THE INFORMATIVENESS OF CONSUMER OPINIONS ON FIRM FUNDAMENTALS:
EVIDENCE FROM AMAZON.COM

By

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Business Administration – Doctor of Philosophy

2019

ABSTRACT

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This study examines whether online consumer product reviews contain information that is associated with firms' earnings and stock returns around earnings announcements. *Ex ante*, it is unclear whether consumer reviews are useful to investors because consumer reviews have not been easily accessible or widely disseminated. Based on 18,794,143 consumer reviews posted on Amazon.com during 1996-2014, I construct quarterly measures of abnormal tone and abnormal rating of consumer reviews and link them to earnings surprises and earnings announcement returns. Focusing on concurrent earnings surprises, I find that negative abnormal tone is significantly associated with more negative earnings surprises while positive abnormal tone is not associated with positive earnings surprises. My analyses of abnormal returns around concurrent earnings announcements show that negative abnormal tone is positively associated with earnings announcement returns, but positive abnormal tone is not. Finally, I find that disagreements in review ratings (measured as the standard deviation of consumer review ratings) are positively associated with unexplained trading volume around earnings announcements, while disagreements in review tone (measured as the standard deviation of consumer review tone) are not. Taken together, these findings suggest that abnormal review tone is more useful than abnormal review rating in explaining concurrent earnings surprises and earnings announcement returns, but the disagreements reflected through the distribution of consumer ratings is more informative about the unexplained trading volume around earnings announcements. My results suggest that both the rating and the tone of consumer reviews are informative, but along different dimensions.

This dissertation is dedicated to my mother and father, Qingxiu Su and Jingyu Jin:
thank you for always believing in me.
I also dedicate this work to my husband, Chang Liu, who encourages me to pursue my dream,
and to my son Ethan, who brings me the best joy and makes me want to become a better person.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

This study investigates whether online consumer product reviews contain information content about firms' earnings and earnings announcement returns, using data aggregated through Amazon.com. *Ex ante*, it is unclear whether online consumer reviews are useful to investors. On the one hand, as Internet-based platforms for consumer opinions grow rapidly, information sharing about products and services becomes increasingly convenient. Consumers often visit such platforms when they need to choose among competing products and reading others' reviews can influence their purchase decisions.[1] Because consumers possess direct information about the quality and value of the products they purchase, they have become important stakeholders for firms selling the products. When aggregated, consumer opinions may signal firms' ability to generate cash flows and underlying firm values, which could affect firms' investors.[2] On the other hand, because consumer reviews have not been systematically analyzed or disseminated, investors may not be sophisticated enough to process such information or respond to it in a timely manner.

In recent years, an emerging body of literature examines how Internet-based wisdom of crowds can help reveal firm fundamentals and stock valuations. Some studies provide evidence that social media platforms such as Twitter helps firms convey value-relevant information to investors (Blankespoor et al., 2014; Lee et al., 2015; Jung et al., 2017) and that aggregate opinions from individual tweets are associated with firms' sales, earnings, and stock returns (Tang, 2017; Bartov et al., 2017). Other studies examine the information content from Internet platforms such as Google Search, financial websites such as Motley Fool and Seeking Alpha, and online forums

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[1] For example, Deloitte (2007) finds that 82% of Internet consumers in the United States report to make their purchasing decisions based on peer consumer reviews.

[2] Duckworth et al. (2009) document that among 448 investment personnel, e.g., analysts and institutional investors, approximately 43% of them suggest that consumer generated information content has become an important determinant in their investment decisions.

such as Yahoo! Finance and Raging Bull, but provide mixed evidence regarding whether information from these platforms helps predict earnings and stock returns (Hirschey et al., 2000; Antweiler and Frank, 2004; Das and Chen, 2007; Da et al., 2011; Drake et al., 2012).

However, empirical evidence remains sparse on whether online consumer opinions contain information regarding a firm's fundamentals and the prospects of its stocks. Among online retail platforms, Amazon.com has become the largest source of Internet consumer reviews and contains an enormous amount of information on consumers' experience based on their purchases.[3] Using consumer reviews from Amazon.com, Huang (2018) develops a trading portfolio that is long on stocks with high abnormal review ratings and short on stocks with low abnormal review ratings. He finds that such a portfolio generates abnormal monthly returns of 55.7 to 73.0 basis points, suggesting that consumer opinions convey useful information about firms' stock prices.[4] While Huang (2018) is the first to examine the impact of Amazon's consumer reviews, he only explores the numerical ratings consumers give to any products, not the textual content of consumer reviews.

In this study, I provide further evidence on the informativeness of consumer reviews posted on Amazon.com by examining the linguistic tone of the consumer review summaries after controlling for the numerical ratings. Specifically, I investigate three research questions: (1) Is abnormal review tone associated with earnings surprises? (2) Is abnormal review tone associated with stock returns around earnings announcements? (3) Are disagreements in the numerical ratings and the review tone associated with unexplained trading volume around earnings announcements?

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[3] Amazon.com has come to dominate retail business and sold 6 times more online than the next eight U.S. largest retailers combined. Amazon's growth in online sales volume was 10 times higher than the eight large retailers combined. Amazon alone generated around 30% of U.S. retail sales growth (www.businessinsides.com).

[4] Anecdotal evidence has also suggested that consume reviews on Amazon.com convey value-relevant information to financial markets. Huang (2018) cited the anecdotal evidence that consumer reviews of TurboTax, a software package made by Intuit Inc., apparently possess useful information about a firm's fundamentals and stock pricing.

To address these questions, I develop a measure of abnormal review tone to capture new information conveyed by the textual content of consumer review summaries. I quantify the content of each review summary using an automated Naïve Bayes Text Classification algorithm that classifies the tone of each review summary as positive (with a tone score between 0 and 1), negative (with a tone score between -1 and 0), or neutral (with a tone score equal to 0). I measure abnormal review tone as the difference between the average tone score of a firm's product review summaries during a calendar quarter and expected tone based on the average tone scores in the previous four calendar quarters. To control for the impact of numerical review ratings, I follow Huang (2018) to construct abnormal review rating as the difference between the average numerical rating during a calendar quarter and the expected review rating. Expected review rating is the average rating of a firm's product reviews posted in the previous four calendar quarters.

Based on 18,794,143 consumer reviews posted on Amazon.com during 1996-2014, I investigate the association between abnormal review tone and earnings surprises and earnings announcement returns. Focusing on concurrent earnings surprises, I find that negative abnormal tone is significantly associated with more negative earnings surprises. In contrast, positive abnormal tone is not associated with positive earnings surprises. When examine the one-quarter ahead earnings surprises, I find that abnormal negative tone appears to be unrelated to future negative earnings surprises while abnormal positive tone is positively associated with future positive earnings surprises.

My analyses of abnormal returns around concurrent earnings announcements show that negative abnormal tone is positively associated with earnings announcement returns, but positive abnormal tone is not. However, neither positive nor negative abnormal tone is associated with one-quarter ahead earnings announcement returns. Collectively, these findings indicate that

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information contained in negative abnormal tone seems to be more informative about concurrent earnings surprises and earnings announcement returns than positive abnormal tone. Interestingly, abnormal rating based on the numerical values of consumers' opinions provides no incremental information about earnings surprises or earnings announcement returns beyond abnormal tone.

Finally, I examine the relation between the disagreements in review ratings and review tone and unexplained trading volume. I find that disagreements in review ratings (measured as the standard deviation of consumer review ratings) are positively associated with unexplained trading volume around earnings announcements, but disagreements in review tone (measured as the standard deviation of consumer review tone) are not.

Taken together, these findings suggest that abnormal review tone is more useful than abnormal review rating in explaining concurrent earnings surprises and earnings announcement returns, but the disagreements reflected through the distribution of consumer ratings is more informative about unexplained trading volume around earnings announcements. My results suggest that both the rating and the tone of consumer reviews are informative, but along different dimensions.

My study differs from Huang (2018) in three dimensions. First, I extend Huang (2018) to examine the information content in the textual review summaries and provide evidence that qualitative information such as the tone of review summaries conveys more useful information about firms' fundamentals than the numerical ratings. Second, Huang (2018) examines the informativeness of overall abnormal ratings, while I further classify abnormal review tone into positive and negative tone to examine whether investors react to them differently. Third, I investigate the association between the disagreements reflected in consumer reviews and investors' reactions to earnings news.

My study contributes to the literature in several ways. First, my study contributes to the literature that investigates the informational role of Internet-based wisdom of crowds in financial markets. Some studies document that the advent of social media platforms such as Twitter helps firms convey value-relevant information to the capital markets (Blankespoor et al., 2014; Lee et al., 2015; Tang, 2017; Bartov et al., 2017). Other studies provide evidence on whether information from Internet search engines, financial websites, and online forums helps predict future earnings and stock returns (Hirschey et al., 2000; Antweiler and Frank, 2004; Das and Chen, 2007; Da et al., 2011; Drake et al., 2012). My study complements these studies by investigating textual features of online consumer reviews and highlights consumer opinions as another important source of wisdom of crowds that is valuable to the capital markets.

Second, my study contributes to the literature that examines the qualitative information of various types of disclosures, including media news (Tetlock, 2007; Tetlock et al., 2008), corporate annual reports such as 10-K and 10-Q filings (Li, 2008; Li, 2010), earnings press releases (Davis et al., 2012; Demers and Vega, 2011; Huang et al., 2014), analyst research reports (Lehavy et al., 2011; Hsieh et al., 2016; De Franco et al., 2015), and conference calls (Larcker and Zakolyukina, 2012; Frankel et al., 2010). These studies provide evidence that qualitative information is informative about firm fundamentals and stock performance. My study expands this literature by examining whether the qualitative information provided in consumer reviews helps investors better understand firms' performance.

Third, my study contributes to the literature on the relation between limited investor attention and the predictability of public information for stock returns. Studies in this area provide evidence that limited investor attention often lead investor to underreact to useful information related to firm fundamentals (Hong and Stein, 1999; Hirshleifer and Teoh, 2003; Peng and Xiong,

2006). Recently, some research shows that negative qualitative information contained in annual reports and news stories can predict firm fundamentals and abnormal returns, due to investors' limited attention to negative textual content (Li, 2006; Tetlock, 2007; Tetlock et al., 2008). My study uses the setting of online consumer reviews and provides evidence of asymmetric impact of positive and negative abnormal review tones on earnings and stock returns.

Finally, my study contributes to the literature on the impact of heterogeneous investor expectations (Lev and Ohlson, 1982; Merton, 1987; Bamber, 1987; Harris and Raviv, 1993; Abarbanell et al., 1995; Kandel and Pearson, 1995; Bamber et al., 1997; Diether et al., 2002; Antweiler et al., 2004; Ajinkya et al., 2004; Doukas et al., 2006; Sadka and Scherbina, 2007; Barron et al., 2009; Garfinkel and Sokobin, 2006; Garfinkel, 2009). Merton (1987) posits that divergent investor opinions can be viewed as a proxy for risk. Investors who are not well diversified will demand compensation for the idiosyncratic risk of the stocks they hold. Thus, the higher the investor opinion divergence on a stock, the higher future returns the stock should earn, and divergent investor opinions will provide explanatory power beyond the standard risk factors. My study presents evidence that the disagreements in consumer reviews can be viewed as another potential source for investor opinion divergence and that the disagreements in consumer reviews have implications for market reactions around earnings announcements.

I organize the rest of the paper as follows. Section 2 reviews related literature. Section 3 develops testable hypotheses. Section 4 describes the sample selection and the abnormal review tone measure based on consumer review summaries. Section 5 discusses the research design. Section 6 presents the empirical results. Section 7 presents supplementary analysis, and Section 8 concludes.

