The Option Market's Anticipation of Information Content in Earnings Announcements

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Abstract

Option market participants must consider anticipated increases in stock price volatility surrounding upcoming earnings announcements when determining option prices. This suggests that option prices prior to the release of earnings news will vary with traders' expectations regarding the extent to which firm characteristics and market conditions affect the sensitivity of stock prices to earning news. In this paper, we exploit information in option prices in order to develop an *ex ante* approach to studying information content. Specifically, we develop a measure of the information content of earnings announcements (the Anticipated Information Content or AIC) that separates the magnitude of the stock market's reaction to earnings information from earnings uncertainty. We document that the option market's anticipation of volatility-induced spikes in stock prices reflects sophistication beyond simply noting that the uncertainty surrounding earnings releases increases stock price volatility. In particular, we find the AIC positively correlates with the *ex post* magnitude of the stock market sensitivity to unexpected earnings, increases with earnings persistence, firm growth prospects, the richness of firms' information environments and the presence of (and changes in) sophisticated ownership, and decreases with discount rates. This paper sheds light on whether and how information content manifests in the option market and, in so doing, it offers researchers a continuously available, *ex ante*, firm- and quarter-specific approach to studying information content.

Keywords: information content of earnings announcements; options; volatility; institutional ownership; information environment; return-earnings relation; earnings response coefficients
JEL Classification: M41; M49; G14; G29

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1. Introduction

In this paper, we examine whether and how the option market incorporates the magnitude of information content in upcoming earnings releases. Because option values closely relate to the market's estimate of the stock return volatility over the option's life, option traders must consider the potential effect that predictable news events have on this volatility. We use this relation between current option prices and future news-induced stock price volatility to extract a forecast of the information content of earnings announcements. In so doing, we isolate the option market's anticipation of the magnitude of the stock price reaction to earnings information from its uncertainty about the level of earnings and show that this predicted sensitivity allows for cross-sectional and time-series differences in the link between returns and earnings.

Absent a volatility-increasing event, options with little time to expiration and with an exercise price approximately equal to their underlying stock price (i.e., at-the-money options) should be virtually worthless (Black and Scholes, 1973). Yet, empirical evidence suggests that short-dated, at-the-money options expiring soon after an anticipated earnings announcement date typically trade for non-trivial market values (Patell and Wolfson, 1979, 1981). In fact, prior work studying the behavior of option prices typically excludes short-dated options from analysis precisely because of these spikes in value (Schmalensee and Trippi, 1978; Patell and Wolfson, 1979, 1981; Manaster and Rendleman, Jr., 1982). We, however, view these options as exceptionally interesting with respect to their ability to supply a measure of traders' allowance for upcoming information content. In particular, we hypothesize that short-dated options derive their market value from traders' forecasting firm- and quarter-specific, earnings-induced increases in stock price volatility. In other words, we predict that soon-to-expire, at-the-money options become valuable when traders believe that an upcoming earnings announcement will elicit a stock market reaction. More specifically, we expect that because option prices reflect forward-looking estimates of the underlying stock price volatility through the option's expiration date (referred to as the implied volatility), they increase or decrease depending upon traders' expectations regarding the strength of the link between stock market behavior and the release of earnings. Consequently, short-dated, at-the-money options, which would trade for very little absent an upcoming earnings release, offer us a powerful setting to study the extent to which anticipated earnings information influences the option market.[1]

Earnings announcements increase stock price volatility (Beaver, 1968) and this is reflected in the option's implied volatility (Patell and Wolfson, 1979, 1981). The magnitude of this earnings-induced increase in implied volatility depends on (1) the uncertainty of earnings information and (2) the magnitude of the market's response to the earnings information. Relying upon this insight, we develop a volatility-driven measure of information content that separates the effect of earnings uncertainty from the stock price's sensitivity to earnings information. Specifically, we isolate the option market's anticipation of information content (AIC) by deflating the price of an equity option expiring soon after an impending earnings announcement by an *ex ante* measure of earnings uncertainty, the standard deviation of analysts' forecasts (Imhoff and Lobo, 1992; Barron et al., 1998). In so doing, we obtain a ratio, the AIC, that

