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Real-time Measure of Analyst Beliefs

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Real-time Measure of Analyst Beliefs

Abstract

Traders' beliefs are the central cognitive link on the revealed preference path from information to trading activities and price. We reconstruct this path explicitly by conjecturing that the tone of the analyst discussion in earnings conferences calls reveals in real time the analyst beliefs in response to new information just disclosed by management. Over a two-day period, a one standard deviation increase in analyst tone is associated with a 0.8 percent point increase in abnormal returns, and a significant increase in institutional net buys. Our measure of analyst beliefs is distinct from other information factors. Textual analysis therefore can be used not just to uncover information released by management, but also the resulting beliefs of capital market participants in real time.

Real-time Measure of Analyst Beliefs

1. Introduction

Analytical models of capital markets link information to prices through a crucial intermediate step: beliefs. In these models, capital market participants receive public information about the firm, and use their knowledge and expertise to revise their existing beliefs about firm value. They then execute trades, which in turn cause prices to move. Our focus in this study is not on the information release, but on measuring traders' beliefs after they receive this information. Specifically, we use analyst Q&A in conference calls to capture analyst beliefs in real time, before their clients potentially move trades and prices. We show that our belief measure captures a distinct phenomenon than management's information release, and strongly predicts future prices and trades. This is an important not just for theoretical reasons, but also because it demonstrates that the traditional research methodology of using textual analysis to uncover information released by management can be extended to uncover beliefs of capital market participants in real time.

Most analytical models of capital markets presume that belief formation occurs almost effortlessly through the Bayes rule (e.g., Grossman 1976). Consequently, a substantial body of finance literature correlates measures of new information releases to trading activities and price changes without explicitly reconstructing beliefs (e.g., Fama, Fisher, Jensen and Roll 1969). However, information in reality often appears in a variety of qualitative and quantitative forms that do not provide any clear and obvious estimates of firm value (i.e., information rarely appears literally in its Bayesian-compatible analytical representation "firm value + noise" with known mean and variance). The Bayesian belief formation process in reality thus may not be so straightforward – for example, the extensive "underreaction" or "overreaction" to information

literature is fundamentally a statement on the underlying belief formation process. Receiver beliefs also become critical when the sender transmits his information with bias or deception. It is therefore worth explicitly separating the receiver's beliefs from the sender's or the management's information release in real time.

This study therefore examines an important and influential class of capital market participants which reacts to management's information release by explicitly revealing its beliefs, namely financial analysts. We measure revelations of analyst beliefs in real time by using analysts' questions and comments in earnings conference calls with management. Conference calls with management and analysts are a significant firm-specific information disclosure event.¹ These calls, which happen very soon after the earnings release, are usually the first time after the earnings announcement that select analysts get to probe management (especially in our post Reg FD era). While the ostensible goal of analysts on the call is to get more information and clarification from management, we conjecture (and find strong evidence) that the tone of analysts' questions, comments, and responses to management replies reveals analyst beliefs in real time.² More crucially, we show that trading responds to beliefs, and not so much directly to the information itself. This result is important because it shows that the standard research approach of using textual analysis to measure sender's information can be extended to measure in real time a theoretically important factor, namely the receiver's beliefs.

An extensive analyst literature has focused on other public measures of analyst beliefs such as their reports or forecasts. This literature examines the price impact of these other analyst

¹ E.g. Frankel et al. (1999); Matsumoto et al. (2011); Mayew and Venkatachalam (2012).

² This communication process should be familiar to anyone who has been to academic seminar: the audience Q&A, while ostensibly seeking to elicit information from the seminar speaker, often reveals the audience's beliefs through its word choice.

opinions, with mixed success (Bradshaw 2012).³ A common conjecture for these mixed results is that the analyst outputs that researchers routinely use are observed too late in real time: analysts always can, and most likely do, inform their paying clients privately in advance of public disclosures such as analyst recommendations and forecasts. Consequently, prices could have already moved by the time the analyst output becomes public (e.g., Green 2006; Irvine et al. 2007; Maber et al. 2013; also see our Appendix A for a log of such private analyst-investor phone calls). The real time nature of our conference call setting largely circumvents these problems, because analysts need some time to consolidate these beliefs into actionable guidance for their clients (we are able to estimate this time-delay to be about 24 to 48 hours).

We identify analyst questions and comments using conference call transcripts. Beliefs are dynamic and change constantly. We conjecture that the tone of analyst questions and comments reflect the current state of analyst beliefs about firm value. For example, if an analyst says “that is great news”, we conjecture that the analyst has developed a more positive belief about firm value. Towards this end, we use the Loughran and McDonald (2011) linguistic tone dictionary to measure the number of positive (i.e., optimistic) versus negative (i.e., pessimistic) words in each analyst question and comment. The net relative score is our tone measure and it reflects the direction and the strength of analyst beliefs (Appendix B contains an illustration).⁴

³ For example, Brav and Lehavy (2003) and Frankel et al. (2006) find that analyst outputs such as price targets and earnings forecasts are associated with stock price movements, but Altinkilic et al., (2013) and Altinkilic and Hansen (2009) find that analyst stock recommendation revisions are not associated with price movements, a finding that Bradley et al. (2013) further dispute. Loh and Stulz (2010) conclude that only a small percentage of analyst recommendations are influential in moving prices. Finally, Lehavy et al. (2011) find that more complex and shorter 10-K filings increase the informativeness of analyst reports.

⁴ We motivate the use of this dictionary in Section 2. The idea that linguistic analysis of informed participants’ communication is informative is by no means new (e.g., Tetlock et al. 2008; Li 2010). However, what is important to note is that, depending on its purpose, linguistic analysis of speech can take different forms: some analyses measure the occurrence of financial words (Matsumoto et al. 2011), while others look for self-attribution and other psychological traits of the speaker (Larcker and Zakolyukina 2012), etc. Our innovation is to use linguistic analysis not to measure information content of management’s disclosures, but to measure in real time the beliefs of capital market participants in response to the earnings disclosure.

We measure analyst tone as the ratio of positive to negative words in 18,814 conference calls from 2002 to 2008 for 1,405 firms in 65 different two-digit SIC industries.⁵ No theoretical model can validate that this ratio indeed reflects analyst beliefs: we must establish this empirically, which we do in detail in Section 3.1. First, we find that on average, analysts utter 1 positive word for each negative word in a conference call (there is no skewness in this ratio measure). This 1:1 mean ratio is consistent with the idea that the average beliefs over many information events in large and deep capital markets should be neutral.⁶ We then test whether our analyst tone construct eventually translates to concrete (and well-studied) outputs such as analyst earnings forecasts, price targets, and analyst stock recommendations.⁷ We find that a one standard deviation increase in analyst tone is associated with a 4.56% increase in the analyst consensus EPS forecast for the subsequent quarter, a 1.44% increase in the consensus price target, and a .013 increase in the consensus stock recommendation level. These and other results in Section 3 attest to the validity of our tone construct to measure analyst beliefs.⁸

We then test if our measure of beliefs triggers stock price changes. To do so, we regress future abnormal stock returns on our tone score. However, the trading beneficiaries of analyst beliefs (e.g., analyst clients) are not the only conduit through which information enters prices. Other traders may interpret the information disclosed in conference call directly and trade on it. To control for this “information disclosure” channel, we include a rich set of quantitative and

⁵ This period is before investment banks agreed to stop differential dissemination of their results to their paying clients, which makes the sample period especially suitable for our trading tests (see Henning 2013).

⁶ We treat all analysts on the conference call as equal because prior research suggests that analysts on the call are typically the select influential few (Mayew et al. 2012). See Section 2.1 for more details.

⁷ We use consensus analyst outputs because of computational tractability and also because analysts on the call are typically more influential (e.g., Mayew et al. 2012); other analysts are therefore likely to herd to them (e.g., Hong et al. 2000; Clement et al. 2005).

⁸ Of course, as with any revealed preference argument, we can never say that we have a definitive validation of our measure; all we can assert is that it plausibly reflects the underlying theoretical construct, namely beliefs. See Kreps (1990, Ch. 2) for a detailed exposition of the revealed preference argument. The basic idea is to infer a decision maker’s internal unobservable preferences or beliefs from her external observable actions such as tone.

qualitative conference call information disclosure controls such as indicators of whether the firm's reported earnings met various benchmarks, the level of earnings surprise, and management's tone in the discussion and presentation sections of the conference call. We also recognize that there could be across-firm variation in tone simply due to variations in unobservable and intangible factors such as analyst-management relationships, manager speaking style, analyst speaking style, and the composition of the listeners. We conjecture that these factors are relatively stable over time, and use firm fixed effects to proxy for them.

Our first main result is that prices adjust to the direction and strength of the analyst tone in the days following the conference call. We find that a one standard deviation increase in analyst tone is associated with a 0.8 percent point increase in abnormal returns over days (0, +1) of the conference call.⁹ Our choice of the returns window is based on the assumption that analyst beliefs in our setting may not be actionable in a matter of minutes; the analyst may take some time to fully consolidate and communicate his revised views to his clients (we validate this assumption in our trading tests).¹⁰ We run our tests over several returns windows (including dropping day 0). We find that the initial change in the stock price is not temporary, but persists over longer time horizons up to three months, suggesting the impounding of real information, and not just volatility, into the price.¹¹

Our analyst belief effect obtains separately and in addition to the information disclosure effect, as evidenced by the significance of our information controls.¹² For example, we find that management tone, both in the presentation and the discussion, is an economically weaker but a

⁹ By comparison, Brav and Lehavy (2003, p. 1947) find a 2.9 percent event-day abnormal return for a standard deviation increase in their measure of the analyst's target price.