2. LITERATURE REVIEW

2.1 Wisdom of Crowds and Firm Fundamentals

A growing body of literature investigates the informational role of Internet-based wisdom of crowds in financial markets. Some studies document that the advent of social media platforms such as Twitter helps firms convey value-relevant information (Blankespoor et al., 2014; Lee et al., 2015; Jung et al., 2017), including whether information from Twitter predicts firm fundamentals and stock returns (Tang, 2017; Bartov et al., 2017), and how Twitter activities influences investor response to earnings (Curtis et al., 2014). Other studies examine investors' use of Internet search engines (e.g., Google search), financial websites (e.g., Motley Fool, Seeking Alpha), and online forums (e.g., Yahoo! Finance, Raging Bull), but provides mixed evidence on whether information from these platforms helps predict future earnings and stock returns (Hirschey et al., 2000; Antweiler and Frank, 2004; Das and Chen, 2007; Da et al., 2011; Drake et al., 2012; Chen et al., 2014). A recent study by Huang (2018) explores consumer opinions and provides evidence of the impact of consumer review ratings posted on Amazon.com on firm performance and stock returns.

My study complements these studies by investigating additional features of Amazon's consumer reviews (quantitative vs. qualitative information, positive abnormal vs. negative abnormal in reviews) to sheds light on the value of aggregate online consumer opinions to the capital market.

2.2 Qualitative Information and Firm Fundamentals

Another stream of literature explores the various textual features of qualitative information and the extent to which stock market prices incorporate such information.[5] Existing studies

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[5] Li (2011) reviews recent tone-related empirical studies in accounting and behavioral finance area.

investigate the qualitative information of various disclosure medium, including media news (Tetlock, 2007; Tetlock et al., 2008), corporate annual report such as 10-K and 10-Q filings (Li, 2008; Li, 2010), earnings press releases (Davis et al., 2012; Demers and Vega, 2011; Huang et al., 2014), analyst research reports (Lehavy et al., 2011; Hsieh and Hui, 2001; De Franco et al., 2013; Huang et al., 2014), and conference calls (Larcker and Zakolyukina, 2012; Frankel et al., 2010). These studies vary with regard to the outcomes investigated. For example, Davis et al. (2012) and Huang et al. (2014) document a positive association between increase in tone optimism of earnings press releases and the stock price response to earnings announcements. Tetlock (2007) and Tetlock et al. (2008) focus on negative media news about a firm and document whether quantified information extracted from negative language provides novel information about firms' earnings and earnings announcement returns.

My study expands this literature by examining whether the tone of consumer reviews can improve our understanding of firms' earnings performance and whether firms' stock market prices efficiently incorporate such information.

2.3 Investor Attention and Firm Fundamentals

A third line of research examines the relation between limited investor attention and the predictability of public information for stock returns. Several seminal studies in this area (Hong and Stein, 1999; Hirshleifer and Teoh, 2003; Peng and Xiong, 2006) posit that, because of limited investor rationality and limited investor attention, investors may only be able to monitor and incorporate a subset of available information, ignoring otherwise useful information relevant to firms' fundamentals. Recent studies particularly explore investors' limited attention to negative information. For example, Li (2006) examines firms' 10-K annual reports and finds that textual information related to risk and uncertainty can predict poor performance in the future and lower

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stock returns. Li (2006) interprets the findings as investors' limited attention to negative textual content hence underreaction to risk sentiment in the annual reports. Similarly, Tetlock et al. (2008) examine negative qualitative information in news stories and provide evidence that negative information leading up to earnings announcement dates predicts both a firm's fundamentals and abnormal announcement returns. Tetlock et al. (2008) interpret their findings as that investors do not fully account for the importance of negative messages embedded in the firm-specific news and consistently underreact to negative words about fundamentals.

My study tests the limited attention hypothesis in the setting of consumer reviews and provides evidence of asymmetric predictability of the information contained in positive abnormal and negative abnormal in reviews for earnings and stock returns.

2.4 Impact of Heterogeneous Investor Expectations

Finally, my study is related to the literature on the impact of heterogeneous investor expectations. Merton (1987) posits that divergent investor opinions can be viewed as a proxy for risk. Investors who are not well diversified will demand to be compensated for the idiosyncratic risk of the stocks they hold. Thus, the higher the investor opinion divergence on a stock, the higher future returns the stock should earn, and divergent investor opinions will hold explanatory power beyond the standard risk factors.

Existing literature has used different proxies for investor opinion divergence and provided empirical evidence that divergent investor opinions not only affect market reactions to earnings announcements, but also have implications for asset prices and stock returns (Lev and Ohlson, 1982). Some studies use bid-ask spread (Houge et al., 2001; Handa et al., 2003) and stock return volatility (Harris and Raviv, 1993; Shalen, 1993; Daigler and Wiley, 1999; Boehme et al., 2006). Other studies focus on analyst forecast variation (Abarbanell et al., 1995; Diether et al., 2002;

Doukas et al., 2006; Sadka and Scherbina, 2007; Barron et al., 2009) and unexplained trading volume (Beaver, 1968; Bamber, 1987; Kandel and Pearson, 1995; Bamber et al., 1997; Ajinkya et la., 2004; Garfinkel and Sokobin, 2006; Garfinkel, 2009; Gomez et al., 2018). For example, Bamber (1987) and Bamber et al., (1997, 1999) find that total trading volume is higher around earnings news that are likely associated with more divergent investor opinions about the value implications of earnings. Ajinkya et al. (2004) document a positive correlation between trading activity and analysts' forecast dispersion. Antweiler and Frank (2004) find that disagreements among the posted messages about stock performance are associated with increased trading volume.

In particular, Garfinkle (2009) constructs the standardized unexplained volume (SUV hereafter) measure using a methodology that mirrors the market model approach to estimating abnormal returns and calculates the measure as a standardized prediction error from a regression of trading volume on the absolute value of returns for a firm. Garfinkel (2009) assesses the proxies for investor opinion divergence common to the extant literature and empirically documents that the SUV measure appears to be the best proxy for investor opinion divergence.

My study considers the disagreements in consumer reviews as another potential source for investor opinion divergence and documents positive association between disagreements in consumer reviews and standardized unexplained trading volume around earnings announcements. My study presents evidence that disagreements in consumer review ratings has implications for market reactions around earnings announcements.

3. HYPOTHESIS DEVELOPMENT

3.1 Abnormal Review Tone and Earnings Surprises

My first research question investigates whether abnormal ratings and abnormal tone contain incremental information about a firm's earnings performance. The theory of wisdom of crowds implies that the aggregate opinion derived from individual opinions may help predicting a firm's future earnings (Subrahmanyam and Titman, 1999; Surowiecki, 2005). This implication would also apply to the aggregate online product reviews that represent opinions of a large and diverse group of consumers making independent assessments of a firm's performance.

Consumer opinions can change when a firm launches new products that are perceived differently than its existing products. Consumer opinions can also change when there are changes in the quality of products, changes in the competitive environment, or changes in consumer preferences (Huang, 2018). Thus, positive change in reviews may suggest that a firm's performance exceeds prior expectations, while negative change in reviews may suggest that the performance disappoints consumers' expectations or reflect otherwise hard-to-quantify unfavorable aspects of the firm's business environment.

If these changes in reviews were unrelated to firms' fundamentals, or if the information was spurious and already fully incorporated by financial analysts in their reported earnings forecasts, then I would not expect an association between the measures of review changes, i.e., abnormal reviews, and firms' quarterly earnings surprises. In contrast, if changes in reviews contain value-relevant information beyond that provided by financial analysts or public financial disclosures, then abnormal reviews should be able to predict earnings surprises.

Further, the textual component of consumer reviews is potentially an important source of information about a firm's fundamental values. Tetlock (2007) and Tetlock et al. (2008) predict

that negative words in media news can be used to form expectations of firms' earnings. As pointed out in Tetlock et al. (2008), stock market investors retrieve information about stock prices mostly from sources such as analysts' forecasts, public financial disclosures, and linguistic descriptions of firms' profit-generating activities. Thus, when analysts' forecasts and public disclosures are incomplete or biased measurement of a firm's earnings, linguistic measures may provide incremental predictability power for the firm's future earnings (Tetlock et al., 2008).

More importantly, I expect that negative changes in reviews are more important for predicting earnings than those positive changes. Li (2006) finds that, in a firm's 10-K document, textual information related to risk and uncertainty signals poor performance in the future and predicts lower stock returns. This evidence suggests that the stock market does not fully reflect such negative information contained in the texts of annual reports about a firm's profitability. Li (2006) interprets the documented predictability as investors' underreaction to risk sentiment in the text portion of the annual reports. Similarly, Tetlock et al. (2008) examine negative qualitative information in news stories and provide evidence that negative information leading up to earnings announcement dates predicts both a firm's fundamentals and abnormal announcement returns. Tetlock et al. (2008) interpret their findings as that investors do not fully account for the importance of negative messages embedded in the firm-specific news and consistently underreact to negative words about fundamentals.

In the case of consumer opinions, positive change in opinions about products are usually actively propagated by firms and retailers through announcements and advertisements, whereas negative change in opinions are usually not rationally anticipated or actively monitored as it is an uncontrollable outcome of aggregate consumer experience. Thus, compared with positive changes in reviews, negative changes in reviews are likely to receive less attention from investors even

though they may contain important value-relevant information. For these reasons, I expect that negative abnormal reviews are more significantly associated with earnings surprises. My first hypothesis is as follows (stated in the null form):

H1: Neither positive nor negative abnormal review rating or tone is associated with earnings surprises.

3.2 Abnormal Review Tone and Abnormal Earnings Announcement Returns

If the results from H1 can provide the evidence that abnormal reviews as associated with earnings surprises, then a natural question becomes whether investors understand that abnormal reviews contain information about future fundamentals. Therefore, my second research question examines whether abnormal reviews provide novel information not already represented in stock market prices and whether positive and negative abnormal reviews have asymmetric predictability of abnormal returns around earnings announcements. I cannot test this conjecture by examining contemporaneous market returns because even if there exists an association between abnormal reviews and contemporaneous market returns, it is difficult to show which variable causes the other.[6] It is possible that investors do not immediately respond in full to the messages embedded in abnormal reviews. To test this prediction, I investigate abnormal stock returns around forthcoming quarterly earnings announcements.

If the information about forthcoming earnings extracted from Amazon.com reviews is impounded into stock prices in a timely fashion, then I would not expect an association between abnormal reviews and abnormal announcement returns. Conversely, if abnormal reviews contain new information that cannot be inferred from other information sources such as analyst forecasts

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[6] Untabluated results show that the associations between measures of abnormal reviews and concurrent stock returns are not significant, suggesting that investors do not react contemporaneously to information embedded in abnormal reviews.

and public financial disclosures, or if investors may be slow in reacting to this earnings information when forming their expectations of earnings and stock prices, I would expect to observe an association between measures of abnormal reviews and abnormal returns around earnings announcements when investors adjust their prior beliefs upon the releases of the announcements.

I further expect that, compared with positive abnormal reviews, negative abnormal reviews are more important for predicting abnormal announcement returns. Li (2006) and Tetlock et al. (2008) both provide the evidence that more negative information, especially that in textual format, predicts lower stock returns because negative textual information receives less attention from the stock market. Similarly, I expect that the value-relevant information contained in negative abnormal reviews is also less likely to have been impounded in the stock prices. I thus expect that negative abnormal reviews are more significantly associated with abnormal announcement returns. My second hypothesis is as follows (stated in the null form):

H2: Neither positive nor negative abnormal review rating or tone is associated with abnormal returns around earnings announcements.

