Investor sentiment and the valuation relevance of accounting information

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Abstract

We correlate investor sentiment with the value relevance of accounting information by explicitly considering the effects of investor sentiment on both predicted earnings growth and required rate of return. Using an aggregate measure of investor sentiment, we find that when sentiment is higher, required rate of return becomes higher, whereas predicted earnings growth becomes higher only when the information uncertainty in the accounting information is also high. Incorporating these two effects, we find a negative correlation between the value relevance of accounting information and sentiment. Subsequent tests show that an increase in sentiment enhances the value relevance of earnings only when the information uncertainty imbedded in the earnings is high.

1. Introduction

Some dramatic movements in the stock market during the past few decades have spurred attention to the role of investor sentiment in the market[1]. Prior studies find that when proxies for sentiment go up, stock return increases. However, most of the studies only document the phenomenon but provide no tests for the mechanism behind the effect of sentiment on stock return. This paper tries to explore the often unremarked forces of sentiment and their implications on the coefficients of accounting based valuation equations.

Based on the review of prior studies, we first decompose the effects of sentiment into the effect on predicted earnings growth and the effect on required rate of return. Test findings pertaining to these two effects are consistent with our hypotheses that sentiment correlates positively with both expected earnings growth and expected cost of equity capital. Next, we predict how the combination of these two effects changes the value relevance of accounting information and again find consistent evidence. Specifically, we find the value relevance of book value is negatively correlated with sentiment while the value relevance of earnings is positively correlated with sentiment when the information uncertainty is high.

Among prior studies about sentiment and stock return, only a few touch upon the mechanism behind the effect of sentiment. Brown and Cliff (2005) assume sentiment only changes the expectation of future cash flow and conjecture that changes in risk aversion and risk exposure will not alter the main effect of sentiment (footnote 3). Baker and Wurgler (2007) point out that sentiment will change both the expectations about future cash flow and

[1] See a detailed review in Baker and Wurgler (2007).

expectations about investment risk. Nonetheless, they did not describe in detail nor separate the two effects. Separating cash flow effects from discount rate effects provide more insights for stock valuation (Campbell and Shiller 1988, Campbell 1991, Voulteenaho 2002); however, aside from mere conjectures, these two distinct effects have not been formally examined in the sentiment literature.

The effect of sentiment on investors' judgments about future cash flow is quite intuitive —when people are happy, they are more optimistic. Following this common sense which is supported by psychology studies, we conjecture that the ratio of predicted earnings against current earnings will increase when investor sentiment increases. Perceived earnings growth is chosen to represent cash flow news because it plays an important role in the accounting based valuation model in our latter tests. Nonetheless, we are able to find a positive correlation between sentiment and predicted earnings growth only when the information uncertainty embedded in earnings is high.

The effect of sentiment on the required rate of return is more complicated. Conceptually, required rate of return equals the amount of risk (i.e. risk exposure) times the price of risk (i.e. degree of risk aversion or risk preference). With regard to the amount of risk, during high sentiment period when investors are more optimistic, just as they overestimate expected growth, they may underestimate the amount of risk in the same way. However, with regard to the price of risk, some evidence given by behavioral studies suggests that the price of risk increases when sentiment is higher. Nygren et al. (1996) even suggest that the increase in the price of risk is likely to overshadow the decrease in the amount of risk during high

sentiment periods. Therefore, we conjecture that required rate of return would increase with sentiment. Consistent with the hypothesis, we document that when sentiment increases, measures for required rate of return also increase.

If an increase in sentiment brings some optimistic earnings growth forecasts and a higher required rate of return, how do these two effects interact with each other? Based on a simple transformation of the Ohlson (1995) model, we predict both higher perceived earnings growth and higher require rate of return weakens the value relevance of book value. In contrast, we find the correlation between sentiment and value relevance of earnings controversial in the model specifications: while a higher predicted earnings growth strengthens the value relevance of current earnings, a higher required rate of return weakens it. Our test results show that sentiment is negatively correlated with the value relevance of book value. In addition, the relation between sentiment and value relevance of earnings only turns positive when the information uncertainty embedded in earnings is high. The result is consistent with information uncertainty moderating these two effects of sentiment. When information uncertainty increases, the effect of sentiment on perceived growth becomes stronger. When uncertainty decreases, the effect of sentiment on required rate of return becomes stronger.

In sum, this paper examines two channels of the sentiment effect on stock price which have not been directly tested before. We highlight the moderating effect brought about by information uncertainty. Furthermore, we are able to demonstrate the interplay of these two channels through changes in value relevance of accounting information. Specifically, we show that the effects of sentiment through these two channels work in the same direction on the

value relevance of book value but work against each other on the value relevance of earnings. And again, we find evidence consistent with information uncertainty moderating the effect of sentiment on the value relevance of earnings.

Our study adds to the stream of literature that examines cash flow news and discount rate news separately (Campbell and Shiller 1988, Vuolteenaho 2002). In this study, we rely on analysts' earnings forecasts and the implied cost of capital to separate those two different kinds of news. Our study is closely related to Cready and Gurun (2010) which document evidence consistent with discount rate news being negatively correlated with aggregate earnings news. Under the effect of sentiment, we document same negative correlation between those two types of news. Our final result showing that required rate of return predominates over predicted earnings growth (on the value relevance of earnings) is also consistent with the findings in Cready and Gurun (2010).

By adding sentiment as a determinant of value relevance, we also respond to the conjecture that investors' perceptions or sentiment may be an influential correlated omitted variable in the literature (Kothari and Shanken 2003, Shivakumar 2010). Some researchers have suspect that the reliability of accounting information should not fluctuate so much as to account for the large time-series coefficient variation in value-relevance regressions (Kothari and Shanken 2003). We provide evidence that variables such as investor sentiment play an important role in the temporal variations of the coefficients in the value relevance equation.

Our study also complements the findings from prior studies which document a positive correlation between sentiment and stock return (Neal and Wheatley 1998, Brown and Cliff

2003, 2004, Baker and Wurgler 2006, 2007, Ben-Rephael et al. 2010). We show that some of the cross-sectional variations of the sentiment effect come from its interaction with other information. This result also confirms the significance of information uncertainty (Baker and Wurgler 2007, Zhang 2006b). We show that sentiment is positively correlated with both expected growth and the value relevance of earnings only when the information uncertainty is high.

Lastly, we shed some light on building the concept of "information uncertainty". Again, we show that it is a distinct construct from "risk" (Jiang, Lee, and Zhang 2005, Zhang 2006a, b). Under some circumstances (in our case, when sentiment increases), high information uncertainty may actually decrease the required rate of return. Therefore, for studies related to the behavior of capital market participants, the role of information uncertainty should be properly considered.

This paper proceeds as follows. Section 2 reviews the prior literature and develops the hypotheses. Section 3 describes the measures for major variables and provides summary statistics. Section 4 presents the model and results. Section 5 includes an additional test for information uncertainty, and section 6 concludes.

2. Literature review and Hypotheses

Sentiment is one of the affective states that last for a relative long period (Ben-ze'ev 2001). Like other affective states, it can be analyzed with basic positive or negative valence

structure[2] (Stets and Turner 2007:20, Solomon and Stone 2002:418, Kelley 1984, Shelly 2001). One of the most common effects of a positive valence is over-estimating the likelihood of positive events and under-estimating the likelihood of negative ones (Isen 1984, 2004 and Isen et al. 1978,1983,1988, Mittal and Ross 1998). The definition of sentiment in the finance literature mostly stems from this point. For example, Baker and Wurgler (2007) define sentiment as "a belief about future cash flows and investment risks that is not justified by the facts at hand" (p.129) or "simply optimism or pessimism about stocks in general" (p.132).[3] What academics believe is consistent with layman intuition: when speaking of the effect of investor sentiment in the financial market, both practitioners and news media believe high sentiment scores lead to optimism which in turn drives stock return higher. Corroborating this argument, prior studies also find a positive correlation between sentiment measures and stock return (Neal and Wheatley 1998, Shiller 1981, 2000, Brown and Cliff 2003, 2004, Baker and Wurgler 2006, 2007, Ben-Rephael et al. 2010).