[1] For example, consider an option with a $50 strike price that expires in two days. If the firm's stock currently trades for $50 and its normal annual volatility is 25% (1.58% per day, assuming identically and independently distributed returns across the approximately 250 trading days per year), then the theoretical option value (derived using Black and Scholes, 1973) equals 36 or 37 cents using a 4% annual risk-free interest rate. Suppose that the market anticipates that an earnings release will occur the day before the option expires and that the market believes that the impending announcement will cause a three-standard-deviation movement in the stock price. If investors consider the influence of this impending earnings news on the firm's stock price, the market prices the option to incorporate the three-sigma stock price movement. Consequently, in this case, the option sells for around $2.37 (= $50*0.0158*3). Other options might exist for this stock. In this scenario, despite the impending earnings announcement, an out-of-the-money call option with a strike price of $55 remains virtually worthless because the three-sigma movement fails to make the option valuable at expiration. Alternatively, an in-the-money call option with a strike price of $45 increases in value, climbing to a trading value of approximately $7.37. This new price includes $5 due to the current value of the stock price relative to the strike (i.e., the option is $5 in the money) and $2.37 of potential upside associated with the volatility surrounding the impending earnings announcement.

reflects the fact that for any given level of earnings uncertainty, the option price should increase with the forecasted elasticity of the stock market's response to earnings information.

Although we believe that option traders consider the *ex post* sensitivity of stock prices to earnings news, we expect our volatility-driven information content metric to behave distinctly from traditional return-earnings relation metrics, as measured by the earnings response coefficient (ERC). First, in contrast to the ERC's focus on the impact of current period earnings, the AIC responds to forecasted volatility associated with the entire earnings announcement.[2] Second, the firm- and quarter-specific nature of the AIC metric (as well as the inputs used in the calculation) differs fundamentally from the traditional, regression approach to estimate an ERC. Third, and more broadly, our option-market focus, along with our use of analyst data, cause us to study a sample of firms that experience substantial trading interest and stock price volatility such that they attract the attention of option exchanges and financial analysts. This suggests that our sample firms operate in particularly rich information environments characterized by large amounts of pre-disclosure information. Finally, although we hypothesize that option prices anticipate stock market movements (and, therefore, might exhibit ERC-like behavior), volatility drives option prices, which suggests that the AIC might also exhibit behavior similar to that documented in volatility-based studies of information content (e.g., Beaver, 1968; Atiase, 1985). These distinctions eliminate our ability to interpret or compare the scale of the AIC to other measures and yet they also enhance our ability to study information content in new settings.

We use data from OptionMetrics and I/B/E/S to calculate 39,443 unique AICs for 18,214 unique firm quarters from 1996 through 2006. In our sample selection process, we aim to

[2] Indeed, earnings announcements can include additional information (above and beyond information about the firms' current earnings). Yet, for this additional information to influence the AIC, it must be 1) information that option traders can anticipate (i.e., option traders can forecast both content and timing of delivery), 2) information for which an impact on stock prices is expected, (i.e., value-relevant) and 3) information to which option traders cannot assign a valence (as an anticipated sign to the news would cause the underlying stock price to move instead). Given these requirements, we expect that the additional information captured by the AIC that is not captured by traditional ERCs largely pertains to future earnings streams.

increase the power of our tests by restricting our analysis to the observations for which we expect the impending earnings news to most significantly affect the price of the option. Accordingly, we focus on the prices of short-dated, at-the-money options expiring soon after an expected earnings announcement. We then use the AIC to examine how information content manifests in the option market. In so doing, we provide evidence that option traders anticipate the informativeness of earnings releases and do so in a way that allows for cross-sectional and time-series differences in the strength of the link between returns and earnings. In particular, initial tests indicate that our *ex ante* information content metric (the AIC) positively correlates with the magnitude of the *ex post* stock market reaction to unexpected earnings. Subsequent tests document that the AIC increases with earnings persistence, firm growth prospects, the richness of firms' information environments and the presence of (and changes in) sophisticated ownership (i.e., transient institutional investors known to trade aggressively based on earnings information) and decreases with anticipated discount rates (i.e., firm risk and interest rate levels).

In other words, our results suggest that the option market's anticipation of volatility-induced spikes in stock prices reflects sophistication above and beyond simply noting that the uncertainty surrounding earnings releases increases stock price volatility. Rather, our results indicate that option traders' anticipation of information content exhibits thoughtfulness with respect to the magnitude of the market's response and the extent to which this sensitivity varies with firm characteristics and market conditions.