3.3 Disagreements in Review Ratings and Tone and Unexplained Trading Volume

My third research question examines whether the disagreements in review opinions among consumers have any impact on market reactions to earnings announcements. Disagreements in consumer opinions may convey inconsistent information about a firm's fundamentals and can translate into investors' divergent opinions of the prospects of a stock. Merton (1987) posits that divergent investor opinions can be viewed as a proxy for risk. Investors who are not well diversified will demand to be compensated for the idiosyncratic risk of the stocks they hold. Thus, the higher the investor opinion divergence on a stock, the higher future returns the stock should earn, and divergent investor opinions will hold explanatory power beyond the standard risk factors.

If abnormal reviews on Amazon.com were irrelevant to firms' fundamentals, or if such information was already fully incorporated in analysts' earnings forecasts, or if investors do not extract information from review ratings or review summaries, then I would not expect an association between the disagreements in review opinions and unexplained trading volume around earning announcements.

In contrast, if abnormal reviews contain value-relevant information beyond what is provided by financial analysts or public disclosures, then I would expect to observe an association between the disagreements in reviews and investors' reactions to earnings announcements. My third hypothesis is as follows (stated in the null form):

H3: Neither the disagreements in review ratings nor the disagreements in review tone are associated with unexplained trading volume around earnings announcements.

4. SAMPLE SELECTION AND MEASUREMENT OF REVIEW TONE

4.1 Amazon.com Review Data and Sample Selection

Amazon.com allows customers to post reviews about the quality and value of products purchased from the website. Since 1995, more than 10 million customers have posted more than 200 million reviews, making Amazon.com the largest single source of Internet consumer reviews (Huang, 2018). Each customer review contains several components. One component is a numerical rating on a scale of one to five stars, with five being the highest rating and one being the lowest. Another component is a text review providing detailed opinions to support the numerical rating. Finally, all reviews contain a text summary that summarize the opinions expressed in the text review. All three components combined capture consumer's perceptions of product quality and value.

Amazon.com maintains all records of manufacturers, products and reviews on its website even when the products are discontinued. Among all firms that sell or once sold on the Amazon.com, Huang (2018) identifies those public firms listed on NYSE, AMEX, and Nasdaq that have customer product reviews during the period between July 2004 and December 2014. Huang (2018) uses three approaches to identify these public firms. The first approach matches the list of brands from Amazon.com to public firms that own these brands, using sources such as item-Master.com, Consumer Product Information Database, and Google and Wikipedia searches. The second approach searches for the term "Amazon" in firms' 10-K filings of all publicly traded firms in the United States and then checks whether a firm sells its products on Amazon.com. The third approach searches on Amazon.com for the brands and products of rivals of the companies

identified in the above two approaches.[7] All three approaches together identify 346 public firms that sell products and have customer product reviews available on Amazon.com.

I obtain the sample of Amazon.com product reviews published during the period between May 1996 and July 2014. The initial sample contains more than 83 million consumer reviews. All the duplicate reviews posted by the same reviewer account ID on the same day for the same product were removed.[8] Using the list of firm names identified in Huang (2018), I develop an automated textual search algorithm that first inputs each firm's official name and its widely accepted acronym as a textual string and then match the textual strings with the brands and titles of all products with reviews available in the raw sample. This matching procedure results in a selected sample of reviews for all products whose manufacture information perfectly matches with the search strings. For each product available in the selected sample, I collect the title of the product, the Amazon Standard Identification Number (ASIN), the date of the review, the numerical rating, and review summary text.

Next, I require that the firms have financial statement data available on Compustat, stock price data on CRSP, and analyst forecast data on I/B/E/S. I further require that the firms have fiscal quarters ending on calendar quarters so that the financial data period is aligned with the review data period. After meeting all selection criteria, my final sample consists of 18,794,143 product reviews, covering 6,977 firm-quarters from 292 unique public firms, posted by consumers on Amazon.com between May 1996 and July 2014.

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[7] This approach is based on the idea that if an industry has a firm that sells through Amazon.com, then its rivals could sell through the platform as well (Huang, 2018).

[8] I would like to thank Julian McAuley for sharing the Amazon.com review data with all duplications removed.

4.2 Measure of Abnormal Review Tone

I construct a linguistic tone measure to quantify the textual content of each review summary by using a Naïve Bayes Text Classification algorithm. Based on the positive or negative sentiment expressed in each review summary, the algorithm classifies each individual summary as positive (tone score between 0 and 1), negative (tone score between -1 and 0), or neutral (tone score equal to 0). The review tone variable thus is a signed measure with values greater than 0 and less than 1 representing positive consumer opinions about the products being reviewed, and values less than 0 and greater than -1 representing negative consumer opinions about the products. The more positive the tone values, the more positive the review opinions about the products being reviewed. Similarly, the more negative the tone values, the more negative the review opinions.

I choose to examine the review summaries instead of detailed reviews because, compared with detailed reviews, review summaries deliver more concise but at the same time better articulated opinions about consumers' experience. For example, detailed reviews sometimes involve discussions of personal experience irrelevant to product quality. Detailed reviews also often consist of comparisons of products across firms, making the overall tone of the review mixed. Thus, tone analysis using detailed reviews would be expected to have potentially large measurement error when the algorithm does not correctly capture the overall signal of the text.

5. RESEARCH DESIGN

5.1 Abnormal Review Tone and Earnings Surprises

In this section, I examine whether abnormal rating and abnormal tone contain incremental information about a firm's future earnings and are associated with earnings surprises. According to H1, I expect that abnormal reviews are significantly associated with earnings surprises and that negative abnormal reviews are more powerful in predicting forthcoming earnings. To test H1, I follow Huang (2018) and Bartov et al. (2018) and estimate Equation (1) below:

$$Earnings\_Surprise_{i,q} = \beta_1 * Abnormal\_Rating\ (Abnormal\_Tone)_{i,q}$$
$$+ \beta_2 * Forecast\_Dispersion_{i,q} + \beta_3 * Ln\_MVE_{i,q} + \beta_4 * BM_{i,q}$$
$$+ \beta_5 * Ln\_R\&D_{i,q} + \beta_6 * ROA_{i,q} + \beta_7 * Loss_{i,q} + \beta_8 * Q4_{i,q}$$
$$+ \beta_9 * Prior\_Earnings\_Surprise_{i,q} + Fixed\ Effects + \varepsilon_{i,q} \qquad (1)$$

I measure *Earnings_Surprise* as the difference between reported quarterly Earnings Per Share (EPS hereafter) and the median EPS forecast of all analysts issued during the fiscal quarter prior to the earnings announcement date, scaled by the stock price as of the earnings announcement date. Based on whether an earnings surprise is greater than or less than zero, I classify all non-zero earnings surprise observations into *Positive_Earnings_Surprise* or *Negative_Earnings_Surprise*. I then regress *Positive_Earnings_Surprise* and *Negative_Earnings_Surprise* respectively on measures for abnormal ratings and abnormal tone.

Following Huang (2018), for each firm-quarter observation, I compute *Abnormal_Rating* as the average review rating of a firm's all product reviews on Amazon.com during a calendar quarter q minus the average rating of the same firm's reviews during the previous four calendar quarters. Similarly, I compute *Abnormal_Tone* as the average tone score of a firm's all textual product review summaries on Amazon.com during a calendar quarter q minus the average tone

score of the same firm's review summaries during the previous four calendar four quarters.[9] The average ratings and average tone in the previous four calendar quarters are essentially considered as the benchmarks of a firm's performance. Both *Abnormal_Rating* and *Abnormal_Tone* are signed measures of the aggregate opinions from Amazon.com reviews. The more positive the values in the abnormal reviews, the mores positive the changes in the average reviews during a calendar quarter from the average reviews during the previous four calendar quarters. Similarly, the more negative the values in the abnormal reviews, the more negative the changes in the average reviews during a calendar quarter from the average reviews during previous four calendar quarters.

I then construct four measures to reflect the directions of abnormal reviews. Specifically, based on whether an abnormal rating is greater than or less than zero, I classify all non-zero abnormal rating observations into *Positive_Abnormal_Rating* or *Negative_Abnormal_Rating*. Similarly, based on whether an abnormal tone is greater than or less than zero, I classify all non-zero abnormal tone observations into *Positive_Abnormal_Tone* or *Negative_Abnormal_Tone*. The two positive measures of abnormal reviews, *Positive_Abnormal_Rating* and *Positive_Abnormal_Tone,* measure favorable information extracted about a firm's performance from consumer reviews. The two negative measures of abnormal reviews, *Negative_Abnormal_Rating* and *Negative_Abnormal_Tone,* measure unfavorable information extracted about a firm's performance from consumer reviews.

I also include in Equation (1) various firm-specific and analyst-level characteristics to control for effects shown by prior literature to explain the cross-sectional variations in earnings surprises. I define *Ln_MVE* as the natural logarithm of market value of equity as of the end of a fiscal quarter. *BM* is the ratio of book value of equity to market value of equity as of the end of a

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[9] Huang (2018) points out that consumers reviews on Amazon.com could be systematically upward-biased, hence the use of abnormal changes in reviews can difference out time-invariant biases in consumer reviews.

fiscal quarter. *Ln_R&D* is calculated as the natural logarithm of one plus research and development expenditures, scaled by total revenue as of the end of a fiscal quarter. *ROA* (Return on Assets) is calculated as net income divided by total assets as of the end of a fiscal quarter. *Loss* is an indicator variable equal to 1 if earnings before extraordinary items is strictly negative in a fiscal quarter, and 0 otherwise. *Q4* if an indicator variable equal to 1 if the quarter is the fourth fiscal quarter, and 0 otherwise. *Prior_Eearnings_Surprise* is the earnings surprise in the fiscal quarter q-1, prior to the fiscal quarter q being examined. Finally, *Forecast_Dispersion* is the standard deviation of the quarterly earnings per share (EPS) forecasts by all analysts following a firm during a fiscal quarter, scaled by the absolute value of the median of these forecasts.

5.2 Abnormal Review Tone and Abnormal Earnings Announcement Returns

In this section, I investigate whether abnormal review tone is associated with abnormal returns around earnings announcements. According to H2, I expect that abnormal ratings and abnormal tone are significantly associated with earnings announcement returns and that negative abnormal reviews show more significant associations. To test H2, I follow Bartov et al. (2018) and Tetlock et al. (2008) and estimate Equation (2) below:

$$CAR\ (-1,+1)_{i,q}\ or\ CAR\ (-3,+3)_{i,q} = \beta_1 * Abnormal\_Rating\ (Abnormal\_Tone)_{i,q}$$

$$+ \beta_2 * Pos\ (Neg)\_Earnings\_Surprise\_Dummy_{i,q}$$

$$+ \beta_3 * Pos\ (Neg)\_Earnings\_Surprise\_Dummy_{i,q}$$

$$* Abnormal\_Rating\ (Tone)_{i,q}$$

$$+ \beta_4 * Earnings\_Surprise_{i,q} + \beta_5 * Ln\_MVE_{i,q}$$

$$+ \beta_6 * BM_{i,q} + \beta_7 * Loss_{i,q} + \beta_8 * ROA_{i,q} + \beta_9 * Q4_{i,q}$$

$$+ \beta_{10} * Analyst\_Following_{i,q} + \beta_{11} * Prior\_Return_{i,q}$$

$$+ \beta_{12} * Stock\_Turnover_{i,q} + \beta_{13} * Ret\_Volatility_{i,q}$$

$$+ \textit{Fixed Effects} + \varepsilon_{i,q} \hspace{4cm} (2)$$

My dependent variables are two measures of cumulative abnormal returns over the short-term window centered around earnings announcements. The dependent variable *CAR (-1, +1)$_{i,q}$* is calculated as the cumulative abnormal returns (in percent) using Carhart's (1997) four-factor model for the window specified, where day 0 is the quarterly earnings announcement date. The cumulative abnormal returns are measured over three trading days, beginning on 1 trading day prior to the quarterly earnings announcement and ending on 1 trading day after the earning announcement date. The dependent variable *CAR (-3, +3)$_{i,q}$* is calculated as the cumulative abnormal returns (in percent) using Carhart's (1997) four-factor model for the window specified, where day 0 is the quarterly earnings announcement date. The cumulative abnormal returns are measured over seven trading days, beginning on 3 trading days prior to the quarterly earnings announcement and ending on 3 trading days after the earning announcement date. I choose to examine *CAR (-3, +3)$_{i,q}$* in addition to *CAR (-1, +1)$_{i,q}$* because prior literature shows that the market often appears to underreact to earnings announcements and the cumulative abnormal returns are expected to continue to increase after the 3-day window centered around the announcement dates (Ball and Brown, 1968). I then regress *CAR (-1, +1)$_{i,q}$* and *CAR (-3, +3)$_{i,q}$* respectively on the four measures of abnormal ratings and abnormal tone.

