudes and directions of relative forecast errors are similar to that of previous studies. In the post-crisis period, however, relative forecast errors differ significantly. The relative

precision is approximately half as good, which implies that each newly issued earnings forecast revision adds much less value to the market than what is seen historically. The decrease in value-add holds for all trading day intervals relative to firms' own earnings announcements, but is especially apparent for those preceding an announcement. While periods preceding an earnings announcement on average experience almost three percentage points decrease in relative precision, periods succeeding an announcement experience slightly more than one percentage point decrease. As a consequence, the difference in relative forecast error between discovery and interpretation periods has decreased, and the two sources of analyst value-add therefore seem less different in recent years. Put differently, we argue that the discovery of new information no longer creates as much incremental value, whilst still being superior to the interpretation of public information.

The last part of our results shows a statistically significant, but economically limited, relationship between analysts' workload and the decrease in relative precision of forecast revisions. The relationship can only be observed for reports issued in the discovery period. This provides some confirmation of our hypothesis that increased workload especially affects revisions that are based on information discovery. While the identified effect of increased workload may be slightly underestimated, due to our research design, the limited economic significance shows that analyst have managed the increased workload well. In some sense, they have thus become more efficient. Still, a large drop in relative precision of forecast revisions remains to be explained.

5.2 Data description and change in analyst workload

We begin by reporting summary statistics for the full data set in order to best describe the analyst coverage climate as a whole. We then turn to only reporting numbers for analysts who release a minimum of one one-quarter-ahead earnings forecast, as these analysts are the most important in our analyses. However, analyst specific variables calculated in the larger data set are kept unchanged.

5.2.1 Analyst coverage climate

TABLE I. SUMMARY STATISTICS FOR 1Q AND 1Y EARNINGS FORECASTS, AND STOCK RECOMMENDATIONS

Year	No. of analysts	No. of covered stocks	No. of brokerage houses	No. of analysts per brokerage house		No. of covered stocks per brokerage house		No. of covered stocks per analyst and year		No. of reports per analyst and year	
				Mean	Median	Mean	Median	Mean	Median	Mean	Median
2004	12,693	15,142	961	15.4	6	93.7	28	8.6	7	32.5	22
2005	12,866	16,350	981	15.4	6	96.0	28	8.7	7	32.5	22
2006	13,888	18,031	990	16.6	7	101.4	33	8.7	7	31.8	20
2007	15,144	19,523	1,001	18.2	8	108.3	35	8.7	7	31.4	19
2008	15,039	18,899	1,009	18.7	8	109.8	34	8.6	7	35.1	22
2009	14,695	18,510	1,117	17.4	7	99.7	30	9.0	8	36.0	22
2010	15,673	19,338	1,196	15.2	7	102.5	29	9.0	8	34.5	21
2011	16,634	19,311	1,150	15.3	7	112.8	33	9.1	8	34.5	21
2012	15,900	19,131	1,090	13.8	6	110.6	29	9.3	8	34.9	20
Pre-crisis	20,600	23,441	1,258	16.0	7	98.6	29	8.7	7	32.2	21
Post-crisis	22,878	25,241	1,429	15.2	7	106.6	30	9.1	8	34.7	21

Data is obtained from I/B/E/S, and includes all available one-quarter-ahead and one-year-ahead earnings forecasts, as well as stock recommendations. In order to best illustrate analyst coverage, both US and international data is included. An analyst enters the sample a given year if they release at least one of the three types of reports. Similarly, underlying stocks and brokerage houses enters the sample if they occur at least once during the year. Number of reports per analyst and year is adjusted for maximum one report per analyst, underlying stock and day. We do this to avoid double counting of reports based on the same research, as we wish to reflect the underlying workload. Pre-crisis refers to January 2004 to June 2007, and post-crisis to July 2009 to December 2012.

There has been a general increase in the number of analysts and covered stocks in the data set. As the number of brokerage houses in the data has increased as well, there are some indications that the I/B/E/S database becomes more complete over time, which may be especially true as we include non-US data. By calculating the number of analysts for each brokerage house, and the number of covered stocks for each brokerage house, we create more robust statistics. Both variables peaked in 2008, reaching averages of 18.7 and 109.8, respectively. When comparing pre- and post-crisis data, we observe a 0.8 decrease in the average numbers of analysts per brokerage house, which confirms Greenwich Associates' (2012) findings of decreased size of research departments. At the same time, there has been an 8.0 increase in the average number of covered stocks per brokerage house. This may reflect an increased globalization in the forecast market, or that brokerage houses are expected to cover a wider range of stocks. The changes are accompanied by a shift in number of covered stocks and number of reports per analyst and year. In the period Mid-2009 to 2012 (post-crisis), the average analyst in the sample covers 0.4 more stocks than in 2004 to Mid-2007 (pre-crisis), and issues 2.5 more reports per year. We especially observe two shifts in the number of covered stocks per analyst. Both in 2009 and in 2012, the figure increased significantly. These results give a first indication of the answer to our initial research question. It seems as if analysts have slightly greater workload post-crisis, which is in line with our expectations. For the purpose of this study,

we are most interested in learning if the workload has changed for analysts who release one-quarter-ahead earnings forecasts. This is since our study primarily aims at describing changes in relative forecast error for one-quarter-ahead earnings forecasts revisions.

5.2.2 One-quarter-ahead earnings forecasts and revisions

In our cleaned data set, there are a total of 1,409,772 one-quarter-ahead earnings forecasts. Out of all forecasts, 1,049,564 observations are revisions, whereof 605,590 are downward revisions, 435,281 upward revisions, and the remaining 8,323 reiterations. The greater amount of downward revisions is consistent with findings of earlier papers, and the theory of optimism bias among analysts. It implies that analysts in general issue too optimistic forecast, which they later on have to revise. It is also consistent with papers hypothesizing that managers intentionally guide analysts downwards in order to avoid negative earnings surprises.