This paper studies the information content of earnings reports by shifting attention from how earnings news influences stock prices to considering the role that earnings information plays in shaping option-market behavior. Recent work indicates that option traders anticipate a stock-market reaction to firms' earnings disclosures (Amin and Lee, 1997; Ni et al., 2008; Xing et al., 2009). We use a powerful setting in the option market to develop an approach to studying information content that isolates the volatility-induced spike in option price that stems from traders' expectations of the sensitivity of the stock market's response to the release of earnings. Accordingly, we build on recent work by supplying evidence that is consistent with option traders playing an important role in the price discovery process via their anticipation of the magnitude of the stock market's response to earnings news. As a result, we connect the recent stream of literature examining trading behavior in the option market to the fundamental stream of accounting literature examining the information content of earnings. Consequently, this paper sheds light on whether and how information content manifests in the option market and, in so doing, it offers researchers a continuously available, *ex ante*, firm- and quarter-specific approach to studying the totality of information associated with earnings announcements that introduces opportunities for future research.

Although both the AIC and the traditional ERC represent measures of the investors' sensitivities to earnings information, conceptual and methodological differences cause each metric to enjoy distinct advantages, depending upon the aim of the study. For example, the AIC allows researchers to study firm-specific events that might influence the informativeness of firms' earnings without waiting until the next earnings announcement and without pooling across firms. Because researchers obtain traditional ERCs from pooled, cross-sectional regressions, examining the typical sensitivity of the return-earnings link is enhanced. Yet, studying changes in the sensitivity of stock prices to earnings information via an ERC analysis presents challenges.[3] Accordingly, even though an important and vast literature studies information content by using ERCs, limited evidence exists regarding changes in (as opposed to levels of) the

[3] Indeed, to use event-study methodology to study the influence of a firm-specific shock to a firm's ERC, researchers must either 1) assume that a firm's ERC remains constant across sufficient quarters both prior to and following the event of interest or 2) pool across firms that face similar events of interest.

market's sensitivity to earnings information (see Skinner, 1990; Moreland, 1995; Hackenbrack and Hogan, 2002) perhaps in part due to the measurement challenges associated with estimating firm- and quarter-specific sensitivities. Because the AIC captures the market's current information regarding the likely stock-price impact of a specific upcoming earnings announcement in a frequently measurable, firm- and quarter-specific fashion, researchers can conduct event studies that more precisely examine the changes in (as opposed to levels of) the market's sensitivity to earnings information.[4]

In addition to the benefits associated with frequent measurability and firm- and quarter-specificity of the AIC, other features of the option-market setting supply researchers with the ability to study the return-earnings link in new contexts. For example, the *ex ante* nature of the AIC affords researchers the opportunity to investigate the degree to which the market anticipates as opposed to reacts to the event of interest. Further, in contrast to a focus on the impact of current period earnings, the AIC captures forecasted volatility associated with the entirety of information accompanying an earnings release. Consequently, our approach to studying earnings informativeness allows researchers to assess the role that supplemental disclosures (e.g., conference call discussions) play in affecting market participants' beliefs about the strength of the link between stock market behavior and earnings information.

The remainder of this paper progresses as follows. Section 2 discusses related literature. Section 3 describes our sample selection process and relates our research design. Following that,

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[4] For example, researchers might exploit the firm- and quarter-specificity of the AIC to investigate whether firm- and quarter-specific disclosures that speak to the quality of a firm's financial reporting affect investors' anticipation of the strength of the return-earnings relation. Following prior literature that uses the traditional ERC as a proxy for earnings quality (Teoh and Wong 1993; Moreland 1995; Hackenbrack and Hogan 2002; Balsam, Krishnan and Yang, 2003), one might expect changes in the reliability of financial statements (as measured by the presence of high abnormal accruals, a restatement, or a material weakness disclosure) to be associated with decreases in firm- and quarter-specific AICs at the time the event occurs. Indeed, the frequent availability of the AIC affords researchers the opportunity to study the influence of any event on the magnitude of the return-earnings relation on a timely basis.

we present our results in Section 4. Finally, Section 5 concludes with a summary of our findings as well as a discussion of future research.