In addition to the key independent variables, I control for other explanatory variables that prior literature has shown to be correlated with abnormal stock returns around earnings announcements. These control variables include market value, book-to-market ratio, whether the firm experiences an earnings surprise, a loss, return on assets, number of analysts following the stock, stock returns, stock turnover and stock return volatility prior to the earnings announcement. In addition to those have been defined in Equation (1), *Neg_Eearnings_Surprise_Dummy* is an

indicator variable equal to 1 if the firm experience an earnings surprise less than zero, and 0 otherwise. *Analyst_Following* is calculated as the number of unique analysts making earnings per share (EPS) forecasts for a firm's stock during a fiscal quarter. *Prior_Return* is the cumulative stock return during the period from beginning of the fiscal quarter to 3 trading days prior to the quarterly earnings announcement. *Stock_Turnover* is the average daily number of shares traded divided by number of shares outstanding, during the period from beginning of the fiscal quarter to 3 trading days prior to the quarterly earnings announcement. *Ret_Volatility* is calculated as the standard deviation of stock returns during the period from beginning of the fiscal quarter to 3 trading days prior to the quarterly earnings announcement.

5.3 Disagreements in Review Ratings and Tone and Unexplained Trading Volume

In this section, I investigate whether the disagreements in review ratings and the disagreements in review tone are associated with unexplained trading volume or abnormal stock return around earnings announcements. According to H3, I expect that the disagreements in review ratings and the disagreements in review tone are positively associated with earnings announcement returns. To test H3, I follow Johnson (2004) and Berkman et al. (2009) to estimate Equation (3) below:

$$SUV \ (-1,+1)_{i,q} \ or \ SUV \ (-3, +3)_{i,q} = \beta_1 * StdDev\_Rating \ (StdDev\_Tone)_{i,q}$$

$$+ \ \beta_2 * Ln\_MVE_{i,q} + \beta_3 * BM_{i,q} + \beta_4 * Loss_{i,q} + \beta_5 * ROA_{i,q}$$

$$+ \ \beta_6 * Q4_{i,q} + \beta_7 * Earnings\_Surprise_{i,q}$$

$$+ \ \beta_8 * Analyst\_Following_{i,q} + \beta_9 * Forecast\_Dispersion_{i,q}$$

$$+ \ \beta_{10} * Prior\_Return_{i,q} + \beta_{11} * Stock\_Turnover_{i,q}$$

$$+ \ \beta_{12} * Ret\_Volatility_{i,q} + \beta_{13} * Inst\_Ownership_{i,q}$$

$$+ \ \beta_{14} * Leverage_{i,q} + Fixed \ Effects + \varepsilon_{i,q} \qquad (3)$$

My dependent variables in Equation (3) are two measures of standardized unexplained volume (SUV) over the short-term window centered around earnings announcements as defined in Garfinkel (2009). The SUV measure is estimated as the standardized prediction error from a regression of trading volume on the absolute value of returns for a firm. The dependent variable $SUV\ (-1,\ +1)_{i,q}$ is calculated as the average standardized unexplained volume for the window specified, where day 0 is the quarterly earnings announcement date. The standardized unexplained volumes are measured over three trading days, beginning on 1 trading day prior to the quarterly earnings announcement and ending on 1 trading day after the earnings announcement date. The dependent variable $SUV\ (-3,\ +3)_{i,q}$ is calculated as the average standardized unexplained volume for the window specified, where day 0 is the quarterly earnings announcement date. The standardized unexplained volumes are measured over three trading days, beginning on 3 trading days prior to the quarterly earnings announcement and ending on 3 trading days after the earnings announcement date. I then regress $SUV\ (-1,\ +1)_{i,q}$ and $SUV\ (-3,\ +3)_{i,q}$ respectively on the independent variables.

The key independent variables in Equation (3) are *StdDev_Rating* and *StdDev_Tone*. For each firm-quarter, I calculate *StdDev_Rating* as the standard deviation of the ratings of a firm's all product reviews on Amazon.com during a calendar quarter, scaled by the average of these ratings during the same calendar quarter. I define *StdDev_Tone* as the standard deviation of the tone scores of a firm's all review summaries on Amazon.com during a calendar quarter, scaled by the average of all tone scores during the same calendar quarter. Both *StdDev_Rating* and *StdDev_Tone* are considered as potentially important sources of the differences of investors' opinions.

Following prior literature, I include control variables that have shown to have impact on abnormal stock returns, including market value, book-to-market ratio, whether the firm

experiences a loss, return on assets, number of analysts following the stock, analyst forecast dispersion, stock return prior to earnings announcement, stock turnover, stock return volatility, and earnings surprise.

In addition, I include *Inst_Ownership*, the number of shares held by institutional investors scaled by total shares outstanding as of the quarter-end, as a proxy for short-sales constrains for institutional investors. Prior literature shows that stocks with low institutional ownership are difficult or costly to sell short thus cannot trade against overpriced stocks, leading to persistent overpricing behavior hypothesized by Miller's theory (Ali et al. 2003; Nagel, 2005). I also include *Leverage*, the ratio of total debt divided by total assets at the end of a fiscal quarter, because Johnson (2004) claims that the relation between differences of opinions and stock returns should be increasing in financial leverage and that the differences of opinion should have no explanatory power in the returns for firms with no leverage.

6. EMPIRICAL RESULTS

6.1 Descriptive Statistics

Table 1 presents the distributions of consumer reviews, firm-quarters, and unique firms by the Fama and French 12 industry groupings for my sample. The top three industries in terms of the number of product reviews are manufacturing (5.6 million reviews, 1,419 firm-quarters, 59 firms), consumer nondurables (4.4 million reviews, 1,325 firm-quarters, 56 firms), and business equipment (3.6 million reviews, 1,451 firm-quarters, 53 firms). To address problems arising from potential industry clustering within the sample, I include industry fixed effects in all my research design.

[Table 1 about here]

Panel A of Table 2 reports the quarterly average statistics of key analysis variables. The statistics show that both *Abnormal_Rating* and *Abnormal_Tone* have almost zero means (0.002 and 0.000), with both medians close to zero (0.027 and -0.001), indicating that both variables are not heavily skewed and are in general normally distributed. *Abnormal_Rating* and *Abnormal_Tone* show considerable variations within sample, with standard deviations of 0.718 and 0.224 respectively.

The summary statistics for the key dependent variables are consistent with those from existing literature. For example, *Earnings_Suprise* has a negative mean of -0.022% and a median of 0.048%. The two measures of abnormal returns around earnings announcements, *CAR (-1, +1)* has a slightly positive mean, 0.015 percent, and a slightly positive median, 0.05 percent. *CAR (-3, +3)* has a slightly higher positive mean, 0.075 percent, and a slightly negative median, -0.108 percent.

The summary statistics for the remaining analysis variables are similar to those from previous literature. For example, the average firm has a market capitalization of $25.71 billion, a book-to-market ratio of -0.05 with median of 0.369, a quarterly buy-and-hold return of 3.5% between 90 days prior to and 3 days prior to the earnings announcement. In addition, an average institutional ownership of 68.4% and an average analyst coverage of 21 or 22 may suggest my sample consists of firms in relatively strong information environment.

[Table 2 Panel A about here]

[Table 2 Panel B about here]

6.2 Abnormal Review Tone and Earnings Surprises

Panel A of Table 3 presents the regression results with earnings surprise measures as the dependent variables and *Negative_Abnormal_Rating* and *Negative_Abnormal_Tone* as key independent variables. Focusing on concurrent earnings surprises, the results show that, when included alone in the regressions, *Negative_Abnormal_Rating* and *Negative_Abnormal_Tone* both are significantly positively associated with negative earnings surprises. When regressed together, however, only *Negative_Abnormal_Tone* is significantly positively associated with negative earnings surprises.

The association between negative abnormal tone and negative earnings surprises holds after controlling for other determinants of negative earnings surprises, including market capitalization, book-to-market ratio, R&D spending and incidence of loss, all of which are to some extent significantly related to the earnings surprise variables. Earnings surprises in the prior fiscal quarter also has significantly positive coefficients in most specifications, which is consistent with findings in prior research indicating a positive serial correlation in quarterly earnings surprises (e.g. Bernard and Thomas, 1990; Ball and Bartov, 1996; Bartov et al., 2018).

When examine the one-quarter ahead earnings surprises, abnormal negative tone appears to be unrelated to future negative earnings surprises.

[Table 3 Panel A about here]

Panel B of Table 3 presents the regression results with earnings surprise measures as the dependent variables and *Positive_Abnormal_Rating* and *Positive_Abnormal_Tone* as key independent variables. The results show that positive abnormal tone is not associated with concurrent positive earnings surprises. yet positive abnormal tone is positively associated with future positive earnings surprises in the next quarter.

[Table 3 Panel B about here]

Taken together, Panel A and Panel B of Table 3 present two findings from testing H1. First, these findings collectively indicate that information contained in negative abnormal tone seems to be more informative about concurrent earnings surprises than positive abnormal tone. This suggests that compared with positive abnormal tone, negative abnormal tone may receive even less attention from financial analysts and investors when forming their expectations of earnings (Li, 2006; Tetlock, 2007; Tetlock et al., 2008).

Second, the lack of associations between abnormal ratings and earnings surprises after including abnormal tone may indicate that abnormal ratings do not provide as much information as abnormal tone. It is also possible that information contained in abnormal ratings has been incorporated by analysts in their earnings forecasts in a timely fashion prior to earnings announcements.

6.3 Abnormal Review Tone and Abnormal Earnings Announcement Returns

Table 4 reports the regression results from testing H2 by estimating the association between abnormal reviews and abnormal earnings announcement returns. The results in Panel A of Table

4 suggest a significant positive relation between negative abnormal tone and abnormal earnings announcement returns. The coefficients on *Negative_Abnormal_Tone* are significantly positive with significant levels at 1% in all specifications (coefficient = 4.898, 5.522, 7.250, 7.452, t-statistic = 2.72, 2.73, 3.22, 3.09). This positive relation is beyond the effects of all remaining explanatory variables included in the specifications to explain the cross-sectional variations in abnormal earnings announcement returns.

[Table 4 Panel A about here]

In contrast, the results in Panel B of Table 4 show no association between abnormal earnings announcement returns with positive abnormal tone. Further, the economic magnitudes of the coefficients on *Negative_Abnormal_Tone* increase from 4.898 and 5.522 when the dependent variable is *CAR (-1,+1)* to 7.250 and 7.452 when the dependent variable is *CAR (-3,+3)*. This evidence indicates that market appears to underreact to earnings announcements during the 3-day window and the abnormal returns continue to increase after the 3-day window centered around the announcement dates (Ball and Brown, 1968).

[Table 4 Panel B about here]

Further, Panel C of Table 4 and Panel D of Table 4 show that neither negative abnormal tone nor positive abnormal tone are associated with any abnormal returns around the earnings announcement dates in the next fiscal quarter.