Although a positive sentiment-return relation with some cross-sectional variations has been established, the exact mechanism of how sentiment affects stock price has not been fully examined. For example, Brown and Cliff (2005) assume sentiment only changes the expectation of future cash flow and conjecture that changes in risk aversion and risk exposure will not alter the main effect of sentiment (footnote 3). In contrast, Baker and Wurgler (2007) point out that sentiment will change both the expectations about future cash flow and expectations about investment risk. However, they did not describe in detail nor separate the two effects.

[2] Valence refers to the positive or negative motional charge.

[3] Shefrin (2008) give similar definitions to sentiment. It is "the aggregate errors of investors being manifested in security prices. In the case of irrational exuberance and technology stocks, the sentiment of investors was regarded as having been excessively optimistic". (p.216)

Different from prior studies which rely mainly on stock returns to examine the effect of sentiment, we argue that accounting based valuation models provide different and perhaps richer context in which the interplay of these two effects can be observed. These two separate effects of sentiment on predicted earnings growth and required rate of return can be operationalized in the residual income model (Ohlson 1995) in the form of earnings persistence and cost of equity capital. In Ohlson (1995), stock price of the firm is expressed as a function of the book value (Y_t), abnormal earnings (X_t^a), and other information (V_t) in the market (p.669).

$$P_t = Y_t + \frac{\omega}{R_f - \omega} \times X_t^a + \alpha_2 V_t \quad \text{.....(A)}$$

The coefficient on X_t^a which represents the value relevance of abnormal earnings is a function of risk free discount factor (R_f) and ω. Following the information dynamics in Ohlson (1995), ω can be deemed as the implication of current abnormal earnings on next period abnormal earnings as shown in equation (B).

$$x^a_{t+1} = \omega x^a_t + v_t + \varepsilon_{t+1} \quad \text{.....(B)}$$

If predicted earnings growth $\frac{E(X_{t+1}^a)}{X_t^a}$ for next year is higher, ω will be higher and current earnings will be more value relevant.[4] At the first sight, the cost of equity does not seem to matter in equation (A). This is because in the original Ohlson (1995) equation, risk adjustment was introduced as a certainty-equivalent reduction of the expected abnormal earning. However, Feltham and Ohlson (1999) acknowledge that practical valuation analysis tends to use risk

[4] To be more precise, ω stands for earnings persistency. Later in our empirical tests based on this measure, we separate loss firms from profit firms. For profitable firms, earnings growth means stronger persistency. However, for loss firms, earnings growth means weaker persistency.

adjusted discount factors (p.174) where the risk adjusting process is embedded in the denominator rather in the numerator of a valuation equation. We argue that using risk adjusted discount factors for both abnormal earnings calculation and discounting purpose is appropriate in empirical settings where ω is usually based on investors' judgments (or analysts forecasts) which is not "risk adjusted". If one uses required rate of return to calculate and discount the abnormal earnings, then he should replace R_f in equation (A) with the implied cost of equity capital.

$$P_t = Y_t + \frac{\omega}{COC-\omega} \times X_t^a + \alpha_2 V_t \quad \text{.....(C)}$$

Based on equation (C), we confirm that sentiment possibly changes the value relevance of accounting information through two channels: changes in beliefs about future earnings growth (ω) and changes in required rate of return (COC).

Regarding the first channel, "affect"[5] studies in psychology show that when people are in a positive affective state, they are more optimistic (e.g., Isen 1984, 2004 and Isen et al. 1978,1983,1988, Mittal and Ross 1998). Although studies find analysts make more positive forecast errors during high sentiment periods (e.g., Bergman and Roychowdhury 2008, Hribar and McInnis 2009, Qian 2009, Mian and Sankaraguruswamy 2010), to the best of our knowledge, so far no study directly links sentiment with perceived growth (i.e. the implication of current earnings on future earnings). The implication of current earnings on future earnings

[5] Most psychology studies use the more general term *affect* instead of *sentiment*. Affect refers to an evaluative reaction to a stimulus that has either positive or negative valence (Fiske and Taylor 1991). Sentiment is one of four types of affective phenomena (Ben-ze'ev 2001). Compared with the other three, sentiment has specific intentionality, is longer, and more stable. Although differing on various dimensions, all four phenomena fall into the basic positive-negative valence structure of affect.

(i.e. ω in equation B) is particularly important as ultimately it plays a role in the value relevance of accounting information. Based on the affect studies, we predict that investors will be optimistic about the growth of future earnings when sentiment increases.

Hypothesis 1: When sentiment increases, investors' predicted earnings growth also increases.

Next, we consider the role of information uncertainty in the effect of sentiment on predicted earnings growth. Hirshliefer (2001) points out that "mood states tend to affect relatively abstract *judgments* more than specific ones about which people have concrete information". (p.1551) Zhang (2006a, 2006b) shows that information uncertainty[6] mainly affects the judgment about cash flow, and analysts are more susceptible to this effect when they make forecasts for stocks with high information uncertainty. In psychology studies, Affect Infusion Model (AIM) suggests that the effects of sentiment become more intense in judgments based on ambiguous stimuli that demand substantial cognitive processing. This happens because substantial and prolonged processing leaves more room for affect-priming effects to occur (Forgas 1995). This affect-priming effect is the exact mechanism that leads to optimistic or pessimistic judgments (e.g., Wright and Bower 1992). More importantly, Baker and Wurgler (2006, 2007) find that the positive sentiment-return relation is stronger for firms with high uncertainty—firms that are hard to value and/or difficult to arbitrage.

[6] "Information uncertainty" is "the ambiguity with respect to the implications of new information for a firm's value" (Zhang 2006b, p.567). Zhang (2006a, 2006b) shows that risk and information uncertainty are two separate constructs. Zhang (2006a) shows that high information uncertainty leads to a delayed response to the cash flow shock. Zhang (2006b) shows that this delayed response due to information uncertainty also exists in analysts' forecasts.

Combining the above theory and empirical evidence, we hypothesize that the effect of sentiment on predicted earnings growth also varies in the cross-section with information uncertainty. When sentiment increases, the predicted earnings growth will be higher for firms with high information uncertainty than firms with low information uncertainty.

Hypothesis 2: When sentiment increases, perceived earnings growth for firms with high earnings uncertainty becomes higher than firms with low earnings uncertainty.

The effect of sentiment on the required rate of return is controversial. Sentiment may not have substantial effect on the required rate of return, as Brown and Cliff (2005) suggest. However, many financial and psychology studies claim otherwise. Since conceptually, required rate of return is the product of the amount of risk times the price for risk[7], we separate the discussion into these two aspects:

With respect to the amount of risk, Baker and Wurgler (2007) suggest sentiment not only changes investors' beliefs about cash flow but also their beliefs about investment risk. However, they do not further elaborate on this point. Reviewing related literature, we observe at least two different theories about the relation between sentiment and the assessment of risk exposure. A couple of psychology studies find that when people are optimistic, they expect risk exposure to be lower (e.g., Johnson and Tversky 1983 , Wright and Bower 1992). These studies demonstrate that optimism not only affects the perceived growth but also the perceived amount of risk. In the behavioral finance literature, Shefrin (2008) develops a model about the

[7] "Price of risk" which remains the same for all assets (Chochran 2001, p.16) is usually used to measure the risk preferences. If investors are more risk averse, the "price of risk" will be higher. If they are less risk averse, the "price of risk" will be lower.

relation between sentiment and the discount factor. He shows that during high sentiment periods, people are more optimistic and thus lead to a lower discount factor (p.243). We think his model is consistent with what psychologists found that people would think risk exposure to be lower when sentiment is high. However, in his model sentiment does not directly change people's risk preference, and therefore, the risk premium is only being affected by changes in the degree of optimism.

In addition to the amount of risk (or risk exposure), investors' risk preferences may also be affected by sentiment.[8] In attempt to depict the relation between sentiment and risk preferences, "affect" studies sustain that when sentiment level is lifted, investors will become more risk averse (e.g., Isen et al. 1988, Nygren et al. 1996, Kliger and Levy 2003, Andrade 2005). Psychological explanation for this perplexing phenomenon is that people in positive sentiment are motivated to maintain their positive states. They have more to lose (do not want to lose the positive sentiment) and are less willing to take risks than the control group in the same situation (e.g., Isen and Simmonds 1978). Isen et al. (1988) measure and draw out the utility functions of subjects under different affective states. They show that a positive feeling state accentuates an aversion to choosing riskier options by altering the perceived disutility associated with negative outcomes.