TABLE II. SUMMARY STATISTICS FOR 1Q EARNINGS FORECASTS

Year	No. of forecasts (incl. revisions)	No. of revisions	% upward revisions	% downward revisions	No. of analysts per quarterly earnings announcement		No. of forecasts per quarterly earnings announcement		Calculated from Table I data set			
									No. of covered stocks per analyst and year		No. of reports per analyst and year	
					Mean	Median	Mean	Median	Mean	Median	Mean	Median
2004	115,096	74,391	47%	52%	5.4	3	7.4	4	11.2	11	50.7	43
2005	132,170	94,209	43%	56%	5.6	4	7.7	4	11.2	11	50.6	43
2006	138,957	99,245	42%	57%	5.5	4	7.4	4	11.4	11	51.2	43
2007	146,898	106,894	39%	61%	5.4	4	7.3	4	11.5	11	51.8	42
2008	162,754	123,244	32%	67%	5.4	4	8.0	5	11.3	11	57.1	44
2009	162,972	124,947	43%	57%	5.6	4	8.1	5	11.7	11	58.3	50
2010	180,022	136,699	50%	49%	5.9	4	8.2	5	11.6	11	56.0	46
2011	189,035	146,226	42%	58%	6.1	4	8.6	5	11.8	11	56.7	46
2012	181,868	143,709	38%	61%	5.9	4	8.2	5	12.6	11	61.4	50
Pre-crisis	458,695	318,684	43%	56%	5.5	4	7.4	4	11.4	11	51.0	43
Post-crisis	634,383	491,426	44%	55%	5.9	4	8.3	5	11.9	11	58.0	48

A forecast is considered a revision if the same analyst has previously produced an earnings forecast for the relevant stock and quarter, not including forecasts produced more than one earnings announcement back in time. The direction of the revision is based on the same analyst's previous forecast. Number of covered stocks per analyst, and reports per analyst, are calculated in the data set that includes one-quarter-ahead and one-year-ahead earnings forecasts, and stock recommendations, to best represent analysts' work load (cf. Table I). This table, however, only present these values for analysts who release at least one one-quarter-ahead earnings forecast each year. Pre-crisis refers to January 2004 to June 2007, and post-crisis to July 2009 to December 2012. Data is obtained from I/B/E/S, and includes both US and international observations.

Following up the observed patterns in Table I, we still observe a post-crisis increase in the number of covered stocks per analyst and number of reports per analyst, namely 0.5 stocks and 7.0 reports, respectively. Note that the reason for the deviations from Table I is that we now only include analysts who issue at least one one-quarter-ahead earnings forecast during a year. Analyst specific figures of covered stocks and issued reports are, as mentioned, calculated using the whole data set.

Table II further shows that the analyst coverage and frequency of forecasts per underlying stock has increased. On average, each quarterly earnings announcement is covered by 0.4 more

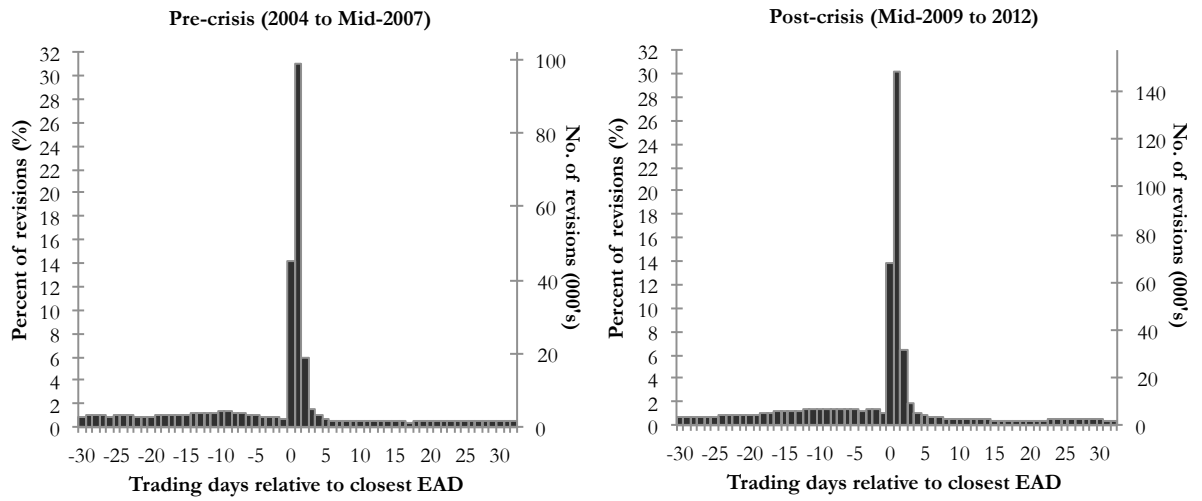
analysts post-crisis, as compared to pre-crisis. The average number of reports per earnings announcement has increased by 0.9.

Lastly, we note that the year of 2008 is the one with the most bias towards downward revisions, implying that many analysts had to adjust their revisions as the financial crisis hit. 2010 is the only year with less downward than upward revisions, which could be a reflection of a crisis rebound.

Distribution of forecast revisions

While number of revisions has increased rather significantly each year, the distribution in relation to earnings announcements remains very similar.