[Table 4 Panel C about here]

[Table 4 Panel D about here]

Abnormal rating based on the numerical values of consumers' opinions provides no incremental information about earnings surprises or earnings announcement returns beyond abnormal tone. One way to interpret the above findings is that the information contained in

negative abnormal tone is likely new information that cannot be inferred from other information sources such as analyst forecasts and public financial disclosures, leading to the usefulness of such information in explaining stock returns. It is also possible that investors may underreact to (Li, 2006; Tetlock et al., 2008; Bartov et al., 2018) this earnings information when forming their expectations, leading to significant belief adjustments and price movements upon the earnings announcements. Untabluated results show that the associations between negative abnormal reviews and concurrent stock returns are insignificant, suggesting that market participants do not immediately react to this earnings information.

Collectively, a comparison of the results between Table 3 and Table 4 presents an interesting observation. Negative abnormal tone appears to matter both for the forecasting of earnings and the market reactions to earnings announcements. Thus, negative abnormal tone provides information relevant to both earnings and stock valuation. Positive abnormal tone, on the other hand, is not useful for valuation, yet still providing relevant information for future earnings.

6.4 Disagreements in Review Ratings and Tone and Unexplained Trading Volume

Table 5 reports the results from testing H3 by estimating the impact of disagreements in review opinions on unexplained trading volume around earnings announcements. Table 5 shows that, when use the standard deviation of review ratings as the proxy for differences of review opinions, there exists a significant positive relation between differences of review ratings and unexplained trading volumes around earnings announcements. However, disagreements in review tone are not associated with unexplained trading volume or earnings announcement returns.

[Table 5 about here]

One way to interpret the above findings is that the disagreements in review ratings represent an important source of investors' opinion divergence therefore is highly positively

correlated with unexplained trading volume, which is a relatively reliable measure of divergent investor opinions as discussed in Garfinkel (2009). An alternative way to interpret the findings is that because only a subset of investors is aware of the information contained in the review ratings, these investors are better informed than others and are able to trade at an informational advantage based on the information that they have acquired. Thus, material, public, but costly information, such as consumer review ratings, increases information asymmetry across investors which leads to increased differential belief revisions and consequent trading activities at the time of the earnings announcements.

7. SUPPLEMENTARY ANALYSIS

To provide an explanation for the channel through which abnormal reviews can provide earnings information, I examine the associations between abnormal reviews and abnormal sales growth. *Abnormal_SalesGrowth* is measured as the difference between reported quarterly sales during a fiscal quarter and the average of quarterly sales in the previous four fiscal quarters, scaled by the average sales during the previous four fiscal quarters. *Positive_Abnormal_SalesGrowth* is defined as when abnormal sales growth in a fiscal quarter is greater than zero, while *Negative_Abnormal_SalesGrowth* is defined as when abnormal sales growth in a fiscal quarter is less than zero. I then estimate the following equation:

$$Abnormal\_SalesGrowth_{i,q} = \beta_1 * Abnormal\_Rating\ (Abnormal\_Tone)_{i,q}$$

$$+ \beta_2 * Forecast\_Dispersion_{i,q} + \beta_3 * Ln\_MVE_{i,q} + \beta_4 * BM_{i,q}$$

$$+ \beta_5 * Ln\_R\&D_{i,q} + \beta_6 * ROA_{i,q} + \beta_7 * Loss_{i,q} + \beta_8 * Q4_{i,q}$$

$$+ Fixed\ Effects + \varepsilon_{i,q} \tag{4}$$

Table 6 presents the results from estimating Equation (4). Panel A of Table 6 shows that, *Negative_Abnormal_Rating* and *Negative_Abnormal_Tone* are associated with negative abnormal sales growth in both the concurrent and the next fiscal quarters. Panel B of Table 6 shows that *Positive_Abnormal_Rating* forecasts positive abnormal sales growth in the next fiscal quarter.

[Table 6 Panel A about here]

[Table 6 Panel B about here]

The results from Table 6 suggest that consumers monitor and understand the differences between positive and negative abnormal review opinions and make purchase decisions accordingly, leading to abnormal changes in sales. Meanwhile, the evidence that abnormal ratings are associated with sales growth but not earnings surprises or abnormal announcement returns

suggests that the value-relevant information contained in review ratings may have already been incorporated by analysts and investors when forming their expectations about firms' earnings and stock prices.

8. CONCLUSION

In this study, I examine whether online consumer product reviews contain information content about firms' earnings and earnings announcement returns. Using a sample of 18,794,143 reviews posted by consumers on Amazon.com during the period between May 1996 and July 2014, I find that negative abnormal tone is significantly associated with more negative earnings surprises in concurrent fiscal quarters, while positive abnormal tone is not associated with positive earnings surprises. In contrast, I find that abnormal negative tone appears to be unrelated to future negative earnings surprises while abnormal positive tone is positively associated with future positive earnings surprises.

My analyses of abnormal returns around concurrent earnings announcements show that negative abnormal tone is positively associated with earnings announcement returns, but positive abnormal tone is not. However, neither positive nor negative abnormal tone is associated with one-quarter ahead earnings announcement returns. Collectively, these findings indicate that information contained in negative abnormal tone seems to be more informative about concurrent earnings surprises and earnings announcement returns than positive abnormal tone.

Finally, I examine the relation between the disagreements in review ratings and review tone and unexplained trading volume. I find that disagreements in review ratings are positively associated with unexplained trading volume around earnings announcements. Disagreements in review tone are not associated with unexplained trading volume or earnings announcement returns.

Taken together, these findings suggest that abnormal review tone is more useful than abnormal review rating in explaining concurrent earnings surprises and earnings announcement returns. But the disagreements reflected through the distribution of consumer ratings is more informative about the unexplained trading volume around earnings announcements. My results

suggest that both the rating and the tone of consumer reviews are informative, but along different dimensions.

There are several limitations to my study. First, my methodology in constructing the review tone measure using the Naïve Bayes Text Classification algorithm may contain potential measurement error if the algorithm does not correctly detect the overall sentiment of the review summaries. The constructed tone measure thus may contain noise. Second, some online reviews provide false information despite Amazon.com's commitment to take off fake reviews. This issue may result in biased reviews and hence affect my inferences. Given these limitations, I do not claim that my abnormal review tone measure subsumes or dominates traditional accounting measures of firm fundamentals. I leave it for future research to develop a more refined measure of consumer review tone.

APPENDICES

Appendix A: Variable Definitions and Data Sources

Variable	Definition	Source
Abnormal_Rating	The average rating of a firm's all product reviews on Amazon.com during a calendar quarter q minus the average rating of the same firm's reviews during the previous four calendar quarters.	Amazon.com
Abnormal_Tone	The average tone score of a firm's all product review summary texts on Amazon.com during a calendar quarter q minus the average tone score of the same firm's review summary texts during the previous four calendar quarters; tone scores are computed using naïve Bayes classification algorithm and range between -1 and 1.	Amazon.com
Abnormal_SalesGrowth	A firm's reported sales during a fiscal quarter q minus the average sales during the previous four fiscal quarters, scaled by the average sales during the previous four fiscal quarters.	Compustat
Analyst_Following	Number of unique analysts making earnings per share (EPS) forecasts for a firm's stock during a fiscal quarter.	I/B/E/S
BM	Ratio of book value of equity to market value of equity as of the end of a fiscal quarter.	Compustat
CAR (-1, +1)	Cumulative abnormal returns (in percent) using Carhart's (1997) four-factor model for the window specified, where day 0 is the quarterly earnings announcement date. The cumulative abnormal returns are measured over three trading days, beginning on 1 trading day prior to the quarterly earnings announcement and ending on 1 trading day after to the earning announcement date.	CRSP
CAR (-3, +3)	Cumulative abnormal returns (in percent) using Carhart's (1997) four-factor model for the window specified, where day 0 is the quarterly earnings announcement date. The cumulative abnormal returns are measured over seven trading days, beginning on 3 trading days prior to the quarterly earnings announcement date and ending on 3 trading days after the earning announcement date.	CRSP
Earnings_Surprise	The difference between the reported quarterly earnings per share (EPS) and the median analyst forecast of earnings per share (EPS) issued during the fiscal quarter prior to the earnings announcement date, scaled by the stock price as of the earnings announcement date.	I/B/E/S

Appendix A: (continued)

Variable	Definition	Source
Forecast_Dispersion	The standard deviation of the quarterly earnings per share (EPS) forecasts by all analysts following a firm during a fiscal quarter, scaled by the absolute value of the median of these forecasts.	I/B/E/S
Inst_Ownership	Number of shares held by institutional investors scaled by total shares outstanding as of the end of a fiscal quarter.	Thomson
Leverage	Ratio of total debt divided by total assets as of the end of a fiscal quarter; total debt equals long-term debt plus debt in current liabilities.	Compustat
Ln MVE	The natural logarithm of the market value of equity as of the end of a fiscal quarter.	Compustat
Ln_R&D	The natural logarithm of one plus research and development expenditure, scaled by total revenue as of the end of a fiscal quarter.	Compustat
Loss	An indicator variable equal to 1 if earnings before extraordinary items is strictly negative in a fiscal quarter, and 0 otherwise.	Compustat
Prior_Return	Cumulative stock return during the period from beginning of the fiscal quarter to 3 trading days prior to the quarterly earnings announcement.	CRSP
Q4	An indicator variable equal to 1 if a fiscal quarter is the fourth fiscal quarter, and 0 otherwise.	Compustat
ROA	Return on assets, calculated as net income divided by total assets as of the end of a fiscal quarter.	Compustat
Ret_Volatility	The standard deviation of stock returns during the period from beginning of the fiscal quarter to 3 trading days prior to the quarterly earnings announcement.	CRSP
StdDev_Rating	The standard deviation of the ratings of a firm's all product reviews on Amazon.com during a calendar quarter, scaled by the average of these ratings during the same calendar quarter.	Amazon.com
StdDev_Tone	The standard deviation of the tone scores of a firm's all review summaries on Amazon.com during a calendar quarter, scaled by the average of all tone scores during the same calendar quarter.	Amazon.com

Appendix A: (continued)

Variable	Definition	Source
SUV (-1, +1)	Standardized unexplained volume as defined in Garfinkel (2009), calculated as the average standardized unexplained trading volume for the window specified, where day 0 is the quarterly earnings announcement date. The standardized unexplained volumes are measured over three trading days, beginning on 1 trading day prior to the quarterly earnings announcement and ending on 1 trading day after the earnings announcement date.	CRSP
SUV (-3, +3)	Standardized unexplained volume as defined in Garfinkel (2009), calculated as the average standardized unexplained trading volume for the window specified, where day 0 is the quarterly earnings announcement date. The standardized unexplained volumes are measured over three trading days, beginning on 3 trading days prior to the quarterly earnings announcement and ending on 3 trading days after the earnings announcement date.	CRSP
Stock_Turnover	Average daily turnover, during the period from beginning of the fiscal quarter to 3 trading days prior to the quarterly earnings announcement; daily turnover equals number of shares traded divided by number of shares outstanding.	CRSP

Appendix B: Figures

Figure 1: Amazon.com Reviews Illustration

This figure shows parts of a webpage on Amazon.com that contain product and review information.[10] The following information from this webpage: the name of the product (Samsung Galaxy Watch), the name of the manufacturer (Samsun), the Amazon Standard Identification Number (B07FTRZMJR), the numerical rating (five stars), the review summary text ("Awesome Watch"), the date of the review (August 26, 2018), and the full text of the review.

40

Figure 1: (continued)

Pierce **VINE VOICE**

★★★★★ **Looks Good, Wears Nice, Works Great**

September 21, 2018

Color: Midnight Black (42mm) | **Vine Customer Review of Free Product** (What's this?)