[8] In the finance literature, although researchers agree the price of risk (or risk premium) do change over time, there are little theory or empirical evidence about the relation between sentiment and the price of risk. In the multifactor pricing models, if one treats factor sensitivity as amount of risk, then factor risk premium can be treated as the price of risk. Vassalou (2003) find that news related to future GDP growth is priced as a risk factor. Therefore, it is possible that sentiment, which is often treated as a leading indicator for the macro-economy, may also affect the price of risk.

To reconcile the findings on judgment of risk (Johnson and Tversky 1983) and risk preferences (Isen et al. 1988), Nygren et al. (1996) argue that people in positive affective states are more likely to shift their decision rule from probabilities (beliefs about risk exposure) to utilities (risk preferences). Accordingly, even if people in a positive sentiment state perceive the risk exposure to be low, they may still feel it is not "worth the risk" to take actions. Based on the argument in Nygren et al. (1996), we develop the third hypothesis:

Hypothesis 3: When sentiment increases, investors' required rate of return also increases.

Lastly, we test the effect of sentiment on the relation between stock price and accounting information using residual income valuation model. Because empirical measures for expected abnormal earnings are difficult to construct, we replace abnormal earnings with accounting earnings in the model. To achieve this, we transform equation (A) into equation (C).

$$P_t = Y_t + \frac{\omega}{R_f - \omega} \times X_t^a + \alpha_2 V_t \text{.....(A)}$$

$$= Y_t + \frac{\omega}{R_f - \omega} \times (X_t - (R_f - 1) \times Y_{t-1}) + \alpha_2 V_t$$

$$= Y_t + \frac{\omega}{R_f - \omega} \times (X_t - (R_f - 1)(Y_t - X_t + d_t)) + \alpha_2 V_t$$

$$= (1 - (R_f - 1)\frac{\omega}{R_f - \omega})Y_t + (R_f - 1)\frac{\omega}{R_f - \omega}(\frac{R_f}{R_f - 1} \times (X_t - d_t)) + \alpha_2 V_t$$

$$= \left(\frac{R_f - R_f\omega}{R_f - \omega}\right) Y_t + \left(\frac{R_f\omega}{R_f - \omega}\right) X_t + (\frac{\omega - R_f\omega}{R_f - \omega})d_t + \alpha_2 V_t \text{.....(C)}$$

Again, for the same reasons stated before (Feltham and Ohlson 1999), we replace R_f with COC and obtain the following equation:

$$P_t = \left(\frac{COC - COC\omega}{COC - \omega}\right) Y_t + \left(\frac{COC\omega}{COC - \omega}\right) X_t + \left(\frac{\omega - COC\omega}{COC - \omega}\right) d_t + \alpha_2 V_t \quad \text{.....(D)}$$

We can observe how the two channels of sentiment change value relevance of accounting information by differentiating the first two coefficients in equation (D) on COC and ω respectively.

$$\partial\left(\frac{COC - \omega COC}{COC - \omega}\right) / \partial\omega = \frac{COC(1 - COC)}{(COC - \omega)^2} < 0$$

$$\partial\left(\frac{COC - \omega COC}{COC - \omega}\right) / \partial COC = \frac{\omega(\omega - 1)}{(COC - \omega)^2} < 0$$

Under normal conditions, both COC and ω are positive; therefore, the exercise indicates that when both ω and COC increase, the coefficient on Y_t decreases. Based on our first two hypotheses, an increase in sentiment shall lead to increases in both ω and COC. The combined effect then leads us to predict that an increase in sentiment will result in a decrease in the value relevance of book value (Y_t).

Hypothesis 4: When sentiment increases, the value relevance of book value weakens.

$$\partial\left(\frac{COC\omega}{COC - \omega}\right) / \partial\omega = \frac{COC^2}{(COC - \omega)^2} > 0$$

$$\partial\left(\frac{COC\omega}{COC - \omega}\right) / \partial COC = \frac{-\omega^2}{(COC - \omega)^2} < 0$$

In contrast to the value relevance of book value, we find that ω and COC work against each other on the coefficient for X_t. Consequently, the coefficient for earnings (X_t) can either go up or down depending which effect predominates over the other. Prior studies find cash flow shocks

and discount rate shocks are negatively correlated, with cash flow shocks dominating discount rate shocks at the firm level (Vuolteenaho 2001) and discount rate shocks dominating cash flow shocks at the market level (Campbell and Ammer 1993). Recently, Cready and Gurun (2010) examine how aggregate accounting news influence individual stock return and find evidence showing that discount rate shocks dominate cash flow shocks. Therefore, we make no prediction on the direction of sentiment effect on the value relevance of earnings. If predicted earnings growth predominates over the required rate of return, we expect the effect of sentiment on the value relevance of accounting numbers to be positive. If the effect on required rate of return is stronger than the effect on predicted growth, we expect the combined effect to be negative.

Lastly, we consider the role of information uncertainty in the value relevance of earnings. Following the argument in hypothesis 2, we also conjecture that in cases of high uncertainty, the predicted earnings growth effect will be stronger; therefore, in these cases, we shall observe a more positive correlation between sentiment and value relevance of earnings compared to cases of low information uncertainty.

Hypothesis 5: When sentiment increases, the value relevance of earnings with high uncertainty becomes stronger than earnings with low uncertainty.

3. Measures and Data

Our investor sentiment score comes from Baker and Wurgler (2006, 2007). In prior studies, different measures of sentiment have been proposed including various surveys, closed-end-fund discount, trading volume, IPO activities, volatility measures, mutual fund flow, retail

investor trades, dividend premium, and insider trading activities.[9] Using principle component analysis, Baker and Wurgler (2006, 2007) construct a comprehensive sentiment score out of six measures that provides enough time series data available over the past forty years. In addition, they also orthogonalize the score on six macro-economic measures to make sure that this is the "irrational" components of the sentiment.

We use implied cost of equity instead of realized return to measure investors' required rate of return. Although traditionally, realized return has been widely used as a proxy for required rate of return, correlation between ex-ante required rate of return and realized returns is weak (Elton 1999). More importantly, studies show that realized return cannot serve as a good proxy for ex-ante expected return if there is a cash flow shock (Ogneva 2010). The ex-post realized return is especially not an appropriate measure in this paper since we expect sentiment will change both expected cash flow and expected risk exposure. In addition, studies find implied cost of capital is more useful then realized returns in estimating the temporal risk-return tradeoff (e.g., Pastor, SInha, and Swaminathan 2008). Therefore, we use implied cost of capital instead of realized return to measure the ex-ante required rate of return. We use average implied cost of capital based on IBES analysts forecasts calculated from four different methodologies (Claus and Thomas 2001, Gebhardt, Lee, and Swaminathan 2001, Ohlson and Juettner-Nauroth 2005, and Easton 2004). We also obtain Value Line implied cost of capital measure from Brav, Lehavy, and Michaely (2005) for validity check.

Firm characteristics are measured based on the intersection of the CRSP Monthly Stock File and the COMPUSTAT Industrial Annual File. Analysts' consensus forecast is from I/B/E/S.

[9] Please see Baker and Wurgler (2007) for a complete review.

The risk free rate is collected by Prof. French, obtained through Wharton Research Data Services (WRDS). The GDP growth rate is from the Bureau of Economic Analysis. Because consensus forecast in I/B/E/S is only available after 1983 and the sentiment measure from Baker and Wurgler is only up to 2007, our sample period runs from 1/1/1983 to 12/31/2007 with 36,375 firm-year observations excluding financial service and utility industries. Table 1, Panel A describes the sample selection process.

[Insert table 1 here]

Table 1, Panel B provides descriptive statistics pertaining to major variables in our tests. It includes our analysts forecast optimism measure, measures for cost of equity capital, major firm characteristics, other common measures related to risk and analysts forecasts. The median risk premium based on our calculation is about seven percent which is consistent with findings from surveys (Welch 2000) and empirical studies (Botoson 1997).