2. Related literature

An extensive accounting literature takes various approaches to assessing the link between stock market behavior and the release of earnings (Ball and Brown, 1968; Beaver, 1968; May, 1971; Chambers and Penman, 1984; Amin and Lee, 1997; Ni et al, 2008; Xing et al., 2009). Our paper combines insights from: (1) work documenting the information content of accounting earnings and (2) studies of option markets around earnings announcements. The stream of literature examining the stock market reaction to earnings begins with the seminal work of Beaver (1968) and Ball and Brown (1968). The majority of subsequent work focuses on the relation between earnings news and stock returns. Early studies document a positive correlation between magnitudes of earnings innovations and stock returns (e.g., Beaver, Clarke, and Wright, 1979; Beaver, Lambert, and Morse, 1980), suggesting that good earnings news results in a positive revaluation of the firm's equity. Building upon this early work, researchers frequently test the information content of accounting earnings by regressing earnings innovations on contemporaneous stock returns (or estimating a reverse regression of these variables). The slope coefficients from these regressions are known as earnings response coefficients (ERCs). Given evidence of a return-earnings relation, later studies (e.g., Kormendi and Lipe, 1987; Collins and Kothari, 1989; Easton and Zmijewski, 1989; summarized in Kothari 2001) document cross-sectional and time-series differences in ERCs. In particular, these studies supply evidence of a positive relation between ERCs and both earnings persistence and economic growth opportunities and evidence of a negative relation between ERCs and anticipated discount rates (i.e., firm risk and interest rate levels).

The intuition behind our option-market approach to examining earnings informativeness begins by observing that option traders play an important role in the price discovery process (Cremers and Weinbaum, 2010). Because option prices reflect forward-looking estimates of the underlying stock price volatility through the option's expiration date, traders should rationally anticipate the impact of impending news, including sharp increases in stock price volatility around earnings releases. Indeed, Patell and Wolfson (1979, 1981) find that implied volatilities increase dramatically as earning dates approach and collapse thereafter. They also find that the volatilities forecasted by the option market are, on average, realized. Consistent with this notion, recent work documents that option-market traders appear to anticipate upcoming earnings releases. Should traders believe that they can forecast the direction of stock price changes associated with future earnings releases (see Amin and Lee, 1997), the current stock price will reflect these favorable/unfavorable beliefs. To the extent that option traders are uncertain about direction (i.e., they cannot assign an expected sign to the upcoming information), but anticipate an increase in stock price volatility around the earnings announcement, option prices should incorporate this expected variance (e.g., Ni et al, 2008; Xing et al., 2009).

As we discussed earlier, although we expect the AIC to exhibit similarities to ERCs, we also expect our measure to behave distinctly from traditional information content metrics. First, the AIC captures anticipated volatility associated with the entirety of value-relevant information released in the earnings announcement (as opposed to the ERC's focus on current period earnings). Second, the AIC is a firm- and quarter-specific calculation (as opposed to a coefficient obtained from estimating pooled, cross-sectional regressions). Third, the option-market setting (along with the use of analyst forecast data) associated with the AIC calculation causes us to study firms that likely operate in particularly rich information environments, characterized by large amounts of pre-disclosure information. Finally, the volatility-driven nature of the AIC may cause it to behave in manners consistent with evidence presented in volatility-based (as opposed to return-based) studies of information content (e.g., Beaver, 1968; Atiase, 1985). Taken collectively, these methodological distinctions: 1) eliminate our ability to compare the scale of the AIC to other measures, 2) cause us to expect only a modest, yet significant, correlation between the AIC and the ERC, and 3) lead us to believe that our sample firms' information environments might differ substantively from prior samples. At the same time, these differences allow us to study the link between earnings and market behavior from a new perspective.

In summary, the study of the link between earnings information and stock market behavior addresses a fundamental question in the accounting literature. At the same time, research examining trading behavior in the option market surrounding earnings releases suggests that option prices reflect traders' anticipation of earnings-induced volatility. In the next section, we combine insights from these two established literatures to develop a measure of anticipated information content that exploits information in option prices prior to firm's earnings releases. Although we expect this measure to differ from traditional earnings informativeness measures in meaningful ways, we use prior work that examines the information content of earnings (with a particular emphasis on those studies that focus on the return-earnings relation) to guide us in forming our predictions about our measure's cross-sectional and inter-temporal variation.

3. Sample selection and research design

We define the option market's anticipation of information content (AIC) as the price of an equity option expiring soon after an impending earnings announcement normalized by the standard deviation of analysts' earnings forecasts for the quarter. The choice of numerator reflects the fact that option prices should consider (and, therefore, incorporate) the stock price volatility that investors expect to accompany earnings news. We deflate the option price by the standard deviation of analysts' forecasts – our *ex ante* measure of earnings uncertainty (Imhoff and Lobo, 1992; Barron et al., 1998). As a result, we obtain a ratio that reflects the fact that for a given level of earnings uncertainty, the option price should increase with the forecasted elasticity of the stock market's response to unexpected earnings-announcement news. Furthermore, because the AIC captures investors' anticipation of the link between earnings information and returns, we expect the AIC will differ both across firms and over time depending upon the expected strength of the return-earnings relation.[5]