¹⁰ For example, see the analyst phone call analysis in Maber et al. (2012). This logic is of course less applicable to actionable analyst outputs such as recommendations, which, studies such as Altinkilic and Hansen (2009) and Bradley et al. (2013) argue, should be priced in the capital markets in a matter of minutes.

¹¹ We also control for past returns, so our returns results cannot be attributed to momentum from pre-news events.

¹² Our setting is post Reg-FD, thus mitigating the possibility that management has privately informed some analysts about earnings in advance.

statistically significant predictor of returns, consistent with the information disclosure aspect of the conference call setting. Likewise, our financial information disclosure controls (such as various measures of earnings surprise) are also significant. The controls above provide assurance that our returns results for analyst tone are driven by analyst beliefs, and not directly by other traders acting on the information disclosed by the firm (we will shortly identify a class of traders who are responding to analyst beliefs). In fact, we find that analyst beliefs are more predictive of returns when management information release has a larger unexpected element, suggesting that analysts are more influential when there is new information to interpret. These results combined highlight the importance of thinking of the receiver's beliefs as a construct different from the sender's information. This separation is obvious in analytical models, but not as much in empirical research.

The (persistent) impact of our belief measure on price warrants further investigation into the mechanism through which this price change is effected. While it is always possible that some astute outside trader is listening to analyst tone on the call and trading directly on it, we conjecture that institutional investors, who are the main clients of analysts, are more likely the immediate beneficiaries of analyst beliefs (Mikhail et al. 2007; also see our Appendix A for a log of private investor-analyst phone calls). We directly examine institutional investor trading in the days following the conference call using a large database of institutional investor trades from Abel Noser (see Puckett and Yan 2011 for a detailed description of this data set). We find that when our measure of analyst beliefs moves up, there is a significant increase in institutional investor net buying on day 0 and even more so on day +1. All subsequent days are insignificant. These results suggest that analysts inform their clients (e.g., via squawk box, phone calls, etc.), who then trade on it, all within 48 hours. Our methodology, which captures analyst beliefs prior

to institutional trading, complements Irvine et al. (2007), who conclude from institutional trading prior to the public release of analyst reports that analysts are privately informing institutional investors.¹³

More important, our finding of significant institutional trading both on day 0 and day 1 indicates that unlike fully actionable analyst outputs such as recommendations, it takes some time for our initial beliefs to translate into trading. This result explicitly validates our choice of the returns window. Furthermore, our institutional net buying measure has no association with management tone and other information disclosure measures. These results, in conjunction with our returns tests, suggest that this particular class of investors is responding to information not as much directly, but instead through analyst beliefs. By measuring beliefs in a timely manner, our setting showcases the importance of beliefs on the revealed preference path from information to trading and prices. In addition, we show that the methodology of textual analysis, which prior studies have primarily used to extract the sender's information, can be also be used to extract the receiver's beliefs in real time. We discuss prior literature next.

1.1 Contribution to the Textual Tone, Conference Call, and Analyst Literature

A growing literature uses textual analysis to establish the information content of analyst and management written and vocal output.¹⁴ Our incremental contribution to this literature is to

¹³ Our maintained assumption that ties all our results together is that the price impact of analyst revisions is occurring through the trades of analysts' institutional clients, a subset of whom we hope to have captured in the Abel Noser dataset. In addition, note that our trading tests are valid for our sample period, which predates banks' settlement with regulators to disseminate analyst reports to all paying clients simultaneously (Henning 2013).

¹⁴ Davis et al. (2010a) find a positive 3-day market reaction to the unexpected net optimistic language in earnings press releases after controlling for other quantifiable information and disclosures. Demers and Vega (2010) also find the earnings press release result, but they additionally control for management earnings forecasts issued with the press release. Davis et al. (2010b) examine the market reaction to optimistic language in the earnings press release versus the MD&A, and find that the language in the earnings press releases provides more information than the MD&A. However, the content of the earnings press release is similar to that of the presentation portion of the call (Matsumoto et al. 2011), which we control for.

show that text and speech can be used to measure in real time not only the information content of the message of the sender (i.e., management), but also the resulting belief of the receiver (i.e., analysts).¹⁵ This separation is important because studies suggest that the information transmitted through text and tone can be biased. For example, Rogers et al. (2010) show that optimistic disclosures increase the likelihood of shareholder litigation, while Larcker and Zakolyukina (2010) show that managers who commit fraud use deceptive language. Similarly, Hobson et al. (2012) show that vocal dissonance predicts financial misreporting. Receiver beliefs therefore become crucial to interpreting the sender's message. For these reasons, the distinction between the sender's information and the receiver's belief is critical for analytical models, but has been insufficiently explored empirically. Much of the textual analysis literature instead directly jumps over this fundamental step and links information to prices directly.¹⁶

A rich literature establishes conference calls to be significant information events, thus justifying our use of this setting for another purpose, namely using textual analysis to measure the beliefs of the recipients of the information. For example, Mayew and Venkatachalam (2012) document (using commercial but proprietary voice analysis software) that management's vocal tone during the discussion conveys information about future firm prospects. Hollander et al. (2010) find that management's refusal to answer questions is also informative to the market. Analogously, Brochet et al. (2012) show that linguistic complexity of management discussion impacts the information content of conference calls. Price et al (2012) find a 3-day price reaction to the tone of the entire Q&A conference call session. These studies do not explicitly

¹⁵ Capital market models such as Grossman (1976) define information very expansively: prices and observable beliefs of others all carry information. Our definition of public information does not include these factors, but primarily refers to the information disclosed by management.

¹⁶ In a related study, Lehavy et al. (2011) examine analyst response to the readability of the firm's financial reports. However, their goal is to document the extent to which analyst reports become a substitute information source when the firm's reports are unreadable. Our goal is understand in real time how analysts form their beliefs in response to the information released by management in the conference call.

differentiate between sender's information and the receiver's beliefs explicitly (in real time), nor do they make any conjecture that their textual measures capture anything other than information, like we do. Somewhat differently, Matsumoto et al. (2011) find that the magnitude of returns is higher *not* during the management presentation period of the conference call, but during the discussion time period. Matsumoto et al. (2011) then additionally show that management uses fewer financial words and more future-oriented words when performance is poor. These information-based findings further justify our use of the conference call setting to extract analyst beliefs.

Our study also speaks to the analyst literature. This literature is voluminous, and any statement on our contribution to this literature requires framing its broad themes. We follow Bradshaw's (2012) framework. Bradshaw argues that the superiority of analyst forecasts over other forecasting methods is beyond doubt, but establishing the value of analyst outputs to investors has been more challenging.¹⁷ A large body of analyst research has focused on understanding the properties of one analyst output, namely earnings forecasts. The wealth and the variation of this literature's findings then spurred comparative statics analyses on analyst incentives, motives, and payoffs driving their decision to follow stocks and provide forecasts. The interest in analyst motives prompted analyst research to move beyond earnings forecasts to other analyst outputs such as price targets and stock recommendations. The value of these outputs to investors is also nuanced, and depends once again on the characteristics of specific analysts, their talents, and their motives. Commenting on this literature, Bradshaw suggests that future analyst research could move from analyst outputs to understanding in the more detail the process that leads analysts to issue these outputs.

¹⁷ Bradshaw (2012, p.12) notes: "The economic magnitude of analysts' superiority appears to be small, suggesting that analysts' value to the capital markets likely rests on other roles than simply forecasting earnings." Also see footnote 3.

Our study enters the literature precisely at this point. We identify a setting where we can observe in a timely manner analyst reaction to new information release. We show this initial analyst reaction feeds into returns quickly, suggesting that analysts are indeed informing capital market participants through ways other than publicly observable analyst outputs such as stock recommendations and earnings forecasts. Our main result obtains very robustly on average with firm fixed effects, and is supported by several additional analyses. Our central message therefore is that it is important to be able to measure analyst beliefs in real time if we wish to empirically demonstrate the basic theoretical prediction that beliefs of informed capital market participants such as analysts should impact prices.

An added advantage of our setting is that we view analysts as informed capital market participants on average, and abstract from cross-sectional variations across individual analysts. Our motive for this comes from Mayew et al. (2012), who show that analysts on the conference call are typically superior analysts, and Hong et al. (2000), who show that superior analysts are leaders of herding behavior. The variation in analyst motives, incentives, and talents in this select subsample is therefore likely to be smaller than the variation in the overall analyst population (a subject that has received substantial research attention). This feature considerably simplifies the design of our tests.

Section 2 describes the data and the variables. Section 3 describes the results. Section 4 concludes.