Table 1, Panel C provides simple correlations among our major variables. The correlation between sentiment level and change in sentiment is negative, suggesting a mean reversion time-series process. The correlations between sentiment and our two major variables of interest – cost of equity and perceived earnings growth are weak. Our measure of information uncertainty is positively correlated with cost of equity and perceived earnings growth.

4. Models and tests

Under the residual income framework, we decompose the effect of sentiment on value relevance of accounting information into the effect on predicted earnings growth (ω) and the effect on required rate of return (COC). First, we test whether sentiment changes investors' perceived earnings growth.

$$\text{Perceived earnings growth}_{i,t} = \beta_0 + \beta_1 \Delta\text{Sentiment}_t + \text{Control variables}_{i,t}$$

where perceived earnings growth in year t is measured as consensus forecast for annual earnings in year t minus the realized earnings in year t-1 divided by the absolute value of realized earnings in year t-1. The consensus forecast is the first available consensus forecast for year t annual earnings after the year t-1 annual earnings announcement. If the earnings announcement date is not available, we assume that earnings number is announced 90 days after the t-1 fiscal period end date. The change in sentiment is measured as the sentiment score at the end of year t minus the sentiment score at the end of year t-1.

We also use the level of sentiment at the end of the year t-1 as a control variable. While Baker and Wurgler (2007) demonstrate a general positive correlation between stock return and sentiment change in the concurrent period, Baker and Wurgler (2006) show a negative correlation between stock return and sentiment level at the beginning of that period. They suggest that the negative correlation between return and beginning sentiment level was due to overreaction brought about by sentiment. Therefore, we expect to see a negative coefficient on this variable.

Firm characteristics such as firm size and book to market ratio are included in the model. To be consistent with the subsequent test, other risk related variables such as firm beta, leverage, dividend payout ratio, and momentum effect are also included. To control the characteristics of the information environment captured by analysts' forecasts, we further include number of analysts following the firm, average experience of analysts following the firm, and a dummy variable for the implementation of regulation FD. Finally, GDP growth, risk free rate, and a trend variable are also included to capture variations due to time-series changes in the general economic environment.

[Insert table 2 here]

We expect to see a positive coefficient for the change in sentiment. However, we fail to observe such a correlation across all the observations. In Table 2 model 1 to 3, the coefficient is not significant. Baker and Wurgler (2006, 2007) point out the importance of the cross-sectional variation in the effect of sentiment; therefore, we suspect that the coefficient will not be significant if the moderating effect is not properly considered. With the concern in mind, we move on to test our second hypothesis.

In the second hypothesis, we propose that the effect of sentiment on perceived earnings growth varies with information uncertainty. The information uncertainty here is measured as the standard deviation of the past five year EPS divided by the mean of the absolute EPS in the past five years. We use EPS volatility instead of return volatility because we think the latter captures an aggregate uncertainty level of all the information related to the firm.

However, in this study, because we focus on the value relevance of accounting information, only information uncertainty related to accounting information needs to be considered.

In Table 2 Model 2 to 5, we add the interaction term of sentiment and information uncertainty in the regression and expect to see a positive coefficient on this term. The result is consistent with our prediction. When the information uncertainty is high, the positive effect of sentiment on predicted earnings growth is stronger. To better illustrate the cross-sectional differences in the effect of sentiment on perceived growth, we sort our observations into quartiles based on earnings volatility and replace the VOL measure with the rankings of 1 to 4 (1 is most stable and 4 is most volatile) in Table 2 Model 6. The result suggests that one standard deviation increase in the sentiment score will result in 4.7% (0.603×4×0.033-0.603×(-0.054)=0.047) increase in the perceived earnings for firms in the highest volatility quartile, while the firms in the lowest volatility quartile will suffer a decrease of 1.3%. One intriguing observation is that after we add the sentiment-volatility interaction term, the main effect of sentiment is negative and significant.

Next, we conduct our test about the relation between required rate of return and sentiment.

$$\text{Required rate of return}_{i,t} = \delta_0 + \delta_1 \Delta\text{Sentiment}_t + \text{Control vriables}_{i,t}$$

To be consistent with our first test, the required rate of return is measured based on the analysts' forecast in the same month when the perceived earnings growth is measured. We use the required rate of return calculated separately based on four methods from prior studies (Claus and Thomas 2001, Gebhardt, Lee, and Swaminathan 2001, Ohlson and Juettner-Nauroth

2005, and Easton 2004). To mitigate the measurement error from different required rate of return calculations, we take the average of the four measures as our proxy for required rate of return. The control variables are the same as in the first test.

[Insert table 3 here]

Consistent with our prediction, we find that an increase in investor sentiment will also increase the required rate of return. Again, to better illustrate the economic significance, in Table 3 Model 6 we replace the original measure for VOL with the quartile rankings. The model shows that one standard deviation increase of Δsentiment will increase the required rate of return by 2 basis points (0.603×0.006+0.603×4×(-0.0014)=0.0002) for the firms with most volatile earnings in our quartile ranking. For the most stable firms, the required rate of return will increase by 28 basis points. Although required rate of return increases across all the firms, firms with low information uncertainty actually increases more than firms with high information uncertainty. It is very interesting and consistent with the way we predicted about the effect of sentiment on amount of risk and price of risk. Information uncertainty provides room for optimism to kick in, which lowers the perceived amount of risk and in turn lowers the required rate of return.

Untabulated results show that replacing the average implied cost of equity capital with individual measures does not change the signs on the coefficients for sentiment. As a robustness test, we also try the Brav, Lehavy, and Michaely (2005) measure of required rate of return from their website and find consistent results.

Finally, we test the relation between sentiment and the value relevance of accounting information under the residual income framework. The dependent variable is the price three month after the fiscal period end date. To observe the moderating effect of information uncertainty, we rank the firms based on their five-year earnings volatility on rolling basis and run the following two value relevance equations:

$$\text{Price} = \theta_0 + \theta_1 \text{EPS}_t + \theta_2 \text{BV}_t$$

$$\text{Price} = \gamma_0 + \gamma_1 \text{EPS}_t + \gamma_2 \text{EPS}_t * \Delta\text{SENTIMENT}_t + \gamma_3 \text{BV}_t + \gamma_4 \text{BV}_t * \Delta\text{SENTIMENT}_t$$

[Insert table 4 here]

The results are intriguing and consistent with our prediction in general. We observe a see-saw effect similar to the one document in Baker and Wurgler (2007) on the main effect of sentiment: when sentiment score increases, stock prices increase for the firms with volatile earnings but decrease for the firms with stable earnings. We also observe a convex relation between book value and earnings similar to Burgstahler and Dichev (1997): when information uncertainties contained in earnings are high, the market put more weight on the book value. In contrast, when earnings are more stable, earnings demonstrate a stronger relation with stock price.

In Table 4 Panel B, we add the interaction between sentiment and accounting information to the equation. The correlation between sentiment and value relevance of book value is negative as predicted. The correlation between sentiment and the value relevance of earnings is apparently moderated by information uncertainty. Table 4 Panel B shows that for

firms with earnings of high information uncertainty, the coefficient on the interaction term between earnings and sentiment is strongly positive.

Another interesting observation is that the main effect of sentiment on price also varies with information uncertainty. In Table 4 Panel A, it is positive for stocks with high information uncertainty and negative for stocks with low information uncertainty. However, in Panel B, when we add the interaction of accounting information and sentiment in the equation, the main effect of sentiment becomes positive across all the stocks.

5. Additional test

5.1 Different measures for information uncertainty

In this section, we try to extend our tests for both hypothesis 2 and hypothesis 5 with regard to the role of information uncertainty. This time the uncertainty is embedded in a specific earnings component rather than in the earnings as a whole. Specifically, we want to test how sentiment affects the value relevance of an earnings component that will "bring future benefits with high uncertainty" (Kothari et al. 2002). We follow Kothari et al. (2002) procedure and confirm that R&D expenses generate future benefits of the highest uncertainty during our sample period among the three earnings items the authors choose (R&D, advertising, special items). We conjecture that the effect of sentiment on predicted growth will be strongest on this item. Therefore, we expect that the coefficient for the interaction term between sentiment and R&D will be positive and significant.

$$\text{Price} = \tau_0 + \tau_1 \text{EPS}_{\text{adj}_t} + \tau_2 \text{EPS}_{\text{adj}_t} * \Delta\text{SENTIMENT}_t$$

$$+\tau_3 \mathrm{R\&}D_t + \tau_4 \mathrm{R\&}D_t * \Delta\mathrm{SENTIMENT}_t + \tau_5 \mathrm{BV}_t + \tau_6 \mathrm{BV}_t * \Delta\mathrm{SENTIMENT}_t$$

[Insert table 5 here]

In Table 4 Model1 and 2, we find evidence consistent with our prediction. The coefficient τ_4 is positive and significant. Originally, the main effect of one dollar increase in R&D will decrease stock price. However, the positive interaction between sentiment and R&D expense is likely to overshadow the negative main effect. In that case, a one dollar increase in R&D with one standard deviation increase in sentiment will increase stock price by 29 cents on per share basis. This is consistent with the theory that the effect of optimism overshadows the effect of required rate of return only for information with high uncertainty.