I am not an Apple user. I have tried three different Android watches and was never satisfied with the software or the hardware. I wear a classic watch every day, but I have always wanted a nice looking watch that also measured my heart rate, steps, and sleep. This is it. I really did not like Android Wear. The Samsung software, Tizen is much more intuitive, for me. The number of watch faces available can be daunting, and I'm not sure I've really found the face I want, but they all look great and range from simple analog to complex animated. I am very interested in heart rate and this watch can be set to constantly measure HR. Of course, this used up a lot of battery, but if it gets me through a day, I am happy. The watch is comfortable and good looking. One caveat, the phone software seems to mainly exist to sell watch faces. I have had a hard time finding the page that gives me the health measurements I want. Also, step measurement is different from the Motiv Ring, and the Fitbit Charge 2. But I am still learning to use it. I wear it every day. Recommended.

| Helpful | ⌄ Comment | Report abuse |

Kindle Customer

★☆☆☆☆ **Costly, Crippled by Slow Processor & Tizen**

September 23, 2018

Color: Midnight Black (42mm)

Like all Samsung products, this smart watch costs twice as much as similar watches which have more functionality. Samaung hides the fact their watches run Tizen OS not Android. This virtually eliminates apps and hinders functionality.

Rather than use Qualcomm's new 3100 watch processor, Samsung used an inferior processor to save a couple of dollars. Coupled with the lack of apps for Tizen, this phone can do little more than receive notifications. There are a number of Smartwatches under $100 that receive notifications just as well and have weeks long battery life.

When it comes to app availability, functionality and a poweful processor; Apple makes the best watches by far. (If it matters, I have been using Android exclusively for 10 years). If you want Android on your wrist, buy a Smartwatch with the new Qualcomm 3100 processor.

4 people found this helpful

| Helpful | ⌄ 1 comment | Report abuse |

Appendix C: Tables

Table 1: Distribution of Amazon.com Reviews by Fama-French 12-Industry Classification

This table presents the descriptive statistics for the sample of Amazon.com consumer product reviews of selected public firms from May 1996 to July 2014. The table reports the number of reviews, firm-quarter, and unique firms for the full sample as well as by Fama-French 12-industry classification. The industries that do not have firms with Amazon.com reviews are Energy, Utilities, and Financial industries.

Industry Group Description	Reviews		Firm-Quarters		Unique Firms	
	N	%	N	%	N	%
Business Equipment	3,640,270	19.37	1,451	20.80	53	18.15
Chemicals	1,118,677	5.95	467	6.69	17	5.82
Consumer Nondurables	4,416,459	23.50	1,325	18.99	56	19.18
Consumer Durables	1,358,455	7.23	562	8.06	26	8.90
Healthcare	650,795	3.46	568	8.14	26	8.90
Manufacturing	5,623,754	29.92	1,419	20.34	59	20.21
Others	475,729	2.53	271	3.88	12	4.11
Shops	390,990	2.08	719	10.31	33	11.30
Telecommunication	1,119,014	5.95	195	2.79	10	3.42
All Industries	18,794,143	100.00	6,977	100.00	292	100.00

Table 2: Descriptive Statistics of Analysis Variables

This table reports summary statistics and the correlation matrix of key analysis variables for the sample of firms with consumer product reviews from May 1996 through July 2014. Variables are defined in Appendix A.

Panel A: Summary Statistics of Key Analysis Variables

Variable	N	Mean	Std. Dev.	Q1	Median	Q3
Review Variables:						
Abnormal_Rating	6,977	0.002	0.718	-0.209	0.027	0.282
Abnomral_Tone	6,977	0.000	0.224	-0.084	-0.001	0.072
Negative_Abnormal_Rating	3,154	-0.503	0.680	-0.591	-0.248	-0.092
Negative_Abnormal_Tone	3,500	-0.144	0.172	-0.200	-0.083	-0.028
Positive_Abnormal_Rating	3,740	0.425	0.469	0.102	0.251	0.588
Positive_Abnormal_Tone	3,436	0.147	0.183	0.028	0.074	0.190
StdDev_Rating	6,977	0.255	0.142	0.167	0.300	0.357
StdDev_Tone	6,977	0.344	0.162	0.319	0.403	0.437
Dependent Variables:						
Earnings_Suprise (pct)	6,977	-0.022	2.662	-0.015	0.048	0.175
CAR (-1, +1) (pct)	6,977	0.015	8.115	-3.789	0.050	3.859
CAR (-3, +3) (pct)	6,977	0.075	9.271	-4.473	-0.108	4.432
SUV (-1, +1)	6,977	1.838	2.592	0.452	1.341	2.632
SUV (-3, +3)	6,977	1.211	1.688	0.225	0.859	1.804
Firm Characteristics:						
MVE ($millions)	6,977	25,710.590	57,096.020	880.084	4,801.200	19,392.440
BM	6,977	-0.056	15.980	0.214	0.369	0.591
ROA	6,977	0.014	0.041	0.005	0.016	0.029
Ln_R&D	6,977	0.063	0.059	0.020	0.053	0.093
Loss	6,977	0.174	0.380	0.000	0.000	0.000
Q4	6,977	0.240	0.427	0.000	0.000	0.000
Analyst_Following	6,977	21.514	23.707	7.000	16.000	26.000
Forecast_Dispersion	6,977	0.046	0.087	0.015	0.026	0.049
Prior_Return	6,977	0.035	0.175	-0.052	0.032	0.114
Stock_Turnover	6,977	0.755	0.193	0.628	0.793	0.922
Inst_Ownership	6,977	0.684	0.240	0.585	0.711	0.854
Leverage	6,977	0.247	0.276	0.069	0.202	0.332

Table 2: (continued)

Panel B: Correlation Matrix of Key Analysis Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) *Positive_Abnormal_Rating*	1.000										
(2) *Positive_Abnormal_Tone*	0.544 ***	1.000									
(3) *Negative_Abnormal_Rating*	N/A	-0.313 ***	1.000								
(4) *Negative_Abnormal_Tone*	-0.335 ***	N/A	0.603 ***	1.000							
(5) *StdDev_Rating*	-0.517 ***	-0.551 ***	0.385 ***	0.394 ***	1.000						
(6) *StdDev_Tone*	-0.446 **	-0.595 ***	0.512 ***	0.502 ***	0.679 ***	1.000					
(7) *Earnings_Suprise*	-0.040	-0.048 **	0.101 ***	0.111 ***	0.007	0.045 ***	1.000				
(8) *CAR (-1, +1)*	-0.022	-0.031	0.003	0.047 ***	0.047 ***	0.028	0.159 ***	1.000			
(9) *CAR (-3, +3)*	-0.019	-0.028	0.020	0.080 ***	0.042 **	0.025	0.119 ***	0.872 ***	1.000		
(10) *SUV (-1, +1)*	-0.030	-0.066 **	0.004	-0.022	0.064 ***	0.037 *	0.041 *	0.019	0.028	1.000	0.942 ***
(11) *SUV (-3, +3)*	-0.033	-0.072 **	0.025	-0.014	0.065 ***	0.041 *	0.044 **	0.001	0.011	0.942 ***	1.000

Table 3: Abnormal Review Tone and Earnings Surprises

This table reports the results from the OLS regressions of earnings surprises on abnormal ratings and abnormal tone. Panel A reports the results from OLS regressions of negative earnings surprises on negative abnormal ratings and negative abnormal tone and control variables described in Eq. (1). Column (1) through (3) report the results when the dependent variable is concurrent quarter negative earnings surprise. Column (4) through (6) report the results when the dependent variable is next quarter negative earnings surprise. All regressions include industry and year fixed effects. ***, **, * indicate statistical significance at p<0.01, p<0.05, and p<0.10 (two-tailed), respectively. Variables are defined in Appendix A.

Panel A: <u>Negative</u> Abnormal Review Tone and <u>Negative</u> Earnings Surprises

	Negative Earnings Surprise			Next Quarter Negative Earnings Surprise		
	(1)	(2)	(3)	(4)	(5)	(6)
Negative_Abnormal_RATING	0.811 *		0.031	0.179		0.015
	(1.870)		(0.060)	(0.900)		(0.050)
Negative_Abnormal_TONE		2.759 **	3.959 **		1.016	0.918
		(1.990)	(1.970)		(1.550)	(0.850)
Forecast_Dispersion	-1.659 *	-8.878 ***	-2.544	-6.013 ***	-4.173 **	-7.063 ***
	(-1.860)	(-3.860)	(-0.960)	(-2.900)	(-2.140)	(-2.930)
Ln_MVE	0.463 ***	0.739 ***	0.435 ***	0.293 ***	0.276 ***	0.317 **
	(2.650)	(4.950)	(2.760)	(2.610)	(2.810)	(2.150)
BM	4.609 ***	6.654 ***	5.422 ***	-0.051	-1.277 **	0.032
	(19.240)	(23.850)	(17.760)	(-0.080)	(-2.300)	(0.040)
Ln_R&D	14.126 **	8.067	5.494	-8.926 **	-5.950 *	-4.898
	(2.380)	(1.590)	(0.770)	(-2.300)	(-1.710)	(-0.930)
ROA	45.010 ***	31.728 ***	38.754 ***	-6.906	-19.138 ***	-8.440
	(7.410)	(4.870)	(5.650)	(-1.100)	(-2.810)	(-0.950)
Loss	0.861	0.067	-1.073	-1.202 **	-1.749 ***	-1.110 *
	(1.390)	(0.100)	(-1.800)	(-2.290)	(-3.680)	(-1.670)
Q4	-0.539	-0.233	-1.073 *	0.654 **	0.611 **	0.755 *
	(-0.970)	(-2.360)	(-1.800)	(2.130)	(2.100)	(1.880)
Prior_Earnings_Surprise	0.190 ***	0.192 ***	0.304 ***	-0.071	0.027	-0.078
	(4.380)	(4.910)	(2.830)	(-0.600)	(0.280)	(-0.570)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	791	889	590	791	889	590
Adjusted R-squared	31.12%	46.89%	35.62%	1.98%	2.37%	1.85%

Table 3: (continued)

Panel B reports the results from OLS regressions of positive earnings surprises on positive abnormal ratings and positive abnormal tone and control variables described in Eq. (1). Column (1) through (3) report the results when the dependent variable is concurrent quarter positive earnings surprise. Column (4) through (6) report the results when the dependent variable is next quarter positive earnings surprise. All regressions include industry and year fixed effects. ***, **, * indicate statistical significance at p<0.01, p<0.05, and p<0.10 (two-tailed), respectively. Variables are defined in Appendix A.