FIGURE II. DISTRIBUTIONS OF FORECAST REVISIONS, RELATIVE TO EARNINGS ANNOUNCEMENTS DAYS



EAD refers to an earnings announcement day of the underlying firms' quarterly earnings. Each forecast revision is given a timeline value of -30 to 32 (or missing) based on the number of trading days to its closest EAD. The analyst forecast per se is however always attributable to the succeeding quarterly earnings announcement. Hence, if trading days -30 to -1 are attributable to EAD(q), the following trading days 0 to 32 are attributable to EAD(q+1). The histograms only include forecast revisions, as these are the most important to our study. Data is obtained from I/B/E/S.

The histograms in Figure II illustrate when in time revisions are released, in relation to the closest quarterly earnings announcement day (EAD) of the underlying firm. As discussed, previous studies have seen a large bias towards revisions on the first days after a public earnings announcement. Remember that all forecasts on the day of an EAD and onwards, are attributable to the forthcoming quarter. The large amount of forecast revisions occurring on days following an EAD is evidence that analysts primarily use interpretation of recent public announcements to revise their forecasts. Following the lack of difference between pre- and post-crisis data, we show that this pattern is consistent across years.[13] Pre-crisis, slightly more than 51 percent of all analyst revisions are published on day 0, 1 and 2. Post-crisis, the same days stand for 50.5

[13] The distribution of forecast revisions during the crisis period (Mid-2007 to Mid-2009) is very similar to that of pre- and post-crisis.

percent of all revisions. In general, however, there is a slight trend towards more revisions closer to EADs post-crisis than pre-crisis. The share of reports has increased on all days from -17 to +9 (except day 0 and 1), and decreased on all days from +10 to +32 and -30 to -18. The magnitudes of changes are however small; very seldom over 0.3 percentage points, and never greater than 0.5 percentage points.

5.2.3 Confirmation of change in analyst workload

To statistically confirm the findings of above tables, we now continue by regressing the number of covered stocks per analyst on pre- versus post-crisis time periods. We do the same for number of released reports per covered stock, to investigate whether analysts compensate by releasing fewer reports for each stock. As workload increases, the analyst may also choose to shift the production of forecasts away from the discovery period, as discovery forecasts generally require more search costs. While the histograms on revision distributions (Figure II) indicate that this is not the case, we statistically confirm this by running a regression on the share of reports published during a discovery period. All dependent variables are expressed on a yearly basis for each analyst, and are thus well suited for fixed effects regressions on analyst level with year as time factor.

TABLE III. REGRESSIONS OF CHANGES IN ANALYSTS' STOCK COVERAGE AND TIMING OF REPORTS

	All revisions			
	(1)	(2)	(3)	(4)
	Number of covered stocks	Number of issued reports	Number of reports per stock	Percentage of reports in discovery period
Post-crisis	3.043***	16.460***	-0.229***	-0.593
	(0.183)	(1.273)	(0.072)	(0.427)
Number of covered stocks			0.035***	-0.138***
			(0.004)	(0.029)
Constant	16.786***	49.533***	0.942**	28.968***
	(1.016)	(6.518)	(0.426)	(2.748)
Control variables				
Market uncertainty (VIX)	Yes	Yes	Yes	Yes
Firm size	Yes	Yes	Yes	Yes
Industry	No	No	No	No
N, Obs.	25,560	25,560	25,560	25,557
N, Groups (Analys id)	8,976	8,976	8,976	8,976
$\mathbf{R^2}$	0.047	0.050	0.019	0.004

The dependent variables are constructed by computing yearly averages for each analyst who releases at least one one-quarter-ahead earnings forecast during the year. *Post-crisis* is a dummy variable that equals 1 for observations in Mid-2009 to 2012, and equals 0 for observations in 2004 to Mid-2007. The regressions only include observations within the pre- or post-crisis period. All dependend variables are calculated using one-quarter-ahead and one-year-ahead earnings forecast, and stock recommendations. *Number of covered stocks* represents the number of stocks an analyst covers during a year, *Number of issued reports* represents the number of reports an analyst issue during a year, and *Number of reports per stock* represents the yearly average number of reports issued per covered stock. *Percentage of reports in discovery period* refers to the share of reports that an analyst issues on trading days -30 to -1 to closest quarterly earnings announcement, as part of all reports the analyst issue on days -30 to +32 to an quarterly earnings announcement. It is calculated on a yearly basis, and one unit increase implies one percentage point increase. *Market uncertainty (VIX)* is included as a control variable, as increased volatility may lead to increased forecast dispersion, which in turn may affect relative forecast error. It is measured as the 6-month simple moving average of VIX. *Firm size* measures underlying firms' market capitalization. It is included as control variable since different firm sizes may imply different reporting standards and media coverage, both which should affect analysts' research efforts. To match the other variables, they are expressed as yearly averages for each analyst, with each observation receiving equal weight. *Industry,* which is used in other regressions to control for if different industries provide different research conditions, is not included as we cannot calculate a yearly mean of industry codes. By using yearly averages for each analyst, we obtain panel data. All regressions are run using a fixed effects model on analyst id, to control for systematic differences across analyst. Further, we use robust standard errors to relax the assumption of identically distributed error terms. These are reported in parentheses. Statistically significant coefficients are marked *** for p-value < 0.01, ** for p-value < 0.05, and * for p-value < 0.1.