To be consistent with previous tests, a substantial number of observations are lost when we require both return information and analysts' consensus variables. To address the potential survival bias in our sample selection process, in Table 4 Model 3 and 4, we remove these data requirement. The sample size increased from 22729 firm-year observations to 41940 firm-year observations. The results remained the same.

5.2 Fama-MacBeth procedure

In this session, we test hypotheses 4 and 5 regarding value relevance of accounting information with the Fama-MacBeth method that was widely adapted in prior papers. In this way, we can avoid the interaction term in the equation and perhaps draw a more intuitive inference from the coefficient. Following the process in Core et al. (2003), we first run the following equation on annual basis:

$$\text{Price}_t = \theta_0 + \theta_1 \text{ADJ\_EPS}_t + \theta_2 \text{RD}_t + \theta_3 \text{BV}_t$$

Again, R&D is used here to represent earnings items that bring future benefits with high uncertainty. In the second stage, we take the estimated coefficients θ_1, θ_2, and $\theta_3$as dependent variable and run a time series regression in the following fashion:

$$\hat{\theta}_{i,t} = \omega_{i0} + \omega_{i1} \Delta\text{Sentiment}_t + \text{Control variables}_t$$

We control variables capturing the changes in the Micro-economic environment such as GDP growth, risk free rate, and a trend variable. We also control for variables proposed by prior studies (Collins et al. 1997) including average firm size, percentage of one-time items across all the firms, proportion of loss firms, and proportion of firms in the industry with high intangibles.

The test results are consistent with our previous tests. The effect of sentiment on the value relevance of book value is negative and the effect of sentiment on the value relevance of earnings items with high uncertainty (which is R&D in this test) is positive. Some of the coefficients for $\Delta\text{Sentiment}_t$ in the test is only marginally significant. This might be due to the small sample size we have in the time-series.

5.3 Using earnings persistency instead of earnings growth

In the original information dynamics proposed by Ohlson (1995), the coefficient ω should be best described as earnings persistency. Perceived earnings persistency can be roughly measured by the ratio of consensus forecast for EPS_{t+1} over EPS_t. However, in our hypothesis development and empirical test, we use perceived earnings growth $\frac{E(EPS_{t+1}) - EPS_t}{abs(EPS_t)}$ which is not

exactly perceived earnings persistency. Therefore, we use measures for perceived earnings persistency and re-run the test in Table 2 to see if it changes the results.

We argue that when EPS_t is positive, the concept of earnings growth is a good approximation for earnings persistency. Whereas when EPS_t is negative, the higher the earnings persistency the lower the earnings growth. Therefore, we re-run the tests in Table 2 separately for profitable firms and loss firms using $\frac{E(EPS_{t+1})}{EPS_t}$ as the dependent variable. The results confirm our argument and show that the result in our value relevance test is probably mainly driven by profitable firms where expected earnings growth increases earnings persistency.

6. Conclusion

We provide a framework to investigate the effect of sentiment based on the residual income model. Under the framework, we identify two channels through which sentiment influences the value relevance of accounting information: the effect on predicted earnings growth and the effect on required rate of return. We find that an increase in market wide sentiment will increase the required rate of return. The effect is significant even after controlling the Fama-French three risk factors, the momentum factor, and other risk related firm characteristics. It indicates that investors ask for a higher required return during high sentiment periods.

We also mark out that information uncertainty plays a key role in the relation between sentiment and predicted earnings growth. In contrast to studies that find analysts make more positive errors across all the firms when sentiment increases (Bergman and Roychowdhury

2008, Hribar and McInnis 2009, Qian 2009, Mian and Sankaraguruswamy 2010), we find no evidence showing that analysts make optimistic growth forecasts for all the firms. However, consistent with prior studies which conclude that sentiment effect is stronger when uncertainty is high (Baker and Wrugler 2006, 2007) and that uncertainty acerbates the effect of behavioral factors (Zhang 2006a, 2006b), we find sentiment only drives up predicted earnings growth when the information uncertainty is high.

Combining our findings in the above two effects, our final test shows that the value relevance of book value is negatively related to sentiment. Furthermore, information uncertainty again plays a key role in the relation between sentiment and value relevance of earnings. The value relevance of earnings is positively correlated with sentiment only when information uncertainty is high. The results demonstrate that the accounting based valuation equation provides richer context than mere stock return in testing the two effects of sentiment.

This paper adds to the literature about the effects of sentiment. We examine two channels of sentiment effect on stock price which have not been directly tested before. We are able to demonstrate the interplay of these two effects through changes in value relevance of accounting information. Specifically, these two effects work in the same direction on the value relevance of book value but work against each other on the value relevance of earnings.

This paper also enhances our understanding about the value relevance of accounting information. We respond to the conjecture that behavioral factors may explain temporal variations in earnings response coefficients (e.g., Kothari and Shanken 2003) and demonstrate

that, both the implications of earnings and book values on stock price are subject to the influence of sentiment.

This paper also shed some light on the stream of literature that looks at the relation between cash flow shocks and discount rate shocks. We find sentiment could be one of the exogenous factors that contribute to the positive correlation between these two shocks. We also find information uncertainty plays an important role in the interplay of these two shocks. Specifically, in the setting of value relevance for earnings, we show that information uncertainty can magnify the effect of cash flow shocks to the extent that will overshadow the discount rate shocks.

There are a couple of limitations for the study. First, we rely on the assumption that analysts' judgment is an adequate proxy for average investors' judgment. Also, we have not incorporated the possibility of management decisions such as earnings management or disclosure being influenced by investor sentiment (Bergman and Roychowdhury 2008, Rajgopal, Shivakumar, and Simpson 2008). We consider both level and change in the measure for sentiment, future studies may also examine other attributes of the sentiment measure such as the distribution of the sentiment score (Shefrin 2008).

Appendix: variable definitions

Variable	Definition
$Sentiment_{t-1}$	Investor sentiment score at the beginning of year t from Baker and Wurgler (2006)
Δ $Sentiment_t$	Changes in sentiment score: investor sentiment score at the end of year t minus the score at the beginning of year t
RR	Average of the four implied cost of equity capital calculated based on Gebhardt, Lee, and Swaminathan (2001), Claus and Thomas (2001), Easton (2004), and Ohlson and Juettner-Nauroth (2005)
GRO	Perceived earnings growth: consensus forecast for annual earnings (medest) in year t from IBES minus the actual earnings (value) from IBES in year t-1 divided by the absolute value of the actual earnings in year t-1. The consensus forecast is the first available consensus forecast for year t annual earnings after the year t-1 annual earnings announcement.
VOL	Earnings volatility: the standard deviation of annual earnings per share (epspx adjusted by ajex) from t-5 to t-1 divided by the mean of the absolute value of earnings per share from t-5 to t-1
PRC	Stock price three month after fiscal period end date
CEQ	Book value of equity from COMPUSTAT
EPS	Earnings per share from COMPUSTAT
XRD	R&D expenses from COMPUSTAT
DVC	Dividend payout ratio: current year dividend (COMPUSTAT annual items: dvc/csho) per share divided by earnings per share (epspx)
LMV	Size: log of the market value of the firm (prcc_c*csho)
LEV	The leverage ratio, measured as total debt divided by total assets, at the end of year t-1 ((dlc+dltt/(dlc+dltt+prcc_c*csho)))
BM	Book to market ratio (ceq/(prcc_c*csho))
BETA	CAPM beta: calculated based on the daily return since 5 years before the consensus date
MOM	Momentum effect: calculated as the cumulative monthly return start from 12 month and end on 2 month before the consensus date
NUM	Number of analysts following: measured as the number of annual earnings forecasts being made in the IBES database (numest)
EXP	The average experience of the analysts following the firm: calculated as the average number of years each analyst appears in the IBES database
RF	One month Treasury Bill rate, taken from WRDS
TIME	Time trend: calendar year of the observation minus 1982
FD	A dummy variable for REG FD: if calendar year >=2000 then the value is one, otherwise it is zero
GDP	GDP growth ratio, from the Bureau of Economic Analysis