2. Data, Variable Definitions, and Descriptive Statistics

2.1 Analyst Tone Measure

We obtain a sample of 18,814 U.S. public company quarterly earnings conference call transcripts produced by ThomsonReuters from August 2002 to April 2008 for which accompanying Compustat, CRSP, and I/B/E/S data is also available. The 2002-2008 period is post Reg FD where analysts are not supposed to have private access to management information, and is also after the Internet bubble, which was a period of frothy financial markets. The institutional trading data are from Abel Noser Ltd., used by studies such as Irvine et al. (2007) and Puckett and Yan (2011). More important, this sample period predates banks' settlements with regulators not to selectively divulge analyst reports earlier to subsets of paying clients (Henning 2013). We therefore have more confidence in interpreting the results of our trading tests as implying that these traders had early access to analyst beliefs.¹⁸

The variables used in this study, along with their source, are tabulated in Appendix C. Table 1 provides a full set of descriptive statistics, including winsorizing details (our results are not sensitive to winsorizing). Table 1 indicates that the number of conference calls has increased in recent years, reflecting the growing number of managers choosing to have conference calls and an increase in coverage by ThomsonReuters.

The earnings conference call transcripts have XML-friendly headers containing the date of the call, firm identifiers, and whether the call was related to an earnings announcement. XML tags also identify different segments of the call (e.g., presentation and discussion) and individuals like analysts and managers. We parse through the text using a Perl script and require at least one manager and one analyst to be present in each call.

Analyst beliefs about a firm's future are a continuously evolving construct. We attempt to measure the belief of the analysts in real time using the tone of their comments in the Q&A, a

¹⁸ Note that the beliefs an analyst forms about the future of the firm based on public information is not per se inside information. If the analyst forms his or her belief based on insider information, then matters could be different (Henning 2013).

measure we validate at length in Section 3.1. We use the Loughran and McDonald (2011) positive and negative word dictionaries to calculate tone.¹⁹

There are many dictionaries that can be used to measure textual tone (e.g., Harvard IV-4 TagNeg H4N). Our motive for using the Loughran and McDonald (2011) dictionary is that it is designed specifically to measure the optimism/pessimism tone of financial communications, which is exactly our setting. Other studies such as Matsumoto et al. (2011) have developed different dictionaries for financial communications, but for different goals such as identifying the information content of financially-oriented and forward-looking words. We show later that these information-based measures are substantially different than our tone-based belief measure.

On average, analysts speak a total of 1,187 words during the discussion portion in the sample of calls. In order to alleviate concerns about conference call length and scaling issues, we create one relative measure for tone, using a ratio similar to those suggested by Henry (2008) and employed in other studies (e.g., Demers and Vega 2011; Price et al. 2012). We call this ratio *ANALYST TONE*:

$$ANALYST\ TONE_i = \frac{ANALYST_POSITIVE_i}{ANALYST_NEGATIVE_i}$$

For each conference call i , $ANALYST_POSITIVE_i$ equals the number of positive words (according to our dictionary) spoken by analysts and $ANALYST_NEGATIVE_i$ equals the number of negative words (according to our dictionary) spoken by all analysts on the call.²⁰ We do not distinguish among the analysts because these analysts are the select influential few (e.g., Mayew et al. 2012), and are thus likely to have lower levels of heterogeneity compared to the analyst

¹⁹ http://www.nd.edu/~mcdonald/Word_Lists.html.

²⁰ All calls have at least one positive and one negative word. We also count different tenses of the positive and negative words (e.g., “concerned” would count negative for “concern”). We also compute analyst tone as (positive words – negative words) / (positive words + negative words). This measure is correlated with our measure at 0.97, and all results in the study hold with this alternative measure as well.

population. Appendix B provides a small sample of this calculation, though we caution the reader not to over-interpret what are but two sample observations. Section 3.1 provides an extensive set of systematic validity checks of this measure.

2.2 Dependent Variables

Future Abnormal Returns: We measure abnormal returns over several time windows (in days). We use CRSP data to estimate cumulative abnormal returns using a daily market-model beta with a one year estimation period.

Our first set of windows start with the conference call date, which we call day 0.²¹ Our choice of the length of the windows (in days) is guided by the following logic. What we measure in the analyst tone variable is not a fully formed analyst recommendation, but a measure of his or her emerging beliefs. This new belief may take some time to find its way to the analyst's clients (we will test this claim explicitly in Section 3.4).²² We also recognize that short-term window returns could reverse due to volatility and other factors; we therefore supplement our short-term windows with long-term windows to verify the persistence of our results.

We also use returns windows of (+1, +2 days) and (+1, +5 days). Our reasoning is that if information released by management in the conference call is priced on that day itself (by other traders, for example), but analysts take some time to translate their emerging beliefs to private client recommendations, eliminating day 0 from the return window would further distinguish the

²¹ For evening afterhours calls, we set day 0 to the first trading day following the call.

²² This is why we eschew the minute-by-minute returns analysis performed by Altinkilic and Hansen (2009) on analyst recommendations. For a discussion of the problems in correctly identifying timestamps for these short-durations tests, see Bradley et al. (2013).

analyst belief effect from the information disclosure effect (including astute outside traders observing and acting on the analyst tone).

Our aim with the next three dependent variables is to show that the analyst belief we capture in our analyst tone measure indeed translates to future analyst disclosures about their beliefs (e.g., forecasts, price targets, and recommendations). While we would ideally like to match individual analyst tone to her future outputs, the lack of analyst names in many of the I/B/E/S databases precludes such matching. However, given that analysts who participate in the call are more likely to be influential (Mayew et al. 2012), and thus drive the herding behavior among the other analysts (Hong et al. 2000; Clement et al. 2005), we conjecture that our method of measuring tone will capture the beliefs of a firm's best analysts and thus its analyst population at large.²³ The three future outputs we measure are (see Appendix C for details):

Analyst EPS Forecasts: We obtain EPS forecasts, stock recommendations, and price targets from I/B/E/S. We calculate the percentage change in the analyst consensus EPS forecast by comparing the analyst consensus EPS forecast for the next quarter at day +60 to the analyst consensus EPS forecast for the current quarter at day 0 (conference call day).

Analyst Price Targets: We calculate the percentage change analyst in price target by comparing the analyst consensus price target for a firm's stock at day +60 to day 0.

Analyst Recommendation Level: We calculate the change in analyst recommendations by comparing the analyst consensus recommendation level for a firm's stock at day +60 to day 0.

Our last set of analyses focuses on an important mechanism through which analyst beliefs get impounded into prices, namely trading by institutional investors, who are typically analyst clients (Mikhail et al. 2007). We obtain institutional investor trading activity from Abel Noser

²³ Furthermore, our unit of analysis for the tone score is compatible with our other measures of analyst outputs, as explained next.

Solutions Ltd., a dataset that has been used by prior studies such as Goldstein et al., (2009) and Puckett and Yan (2011).²⁴ Of course, the question arises as to the precise configuration of the explicit and implicit interrelationships between specific institutional investors, analysts, and brokerage houses. It is virtually impossible to discover the nature these relationships without access to proprietary data (e.g., Maber et al. 2013) or litigation (see our Appendix A and Henning 2013). Following Goldstein et al. (2011, Table 4), Irvine et al. (2007, Section 1) and Irvine (2004), we do not attempt to uncover these interrelationships, but assume that analysts on conference calls, who are typically top analysts on average, are influential with the institutional investors tracked by Abel Noser.

To get a directional measure of daily institutional trading activity, we construct a measure of abnormal institutional investor net buying in a manner similar to Irvine et al. (2007, Table 4), which is similar to the measure used in Griffin et al. (2003). Abnormal institutional investor net buying for each firm, which we will refer to here as AIB_t , is calculated at the conference call-firm level by first taking the net trading imbalance scaled by shares outstanding for the given day t :

$$R_t = \frac{\text{Total Institutional Buys}_t - \text{Total Institutional Sells}_t}{\text{Shares Outstanding (in 1,000s)}_t}$$

We then subtract the average daily net trading imbalance for that firm over the control period of (-60, -20 day) and (+20, +60 day). As an example, the calculation for day zero *Abnormal Institutional Investor Net Buying* for a given firm is as follows:

²⁴ This database contains all trades executed by Abel Noser Ltd.'s large institutional investor clients. Their clients include, but are not limited to, hedge funds, public and private pension funds, and mutual funds. The data contains all open market trades made by their clients. During the period of 1999 to 2005, this data captures approximately 8% of all CRSP trading volume (Puckett and Yan 2011); its coverage is even greater from 2006-2008, the remaining years of our sample. The Data Appendix in Puckett and Yan (2011) describes the data in further detail.

$$AIB_0 = R_0 - \frac{1}{\text{Number of trading days in } (-20, -60) \text{ and } (20, 60)} \left(\sum_{i=-60}^{-20} R_i + \sum_{i=20}^{60} R_i \right)$$

We look at trading days $t = 0, 1, 2, 3,$ and 4 .²⁵ Similar to returns, the reasoning for using these days is that if information released by management in the conference call is acted on that day itself, but analysts take some time to consolidate and communicate their emerging beliefs to private clients, eliminating day 0 from the return window would further distinguish the analyst belief effect from the information disclosure effect.

2.3 Control Variables

We employ several control variables, all of which are described in Appendix C. We have taken care to ensure that our descriptive statistics in Table 1 match prior studies.