We observe an increase of 3.04 (robust standard error of 0.18) covered stocks per analyst post-crisis, along with an increase in the number of reports issued of 16.46 (1.27). Both which are statistically significant at the 0.01 level. We find no decrease in the number of reports per stock as a result of increased coverage, if anything, rather the opposite effect. We do observe a small additional post crisis effect, of -0.23 (0.07). The combination of these two coefficients does not imply any major changes in the analyst behavior when it comes to number of reports per stock. Moving on, we do not find any statistically significant post-crisis effect on the share of reports that analysts issue in discovery periods. We do however find that an increasing number of stocks per analyst somewhat decreases the share of reports that analysts issue in the discovery period. If an analyst covers one extra stock, the share of reports they issue in the discovery

period is 0.14 (0.03) percentage points lower. The effect should not be considered economically significant, but is statistically significant at the 0.01 level.

Following these results, we have answered our first research question. The analyst workload has increased post-crisis. We expect this to have a negative effect on relative forecast error, especially in the discovery period, as these forecasts should suffer the most from lack of research time.

5.3 Change in relative forecast error, discovery versus interpretation

In examining the incremental value conveyed in of forecast revisions across years, and thus answer our second research question, we present relative forecast errors divided between our time periods. Remember that the relative forecast error measures difference in absolute forecast error between a newly issued revision and the consensus of all forecasts issued until the previous trading day. Hence, a negative forecast error implies that the revision is more accurate than its corresponding consensus. The more negative the relative forecast error, the more additional value the revision conveys.

We not only report relative forecast error for all forecast revisions, but also for upward and downward revisions separately. This is to further confirm consistency with historical findings, and examine if changes across years have different effects on different types of revisions. Due to the very few amount of reiterations, these are not reported separately. We also follow previous studies that test if the average relative forecast error of each trading day interval is different to the corresponding column average for all days except day 0 and 1. If the mean relative forecast error is statistically significantly better, analyst revisions in that trading day interval add more value than revisions in general, and vice versa. By labeling significantly different averages depending on whether the relative forecast error is better or worse than the column average, it is easy to identify which trading days that revisions generally provide more or less incremental value to the market.

TABLE IV. RELATIVE FORECAST ERRORS FOR ONE-QUARTER-AHEAD EARNINGS FORECAST REVISIONS

Trading day, to closest EAD	All revisions			Upward revisions			Downward revisions		
	Pre-crisis	Crisis	Post-crisis	Pre-crisis	Crisis	Post-crisis	Pre-crisis	Crisis	Post-crisis
-30 to -26	-4.75 ***	-4.31 ***	-2.22 ***	-3.29 ***	-2.46 **	-1.94 ***	-6.05 ***	-5.29 **	-2.53 **
-25 to -21	-5.34 ***	-4.43 ***	-2.99 ***	-2.64	-2.29 *	-1.75 ***	-7.43 ***	-5.58 ***	-4.07 ***
-20 to -16	-6.40 ***	-4.76 ***	-2.86 ***	-3.30 ***	-2.09	-2.05 ***	-8.68 ***	-6.10 ***	-3.59 ***
-15 to -11	-6.74 ***	-5.82 ***	-3.34 ***	-4.15 ***	-2.27 *	-2.04 ***	-8.85 ***	-7.49 ***	-4.46 ***
-10 to -6	-7.97 ***	-7.51 ***	-3.47 ***	-4.93 ***	-4.55 ***	-2.47 ***	-10.75 ***	-9.15 ***	-4.41 ***
-5 to -1	-5.26 ***	-3.88	-2.22 ***	-3.58 ***	-2.29 **	-1.73 ***	-6.98 ***	-4.82	-2.72 ***
0	-	-	-	-	-	-	-	-	-
1	0.38 |||	-0.01 |||	0.50 |||	0.07 |||	-0.49 |||	0.10 |||	0.64 |||	0.26 |||	0.84 |||
2 to 6	0.87 |||	0.93 |||	1.49 |||	0.55 |||	0.91 |||	1.75 |||	1.09 |||	0.94 |||	1.29 |||
7 to 11	0.30 |||	0.45 |||	1.02 |||	-0.06 |||	1.19 |||	0.68 |||	0.58 |||	0.01 |||	1.28 |||
12 to 16	-0.65 |||	-0.88 |||	0.63 |||	-0.90 |||	-0.50 |||	0.80 |||	-0.48 |||	-1.14 |||	0.43 |||
17 to 21	-1.46 |||	-1.59 |||	-0.03 |||	-1.07 |||	-1.43		-0.10 |||	-1.90 |||	-1.72 |||	-0.06 |||
22 to 26	-1.68 |||	-2.99		-0.50 |||	-1.20 |||	-2.17		-0.25 |||	-2.21 |||	-3.46 |||	-0.77 |||
27 to 32	-3.39 |||	-4.75 ***	-0.89 |||	-1.81 |||	-2.40 *	-1.25	-4.68 ||	-5.95 ***	-0.64 |||
All days except 0	-3.00	-2.85	-1.04	-1.85	-1.45	-0.72	-3.99	-3.62	-1.34
All days except 0 & 1	-3.97	-3.55	-1.50	-2.42	-1.72	-0.97	-5.30	-4.54	-1.98

Day 0 represents an earnings announcement day (EAD). Forecasts on days -30 to -1 pertain to the fiscal quarter for which earnings are released at day 0. Forecasts on days 0 to +32 pertain to the earnings of the next fiscal quarter. The relative forecast error measures difference between forecast errors of newly issued forecasts and of prevailing consensus. Forecasts errors are calculated as absolute percentage deviation from actual earnings outcome. Consensus is defined as the mean of all forecasts of previous days since the last EAD, given that at least two analysts have contributed. For instance, the relative forecast error of a revision released on day -20 consists of the forecast error of the very revision, minus the forecast error of the average analyst forecasts from days 0 to +32, and -30 to -21. As no consensus has been created on day 0, there is no relative forecast error on that day. The table only includes forecast revisions, as revisions indicate that the analyst have changed their belief about future earnings. A forecast is considered a revision if the same analyst has previously produced an earnings forecast for the relevant stock and quarter, not including forecasts produced more than one earnings announcement back in time. The direction of a revision is based on the revising analyst's previous forecast. *Pre-crisis* refers to 2004 to Mid-2007, *Crisis* refers to Mid-2007 to Mid-2009, and *Post-crisis* refers to Mid-2009 to 2012. Significance levels refer to tests of equality of means between each trading day interval and column average for all days except 0 and 1. To match data characteristics, Welch's t-test for unequal sample sizes with unequal variances, is used. Further, to illustrate which trading day intervals that generally hold better relative forecast errors, two different significance indicators are used.