In order to calculate AICs, we require option pricing data and analyst forecast data. We obtain daily closing option prices and implied volatilities along with the option characteristics (strike prices, expiration dates, and put-call indicators) for individual equity options and these options' underlying-stock closing prices from Ivy DB OptionMetrics. Our sample period starts in January 1996 (the beginning of OptionMetrics) and ends with December 2006. We limit our analysis to options nearing expiration by collecting data for all traded options on individual common stocks starting four weeks (typically 20 trading days) before the option expiration date (EX_DATE). As discussed previously, Patell and Wolfson (1979, 1981) document that implied

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[5] We can formalize the relation between option prices and the anticipated impact of earnings announcements on stock prices in a highly stylized world. Absent earnings news, assume that information is continuously impounded into stock prices so that stock price is a Brownian motion without drift. Earnings announcements, however, represent a discrete news event that potentially causes a "jump" in stock price. In our stylized world, this "jump" equals the magnitude of the earnings news multiplied by a non-negative coefficient representing the valuation relevance per unit of earnings news (e.g., if X represents earnings news, then bX represents the stock price change given a particular earnings surprise). To simplify matters, think of earnings news as a zero-mean, normally distributed, random variable. The expected payoff to a very short-dated, at-the-money option without an earnings announcement is zero. If there is an earnings announcement during the option's life, then the expected payoff to a call option is the valuation-relevance-of-earnings coefficient multiplied by the expected value of the earnings news, conditional on the surprise being positive (e.g., E[call payoff] = b*E[X|X>0]). The expected payoff to a put is analogously defined. Given our assumption about earnings news, its conditional expected value is a numerical constant multiplied by its standard deviation (e.g., E[X|X>0] = a*sigma). This implies that the expected payoff to an option is a numerical constant multiplied by the valuation-relevance-of-earnings coefficient times the uncertainly of earnings (e.g. E[payoff] = a*b*σ). Our measure of information content for a given firm-quarter (expected option payoff divided by earnings uncertainty) is a numerical constant multiplied by the valuation-relevance-of-earnings coefficient (e.g., E[payoff]/σ = a*b). Thus, cross-sectional and time-series influences on the coefficient tying earnings news to ex-earnings-announcement stock price movements also affect our information content metric.

volatility spikes around earnings releases. Because they focus their analysis on the typical behavior of option prices between earnings releases, Patell and Wolfson exclude short-dated options (i.e., those within 20 days of expiration) from their sample. In our study, we view these options as particularly interesting, as we wish to permit the option market the best opportunity to fully anticipate the information content of the upcoming earnings announcement. Because the market is likely better able to forecast near-term events than those events farther away in time and because we wish to reduce the effect of other information events, we focus our attention to these short-dated options expiring soon after an expected earnings announcement.[6]

We obtain analyst forecast data from the summary files of I/B/E/S International, Inc. The initial sample of data retrieved from I/B/E/S focuses on forecasts of current-quarter primary earnings per share (EPS) for U.S. firms covered by at least two analysts. The restriction on the number of analysts allows us to have both a mean estimate (MEANEST) and a standard deviation of analysts' forecasts (STDEV). We remove observations with missing actual reported values (ACTUAL) or missing report dates of actual earnings values (EA_DATE).[7]

We merge the OptionMetrics and I/B/E/S data to obtain an initial sample of firm-quarters with available option and analyst forecast data. As indicated in Figure 1, when merging the two datasets, we require that an EA_DATE falls within the four weeks of option data. Thus, all retained merged data contain a series of option and stock prices that covers the period of time surrounding an EA_DATE.[8] As described in Panel A of Table 1, this process supplies us with

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[6] Unless we have reason to anticipate asymmetric stock price responses for positive or negative earnings surprises (perhaps because of accounting policies), the potential earnings information equally affects put and call options.

[7] Conclusions do not change if we use the unadjusted (for stock splits) analyst forecasts in place of the adjusted forecasts (Payne and Thomas, 2003).