Our first set of control variables pertains to information released by the firm. Our logic is that trading beneficiaries of analyst beliefs are not the only vehicle through which information enters prices; other traders may directly interpret and trade on the firm's disclosures. We control for this possibility using both qualitative and quantitative measures of the conference call disclosures and several measures of firm characteristics:

Concurrent Management Tone Measures: We use management presentation and discussion tone to proxy for management's views, which may also be highly informative to investors. We calculate presentation tone using only words from the scripted presentation portion of the call, and similarly for the management discussion part. On average, and similar to Matsumoto et al. (2011), managers speak 2,632 words in the discussion portion of the call and 2,721 words in the presentation portion. Our management measure is:

²⁵ We keep the control trading periods (-60, -20) and (20, 60) fixed.

$$MANAGER\ TONE_i = \frac{CEO_POSITIVE_i + CFO_POSITIVE_i + COO_POSITIVE_i}{CEO_NEGATIVE_i + CFO_NEGATIVE_i + COO_NEGATIVE_i}$$

Call Characteristics: Prior conference call studies like Matsumoto et al. (2011) and Li et al. (2012) find that call length and management communication patterns are associated with firm performance and firm value, respectively. We therefore control for the length of the presentation and the discussion.

Prior Firm Performance: We control for financial disclosures by including indicators for whether the firm met the zero, prior quarter, and analyst consensus EPS benchmark. We also include the magnitude of any earnings surprise scaled by price.²⁶ Note that an additional prior performance measure is prior management guidance. We do not include it, because we assume it is impounded in prior analyst forecasts and past returns.

Past Returns Measures: It is common practice in the literature to include pre-returns to control for factors such as momentum.²⁷ We use prior abnormal returns to control for this momentum effect. Our prior abnormal return windows for the (0, +1 day), (0, +2 day), (0, +5 day), (0, +1 month), and (0, +3 month) return windows are (-2, -1 day), (-3, -1 day), (-6, -1 day), (-1 month, -1 day), and (-3 months, -1 day), respectively.

Firm Fixed Effects: We use within firm estimators to control for variation in tone due to unobservable and intangible factors such as analyst-management relationships, manager speaking style, analyst speaking style, and the composition of the listeners. We conjecture that these factors are relatively stable over time. We also control for the year, firm size, and analyst

²⁶ The focus on earnings as the metric of financial information is standard in the empirical information literature for two reasons: first, more disaggregated financial items (such as provisions) may vary in importance across firms; earnings by contrast represent a common and important aggregate performance measure for all firms. Second, there exist well-studied measures of expected earnings, thus allowing one to compute earnings news.

²⁷ For example, Atlinkilic and Hansen (2009) argue that such momentum effects could arise from pre-event news releases.

following; and regressions are two-tailed with standard errors clustered by year for our returns tests and by firm for all other tests.

3. Empirical Results

3.1 Analyst Tone as a Measure of Beliefs

The ostensible goal of analysts on the call is to get more information and clarification from management. We conjecture that the tone of analysts' questions, comments, and responses to management replies reveals their beliefs (anyone who has been to an academic seminar has potentially seen audience beliefs reveal themselves in the tone of the audience Q&A). However, since information in our setting does not literally take its analytical representation "firm value + noise" with known mean and variance, no theoretical model can validate that our analyst tone measure reflects beliefs. We must validate our measure empirically. The mean analyst discussion tone in Table 1, Panel A is 1.00, suggesting that analysts utter 1 positive word for each negative word in a conference. This 1:1 mean ratio is consistent with the idea that the average beliefs over many information events in large and deep capital markets should be neutral.

By comparison, the mean manager discussion tone is 1.55, and the mean manager presentation tone is 2.00. The higher mean relative to the analyst tone suggests, as expected, that management is systematically more bullish about the firm's prospects.

The correlation between analyst tone and management presentation tone and management discussion tone is 0.24 and 0.30, respectively, raising the possibility that analysts mimic management tone to some extent (to curry favors, for example). Although we control for the

baseline analyst-management relationship via firm fixed effects, this correlation underscores the importance of controlling for management tone, which we do additionally as well.

To further show that our measure captures the belief component of the analyst conversation, we conduct a series of tests. First, since the ostensible goal of the analyst Q&A is to gain information from the management, we extract the information component of the analyst conversation by using the Matsumoto et al. (2011) financial dictionary. The two components of the analyst conversation are weakly correlated at -0.03 in Table 1, Panel C, suggesting that the analyst belief formation is a distinct process.

We then examine the covariation of our analyst tone measure with other performance measures, to better assess its construct validity. We expect analysts to respond more positively to the conference call if the firm performs better than expected. Table 2 indicates that this is indeed the case. Analyst tone is significantly more positive when the firm's earnings meet any of the three common earnings benchmarks: 1) zero earnings, 2) prior quarter earnings, and 3) the analyst consensus earnings benchmarks (e.g., Burgstahler and Dichev 1997). Note that the specification in Table 2 controls for firm fixed effects; so the analyst tone variation is within-firm, not across-firm. In addition, these results underscore the importance of controlling for these prior performance benchmarks in Table 2.²⁸

We then link our analyst tone measure to future markers of analyst beliefs such as forecasts, price targets, and stock recommendations. As noted in Sections 1 and 2.1 of this study, we do not differentiate across the analysts. Our motive for this choice comes from Mayew et al. (2012), who show that analysts on the conference call are typically superior analysts. The variation in analyst motives, incentives, and talents in this select subsample is therefore likely to

²⁸ We recognize that our subsequent tables use analyst tone as a regressor. We view Table 2 primarily as a confirmatory validity check of the analyst tone measure.

be smaller than the variation in the overall analyst population. In addition, this select subset of analysts is also likely to have a large influence on other analysts, and therefore the consensus forecasts and other analyst outputs (Hong et al. 2000; Clement et al. 2005).

Table 3 examines how the analyst tone measure affects the percent change in consensus analyst EPS forecast, the percent change in consensus price target, and the change in consensus stock recommendation level, all from day 0 to +60 relative to the conference call date. We include a rich set of controls as the returns tests (including firm fixed effects). We expect and find that the coefficient on analyst tone is positive and significant at the 1% level for EPS forecasts and price targets (0.095 and 0.030, respectively). That is, a one standard deviation increase in analyst tone increases the consensus EPS forecast for the next quarter by 4.6% and the price target by 1.4%. The sign on analyst tone for the reverse recommendation score is negative, as expected, and increases the favorableness of the consensus stock recommendation level by 0.013.²⁹ Our analyst belief measure thus presages future (and more commonly used) markers of analyst beliefs. These findings indicate that our analyst tone measure indeed proxies for analyst beliefs, and that too in a timely manner.

3.2 Analyst Tone and Future Stock Returns

Table 4 describes the results of our regressions of abnormal returns on analyst tone and control variables (including firm fixed effects). Our dependent variables are cumulative abnormal returns for return windows of (0, +1 day), (0, +2 day), (0, +5 day), (0, +1 month), (0, +3 month), (+1, +2 day), and (+1, +5 day).³⁰ Note that the regression has several control

²⁹ Recommendations are on a scale of 1 to 5 where 1 represents strong buy and 5 represents sell. Thus the expected sign is negative.

³⁰ As stated in Sections 1 and 2.2, our position is that analyst tone is not immediately actionable (unlike a fully formed analyst recommendation); we therefore do not conduct minute by minute returns tests (e.g., Bradley et al.

variables for other information factors, which we will discuss shortly; for now, we focus on our belief formation measure's effect on price movements.

The coefficient for analyst tone is statistically significant at the 1% level with a coefficient near positive 0.02 for all return windows. The significance over the longer windows (0, +1 month), (0, + 3 month) suggests that the belief that gets impounded into the stock price is not transient but a long-lived one that changes the valuation of the firm for a relatively long duration. Analyst beliefs thus appear to be getting priced persistently and in a timely manner, complementing studies such as Irvine et al. (2007), who argue, albeit based on more indirect evidence, that analyst beliefs reach prices in advance of public analyst outputs such as recommendations. Our findings thus attest to the importance of measuring beliefs in a timely manner if one wants to capture the price impact of analyst activity.

The coefficients for analyst tone in Table 4 suggest an economic impact of +0.8 percent point abnormal return over the (0, +1 day) period for a one standard deviation increase in analyst tone. This magnitude is smaller but still comparable to prior studies. Mayew and Venkatachalam (2012) find that a standard deviation increase in their positive and negative vocal cue measures are associated with a market reaction of positive 1.3% and negative 4.5%, respectively. Brav and Lehavy (2003) find average market reactions between negative 3.96% and positive 3.21% points when analysts adjust their price targets. Finally, note that due to the presence of firm fixed effects, our analyst tone coefficient is capturing more of the within-firm variation, rather than across-firm variation. This property further strengthens our above inference on the analyst tone coefficient.

2013), but use the more plausible window of a day. Also see Section 3.4, where we show that the trading duration of institutional investors is consistent with the lengths of our returns windows.

Information released by management in the conference call will to a certain extent be analyzed and priced on that day itself (due to actions of some traders). But there could be price movements on subsequent days as well, because sophisticated capital market participants such as analysts will need some time to translate their emerging beliefs into actionable recommendations and then inform their private clients, whose trades would then move prices. Eliminating day 0 from the returns window would therefore further distinguish the analyst belief effect from the information disclosure effect.