*** implies p-value < 0.01 and smaller than column average for All days except 0 and 1, ** p-value < 0.05, and * p-value < 0.1.
||| implies p-value < 0.01 and greater than column average for All days except 0 and 1, || p-value < 0.05, and | p-value < 0.1.

For the pre-crisis and crisis time periods, the magnitudes and directions of relative forecast errors are very similar to those seen in previous studies. During these years, revisions on the trading day after an earnings announcement, and in the consecutive two weeks, are generally less accurate than consensus. The only exception is upward revisions on day 1 within the crisis period. In the post-crisis period, however, analyst revisions are less accurate than consensus also on the third week, and provide almost no additional value to consensus in the fourth week after the earnings announcement day. As revisions starts being more accurate than consensus, the value-add per revision increases until the week before the earnings announcement. This pattern is basically the same within all time periods, while the value-add within each respective trading day interval is lower post-crisis. For most trading day intervals, analyst accuracy relative to consensus is approximately half that of the pre-crisis period.

The statistical significances show that the incremental value of each new earnings forecast revision is greater in time periods where analysts' value-add mainly stems from information

discovery, as opposed to information interpretation. While the relative forecast errors are less good post-crisis, the superiority of discovery still holds. The significance levels are almost identical between pre- and post-crisis, with just a few exceptions when separating between upward and downward revisions. When considering all revisions for these two time periods, every trading day interval preceding an earnings announcement contains relative forecasts errors that are better than the column average, and statistically significant at the 0.01 level. On the contrary, all intervals succeeding an earnings announcement consist of revisions with on average worse relative forecast errors, statistically significant at the 0.01 level. During the crisis period, however, there is less statistical significance in the difference across trading day intervals. This is because of higher dispersion in relative forecast errors, probably as a result of more difficult forecasting conditions.

Similar to previous studies, we find that the relative precision of downward revisions is greater than for upward revisions. The reason may be that analysts in general are too optimistic in the early forecasts, and that the information base of downward revisions is more precise than that of upward revisions. We find that the overall decrease in relative revision accuracy holds for both upward and downward revisions. The relative post-crisis changes between the two are different when measured in absolute terms. Relative to their respective previous levels, however, decreases are rather similar.

To statistically confirm above findings, we run regressions including dummy variables for issuance in the discovery period, and post-crisis, respectively. By including an interaction term between the two dummy variables, we separate between the post-crisis change in interpretation and discovery. If the interaction term is statistically significant, the superior relative forecast error of the discovery period, as compared to the interpretation period, is different post-crisis.

TABLE V. REGRESSIONS OF RELATIVE FORECAST ERROR,
FOR ONE-QUARTER-AHEAD EARNINGS FORECAST REVISIONS

	All revisions	Upward revisions	Downward revisions
	(5) Relative FE	(6) Relative FE	(7) Relative FE
Discovery period	-6.073***	-3.100***	-8.278***
	(0.403)	(0.323)	(0.588)
Post-crisis	1.115***	1.368***	0.952**
	(0.347)	(0.399)	(0.480)
Discovery period*Post-crisis	2.644***	1.135***	3.676***
	(0.445)	(0.351)	(0.671)
Constant	-2.696	4.062**	-6.724***
	(1.721)	(1.844)	(2.441)
Control variables			
Market uncertainty (VIX)	Yes	Yes	Yes
Firm size	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	222,011	92,869	126,816
R-squared	0.016	0.006	0.024

Relative forecast error measures difference between forecast errors of newly issued forecast revisions and of consensus from the previous trading day. A forecast is considered a revision if the same analyst has previously produced an earnings forecast for the relevant stock and quarter, not including forecasts produced more than one earnings announcement back in time. *Discovery* period is a dummy variable that equals 1 for observations on trading days -30 to -1 to closest EAD, and equals 0 for observations on trading days 0 to +32 to closest EAD. *Post-crisis* is a dummy variable that equals 1 for observations in Mid-2009 to 2012, and equals 0 for observations in 2004 to Mid-2007. *Discovery period*Post-crisis* is an interaction term between the two dummy variables. The regressions only include revisions within the -30 to +32 timeline, and within the pre- or post-crisis period. In other worlds, the dummy variables equal 0 or 1 for all observations. Like in Table III, control variables for m*arket uncertainty (VIX)* and *firm size* are included. To match with the regressions in this table, control variables are observation specific. Hence, we can include the control variable for *industry* as well. All regressions are clustered on underlying stocks, as extraordinary events for a firm may have large impacts on the relative forecast errors, for all analysts covering the firm. Consequently, the assumption of independence between observations is relaxed for each stock. The robust standard errors are reported in parentheses. We recognize that observations may be dependent across analysts and brokerage houses as well. Clustering on analyst id or brokerage house does however yield lower standard errors than reported above. Statistically significant coefficients are marked *** for p-value < 0.01, ** for p-value < 0.05, and * for p-value < 0.1.