Table 1 Descriptive Statistics

Panel A: Sample size

		Firm-year observations
Compustat data from 1983-2007 with required financial statement related information (CEQ EPSPX BM LMV LEV DVC)		139,278
Less observations missing five year earnings volatility (VOL)	(45,936)	93,342
Less observations missing analysts related information (GRO EXP FOL)	(49,219)	44,123
Less observations missing price related information (PRC MOM BETA)	(7,749)	36,374
Final sample		36,374
Additional tests: Less observations missing R&D expenses (XRD)		22,730 (table 5)

Panel B: Univariate statistics

Variable	N	Mean	Std dev	P5	Q1	Median	Q3	P95
Δ Sentiment$_t$	36374	-0.014	0.603	-1.19	-0.2	0.03	0.24	1.17
Sentiment$_{t-1}$	36374	0.109	0.61	-0.67	-0.18	-0.02	0.42	1.3
RR	36374	0.142	0.079	0.077	0.1	0.121	0.155	0.283
GRO	36374	0.711	1.806	-0.218	0.104	0.209	0.563	3
VOL	36374	0.797	0.482	0.156	0.354	0.753	1.189	1.616
CEQ	36374	10.749	8.61	1.48	4.875	8.494	13.935	28.602
EPS	36374	0.974	1.73	-1.64	0.15	0.88	1.75	3.94
XRD	22730	0.874	1.256	0	0.137	0.516	1.111	2.926
DVC	36374	0.009	0.027	0	0	0	0.006	0.049
LMV	36374	6.153	1.827	3.364	4.81	6.031	7.364	9.465
LEV	36374	0.202	0.203	0	0.025	0.144	0.316	0.625
BETA	36374	0.936	0.571	0.135	0.523	0.867	1.267	2.026
BM	36374	0.574	0.412	0.13	0.297	0.475	0.729	1.362
MOM	36374	0.137	0.518	-0.512	-0.167	0.060	0.313	1.069
NUM	36374	8.157	7.562	1	2	5	11	25
EXP	36374	6.406	3.569	1.23	3.783	6.066	8.475	12.981
RF	36374	0.036	0.016	0.009	0.025	0.039	0.044	0.062
GDP	36374	5.667	1.218	3.4	4.9	5.8	6.4	7.5

Panel C: Pearson (above) and Spearman (below) correlation matrix

Variable	Δ Sen$_t$	Sen$_{t-1}$	RR	GRO	VOL	CEQ	EPS	XRD	DVC	LMV	LEV	BETA	BM	MOM	NUM	EXP	RF	GDP
Δ Sen$_t$	1	**-0.51**	**-0.04**	0.01	-0.01	**-0.03**	0.01	-0.01	**-0.02**	0.01	-0.01	**-0.04**	**-0.04**	**0.09**	0.01	**0.06**	**0.03**	**0.30**
Sen$_{t-1}$	**-0.33**	1	**0.06**	**-0.02**	**0.05**	0.00	-0.01	-0.01	**-0.02**	0.00	**0.03**	**-0.09**	**0.04**	**-0.05**	**-0.04**	0.01	**0.23**	**-0.09**
RR	**-0.04**	**0.05**	1	**0.16**	**0.26**	**-0.15**	**-0.37**	0.00	**-0.02**	**-0.39**	**0.27**	**-0.04**	**0.37**	**-0.21**	**-0.23**	**-0.07**	**0.07**	-0.01
GRO	**0.02**	-0.01	**0.32**	1	**0.21**	**-0.09**	**-0.23**	0.01	**0.03**	**-0.17**	**0.10**	-0.01	**0.12**	**-0.01**	**-0.09**	**-0.03**	0.01	**0.02**
VOL	0.00	**0.04**	**0.30**	**0.33**	1	**-0.27**	**-0.41**	**-0.02**	**-0.14**	**-0.31**	**0.11**	**0.13**	**0.16**	**0.02**	**-0.20**	**-0.08**	**-0.02**	0.00
CEQ	**-0.04**	0.00	**-0.17**	**-0.25**	**-0.34**	1	**0.58**	**0.43**	**0.13**	**0.41**	**0.20**	**-0.07**	**0.22**	**-0.02**	**0.35**	**0.07**	**0.10**	**0.07**
EPS	**-0.02**	0.00	**-0.38**	**-0.48**	**-0.50**	**0.62**	1	**0.17**	**0.10**	**0.44**	**-0.11**	**-0.06**	**-0.18**	**0.13**	**0.32**	**0.07**	**0.12**	**0.09**
XRD	**-0.02**	0.00	**0.02**	**-0.03**	0.02	**0.23**	**0.07**	1	0.00	**0.24**	**0.06**	**0.10**	0.01	**-0.02**	**0.28**	**-0.02**	**0.08**	**0.04**
DVC	**-0.04**	**-0.03**	**-0.15**	**-0.25**	**-0.46**	**0.37**	**0.53**	**0.03**	1	**-0.14**	**0.04**	**-0.18**	**0.08**	**-0.03**	**-0.11**	**-0.04**	**0.13**	**0.07**
LMV	0.01	-0.01	**-0.47**	**-0.28**	**-0.31**	**0.44**	**0.49**	**0.20**	**0.20**	1	**-0.15**	**0.26**	**-0.42**	**0.11**	**0.74**	**0.19**	**-0.15**	**-0.03**
LEV	-0.01	**0.03**	**0.27**	**0.06**	**0.05**	**0.27**	0.00	**-0.05**	**0.07**	**-0.07**	1	**-0.21**	**0.53**	**-0.19**	**-0.06**	**0.06**	**0.10**	0.00
BETA	**-0.04**	**-0.15**	**-0.07**	**0.02**	**0.12**	**-0.06**	**-0.04**	**0.17**	**-0.18**	**0.31**	**-0.21**	1	**-0.22**	**0.08**	**0.24**	**-0.07**	**-0.13**	**-0.02**
BM	**-0.04**	**-0.01**	**0.40**	**0.08**	**0.12**	**0.33**	**-0.14**	**-0.04**	0.00	**-0.42**	**0.47**	**-0.23**	1	**-0.31**	**-0.22**	-0.01	**0.10**	**-0.04**
MOM	**0.04**	**-0.05**	**-0.28**	-0.01	**-0.06**	**0.07**	**0.25**	0.00	**0.09**	**0.20**	**-0.17**	**0.04**	**-0.34**	1	**-0.01**	**-0.03**	**-0.07**	**0.05**
NUM	-0.01	**-0.04**	**-0.31**	**-0.18**	**-0.22**	**0.37**	**0.38**	**0.21**	**0.14**	**0.77**	0.00	**0.31**	**-0.26**	**0.05**	1	**0.03**	**0.03**	**0.05**
EXP	**0.10**	-0.01	**-0.12**	**-0.09**	**-0.10**	**0.14**	**0.12**	**-0.03**	**0.05**	**0.25**	**0.07**	**-0.05**	**-0.04**	0.00	**0.13**	1	**-0.17**	**-0.15**
RF	**-0.05**	**0.27**	**0.15**	**0.04**	**-0.03**	**0.08**	**0.12**	**0.04**	**0.16**	**-0.16**	**0.12**	**-0.13**	**0.13**	**-0.04**	**0.02**	**-0.20**	1	**0.32**
GDP	**0.19**	0.01	-0.01	**0.03**	0.01	**0.04**	**0.06**	0.01	**0.06**	0.00	0.00	0.00	-0.01	**0.07**	**0.03**	**-0.14**	**0.14**	1

Numbers in bold are significant at the 1% level. Variables are defined in the Appendix.