This is exactly what we find in the last two columns in Table 4, where we drop day 0 from the 2-day and the 5-day returns windows. The results obtain significantly in both windows. Turning to magnitudes, the coefficient on the analyst tone drops in magnitude by about 50 percent in the (+1, +2 day) window. The earnings surprise coefficient, a proxy for the information disclosure effect, on the other hand drops to about a third of its original value, suggesting that traders have impounded two-thirds of the quantitative information into prices on day 0. But the analyst belief effect continues to exist strongly, suggesting, at least indirectly, that the trading beneficiaries of analyst beliefs are active on day 1. In Section 3.4, we *directly* test this assumption by examining institutional trades on successive days after the conference call.

We next turn to the information released by management. We first discuss qualitative measures of information. We control for several aspects of the call such as words spoken by management as well as management tone. The management tone variables, both in the presentation in the discussion, are highly significant, attesting to the information disclosure content of earnings conference calls. However, their economic magnitudes are smaller and do not persist over the longer return windows, with a one standard deviation increase in manager presentation tone corresponding to positive 0.5% point abnormal returns for the (0, +2 day)

window. At least from a tone perspective, managers appear to be less influential than analysts. This makes perfect sense if the qualitative or contextual information released by management does not literally take the easily Bayesian-updatable “firm value + noise” analytical representation, but needs sophisticated traders or intermediaries such as analysts to do the Bayesian update.³¹

It is instructive to compare our results to Matsumoto et al. (2011). They show that stock prices move more during the discussion period compared to the management presentation period. We affirm and build on their findings in a directional manner, by showing that analyst tone is a directionally better predictor of price movements compared to management tone, for reasons stated in the previous paragraph.

We also include key measures of financial information disclosures, which behave as expected (also note that these financial measures have clearer links to firm value). The two salient and significant control variables are a) an indicator variable denoting whether the firm met the analyst benchmark and b) the magnitude of the earnings surprise. Both factors have a significant positive effect on stock price, as expected. The inclusion of these financial factors further distinguishes our analyst beliefs effect from the information disclosure effect. In addition, the presence of control variables such as past returns suggests that our results are not an artifact of momentum or other factors such as pre-conference call news releases. These results thus attest to the importance of measuring in real time the receiver’s beliefs separately from the sender’s information. The results also show that the mechanics of textual analysis, which has been primarily used to measure information, can be extended to measure theoretically important factors such as beliefs.

³¹ Lehavy et al. (2011) make a similar point in the context of analyst reports.

Having demonstrated a strong link between our analyst tone measures and price movements, we next delve deeper into demonstrating plausible mechanisms on the revealed preference path from belief formation to prices.

3.3 Comparative Statics

Our fundamental assumption is that the analyst tone measure captures emerging analyst beliefs in response to information released by managers in earnings conference calls. Analysts subsequently update their clients through phone calls or other means (Maber et al. 2013). While we cannot directly observe these analyst activities without access to proprietary data, we can make testable conjectures as to when these activities should have a larger impact on price.

Our first testable conjecture is that firms with higher institutional holdings should respond more to analyst outputs, because these shareholders are natural clients for analysts. Table 5, Panel A presents the results of this conjecture. We include the main effects as well as all the controls, including firm fixed effects. The interaction term for institutional ownership is positive (+0.014) and statistically significant at the 1% level, thus supporting our conjecture. These results continue to hold with a longer return duration of (0, +2 day) in Table 5, Panel B. We build on this test further in Section 3.4.

The above information intermediary role of analysts is static: it depends on the firm's environment and not on the actual information being released. However, theory suggests that new information is a key triggering factor for beliefs, because such revisions are possible only when new information is released. Our setting allows us to test such information dynamics explicitly.

One of the key measures of interest in the earnings conference call is the reported earnings. We can thus use the surprise in the reported earnings (relative to consensus analyst earnings benchmark) as a measure of new information released in the conference call. Following Frankel et al. (2006), we conjecture that analysts are more likely to be a critical information intermediary when more new information is released. In Table 5, Panel A we therefore interact analyst tone with the earnings surprise. The interaction term is positive (+1.381) and significant at the 1% level. A similar result obtains for the longer returns duration in Table 5, Panel B. In addition, the last specification in Table 5, Panels A and B shows that both the static and the dynamic interaction effects obtain concurrently.

In sum, the above comparative statics tests point to timely measures of analyst beliefs, and not the firm's information disclosure, as the key economic force behind our results. We next provide even more direct evidence that institutional investors trade in accordance with analyst beliefs. We will see that this trading evidence further validates our choice of returns windows.

3.4 Institutional Investor Trading

While it is always possible that some astute outside trader observes the analyst tone and trades on it, the more likely channel are traders who act on analyst beliefs are analysts' clients, i.e., institutional traders (Mikhail et al. 2007; Irvine et al. 2007). We use institutional investor trading activity (tracked by Abel Noser) to test our conjecture that analysts communicate their beliefs to their institutional investor clients.³² We use our abnormal institutional investor net buying measure in Section 2.2 for trading days 0, 1, 2, 3, and 4, and regress this measure on analyst beliefs and controls.

³² Section 2.2 discusses the representativeness of the Abel Noser institutional investor subset as a proxy for analyst clients.

Table 6 presents the results. For days 0 and 1, we find a positive and statistically significant relationship between elevated abnormal buying and analyst tone. The results are also economically significant. A one standard deviation increase in analyst tone is associated with a 0.006% point increase in abnormal institutional investor net buying on day 0 (the % now is the percent of the actual number of shares outstanding), and is statistically significant at the 5% level; the effect on day +1 almost *doubles* to 0.012%, and is statistically significant at the 1% level. The magnitude of these effects is similar to those in Table 4 of Irvine et al (2007). They find elevated abnormal buying increases of 0.01% to 0.019% during the days leading up to analyst coverage initiations, suggesting that analysts tip institutional investors ahead of releasing their reports. Our results are also similar to Griffin et al. (2003). In Table 3 of their paper they repeatedly find trading imbalances near 0.01% around their returns events.³³ The comparability of results across our study and these studies provides further assurance that we are using an appropriate institutional trading measure.

Interestingly, days 2, 3, and 4 in Table 6 show no significant relationship between abnormal institutional buying and analyst tone. The analyst appears to be consolidating her initial belief formation into an actionable strategy and privately communicating it to her clients within 48 hours.³⁴ The *especially* active institutional trading on day +1 is crucial to the duration of our returns windows as well: it further validates our choice to use days instead of minutes. Minutes as the returns duration seem more appropriate for immediately actionable public analyst outputs such as recommendations (e.g., Bradley et al. 2013).

³³ Griffin et al. (2003) do not use the same type of control approach but ultimately calculate their trade imbalance measure the same way we do here.

³⁴ See Maber et al. (2013) for proprietary evidence on the nature of these private phone calls and other communications.

Our results complement Irvine et al. (2007), who conclude from institutional trading in *advance* of public information release that analysts are privately informing institutional investors. We, on the other hand, directly capture analyst beliefs *prior* to institutional trading. Our results thus demonstrate the relevance of timely measures of analyst beliefs to the ongoing research debate on whether analysts are critical information intermediaries in capital markets.³⁵

Table 6 also indicates that past stock returns also have a strong effect on institutional trading on days 0 and 1, consistent with the momentum effect (Griffin et al. 2003; Sias et al. 2006). More generally, the strong result on days 0 and 1 also speak to a well-researched question on the information source of institutional investors (e.g., Sias et al. 2006; Bushee and Goodman 2007). Many of these studies have had to infer the informational advantage of these investors indirectly through ownership and stock price changes (see Bushee and Goodman 2007 Section 1). Our contribution, along the lines of Irvine et al. (2007), is to showcase a specific channel of this information advantage, namely early access to beliefs of analysts.

In sum, we have linked our analyst belief formation to price movements and also to trades by a subset of institutional investors. Our maintained assumption that ties all the results together is that the price impact of analyst beliefs is occurring through the trades of analysts' institutional clients, a subset of whom we hope to have captured in the Abel Noser dataset. Of course, what we mean by the price impact of analyst beliefs is the association of our tone measure with price, after controlling for the direct effect of information disclosures on price. In this regard, we cannot help but note the pronounced difference between Table 4 and Table 6 on the incremental impact of the information disclosure regressors. These disclosures are incrementally significant in the returns regressions of Table 4, suggesting that they do move prices. But prices typically do not move without trades, and yet, the Abel Noser class of

³⁵ See Bradshaw's (2012) survey of analyst research and our footnote 3.

institutional investors does not appear to be incrementally responding to these information disclosures in Table 5. We therefore re-estimate Table 6 without the analyst tone measure, but the information disclosure regressors are still insignificant.³⁶ Our conjecture is that our Abel Noser subset of investors is not responding to the information in the way we have represented it through our information measures. Clearly, as Table 3 shows, this information is strongly related to returns, suggesting that *some* other traders in the markets are responding to this information representation in a manner that moves prices.