The above regressions confirm that relative forecast errors have decreased post-, relative to pre-crisis; on average 1.11 percentage points for revisions issued in interpretation periods, and 3.76 for revisions issued in discovery periods. This implies that the average forecast revision made by analysts post-crisis provide less additional value to the market. While the results from Table IV confirm the historical pattern of better relative forecast errors in discovery periods versus interpretation periods, the statistical significances of the interaction terms in Table V show that the absolute difference is smaller post-crisis, both for upward and downward revisions. These results prove that the difference between analysts' two sources of value-add still exists, but is much smaller in recent years than seen historically.

The only coefficient in above regressions that is not statistically significant at the 0.01 level is the post-crisis dummy for downward revisions. This indicates that downward revisions in interpretation periods are the ones least affected by the crisis. In general, however, upward and downward revisions enjoy the same changes, but of different magnitude. In our attempt to find

some explanation to the change in relative forecast error, we will not separate upwards and downwards revisions, as our theory of increased workload should apply to both types of revisions.

5.4 Explanatory value of analyst workload on relative forecast error

Increased analyst workload should lead to less research time per issued report, and especially affect the reports that require more search cost. If the increased workload has no, or only marginal, effect on relative forecast error, it seems as if analyst forecasts are produced more efficiently today. This could be the result of increased reporting standards and transparency among covered firms, technical improvements that eases gathering of data, or increased analyst skill and research efficiency.

We perform a series of regressions of analysts' yearly relative forecasts errors and observe whether the number of covered stock explains some of the post-crisis change. By including the share of reports issued in a discovery period, we control for the slight difference in distribution between discovery and interpretation as a result of the increased stock coverage, and the possible effects on search costs this implies.

TABLE VI. REGRESSIONS OF ANALYSTS' EARLY RELATIVE FORECAST ERROR GIVEN TIME PERIOD OF ISSUANCE, FOR ONE-QUARTER-AHEAD EARNINGS FORECAST REVISIONS

	All revisions		Revisions in Discovery		Revisions in Interpretation	
	(8) Yearly Relative FE	(9) Yearly Relative FE	(10) Yearly Relative FE	(11) Yearly Relative FE	(12) Yearly Relative FE	(13) Yearly Relative FE
Post-crisis	2.386***	2.276***	3.755***	3.536***	1.403***	1.413***
	(0.372)	(0.383)	(0.551)	(0.566)	(0.348)	(0.359)
Number of covered stocks		0.016		0.064**		-0.005
		(0.019)		(0.029)		(0.019)
Percentage of reports in discovery period		-0.067***		0.002		-0.008
		(0.010)		(0.014)		(0.010)
Constant	-8.083***	-6.748***	-16.538***	-17.984***	1.922	2.191
	(2.441)	(2.501)	(3.496)	(3.648)	(2.291)	(2.384)
Control variables						
Market uncertainty (VIX)	Yes	Yes	Yes	Yes	Yes	Yes
Firm size	Yes	Yes	Yes	Yes	Yes	Yes
Industry	No	No	No	No	No	No
N, Obs.	23,412	23,412	21,316	21,316	20,441	20,441
N, Groups (Analys id)	8,159	8,159	7,589	7,589	7,045	7,045
R^2	0.013	0.019	0.019	0.020	0.003	0.003

The dependent variables are constructed by computing an average relative forecast error for all revisions issued by an analyst during a year. Hence, they reflect an analyst's average value-add to prevailing consensus, for a given year. The variables and regressions are designed to illustrate differences between trading days preceding and succeeding a contiguous earnings announcement day (EAD). *Revisions in Discovery* implies that the revisions are issued on trading days -30 to -1 to closest EAD, while *Revisions in Interpretation* implies that the revisions are issued on trading days 0 to +32 to closest EAD. *Post-crisis* is a dummy variable that equals 1 for observations in Mid-2009 to 2012, and equals 0 for observations in 2004 to Mid-2007. The regressions only include revisions within the pre- or post-crisis period. *Number of covered stocks* represents the number of stocks an analyst covers during a year, and is calculated using one-quarter-ahead and one-year-ahead earnings forecast, and stock recommendations (cf. Table I and Table II). *Percentage of reports in discovery period* refers to the share of reports that an analyst issues on trading days -30 to -1 to closest quarterly earnings announcement, as part of all reports the analyst issue on days -30 to +32 to an quarterly earnings announcement. It is calculated on a yearly basis, and one unit increase implies one percentage point increase. Like in the regressions of previous tables, control variables for *market uncertainty (VIX)* and *firm size* are included. To match the other variables, they are expressed as yearly averages for each analyst, with each observation receiving equal weight. *Industry*, however, is not included as we cannot calculate a yearly mean of industry codes. By using yearly averages for each analyst, we obtain panel data. All regressions are run using a fixed effects model on analyst id, to control for systematic differences across analyst. Further, we use robust standard errors to relax the assumption of identically distributed error terms. These are reported in parentheses. Statistically significant coefficients are marked *** for p-value < 0.01, ** for p-value < 0.05, and * for p-value < 0.1.

When considering all revisions or only revisions in the interpretation period, we observe no explanatory power of the number of covered stocks on relative forecast error. The variable does, however, have some explanatory power when only considering relative forecast errors of discovery revisions, which is in line with our hypothesis. The effect for discovery revisions is that each additional covered stock leads to 0.06 (0.03) percentage points worse relative forecast error, which is statistically significant at the 0.05 level. However, the economic magnitude indicates that the relative forecast error of individual analysts is rather unaffected by the number of stocks they cover. A potential reason for the limited economic implication is that analysts vary in their ability to cope with the increased workload. If some analysts' discovery reports suffer from reduced information content, analysts who are less affected by the changing working conditions have more new information to discover. As a consequence, the average incremental value provided in discovery reports may experience less changes.