Panel B: <u>Positive</u> Abnormal Review Tone and <u>Positive</u> Earnings Surprises

	Positive Earnings Surprise			Next Quarter Positive Earnings Surprise		
	(1)	(2)	(3)	(4)	(5)	(6)
Positive_Abnormal_RATING	-0.079		-0.115	-0.078		-0.061
	(-1.300)		(-1.540)	(-1.460)		(-1.380)
Positive_Abnormal_TONE		0.010	0.186		0.108	0.228 *
		(0.070)	(1.030)		(0.920)	(1.960)
Forecast_Dispersion	3.756 ***	0.815 **	1.391 **	2.164 ***	0.252 **	1.561 ***
	(8.800)	(2.210)	(2.570)	(6.140)	(2.010)	(5.130)
Ln_MVE	-0.113 ***	-0.086 ***	-0.083 ***	-0.055 ***	-0.020	-0.025 *
	(-6.460)	(-5.380)	(-4.250)	(-3.250)	(-1.500)	(-1.920)
BM	0.763 ***	0.555 ***	0.633 ***	0.592 ***	0.253 ***	0.203 **
	(6.400)	(5.100)	(4.580)	(4.800)	(2.660)	(2.120)
Ln_R&D	1.277 *	0.249	1.065	1.230 *	-1.427 ***	-0.341
	(1.660)	(0.380)	(1.300)	(1.780)	(-2.640)	(-0.670)
ROA	5.513 ***	8.255 ***	7.381 ***	1.457	-2.653 ***	-1.734 *
	(3.910)	(6.250)	(4.650)	(1.140)	(-2.830)	(-1.720)
Loss	0.342 **	0.381 ***	0.273 *	0.128	0.208 **	0.290 ***
	(2.530)	(3.330)	(1.740)	(1.050)	(2.170)	(3.020)
Q4	0.083	0.090 *	0.129 *	-0.043	0.073 *	0.004
	(1.310)	(1.690)	(1.890)	(-0.780)	(1.680)	(0.090)
Prior_Earnings_Surprise	-0.269 ***	0.098 **	0.141 **	0.135 ***	0.139 ***	0.216 ***
	(-7.850)	(2.230)	(2.480)	(4.600)	(3.640)	(5.530)
Industry/Year Fixed Effects	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Observations	2,496	2,252	1,596	2,496	2,252	1,596
Adjusted R-squared	36.06%	20.41%	21.43%	2.27%	1.61%	2.85%

Table 4: Abnormal Review Tone and Earnings Announcement Returns

This table reports the results from the OLS regressions of cumulative abnormal stock returns around earnings announcement dates on abnormal ratings and abnormal tone. Panel A reports the results from OLS regressions of cumulative abnormal stock returns around earnings announcement dates on negative abnormal ratings and negative abnormal tone and control variables described in Eq. (2). Column (1) and (2) report the results when the dependent variable is cumulative abnormal stock returns over the window of 1 trading day prior to the earnings announcement and 1 trading day after the earnings announcement. Column (3) and (4) report the results when the dependent variable is cumulative abnormal stock returns over the window of 3 trading days prior to the earnings announcement and 3 trading days after the earnings announcement. All regressions include industry and year fixed effects. ***, **, * indicate statistical significance at p<0.01, p<0.05, and p<0.10 (two-tailed), respectively. Variables are defined in Appendix A.

Panel A: <u>Negative</u> Abnormal Review Tone and Earnings Announcement Returns

	Cumulative Abnormal Returns around Earnings Announcements			
	CAR (-1, +1)		CAR (-3, +3)	
	(1)	(2)	(3)	(4)
Negative_Abnormal_RATING	-0.810	-0.699	-0.754	-0.629
	(-1.600)	(-1.280)	(-1.260)	(-0.960)
Negative_Abnormal_TONE	4.898 ***	5.522 ***	7.250 ***	7.452 ***
	(2.720)	(2.730)	(3.220)	(3.090)
Neg_Earnings_Surprise_Dummy		-5.536 ***		-5.641 ***
		(-6.560)		(-5.610)
*Negative_Abnormal_Rating * Neg_Earnings_Surprise_Dummy*		-0.460		-0.576
		(-0.380)		(-0.400)
*Negative_Abnormal_Tone * Neg_Earnings_Surprise_Dummy*		-1.317		1.400
		(-0.270)		(0.240)
Ln_MVE	-0.505 ***	-0.655 ***	-0.421 *	-0.586 ***
	(-2.600)	(-3.470)	(-1.830)	(-2.600)
BM	-1.964 ***	-1.635 ***	-1.537 **	-1.179 *
	(-3.220)	(-2.770)	(-2.130)	(-1.670)
Loss	0.372	1.125	1.148	1.967
	(0.330)	(1.040)	(0.870)	(1.520)
ROA	3.338	0.692	10.390	7.615
	(0.300)	(0.060)	(0.790)	(0.600)
Q4	1.489 **	1.382 **	1.300 *	1.188
	(2.340)	(2.250)	(1.730)	(1.620)
Earnings_Surprise	0.470 ***	0.367 ***	0.290 **	0.168
	(4.430)	(3.510)	(2.300)	(1.350)
Analyst_Following	0.023	0.032	0.018	0.028
	(1.160)	(1.640)	(0.770)	(1.200)
Prior_Return	1.923	0.067	2.001	0.074
	(1.110)	(0.040)	(0.980)	(0.040)
Stock_Turnover	-0.801	-0.827	-0.318	-0.383
	(-0.450)	(-0.480)	(-0.150)	(-0.190)
Ret_Volatility	-15.430	-20.692	17.257	11.848
	(-0.670)	(-0.930)	(0.640)	(0.450)
Industry/Year Fixed Effects	**Yes**	**Yes**	**Yes**	**Yes**
Observations	2,204	2,204	2,204	2,204
Adjusted R-squared	3.31%	11.96%	4.54%	10.01%

Table 4: (continued)

Panel B reports the results from OLS regressions of cumulative abnormal stock returns around earnings announcement dates on positive abnormal ratings and positive abnormal tone and control variables described in Eq. (2). Column (1) and (2) report the results when the dependent variable is cumulative abnormal stock returns over the window of 1 trading day prior to the earnings announcement and 1 trading day after the earnings announcement. Column (3) and (4) report the results when the dependent variable is cumulative abnormal stock returns over the window of 3 trading days prior to the earnings announcement and 3 trading days after the earnings announcement. All regressions include industry and year fixed effects. ***, **, * indicate statistical significance at p<0.01, p<0.05, and p<0.10 (two-tailed), respectively. Variables are defined in Appendix A.

Panel B: <u>Positive</u> Abnormal Review Tone and Earnings Announcement Returns

	Cumulative Abnormal Returns around Earnings Announcements			
	CAR (-1, +1)		CAR (-3, +3)	
	(1)	(2)	(3)	(4)
Positive_Abnormal_RATING	-1.102 *	0.110	-0.674	0.518
	(-1.810)	(0.120)	(-0.970)	(0.500)
Positive_Abnormal_TONE	0.417	0.280	0.190	-1.000
	(0.270)	(0.120)	(0.110)	(-0.370)
Pos_Earnings_Surprise_Dummy		4.796 ***		5.367 ***
		(6.350)		(6.250)
*Positive_Abnormal_Rating **				
Pos_Earnings_Surprise_Dummy		-1.959 *		-1.923
		(-1.650)		(-1.420)
*Positive_Abnormal_Tone **				
Pos_Earnings_Surprise_Dummy		0.691		2.443
		(0.230)		(0.710)
Ln_MVE	0.041	-0.087	-0.282	-0.439 **
	(0.220)	(-0.490)	(-1.360)	(-2.160)
BM	0.561	0.431	0.712	0.554
	(1.420)	(1.120)	(1.580)	(1.260)
Loss	-1.069	-0.636	-1.090	-0.540
	(-1.120)	(-0.680)	(-1.000)	(-0.510)
ROA	-8.929	-8.234	-4.355	-3.513
	(-1.490)	(-1.410)	(-0.640)	(-0.530)
Q4	2.078 ***	2.144 ***	2.540 ***	2.614 ***
	(3.590)	(3.790)	(3.840)	(4.070)
Earnings_Surprise	1.563 ***	1.096 ***	1.467 ***	0.901 ***
	(6.950)	(4.810)	(5.720)	(3.470)
Analyst_Following	0.003	0.009	0.029	0.037 **
	(0.170)	(0.570)	(1.510)	(2.000)
Prior_Return	-3.838 ***	-5.960 ***	-5.486 ***	-8.090 ***
	(-2.610)	(-4.080)	(-3.270)	(-4.860)
Stock_Turnover	0.377	-0.698	0.888	-0.395
	(0.250)	(-0.470)	(0.510)	(-0.230)
Ret_Volatility	1.440	6.189	15.884	21.007
	(0.050)	(0.230)	(0.500)	(0.680)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,475	2,475	2,475	2,475
Adjusted R-squared	7.24%	12.11%	6.61%	12.04%

Table 4: (continued)

Panel C reports the results from OLS regressions of cumulative abnormal stock returns around the next quarter earnings announcement dates on positive abnormal ratings and positive abnormal tone and control variables described in Eq. (2). Column (1) and (2) report the results when the dependent variable is cumulative abnormal stock returns over the window of 1 trading day prior to the next quarter earnings announcement and 1 trading day after the next quarter earnings announcement. Column (3) and (4) report the results when the dependent variable is cumulative abnormal stock returns over the window of 3 trading days prior to the next quarter earnings announcement and 3 trading days after the next quarter earnings announcement. All regressions include industry and year fixed effects. ***, **, * indicate statistical significance at p<0.01, p<0.05, and p<0.10 (two-tailed), respectively. Variables are defined in Appendix A.

Panel C: <u>Negative</u> Abnormal Review Tone and <u>Next Quarter</u> Earnings Announcement Returns

	Cumulative Abnormal Returns around Next Quarter Earnings Announcements			
	CAR (-1, +1)		CAR (-3, +3)	
	(1)	(2)	(3)	(4)
Negative_Abnormal_RATING	0.515	0.563	0.171	-0.064
	(0.980)	(0.980)	(0.290)	(-0.100)
Negative_Abnormal_TONE	-0.335	-2.624	0.057	-1.756
	(-0.170)	(-1.240)	(0.030)	(-0.740)
Neg_Earnings_Surprise_Dummy		2.755 ***		3.399 ***
		(2.940)		(3.220)
Negative_Abnormal_Rating * Neg_Earnings_Surprise_Dummy		-0.283		1.334
		(-0.210)		(0.870)
Negative_Abnormal_Tone * Neg_Earnings_Surprise_Dummy		12.810 **		10.081 *
		(2.550)		(1.780)
Ln_MVE	0.129	0.146	0.476	0.512 **
	(0.600)	(0.680)	(1.970)	(2.120)
BM	2.524 **	2.455 **	5.754 ***	5.669 ***
	(2.560)	(2.500)	(5.190)	(5.140)
Loss	-2.075	-2.137 *	-2.500 *	-2.508 *
	(-1.710)	(-1.770)	(-1.830)	(-1.840)
ROA	3.298	3.073	7.705	7.544
	(0.270)	(0.250)	(0.560)	(0.550)
Q4	-0.194	-0.153	-0.350	-0.308
	(-0.300)	(-0.240)	(-0.480)	(-0.420)
Earnings_Surprise	-0.427	-0.304	-0.567	-0.393
	(-1.390)	(-0.930)	(-1.630)	(-1.060)
Analyst_Following	0.008	0.007	-0.004	-0.008
	(0.350)	(0.290)	(-0.170)	(-0.300)
Prior_Return	-2.740	-1.842	-1.447	-0.458
	(-1.500)	(-1.000)	(-0.700)	(-0.220)
Stock_Turnover	-2.456	-2.678	-1.044	-1.254
	(-1.310)	(-1.430)	(-0.490)	(-0.600)
Ret_Volatility	34.234	34.633	39.369 **	39.048 **
	(1.160)	(1.180)	(2.100)	(2.100)
Industry/Year Fixed Effects	**Yes**	**Yes**	**Yes**	**Yes**
Observations	2,204	2,204	2,204	2,204
Adjusted R-squared	2.76%	4.21%	5.21%	6.65%

Table 4: (continued)

Panel D reports the results from OLS regressions of cumulative abnormal stock returns around the next quarter earnings announcement dates on positive abnormal ratings and positive abnormal tone and control variables described in Eq. (2). Column (1) and (2) report the results when the dependent variable is cumulative abnormal stock returns over the window of 1 trading day prior to the next quarter earnings announcement and 1 trading day after the next quarter earnings announcement. Column (3) and (4) report the results when the dependent variable is cumulative abnormal stock returns over the window of 3 trading days prior to the next quarter earnings announcement and 3 trading days after the next quarter earnings announcement. All regressions include industry and year fixed effects. ***, **, * indicate statistical significance at p<0.01, p<0.05, and p<0.10 (two-tailed), respectively. Variables are defined in Appendix A.