Table 2: Sentiment and predicted earnings growth

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6 (VOL_rank)
Intercept	0.717***	0.065**	0.808***	0.693***	0.735***	0.477***
	(26.17)	(2.44)	(5.69)	(5.71)	(5.40)	(4.05)
VOL		0.825***	0.680***	0.704***	0.700***	0.311***
		(29.71)	(21.36)	(24.29)	(25.18)	(24.17)
Δ Sentiment$_t$	0.001	-0.075***	-0.076**		-0.040	-0.054
	(0.06)	(-2.94)	(-2.13)		(-1.30)	(-1.08)
Δ Sentiment$_t$ *VOL		0.076***	0.154***		0.075***	0.033*
		(2.63)	(3.38)		(2.59)	(1.86)
Sentiment$_{t-1}$	-0.061**	0.023		0.095***	0.074**	0.119***
	(-2.25)	(0.60)		(3.32)	(2.05)	(2.64)
Sentiment$_{t-1}$*VOL		-0.145***		-0.187***	-0.150***	-0.054***
		(-3.52)		(-4.80)	(-3.50)	(-3.07)
RF			-4.410***	-3.428**	-3.572***	-4.446***
			(-3.49)	(-2.54)	(-2.65)	(-4.06)
GDP			0.015	0.020	0.016	0.023*
			(1.01)	(1.44)	(1.10)	(1.89)
DVC			2.890***	2.898***	2.894***	2.791***
			(3.45)	(3.41)	(3.42)	(3.32)
LMV			-0.122***	-0.120***	-0.120***	-0.117***
			(-9.31)	(-9.18)	(-9.20)	(-9.26)
BETA			0.051*	0.044	0.046*	0.033
			(1.93)	(1.62)	(1.68)	(1.21)
BM			0.094**	0.099**	0.096**	0.088**
			(2.41)	(2.51)	(2.47)	(2.30)
MOM			0.032	0.038	0.033	0.026
			(0.66)	(0.76)	(0.68)	(0.54)
LEV			0.502***	0.503***	0.501***	0.489***
			(5.06)	(5.05)	(5.03)	(4.99)
FD			0.033	0.010	0.028	0.010
			(0.58)	(0.18)	(0.52)	(0.22)
NUM			0.010***	0.010***	0.012***	0.010***
			(2.90)	(2.79)	(3.36)	(2.74)
EXP			0.008**	0.008**	0.010***	0.008**
			(2.37)	(2.43)	(2.81)	(2.49)
TIME			-0.013**	-0.010*	-0.011**	-0.009**
			(-2.43)	(-1.95)	(-2.17)	(-2.17)
Adj. R squared	0.0004	0.0511	0.0687	0.0689	0.0691	0.0690
Sample size (firm-year)	36374	36374	36374	36374	36374	36374

***significant at 1% level **significant at 5% level *significant at 10% level

Dependent variable is perceived earnings growth (GRO). Variable definitions are reported in the appendix. Double clustered t-statistics (Petersen 2009, by firm and year) are reported in parentheses. All variables are wonsorized at 1% each tail.

Table 3: Sentiment and implied cost of equity capital

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7 (VOL_rank)
Intercept	0.142***	0.189***	0.182***	0.187***	0.191***	0.191***	0.185***
	(52.16)	(38.71)	(14.89)	(22.73)	(20.20)	(19.41)	(17.76)
Δ Sentiment$_t$	-0.002	0.002	-0.002		0.002	0.005***	0.006***
	(-1.07)	(1.10)	(-1.33)		(1.51)	(2.94)	(3.78)
Δ Sentiment$_t$ *VOL						-0.004**	-0.001*
						(-2.11)	(-1.77)
Sentiment$_{t-1}$	0.007	0.008***		0.007***	0.008***	0.005**	0.005*
	(1.68)	(3.97)		(5.45)	(5.29)	(2.29)	(1.92)
Sentiment$_{t-1}$*VOL						0.004*	0.002*
						(1.76)	(1.90)
LMV		-0.013***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***
		(-20.24)	(-14.96)	(-15.59)	(-15.76)	(-15.79)	(-15.57)
BETA		0.015***	0.010***	0.011***	0.011***	0.011***	0.011***
		(6.10)	(4.59)	(5.28)	(5.30)	(5.26)	(5.18)
BM		0.043***	0.026***	0.026***	0.025***	0.025***	0.025***
		(15.18)	(11.19)	(11.12)	(10.99)	(10.90)	(10.78)
MOM		-0.017***	-0.017***	-0.017***	-0.017***	-0.017***	-0.017***
		(-5.11)	(-5.94)	(-5.77)	(-5.95)	(-5.82)	(-5.82)
VOL			0.020***	0.019***	0.019***	0.019***	0.008***
			(13.04)	(12.85)	(12.73)	(11.93)	(11.12)
RF			-0.005	-0.111**	-0.125**	-0.127**	-0.148***
			(0.07)	(-2.42)	(-2.42)	(-2.43)	(-2.65)
GDP			-0.0001	0.0001	-0.0002	-0.0001	-0.000
			(-0.06)	(0.13)	(-0.25)	(-0.19)	(-0.03)
DVC			-0.153***	-0.148***	-0.148***	-0.149***	-0.153***
			(-6.85)	(-6.62)	(-6.63)	(-6.72)	(-6.80)
LEV			0.052***	0.053***	0.052***	0.053***	0.052***
			(10.15)	(10.10)	(10.07)	(10.15)	(10.17)
Trend			-0.0003	-0.0004	-0.0005**	-0.0005**	-0.0004*
			(-0.86)	(-1.43)	(-2.26)	(-2.17)	(-1.84)
FD			0.002	0.0005	0.002	0.002	0.002
			(0.32)	(0.14)	(0.76)	(0.67)	(0.59)
EXP			-0.0001	-0.0002	-0.0002	-0.0002	-0.0002
			(-0.58)	(-0.83)	(-0.86)	(-0.87)	(-0.85)
FOL			0.0005***	0.0005***	0.0005***	0.0005***	0.0005***
			(4.71)	(5.07)	(5.02)	(5.16)	(5.06)
Adj. R squared	0.0039	0.2269	0.2576	0.2604	0.2606	0.2612	0.2609
Sample size (firm-year)	36374	36374	36374	36374	36374	36374	36374

***significant at 1% level **significant at 5% level *significant at 10% level

Dependent variable is required rate of return (RR). Variable definitions are reported in the appendix. Double clustered t-statistics (Petersen 2009, by firm and year) are reported in parentheses. All variables are wonsorized at 1% each tail.

Table 4: Sentiment and value relevance of accounting information

Panel A: Main effects of sentiment based on information uncertainty

	Rankings based on information uncertainty			
	Rank1 (most stable)	Rank2	Rank3	Rank4 (most volatile)
Intercept	12.21***	12.02***	8.857***	7.098***
	(47.82)	(65.24)	(42.68)	(37.31)
Δ Sentiment$_t$	-0.021	0.521*	2.838***	2.916***
	(-0.08)	(1.87)	(11.12)	(12.00)
Sentiment$_{t-1}$	-0.659**	0.192	2.079***	2.767***
	(-2.53)	(0.70)	(8.22)	(11.52)
BV	0.028	0.531***	0.961***	1.139***
	(1.17)	(23.98)	(53.99)	(61.68)
EPS	11.032***	6.596***	3.241***	2.119***
	(70.84)	(52.07)	(36.16)	(27.82)
N	9082	9097	9103	9089
Adjusted R^2	0.5737	0.5141	0.4637	0.3988

Panel B: Main effect and interaction effect of sentiment based on information uncertainty

	Rankings based on information uncertainty			
	Rank1 (most stable)	Rank2	Rank3	Rank4 (most volatile)
Intercept	11.860***	11.838***	8.696***	6.984***
	(45.65)	(48.49)	(41.74)	(36.55)
Δ Sentiment$_t$	1.052**	2.447***	3.439***	4.224***
	(2.14)	(5.22)	(8.43)	(11.17)
Sentiment$_{t-1}$	2.063***	2.814***	4.082***	4.565***
	(4.29)	(6.15)	(10.30)	(12.18)
BV	0.046*	0.533***	0.977***	1.152***
	(1.87)	(23.78)	(54.38)	(61.81)
BV*Δ Sentiment$_t$	-0.109**	-0.145***	-0.083**	-0.175***
	(-2.33)	(-3.27)	(-2.15)	(-4.45)
BV*Sentiment$_{t-1}$	-0.139***	-0.113***	-0.221***	-0.242***
	(-3.06)	(-2.71)	(-6.12)	(-6.28)
EPS	11.077***	6.675***	3.258***	2.113***
	(69.87)	(51.86)	(35.54)	(26.72)
EPS*Δ Sentiment$_t$	0.166	-0.204	0.239	0.467***
	(0.55)	(-0.82)	(1.35)	(3.32)
EPS*Sentiment$_{t-1}$	-0.489*	-1.011***	0.133	0.302**
	(-1.65)	(-4.22)	(0.78)	(2.09)
N	9082	9097	9103	9089
Adjusted R^2	0.5758	0.5178	0.4663	0.4017

***significant at 1% level **significant at 5% level *significant at 10% level

Dependent variable is stock price three month after fiscal period end date (PRC). Variable definitions are reported in the appendix. All variables are wonsorized at 1% each tail.