The coefficients for percentage of reports in discovery period are very small but statistically significant when considering all revisions. The coefficient should however be interpreted with caution. If time is scarce, there should be some effect that more discovery reports will make time even scarcer, which could affect relative forecast errors. On the other hand, a greater amount of reports in discovery will make yearly relative forecast error better per se, as we have shown that discovery reports provide more incremental value. The latter effect seems to be stronger as the coefficient is negative.

6. Conclusion

In an extension of previous research on equity analysts' role in financial markets, we investigate if and how the information content of analysts' forecast revisions has changed following the financial crisis of 2008. Since previous research pays limited attention to the analyst coverage climate, we begin our study with a general overview of the market. We identify an increased analyst workload post-crisis, in the form of a greater number of covered stocks and issued reports per analyst. This calls for an updated understanding of analyst behavior, and specifically their ability to provide valuable information with changing conditions, like financial crises.

We find that there has been no structural change to which type of information analysts rely on when issuing reports. We therefore move to examining the incremental value analysts' newly revised forecasts brings to the market, and if changes in workload has triggered a post-crisis effect. Using the concept of relative forecast error, we confirm findings of Ivković and Jegadeesh (2004), Chen et al. (2010) and others; the collection and processing of non-public information is the dominant source of analyst value-add. However, following the crisis, this dominance has decreased in comparison to the value-add stemming from analysts' interpretation of public information. We document a statistically, but not economically, significant relationship between analysts' workload and the decreased relative accuracy of forecast revisions in periods where analysts rely on information discovery. We propose the underlying reason to be that information discovery is more time consuming than information interpretation.

As most of the altered value-add of forecast revisions remains unexplained, we conclude our paper by presenting alternative explanations, subject to future research. First, we recognize the opportunity of a more frequently updated, and thus more efficient, consensus. A greater number of forecast revisions should reduce analysts' ability to extract new value-adding information. On the other hand, by the nature of revisions, they will by issued when there is new information to report. Hence, testing the effect of a more frequently updated consensus would

require a carefully designed research method, to avoid confusion about the direction of causality. Second, increased career concerns following the financial turmoil may cause analysts to conform to consensus rather than taking an active stance (Hong et al., 2000; Loh & Stulz, 2014). An increase herding behavior could thus help explaining the decreased magnitude of the relative forecast error. Lastly, we note that firms' own announcement can pre-empt the impact of analysts' subsequent revisions (Chen et al., 2010). Hence, if firms' public announcements are more frequent or more informative following the crisis, this may also help explaining the shift in relative forecast error.

References

Altinkiliç, O., Balashov, V.S. & Hansen, R.S., 2013. Are Analysts' Forecasts Informative to the General Public? *Management Science*, 59(11), pp.2550-65.

Amiram, D., Landsman, W.R., Owens, E.L. & Stubben, S., 2013. Analysts' Forecasts During Periods of High Market Uncertainty. *Columbia Business School Research Paper No. 13-68; Simon School Working Paper No. FR 13-24*.

Arand, D. & Kerl., A.G., 2012. Analyst research and investor reactions: Evidence from the 2008 financial crisis. *Working paper, University of Giessen*.

Asquith, P., Mikhail, M.B. & Au, A.S., 2005. Information content of equity analyst reports. *Journal of Financial Economics*, 75, pp.245–82.

Barber, B., Lehavy, R., NcNichols, M. & Brett, T., 2001. Can investors profit from the prophets? Security analyst recommendations and stock returns. *Journal of Finance*, 56, pp.531-63.

Barron, O.E., Byard, D. & Kim, O., 2002. Changes in the information conveyed by analysts' forecasts after earnings announcements. *Working Paper, Pennsylvania State University*.

Bartov, E., Givoly, D. & Hayn, C., 2002. The rewards to meeting or beating earnings expectations. *Journal of Accounting and Economics*, 33(2), pp.173-204.

Bowers, A.H., Greve, H.R., Mitsuhashi, H. & Baum, J.A.C., 2013. Competitive Parity, Status Disparity, and Mutual Forbearance: Securities Analysts' Competition for Investor Attention. *INSEAD Working Paper No. 2013/43/EFE; Rotman School of Management Working Paper No. 2241497*.

Brown, L.D., 2001. How important is past analyst forecast accuracy? *Financial Analysts Journal*, 57(6), pp.44-49.

Brown, L.D. & Mohd, E., 2003. The predictive value of analyst characteristics. *Journal of Accounting, Auditing and Finance*, 18(4), pp.625-47.

Butler, K.C. & Lang, L.H.P., 1991. The Forecast Accuracy of Individual Analysts: Evidence of Systematic Optimism and Pessimism. *Journal of Accounting Research*, 29(1), pp.150-56.

Chen, X., Cheng, Q. & Lo, K., 2010. On the relationship between analyst reports and corporate disclosures: Exploring the roles of information discovery and interpretation. *Journal of Accounting and Economics*, 49(3), pp.206-26.

Chiarella, D., Härle, P., Neukirchen, M., Poppensieker, T. & Raufuss, A., 2011. Day of Reckoning? New Regulation and Its Impact on Capital Markets Businesses. *McKinsey & Company Banking and Securities*. September

Clement, M.B., 1999. Analyst forecast accuracy: do ability, resources, and portfolio complexity matter? *Journal of Accounting and Economics*, 27, pp.285-303.