Panel D: <u>Positive</u> Abnormal Review Tone and <u>Next Quarter</u> Earnings Announcement Returns

	Cumulative Abnormal Returns around Next Quarter Earnings Announcements			
	CAR (-1, +1)		CAR (-3, +3)	
	(1)	(2)	(3)	(4)
Positive_Abnormal_RATING	0.424	0.320	0.642	0.874
	(0.620)	(0.300)	(0.810)	(0.710)
Positive_Abnormal_TONE	0.336	-0.238	-0.102	-2.450
	(0.200)	(-0.090)	(-0.050)	(-0.790)
Pos_Earnings_Surprise_Dummy		-0.380		-0.740
		(-0.430)		(-0.730)
Positive_Abnormal_Rating * Pos_Earnings_Surprise_Dummy		0.148		-0.468
		(0.110)		(-0.290)
Positive_Abnormal_Tone * Pos_Earnings_Surprise_Dummy		0.910		3.871
		(0.260)		(0.960)
Ln_MVE	0.215	0.220	0.237	0.239
	(0.990)	(1.010)	(0.940)	(0.950)
BM	0.387	0.405	0.926	0.941
	(0.380)	(0.390)	(0.780)	(0.790)
Loss	-1.990 *	-1.980 *	-2.416 *	-2.324 *
	(-1.800)	(-1.780)	(-1.890)	(-1.800)
ROA	-5.466	-5.498	-11.451	-11.199
	(-0.820)	(-0.820)	(-1.490)	(-1.450)
Q4	-0.380	-0.381	-0.111	-0.106
	(-0.590)	(-0.590)	(-0.150)	(-0.140)
Earnings_Surprise	-0.617 *	-0.590 *	-0.568	-0.521
	(-1.930)	(-1.770)	(-1.540)	(-1.350)
Analyst_Following	-0.014	-0.014	-0.016	-0.015
	(-0.700)	(-0.700)	(-0.670)	(-0.630)
Prior_Return	0.921	0.989	-1.255	-1.161
	(0.560)	(0.590)	(-0.660)	(-0.600)
Stock_Turnover	0.263	0.295	1.293	1.333
	(0.150)	(0.170)	(0.650)	(0.660)
Ret_Volatility	22.113	21.541	32.330	30.491
	(0.700)	(0.680)	(0.880)	(0.830)
Industry/Year Fixed Effects	**Yes**	**Yes**	**Yes**	**Yes**
Observations	2,475	2,475	2,475	2,475
Adjusted R-squared	1.65%	1.67%	2.03%	2.15%

Table 5: Disagreements in Review Ratings and Tone and Unexplained Trading Volume

This table reports the results from the OLS regressions of cumulative abnormal stock returns around earnings announcement dates on disagreements in review ratings and disagreements in review tone described in Eq. (3). Column (1) through (3) report the results when the dependent variable is average standardized unexplained trading volume over the window of 1 trading day prior to the earnings announcement and 1 trading day after the earnings announcement. Column (4) through (6) report the results when the dependent variable is average standardized unexplained trading volume over the window of 3 trading days prior to the earnings announcement and 3 trading days after the earnings announcement. All regressions include industry and year fixed effects. ***, **, * indicate statistical significance at p<0.01, p<0.05, and p<0.10 (two-tailed), respectively. Variables are defined in Appendix A.

	Standardized Unexplained Volume (SUV) around Earnings Announcements					
	SUV (-1, +1)			SUV (-3, +3)		
	(1)	(2)	(3)	(4)	(5)	(6)
StdDev_RATING	1.197 **		1.244 *	0.785 **		0.805 **
	(2.380)		(1.920)	(2.500)		(1.990)
StdDev_TONE		0.182	-0.065		0.122	-0.027
		(1.400)	(-0.120)		(1.510)	(-0.080)
Ln_MVE	0.008	0.010	0.009	0.002	0.004	0.003
	(0.120)	(0.150)	(0.130)	(0.060)	(0.090)	(0.060)
BM	0.089	0.145	0.088	-0.024	0.012	-0.025
	(0.280)	(0.460)	(0.280)	(-0.120)	(0.060)	(-0.120)
Loss	-0.075	-0.111	-0.074	-0.016	-0.040	-0.016
	(-0.250)	(-0.370)	(-0.240)	(-0.090)	(-0.210)	(-0.080)
ROA	5.375	5.288	5.370	4.122 *	4.069	4.120 *
	(1.520)	(1.500)	(1.520)	(1.870)	(1.840)	(1.870)
Q4	0.622 ***	0.630 ***	0.622 ***	0.480 ***	0.485 ***	0.480 ***
	(4.120)	(4.170)	(4.120)	(5.110)	(5.160)	(5.110)
Earnings _Surprise	0.041	0.046	0.041	0.035	0.038	0.035
	(0.510)	(0.570)	(0.510)	(0.690)	(0.760)	(0.690)
Analyst_Following	-0.016 ***	-0.016 ***	-0.016 ***	-0.013 ***	-0.013 ***	-0.013 ***
	(-2.900)	(-2.930)	(-2.890)	(-3.900)	(-3.930)	(-3.900)
Forecast_Dispersion	-0.651	-0.612	-0.655	-0.135	-0.108	-0.136
	(-0.610)	(-0.570)	(-0.610)	(-0.200)	(-0.160)	(-0.200)
Prior_Return	0.483	0.514	0.483	0.084	0.103	0.084
	(1.040)	(1.110)	(1.040)	(0.290)	(0.360)	(0.290)
Stock_Turnover	0.602	0.693	0.605	0.524	0.582	0.525
	(1.100)	(1.270)	(1.110)	(1.540)	(1.710)	(1.540)
Ret_Volatility	-3.917	-4.985	-3.872	-4.346	-5.053	-4.327
	(-0.450)	(-0.580)	(-0.450)	(-0.810)	(-0.940)	(-0.800)
Inst_Ownership	0.817 *	0.792 *	0.820 *	0.524 *	0.506 *	0.525 *
	(1.830)	(1.770)	(1.840)	(1.880)	(1.820)	(1.880)
Leverage	-0.213	-0.152	-0.217	-0.181	-0.141	-0.183
	(-0.450)	(-0.320)	(-0.450)	(-0.610)	(-0.470)	(-0.610)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,977	6,977	6,977	6,977	6,977	6,977
Adjusted R-squared	4.22%	4.00%	4.22%	5.14%	4.91%	5.14%

Table 6: Supplementary Analysis: Abnormal Review Tone and Abnormal Sales Growth

This table reports the results from the OLS regressions of abnormal sales growth on abnormal ratings and review tone. Panel A reports the results from OLS regressions of negative abnormal sales growth on negative abnormal ratings and negative abnormal tone and control variables described in Eq. (4). Column (1) through (3) report the results when the dependent variable is the concurrent quarter negative abnormal sales growth. Column (4) through (6) reports the results when the dependent variable is the next quarter negative abnormal sales growth. All regressions include industry and year fixed effects. ***, **, * indicate statistical significance at p<0.01, p<0.05, and p<0.10 (two-tailed), respectively. Variables are defined in Appendix A.

Panel A: Negative Abnormal Review Tone and Negative Abnormal Sales Growth

	Negative Abnormal Sales Growth			Next Quarter Negative Abnormal Sales Growth		
	(1)	(2)	(3)	(4)	(5)	(6)
Negative_Abnormal_RATING	2.961 ***		2.433 **	1.101		2.875 ***
	(4.030)		(2.200)	(1.390)		(2.700)
Negative_Abnormal_TONE		6.048 **	4.466 *		1.260	7.051 *
		(2.160)	(1.750)		(0.420)	(1.750)
Ln_MVE	0.254	0.202	0.210	1.256 ***	0.959 ***	1.188 ***
	(0.970)	(0.790)	(0.650)	(4.920)	(3.720)	(4.500)
BM	-0.199 ***	-0.174 **	-0.227 ***	-0.130 *	-0.110	-0.133 **
	(-2.850)	(-2.340)	(-3.050)	(-1.780)	(-1.500)	(-2.050)
Ln_R&D	-75.381 ***	-59.380 ***	-76.905 ***	-57.155 ***	-42.039 ***	-63.737 ***
	(-7.220)	(-5.940)	(-5.980)	(-5.170)	(-3.900)	(-5.600)
ROA	40.320 ***	29.815 **	37.820 **	-7.526	-28.488 **	-25.698 *
	(3.540)	(2.020)	(2.430)	(-0.670)	(-1.990)	(-1.890)
Loss	-7.157 ***	-9.326 ***	-8.365 ***	-6.310 ***	-9.115 ***	-7.763 ***
	(-5.200)	(-6.570)	(-4.640)	(-3.770)	(-5.490)	(-4.260)
Q4	4.406 ***	1.479	4.020 ***	-0.762	-2.502 **	0.726
	(3.720)	(1.260)	(2.720)	(-0.720)	(-2.350)	(0.630)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,312	1,455	913	1,312	1,455	913
Adjusted R-squared	39.26%	31.43%	37.85%	2.63%	2.35%	3.40%

Table 6: (continued)

Panel B reports the results from OLS regressions of positive abnormal sales growth on positive abnormal ratings and positive abnormal tone and control variables described in Eq. (4). Column (1) through (3) report the results when the dependent variable is the concurrent quarter positive abnormal sales growth. Column (4) through (6) reports the results when the dependent variable is the next quarter positive abnormal sales growth. All regressions include industry and year fixed effects. ***, **, * indicate statistical significance at p<0.01, p<0.05, and p<0.10 (two-tailed), respectively. Variables are defined in Appendix A.

Panel B: Positive Abnormal Review Tone and Positive Abnormal Sales Growth

	Positive Abnormal Sales Growth			Next Quarter Positive Abnormal Sales Growth		
	(1)	(2)	(3)	(4)	(5)	(6)
Positive_Abnormal_RATING	**2.016**		**1.832**	**0.964**		**3.709 ****
	(1.180)		**(1.230)**	**(0.830)**		**(2.280)**
Positive_Abnormal_TONE		**3.964**	**3.999**		**1.230**	**-1.238**
		(1.380)	**(1.080)**		**(0.420)**	**(-0.320)**
Ln_MVE	0.524 ***	-0.737 **	-0.694 *	-1.241 ***	-0.980 ***	-0.999 **
	(4.220)	(-2.440)	(-1.920)	(-3.900)	(-2.940)	(-2.510)
BM	2.420 ***	-0.011	0.602	-3.784 *	-4.086 **	-2.021
	(2.960)	(-0.010)	(0.330)	(-1.840)	(-2.020)	(-0.860)
Ln_R&D	-1.604	19.685 *	27.609 **	14.680	10.982	8.965
	(-0.180)	(1.900)	(2.370)	(1.270)	(0.920)	(0.640)
ROA	183.286 ***	139.078 ***	222.341 ***	81.536 ***	32.488	76.243 **
	(9.480)	(6.570)	(7.400)	(3.430)	(1.270)	(2.410)
Loss	20.128 ***	14.966 ***	20.641 ***	7.766 ***	8.783 ***	10.088 ***
	(10.170)	(6.210)	(6.840)	(3.270)	(3.770)	(3.370)
Q4	4.838 ***	3.638 ***	2.440 *	-3.332 ***	-3.742 ***	-4.470 ***
	(4.760)	(3.190)	(1.730)	(-2.600)	(-2.910)	(-2.850)
Industry/Year Fixed Effects	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Observations	2,203	2,025	1,450	2,203	2,025	1,450
Adjusted R-squared	13.96%	11.18%	15.38%	1.11%	1.29%	1.47%

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