Table 5: Sentiment and value relevance of R&D

	Model 1	Model 2	Model 3	Model 4
Intercept	10.652***	10.138***	11.165***	10.499***
	(15.68)	(21.92)	(16.14)	(25.49)
Δ Sentiment$_t$		3.409***		4.147***
		(3.65)		(3.74)
Sentiment$_{t-1}$		3.878***		3.574***
		(4.11)		(4.16)
BV	0.892***	0.910***	0.570***	0.625***
	(13.18)	(17.40)	(14.09)	(12.64)
BV*Δ Sentiment$_t$		-0.300***		-0.154*
		(-2.94)		(-1.86)
BV*Sentiment$_{t-1}$		-0.295**		-0.182**
		(-2.74)		(-2.49)
EPS_adj	3.356***	3.549***	4.252***	4.531***
	(10.45)	(12.25)	(13.73)	(17.214)
EPS_adj*Δ Sentiment$_t$		0.547***		-0.787
		(2.85)		(-1.18)
EPS_adj*Sentiment$_{t-1}$		-0.548**		-1.288***
		(-2.24)		(-2.55)
XRD	-1.099**	-1.373***	-0.847*	-1.365***
	(-2.36)	(-4.17)	(-1.81)	(-3.78)
XRD*Δ Sentiment$_t$		1.677***		2.270**
		(3.59)		(2.47)
XRD*Sentiment$_{t-1}$		2.664***		2.991***
		(5.75)		(3.91)
Adj. R squared	0.4869	0.5039	0.4707	0.4994
N (firm-year)	22729	22729	41287	41287

***significant at 1% level **significant at 5% level *significant at 10% level

Dependent variable is stock price three month after fiscal period end date (PRC). Variable definitions are reported in the appendix. Double clustered t-statistics (Petersen 2009, by firm and year) are reported in parentheses. All variables are wonsorized at 1% each tail.

Table 6: Sentiment and the time-series variation of value relevance coefficient**

Step1: Annual cross-sectional regression

$Price_t = \theta_0 + \theta_1 ADJ\_EPS_t + \theta_2 RD_t + \theta_3 BV_t$

Step2: Time-series regression on the slope coefficient from step one

$\hat{\theta}_{i,t} = \omega_0 + \omega_1 \Delta Sentiment_t + \omega_2 Sentiment_{t-1} + \omega_3 GDP_t + \omega_4 RF_t + \omega_5 TIME_t + \omega_6 SIZE_t + \omega_7 ONE_t + \omega_8 LOSS_t + \omega_9 IND_t$

Dependent variable	N		ΔSen_t	$Sent_{t-1}$	GDP_t	RF_t	$TIME_t$	$SIZE_t$	ONE_t	$LOSS_t$	IND	R^2
		ω_0	ω_1	ω_2	ω_3	ω_4	ω_5	ω_6	ω_7	ω_8	ω_9	
(1)Coefficient on book value	24	0.921	-0.188	-0.210								0.3133
		(25.80)	(-2.29)	(-2.89)								
	24	2.082	-0.136	-0.161	-0.613	-0.085	-0.014					0.4477
		(0.53)	(-1.62)	(-2.07)	(-0.16)	(-1.73)	(-1.69)					
	24	1.947	-0.135	-0.190	-1.706	-0.080	-0.031	0.231	-0.021	-0.009	0.409	0.5230
		(0.44)	(-1.45)	(-2.17)	(-0.38)	(-3.40)	(-0.95)	(1.03)	(-0.42)	(-0.01)	(0.11)	
(2)Coefficient on Adj. earnings	24	4.103	-0.027	-1.266								0.2988
		(10.74)	(-0.05)	(-2.44)								
	24	5.473	-0.101	-1.108	-4.771	0.383	0.157					0.6722
		(0.27)	(-0.21)	(-2.82)	(-0.24)	(1.64)	(3.81)					
	24	-2.714	-0.287	-1.470	10.827	3.186	0.440	0.107	0.210	2.101	-44.169	0.8484
		(-0.16)	(-0.74)	(-4.48)	(0.60)	(0.14)	(3.47)	(0.12)	(0.97)	(0.34)	(-3.14)	
(3)Coefficient on RD expenses	24	-1.181	0.963	1.885								0.3760
		(-3.46)	(1.54)	(3.46)								
	24	-4.345	1.450	2.523	4.091	-0.352	0.013					0.6531
		(-0.16)	(2.19)	(5.31)	(0.16)	(-1.20)	(0.25)					
	24	8.234	1.506	2.835	-15.802	0.021	-0.312	0.172	-0.359	-7.149	44.858	0.7258
		(0.27)	(2.08)	(5.25)	(-0.47)	(0.06)	(-1.35)	(0.10)	(-0.82)	(-0.64)	(1.81)	

**All estimates in this table are Yule Walker estimates with two lags

$SIZE_t$ is the natural log of the mean market value of equity of firms in year t. ONE is the mean of the absolute value of one-time items as a percent of "core" net income for firms in years t. LOSS is the percentage of loss firms that have core net income <0 in year t. IND is the percentage of firms in year t that are in intangible intensive industries (SIC codes: 282 plastics and synthetic materials, 283 drugs, 357 computer and office equipment, 367 electronic components and accessories, 48 communications, 73 business ervices, 87 engineering accountin, R&D and management related services.) Definitions of all the other variables are reported in the appendix.

Table 7: Sentiment and perceived earnings persistency

	Firms with positive EPS_t	Firms with negative EPS_t
Intercept	1.503***	0.184
	(15.22)	(0.32)
VOL	0.478***	-0.726***
	(22.58)	(-5.45)
Δ $Sentiment_t$	-0.036	0.134
	(-1.25)	(0.71)
Δ $Sentiment_t$ *VOL	0.064*	-0.047
	(2.01)	(-0.41)
$Sentiment_{t-1}$	0.052	-0.261
	(1.63)	(-1.55)
$Sentiment_{t-1}$*VOL	-0.097***	0.418***
	(-2.82)	(2.67)
RF	-2.563**	1.072
	(-2.44)	(0.24)
GDP	0.010	-0.022
	(0.88)	(-0.68)
DVC	4.894***	-7.601
	(6.71)	(-0.91)
LMV	-0.096***	-0.213***
	(-8.86)	(-4.25)
BETA	0.090***	0.476***
	(3.15)	(8.49)
BM	0.081**	-0.163**
	(2.04)	(-2.02)
MOM	0.031	-0.252**
	(0.76)	(-2.47)
LEV	0.336***	-0.039
	(3.67)	(-0.18)
FD	0.002	0.190
	(0.05)	(1.04)
NUM	0.010***	-0.0003
	(3.19)	(-0.03)
EXP	0.001	-0.056***
	(0.71)	(-4.37)
TIME	-0.003	0.055***
	(-0.88)	(3.73)
Adj. R squared	0.0609	0.0497
N (firm-year)	30439	5932

***significant at 1% level **significant at 5% level *significant at 10% level

Dependent variable is stock price three month after fiscal period end date (PRC). Variable definitions are reported in the appendix. Double clustered t-statistics (Petersen 2009, by firm and year) are reported in parentheses. All variables are wonsorized at 1% each tail.

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