Clement, M.B. & Tse, S.Y., 2005. Financial analyst characteristics and herding behavior in forecasting. *The Journal of finance*, 60(1), pp.307-41.

Cooper, R.A., Day, T.E. & Lewis, C.M., 2001. Following the leader: a study of individual analysts' earnings forecasts. *Journal of Financial Economics*, 61(3), pp.383–416.

De Bondt, W.F.M. & Forbes, W.P., 1999. Herding in analyst earnings forecasts: evidence from the United Kingdom. *European Financial Management*, 5(2), pp.143-63.

Dempsey, S.J., 1989. Predisclosure information search incentives, analyst following, and earnings announcement price response . *The Accounting Review*, 64(4), pp.748-57.

Francis, J., Schipperb, K. & Vincent, L., 2002. Earnings announcements and competing information. *Journal of Accounting and Economics*, 33(3), pp.313-42.

Frankel, R., Kotharib, S.P. & Weber, J., 2006. Determinants of the informativeness of analyst research. *Journal of Accounting and Economics*, 41(1-2), pp.29-54.

Gramham, J.R., 1999. Herding among investment newsletters: Theory and evidence. *The Journal of Finance*, 54(1), pp.237-68.

Greenwich Associates, 2013. 2013 Greenwich Quality Leader U.S. Equities, http://www.greenwich.com/~/media/Files/Greenwich%20Rankings/Awards/2013/Jun/USEI-13-leaders.pdf

Guttman, I., 2010. The timing of analysts' earnings forecasts. *The Accounting Review*, 85(2), pp.513-45.

Hirshleifer, D., Lim, S. & Theo, S.H., 2009. Driven to distraction: Extraneous events and underreaction to earnings news. *The Journal of Finance*, 64(5), pp.2289-325.

Hong, H. & Kubik, J.D., 2003. Analyzing the Analysts: Career Concerns and Biased Earnings Forecasts. *The Journal of Finance*, 58(1), pp.313–51.

Hong, H., Kubik, J.D. & Solomon, A., 2000. Security analysts' career concerns and herding of earnings forecasts. *Rand Journal of Economics*, 31(1), pp.121-44.

Imhoff, E.A. & Lobo, G.J., 1984. Information content of analysts' composite forecast revisions. *Journal of Accounting Research*, 22(2), pp.541-54.

Irvine, P.J., 2003. The incremental impact of analyst initiation of coverage. *Journal of Corporate Finance*, 9(4), pp.431–51.

Ivković, Z. & Jegadeesh, N., 2004. The timing and value of forecast and recommendation revisions. *Journal of Financial Economics*, 73(3), pp.433-63.

Kim, Y., Lobo, G. & Song, M., 2011. Analyst characteristics, timing of forecast revisions, and analyst forecasting ability. *Journal of Banking & Finance*, 35(8), pp.2158-68.

Kim, Y. & Song, M., 2009. The Timing of Forecast Revision, the Sources of Value in Analysts' Earnings Forecasts, and Analyst Characteristics. pp.1-50.

Klein, A., 1990. A direct test of the cognitive bias theory of share price reversals.. *Journal of Accounting and Economics*, 13(2), pp.155–66.

Livnat, J. & Zhang, Y., 2012. Information Interpretation Or Information Discovery: Which Role of Analysts do Investors Value More? *Review of Accounting Studies*, 17(3), pp.612-41.

Lo, K., 2012. What do analysts do? Discussion of "Information interpretation or information discovery: which role of analysts do investors value more? *Review of Account Studies*, 17(3), pp.642-48.

Loh, R.K. & Stulz, R.M., 2014. Is Sell-Side Research More Valuable in Bad Times? *National Bureau of Economic Research Working Paper No. 19778*.

Mikhail, M.B., Walther, B.R. & Willis, R.H., 1997. Do security analysts improve their performance with experience? *Journal of Accounting Research*, 35, pp.131-57.

Mohanram, P., & Sunder, S., 2006. How has regulation FD affected the operations of financial analysts? *Contemporary Accounting Research*, 23, pp.491-526.

O'Brien, P.C., 1988. Analysts' forecasts as earnings expectations. *Journal of accounting and Economics*, 10(1), pp.53-83.

O'Brien, P.C., 1990. Forecast accuracy of individual analysts in nine industries. *Journal of Accounting research*, 28(2), pp.286-304.

Petersen, M.A., 2008. Estimating standard errors in finance panel data sets: comparing approaches. *Review of Financial Studies*, 22(1), pp.435-80.

Ramnath, S., Rock, S. & Shane, P.B., 2008. The financial analyst forecast literature: A taxonomy with suggestions for future research. *International Journal of Forecasting*, 24(1), pp.34-75.

Richardson, S., Teoh, S.H. & Wysocki, P., 2003. The walkdown to beatable analyst forecasts: the roles of equity issuance and insider trading incentives. *Unpublished working paper, Massachusetts Institute of Technology, Cambridge*

Scarth, N. & Shah, N., 2014. The future of equity research, *Edison/Frost Consulting*. January

Song, M., Doseong, K. & Chaehwan, W., 2009. Earnings Uncertainty and Analyst Forecast Herding. *Asia-Pacific Journal of Financial Studies*, 38(4), pp.545-75.

The Economist, 2013. Analyse this: The old model of stockmarket research is changing, September 21

Trueman, B., 1994. Analyst forecasts and herding behavior. *The Review of Financial Studies*, 7(1), pp.97-124.

Womack, K.L., 1996. Do brokerage analysts' recommendations have investment value? *The Journal of Finance*, 51(1), pp.137-67.