Our overall interpretation therefore is that what matters for the Abel Noser subset of investors is not information per se, but the resulting beliefs about firm value, a significant aspect of which is captured by our analyst tone construct. This interpretation, which is further justified by our Table 2 results linking analyst tone to information disclosures, only serves to underscore the importance of beliefs in the revealed preference path from information to trading. By measuring these beliefs in a timely manner, we are able to validate this theoretically important step in the decision-making process. In doing so, we also show that the methodology of textual analysis, which prior studies have largely used to extract the sender's information, can also be used to extract the receiver's beliefs in a timely manner.

4. Conclusion

In models of capital markets, beliefs of capital market participants are the main mechanism through which information gets incorporated into trading and price (e.g., Grossman 1976). Because the belief formation process is so obvious and effortless in theory, the empirical literature for most part does not explicitly reconstruct the beliefs, but asserts, based on theory,

³⁶ To give a further belief context to the information disclosures, we interact the earnings surprise with the analyst tone regressor in Table 6. We find that earnings surprise does not significantly modulate the association between analyst beliefs and institutional trading.

that these beliefs must be the factor linking “new” information to trading activities and price changes (e.g., Fama, Fisher, Jensen and Roll 1969). But the reality is that neither information nor the human belief formation processes take the representations given to them by theory (e.g., information rarely literally takes the theoretical representation “firm value + noise” with known mean and variance). As a result, many of the information-returns tests produce results such as “underreaction” or “overreaction,” which fundamentally are statements on the belief formation process of capital market participants. Such receiver beliefs also become critical when the sender transmits his information with bias or deception. This study therefore explicitly separates the real time measurement of the belief of the receiver (i.e., the analyst) from the message of the sender (i.e., the management)

Our setting is earnings conference calls, where we can measure analyst beliefs based on the tone of their questions and comments in a timely manner potentially before these beliefs enter prices and trades (which we estimate takes 24 to 48 hours). Our results indicate that beliefs of sophisticated information intermediaries are an important step in the path from information disclosure to trading and prices in real financial markets.

Our study makes both research and policy contributions. Much of the textual/speech analysis studies view the text as a source of information. Some text is indeed information, but other text reflects in real time the belief formation of persons receiving the information. And in our setting, it is the latter kind of text that has a stronger direct impact on trading and prices. Understanding this dual role of text is not just consistent with theory, but also relevant to regulatory bodies such as FINRA, whose dual mandate is both to monitor firms, and to educate investors on their belief formation processes.

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APPENDIX A

Institutional Traders' Private Calls to Analysts

[Our sample predates analyst banks' settlements on selective disclosure (Henning 2013)]

**COMMONWEALTH OF MASSACHUSETTS
OFFICE OF THE SECRETARY OF THE COMMONWEALTH
SECURITIES DIVISION
ONE ASHBURTON PLACE, ROOM 1701
BOSTON, MASSACHUSETTS 02108**

IN THE MATTER OF:

CITIGROUP GLOBAL MARKETS INC.

Respondent.

Docket No. 2013-0014

SECURITIES DIVISION

2013 OCT -2 PM 4:57

SECRETARY OF THE
COMMONWEALTH

**E. DISTRIBUTION OF CONFIDENTIAL NONPUBLIC RESEARCH
INFORMATION ON DECEMBER 13, 2012**

56. In response to client inquiries following the publication of the Macquarie December 13 Hon Hai Research Report, on December 13, 2012, Kevin Chang forwarded previews of his unpublished research views on Hon Hai to certain of CGMI's large hedge funds and institutional clients. Each of the emails described in this section containing unpublished previews of confidential research information was sent prior to the publication of Kevin Chang's December 14 Hon Hai Research Report.

**a) Kevin Chang Disclosed Confidential Nonpublic Research Information to SAC Capital
*First Recipient of Unpublished Research***

57. A SAC Capital employee contacted a CGMI employee of Citi Equities, asking "can u send me everything u have on the entire iphone 4/4s/5 supply chain?" (Emphasis added.)

58. Within minutes, the Citi Equities employee forwarded the request to two CGMI employees in CIR, directing them to comply with SAC Capital's requests: "Not sure who's world this is in, but can you please send directly to [employee for SAC Capital]? . . . **He needs it asap - works directly for [SAC Capital].**" (Emphasis added).

...

b) Kevin Chang Disclosed Confidential Nonpublic Research Information to Citadel

70. In addition to the above, on December 13, 2012, Kevin Chang replied via email to two (2) Citadel employees delivering his New Forecast, unpublished research and detailed explanations regarding the new Apple iPhone production forecasts.

...

d) Kevin Chang Disclosed Confidential Nonpublic Research Information to T. Rowe Price

75. On December 13, 2012, Kevin Chang replied via email to a T. Rowe Price employee delivering his New Forecast, unpublished research and detailed explanations regarding the new Apple iPhone production forecasts.

76. In reply to the New Forecast email sent to T. Rowe Price, the T. Rowe Price employee shared with Kevin Chang that **“We still own lots of Apple, despite of [sic] profit-taking earlier.”** (Emphasis added).

...

H. TRADING BY RECIPIENTS OF CONFIDENTIAL NONPUBLIC RESEARCH INFORMATION

100. The Division alleges that SAC Capital, Citadel, and T.Rowe Price executed sales of Apple stock on December 13 and 14, 2012.

101. Between 9:00 AM EST December 13 and end of business (adjusted for dividends and splits) on December 14 the price of Apple stock dropped approximately 5.2%, from \$531.15 to \$503.50.

102. Because the December 16 Apple Research Report was published on a Sunday, customers could not act on the information contained therein until trading began on the following day, on Monday, December 17, 2012.

APPENDIX B

Sample of Analyst Comments for a Sample of Conference Calls from 2002-2008

Analyst Comment	Call	Positive Words	Negative Words
<i>"Al, you've done a great job of positioning the company to the future in terms of external changes...Take us through your growth parameters, growth focus; what do you think you can do?"</i>	H.B. Fuller Company, Sept. 24, 2003	1	0
<i>"We're all concerned about a price war out here. If I do the math on the full year revenue guidance it sounds like you guys are expecting about 15% sequential growth in Q3 and Q4."</i>	Intel, April 19, 2006	0	1

APPENDIX C

Variable Definitions for a Sample of Conference Calls from 2002-2008

Variable	Definition
<i>Discussion Analyst Tone</i>	Measure of analyst tone used; calculated by (count of analyst positive words / count of analyst negative words)
<i>Discussion Manager Tone</i>	Measure of manager tone used; calculated in the same way as analyst tone but using sum of manager word counts
<i>Presentation Tone</i>	Measure of presentation tone used; calculated in the same way as analyst tone but using sum of manager word counts
<i>Analyst Financially Oriented Sentences</i>	Financially oriented sentences said by analysts using Matsumoto et al. (2011) dictionary
<i>Manager Financially Oriented Sentences</i>	Financially oriented sentences said by managers using Matsumoto et al. (2011) dictionary
<i>Meet Analyst Forecast Indicator</i>	1 if actual earnings is greater than or equal to consensus mean analyst EPS estimate in I/B/E/S, 0 else
<i>Meet Prior Quarter Earnings Indicator</i>	1 if actual earnings is greater than or equal to prior quarter's earnings in I/B/E/S, 0 else
<i>Meet Zero Earnings Indicator</i>	1 if actual earnings is greater than or equal to zero in I/B/E/S, 0 else
<i>Number of Analyst Forecasts</i>	Number of analyst estimates for a given period from I/B/E/S
<i>Earnings Surprise</i>	$((\text{Actual EPS} - \text{Mean Consensus Analyst Forecast EPS}) / \text{Stock Price})$ from I/B/E/S
<i>Log of Total Words Spoken by Analysts during Discussion</i>	Log of total words spoken by analyst during conference call
<i>Log of Total Words Spoken by Managers during Discussion</i>	Log of total words spoken by managers during question and answer portion of call
<i>Log of Total Words Spoken by Managers during Presentation</i>	Log of total words spoken by managers during presentation portion of call
<i>Institutional Ownership</i>	Percentage of shares held by institutions (in decimals) from the Thomson Reuters 13F Filing Database
<i>%Δ in Analyst Consensus EPS Forecast</i>	$(\text{Consensus mean EPS forecast for subsequent quarter at day +60} - \text{Consensus mean EPS forecast for current quarter at day 0}) / \text{Absolute value of consensus mean EPS forecast for current quarter at day 0})$
<i>%Δ in Analyst Consensus Price Target</i>	$(\text{Consensus mean price target at day +60} - \text{Consensus mean price target at day 0}) / \text{Consensus mean price target at day 0})$
<i>Δ in Analyst Consensus Recommendation Level</i>	$(\text{Consensus mean recommendation at day +60} - \text{Consensus mean recommendation at day 0})$
<i>Abnormal Institutional Investor Net Buying</i>	Abnormal daily net institutional buys scaled by shares outstanding (in 1,000s). See Section 2.2 for details.
<i>CAR Variables</i>	Cumulative abnormal returns (in decimals) calculated using a firm-specific market-model beta with a one year estimation period
<i>Stock Momentum</i>	Cumulative abnormal returns (in decimals) for the return window of the same length as the dependent variable but prior to the conference call, with an additional (-1 day) adjustment.

TABLE 1

Panel A: Descriptive Statistics for a Sample of Conference Calls from 2002-2008

Var. #	Variable	n	Mean	S.D.	Min	25th %	Median	75th %	Max
[1]	<i>Discussion Analyst Tone</i> #	18,814	1.000	0.480	0.200	0.660	0.910	1.250	2.500
[2]	<i>Discussion Manager Tone</i> #	18,814	1.550	0.910	0.308	1.000	1.370	1.890	4.789
[3]	<i>Presentation Tone</i> #	18,814	2.000	1.200	0.688	1.210	1.720	2.450	6.087
[4]	<i>Analyst Financially Oriented Sentences</i> #	18,814	0.020	0.010	0.000	0.020	0.020	0.030	0.100
[5]	<i>Manager Financially Oriented Sentences</i> #	18,814	0.020	0.010	0.000	0.010	0.020	0.020	0.140
[6]	<i>Meet Analyst Forecast Indicator</i>	18,814	0.750	0.430	0.000	0.000	1.000	1.000	1.000
[7]	<i>Meet Prior Quarter Earnings Indicator</i>	18,814	0.610	0.490	0.000	0.000	1.000	1.000	1.000
[8]	<i>Meet Zero Earnings Indicator</i>	18,814	0.920	0.270	0.000	1.000	1.000	1.000	1.000
[9]	<i>Earnings Surprise</i>	18,814	0.0003	0.0054	-0.0400	-0.0001	0.0004	0.0016	0.0200
[10]	<i>Log of Total Assets</i>	18,814	7.820	1.690	2.910	6.600	7.640	8.900	14.370
[11]	<i>Number of Analyst Forecasts</i>	18,814	10.400	6.680	1.000	5.000	9.000	14.000	44.000
[12]	<i>Log of Total Words Spoken by Analysts during Discussion</i> #	18,814	7.110	0.520	2.640	6.860	7.180	7.450	8.850
[13]	<i>Log of Total Words Spoken by Managers during Discussion</i> #	18,814	7.800	0.610	2.200	7.530	7.910	8.190	9.630
[14]	<i>Log of Total Words Spoken by Managers during Presentation</i> #	18,814	7.850	0.400	5.770	7.610	7.900	8.120	9.210
[15]	<i>Institutional Ownership</i>	18,814	0.150	0.140	0.000	0.000	0.030	0.400	1.000
[16]	<i>%Δ in Analyst Consensus EPS Forecast</i> #	18,407	0.100	0.283	-2.505	-0.110	0.050	0.260	2.925
[17]	<i>%Δ in Analyst Consensus Price Target</i> #	16,413	0.020	0.160	-0.990	-0.050	0.020	0.090	4.000
[18]	<i>Δ in Analyst Consensus Recommendation Level</i>	13,337	0.010	0.850	-4.000	-0.500	0.000	0.500	4.000
[19]	<i>Abnormal Institutional Investor Net Buying Day 0</i> #	18,814	-0.100	2.950	-5.029	-0.820	-0.010	0.740	4.464
[20]	<i>Abnormal Institutional Investor Net Buying Day 1</i> #	18,814	0.000	2.970	-4.705	-0.720	0.010	0.790	4.906
[21]	<i>Abnormal Institutional Investor Net Buying Day 2</i> #	18,814	0.000	1.650	-3.174	-0.640	0.010	0.600	2.354
[22]	<i>Abnormal Institutional Investor Net Buying Day 3</i> #	18,814	-0.010	1.500	-2.907	-0.550	0.000	0.560	2.441
[23]	<i>Abnormal Institutional Investor Net Buying Day 4</i> #	18,814	-0.010	0.900	-2.790	-0.530	0.010	0.550	2.361
[24]	<i>(0, +1 Day) CAR</i>	18,814	0.000	0.070	-0.790	-0.030	0.000	0.040	1.000
[25]	<i>(0, +2 Day) CAR</i>	18,814	0.000	0.080	-0.790	-0.030	0.000	0.040	0.800
[26]	<i>(0, +5 Day) CAR</i>	18,814	0.000	0.090	-0.790	-0.040	0.010	0.050	0.920
[27]	<i>(0, +1 Month) CAR</i>	18,814	0.010	0.120	-1.000	-0.050	0.010	0.070	1.260
[28]	<i>(0, +3 Month) CAR</i>	18,814	0.010	0.200	-1.000	-0.090	0.010	0.120	1.900
[29]	<i>(+1, +2 Day) CAR</i>	18,814	0.000	0.060	-0.730	-0.020	0.000	0.020	0.550
[30]	<i>(+1, +5 Day) CAR</i>	18,814	0.000	0.070	-0.730	-0.030	0.000	0.030	0.680

Winsorized at the 1% and 99% level. Our results, including our returns tests, are not sensitive to the winsorization procedure.

TABLE 1 - Continued

Panel C: Pearson Correlations for Tone and Information Content Sentences for a Sample of Conference Calls from 2002-2008

Variable	[1]	[2]	[3]	[4]	[5]
[1] <i>Discussion Analyst Tone</i>	1.00				
[2] <i>Discussion Manager Tone</i>	0.29	1.00			
[3] <i>Presentation Tone</i>	0.23	0.35	1.00		
[4] <i>Analyst Financially Oriented Sentences</i>	-0.03	-0.02	-0.04	1.00	
[5] <i>Manager Financially Oriented Sentences</i>	-0.02	-0.03	-0.02	0.56	1.00

This table shows that our belief revision measure is distinct from information related measures examined in other studies (e.g., Matsumoto et al. 2011). Variables are defined in Appendix C.

TABLE 1 - Continued*Panel D: Sample Breakdown by Industry and Year for a Sample of Conference Calls from 2002-2008*

2-DIGIT SIC	INDUSTRY	2002	2003	2004	2005	2006	2007	2008	Total
1-9	Agriculture, Forestry, And Fishing	46	162	77	91	90	102	33	601
10-14	Mining	19	94	133	137	169	185	49	786
15-17	Construction	9	29	55	59	64	79	21	316
20-39	Manufacturing	249	920	1,228	1,403	1,565	1,702	534	7,601
40-49	Transportation, Communications, Electric, Gas, And Sanitary Services	36	177	242	296	360	413	112	1,636
50-51	Wholesale Trade	17	64	102	108	135	159	43	628
52-59	Retail Trade	39	194	296	317	334	393	137	1,710
60-67	Finance, Insurance, And Real Estate	34	170	405	466	534	625	172	2,406
70-89	Services	135	390	544	568	630	645	180	3,092
91-99	Public Administration	1	9	8	6	5	8	1	38
Total		585	2,209	3,090	3,451	3,886	4,311	1,282	18,814

TABLE 2*Covariates of Analyst Tone for a Sample of Conference Calls from 2002-2008*

Variable	(1) Analyst Tone
Meet Analyst Forecast Indicator	0.114*** (12.29)
Meet Prior Quarter Earnings Indicator	0.038*** (5.35)
Meet Zero Earnings Indicator	0.057*** (3.25)
Earnings Surprise	1.945** (2.26)
Log of Total Assets	-0.015 (-0.80)
Analyst Following	0.001 (0.36)
Log of Total Words Spoken by Analysts during Discussion	-0.078*** (-6.09)
Log of Total Words Spoken by Managers during Discussion	-0.018** (-2.09)
Log of Total Words Spoken by Managers during Presentation	-0.052*** (-3.56)
Firm FE	Y
Year FE	Y
Observations	18,814
Adjusted R-squared	0.205

*** p < 0.01, ** p < 0.05, * p < 0.1. T-statistics are in parentheses and standard errors are clustered by firm. Variables are defined in Appendix C.

TABLE 3*Regressions of Future Changes in Other Analyst Outputs on Analyst Tone for a Sample of Conference Calls from 2002-2008*

Variable	(1)	(2)	(3)
	% Δ in Analyst Consensus EPS Forecast	% Δ in Analyst Consensus Price Target	Δ in Analyst Consensus Recommendation Level
Discussion Analyst Tone	0.095*** (3.47)	0.030*** (10.76)	-0.028* (-1.75)
Discussion Manager Tone	0.040** (2.16)	0.005*** (2.92)	0.012 (1.36)
Presentation Tone	0.025** (2.18)	0.010*** (7.68)	-0.007 (-1.28)
Meet Analyst Forecast Indicator	0.103*** (3.50)	0.035*** (11.00)	0.028 (1.41)
Meet Prior Quarter Earnings Indicator	-0.315*** (-10.10)	0.009*** (3.51)	0.007 (0.47)
Meet Zero Earnings Indicator	-1.068*** (-7.43)	-0.032*** (-4.04)	0.046 (1.50)
Earnings Surprise	42.354*** (10.32)	3.669*** (8.38)	-0.358 (-0.19)
Log of Total Assets	-0.096* (-1.80)	-0.036*** (-5.61)	-0.003 (-0.78)
Analyst Following	-0.011** (-2.32)	-0.003*** (-5.32)	-0.001 (-0.84)
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	18,407	16,413	13,337
Adjusted R-squared	0.101	0.136	0.002

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. T-statistics are in parentheses and standard errors are clustered by firm. All changes in future analyst outputs are measured from day 0 to day +60 relative to the conference call. Stock recommendations are on a 1 to 5 scale, 1 being a strong buy, 3 being a hold, and 5 being a sell. Variables are defined in Appendix C. Sample sizes vary depending on availability of data from I/B/E/S.

TABLE 4

Regressions of Abnormal Returns on Analyst Tone for a Sample of Conference Calls from 2002-2008

Variable	(1) (0, +1 Day)	(2) (0, +2 Day)	(3) (0, +5 Day)	(4) (0, +1 Month)	(5) (0, +3 Month)	(6) (+1, +2 Day)	(7) (+1, +5 Day)
Discussion Analyst Tone	0.016*** (7.08)	0.018*** (7.11)	0.018*** (6.70)	0.019*** (5.90)	0.017** (2.89)	0.008*** (4.22)	0.008*** (3.84)
Discussion Manager Tone	0.002** (3.11)	0.001* (2.09)	0.002** (2.81)	0.003* (2.13)	0.002 (1.01)	0.000 (0.19)	0.001 (1.14)
Presentation Tone	0.004*** (13.08)	0.004*** (11.22)	0.003*** (9.38)	0.002 (1.67)	-0.003 (-1.02)	0.002*** (8.37)	0.001** (3.36)
Meet Analyst Forecast Indicator	0.032*** (9.87)	0.033*** (10.00)	0.033*** (9.17)	0.028*** (5.58)	0.027*** (5.35)	0.011*** (6.18)	0.012*** (5.42)
Meet Prior Quarter Earnings Indicator	0.009*** (7.59)	0.010*** (6.95)	0.012*** (8.34)	0.011*** (3.85)	0.007 (1.62)	0.006*** (6.66)	0.008*** (7.29)
Meet Zero Earnings Indicator	-0.021** (-3.33)	-0.021** (-2.68)	-0.025** (-3.10)	-0.037** (-3.16)	-0.079*** (-4.19)	-0.010* (-2.34)	-0.013** (-2.77)
Earnings Surprise	2.258*** (7.41)	2.489*** (8.15)	2.650*** (9.26)	3.085*** (7.09)	2.134** (3.16)	1.003*** (6.29)	1.162*** (7.45)
Log of Total Assets	-0.008** (-2.77)	-0.010** (-2.59)	-0.009 (-1.75)	-0.011 (-1.35)	-0.025 (-1.01)	-0.004 (-1.11)	-0.003 (-0.73)
Analyst Following	-0.001** (-3.48)	-0.001*** (-4.64)	-0.001** (-3.42)	-0.001** (-2.37)	-0.002*** (-4.75)	-0.001** (-3.40)	-0.001** (-3.02)
Log of Total Words Spoken by Analysts during Discussion	0.001 (0.35)	0.000 (0.16)	-0.001 (-0.17)	0.002 (0.85)	0.004 (0.79)	0.001 (0.68)	0.000 (0.18)
Log of Total Words Spoken by Managers during Discussion	-0.003 (-1.68)	-0.003 (-1.65)	-0.001 (-0.72)	-0.001 (-0.63)	0.001 (0.44)	-0.001 (-0.73)	0.000 (0.29)
Log of Total Words Spoken by Managers during Presentation	0.005 (1.62)	0.005 (1.32)	0.007 (1.22)	0.009 (1.14)	0.014 (1.10)	0.002 (0.81)	0.004 (0.88)
Stock Momentum	-0.210*** (-12.04)	-0.197*** (-16.02)	-0.093*** (-6.31)	0.052** (2.64)	0.103*** (3.85)	-0.053*** (-3.76)	0.007 (0.51)
Firm FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Observations	18,814	18,814	18,814	18,814	18,814	18,814	18,814
Adjusted R-squared	0.131	0.129	0.105	0.049	0.023	0.036	0.030

*** p < 0.01, ** p < 0.05, * p < 0.1. T-statistics are in parentheses and standard errors are clustered by year. Day 0 is conference call date. The 3 month time window ends the day before the earnings announcement date of the subsequent quarter. All earnings announcements coincide with the conference call date in our sample. Variables are defined in Appendix C.

TABLE 5*Panel A: Comparative Statics for (0, +1 Day) Returns Tests for a Sample of Conference Calls from 2002-2008*

Variable	(1) (0, +1 Day) CAR	(2) (0, +1 Day) CAR	(3) (0, +1 Day) CAR
Discussion Analyst Tone	0.007** (3.36)	0.015*** (6.83)	0.006** (2.81)
Institutional Ownership	-0.032** (-2.55)		-0.032** (-2.53)
Discussion Analyst Tone * Institutional Ownership	0.014*** (3.44)		0.014** (3.25)
Earnings Surprise		1.180** (2.50)	1.159** (2.51)
Discussion Analyst Tone * Earnings Surprise		1.381*** (3.69)	1.385*** (3.69)
Controls from Table 4	Y	Y	Y
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	18,814	18,814	18,814
Adjusted R-squared	0.133	0.133	0.134

*** p < 0.01, ** p < 0.05, * p < 0.1. T-statistics are in parentheses and standard errors are clustered by year. Day 0 is conference call date. In these regressions we include all control variables that appear in the regressions in Table 4 but do not tabulate their coefficients. Variables are defined in Appendix C.

TABLE 5*Panel B: Comparative Statics for (0, +2 Day) Returns Tests for a Sample of Conference Calls from 2002-2008*

Variable	(1) (0, +2 Day) CAR	(2) (0, +2 Day) CAR	(3) (0, +2 Day) CAR
Discussion Analyst Tone	0.008** (3.38)	0.017*** (6.94)	0.007** (2.83)
Institutional Ownership	-0.037** (-2.44)		-0.037** (-2.42)
Discussion Analyst Tone * Institutional Ownership	0.015** (3.49)		0.015** (3.31)
Earnings Surprise		1.393** (2.54)	1.368** (2.55)
Discussion Analyst Tone * Earnings Surprise		1.403** (3.22)	1.408** (3.25)
Controls from Table 4	Y	Y	Y
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	18,814	18,814	18,814
Adjusted R-squared	0.130	0.130	0.132

*** p < 0.01, ** p < 0.05, * p < 0.1. T-statistics are in parentheses and standard errors are clustered by year. Day 0 is conference call date. In these regressions we include all control variables that appear in the regressions in Table 4 but do not tabulate their coefficients. Variables are defined in Appendix C.

TABLE 6

Regressions of Elevated Abnormal Institutional Investor Buying on Analyst Tone for a Sample of Conference Calls from 2002-2008

Variable	Abnormal Institutional Investor Net Buying				
	(1) Day 0	(2) Day 1	(3) Day 2	(4) Day 3	(5) Day 4
Discussion Analyst Tone	0.126** (2.18)	0.213*** (2.69)	0.062 (1.33)	0.012 (0.25)	-0.049 (-1.14)
Discussion Manager Tone	0.012 (0.45)	0.004 (0.12)	-0.017 (-0.50)	-0.029 (-1.14)	0.021 (0.91)
Presentation Tone	0.017 (0.70)	0.035 (1.09)	-0.048* (-1.79)	-0.034 (-1.58)	-0.005 (-0.22)
Meet Analyst Forecast Indicator	0.067 (0.85)	0.044 (0.49)	0.029 (0.45)	-0.013 (-0.21)	0.015 (0.28)
Meet Prior Quarter Earnings Indicator	-0.028 (-0.52)	-0.082 (-1.23)	-0.000 (-0.01)	0.003 (0.08)	0.056 (1.49)
Meet Zero Earnings Indicator	-0.039 (-0.27)	0.006 (0.04)	0.059 (0.32)	0.101 (0.61)	-0.058 (-0.55)
Earnings Surprise	7.097 (0.77)	12.176 (1.44)	2.168 (0.23)	5.878 (0.78)	9.966 (1.49)
Log of Total Assets	-0.492* (-1.87)	-0.262* (-1.74)	-0.054 (-0.39)	-0.011 (-0.08)	-0.170 (-1.43)
Analyst Following	-0.018 (-1.32)	-0.025 (-1.49)	0.002 (0.17)	-0.015 (-1.42)	-0.014* (-1.70)
Log of Total Words Spoken by Analysts during Discussion	-0.275** (-2.10)	-0.207** (-2.18)	-0.060 (-0.84)	0.001 (0.02)	-0.099* (-1.86)
Log of Total Words Spoken by Managers during Discussion	0.007 (0.07)	0.078 (0.89)	0.013 (0.21)	-0.048 (-0.76)	0.034 (0.74)
Log of Total Words Spoken by Managers during Presentation	0.056 (0.50)	-0.048 (-0.39)	0.067 (0.66)	-0.002 (-0.03)	-0.110 (-1.30)
Abnormal Return (-5, -1 day)	5.524*** (5.67)	2.339*** (2.89)	0.285 (0.34)	0.589 (0.94)	-0.799 (-1.21)
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Observations	18,814	18,814	18,814	18,814	18,814
Adjusted R-squared	0.045	0.064	0.016	0.015	0.006

*** p < 0.01, ** p < 0.05, * p < 0.1. T-statistics are in parentheses and standard errors are clustered by firm. Day 0 is conference call date. Variables are defined in Appendix C.