[8] Chambers and Penman (1984) provide evidence that earnings announcement dates vary little from year to year. Similarly, Bagnoli, Kross, and Watts (2002) provide evidence that the vast majority of earnings announcements occur on the date expected. Accordingly, assuming that the EA_DATE is known (one day before) is not unreasonable. Because of the firm-specific nature of earnings announcements, the length of the series of data leading up to and following the EA_DATE varies. If the EX_DATE falls on the EA_DATE, the series of data ends when the option expires and we remove the observation from the sample. In other

approximately 12.7 million total observations associated with 651,811 unique options and 4,363 unique firms. During the eleven-year sample period, we have 55,936 unique firm-quarters with data. In classifying our observations by year, we use the fiscal period ending date on I/B/E/S. As the EA_DATE typically follows the end of the fiscal period by several days or weeks, some data classified in a given year actually comes from the following calendar year.

The next step in our sample selection process aims to increase the power of our tests by restricting the sample to observations for which we expect the impending earnings news to most significantly affect the option's price (OPTPRICE). To do this, we compute the option's "moneyness" (M) by comparing the option's strike price (STRIKE) to the underlying stock's closing price (PRICE). Specifically, we calculate M for call (put) options as PRICE (STRIKE) divided by STRIKE (PRICE). We then limit our analysis to at-the-money (ATM) options by focusing on observations where M falls between 0.95 and 1.05.

We focus on at-the-money (ATM) options for several reasons. Fleming, Ostdiek and Whaley (1996) note that trading volume is highest and bid-ask spreads are lowest for ATM options. The former suggests that ATM options are likely to have higher quality data and the latter suggests why traders might gravitate toward ATM options. In addition, because trading in anticipation of earnings releases reflects volatility-minded strategy, we suspect that traders employing this approach focus on options with the highest vegas (i.e., the highest sensitivity to changes in volatility). In other words, we anticipate that ATM options will attract the most trading interest because of their high sensitivity to changes in implied volatility and because of their ability to offer the most transactional leverage.

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words, we do not include any options that expire on or before the EA_DATE. Conclusions are unchanged if we limit our sample to observations having 17 (the median) or fewer calendar days between the EX_DATE and the EA_DATE.

We exclude out-of-the-money (OTM) and in-the-money (ITM) options for several reasons. Because the potential movement in stock price associated with the impending earnings news is less likely to affect an OTM option, OTM option prices are less responsive to volatility spikes. Thus, we remove observations where $M < 0.95$. Although the anticipated stock price movement affects all ITM options (i.e., all options with M above 1), we remove options where $M > 1.05$. Just as OTM option prices experience a muted effect due to the current value of the stock relative to the strike price (i.e., the potential earnings-induced price movement may not bring the option into the money), ITM option prices include more than just the pricing effect associated with the impending earnings news. Specifically, ITM option prices reflect both the current moneyness that stems from the current value of the stock price relative to the strike price as well as the boost in value that stems from the anticipated earnings-induced volatility. Only the latter is of interest to our study.[9]

Finally, OptionMetrics does not compute the implied volatility (IVOL) for options with non-standard settlement arrangements. Because non-standard settlement may affect the option price in ways that add noise to our calculations, we remove observations with missing implied volatility measures. In Panel B of Table 1, we report that these restrictions reduce our final "AIC sample" to 39,443 options on 3,327 unique firms. Over our eleven years of data, we now have 18,214 unique firm-quarters.

We compute AIC by dividing the option price by the contemporaneous standard deviation of analysts' forecasts.[10] That is,

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[9] Our sample selection criteria and our definition of moneyness inevitably allow some slightly OTM and ITM options into our final sample of option prices. Because the option price depends on the strike price (i.e., the option's moneyness), we have explored more restrictive sample selection requirements. Limiting our analysis to observations where M falls between 0.99 and 1.01 reduces the sample size by approximately 75%, but all of our findings and associated conclusions do not change.
[10] As an alternative to using the standard deviation of analysts' earnings forecasts in the denominator, we could use the expected absolute forecast error (i.e., the earnings news). Assuming that the analyst forecasts are normally distributed, then the expected absolute forecast error is $STDEV*\sqrt{(2/\pi)}$. As this essentially multiplies STDEV by a constant, we choose to use STDEV as our

$$AIC_{t,i,j} = \frac{OPTPRICE_{t,i,j}}{STDEV_{t,i}}, \quad (1)$$

where:

t	=	day -2 or -1 in relation to the EA_DATE;
i	=	the index of individual firms;
j	=	the index of individual options;
$OPTPRICE_{t,i,j}$	=	the price of option j of firm i on time t; and
$STDEV_{t,i}$	=	the standard deviation of analysts' forecasts of firm i on time t.

Because some options have missing data, we attempt to compute AICs both one and two days prior to the earnings release date. If we can compute an AIC on day -1 for a given option-firm-quarter, we do not also use the day -2 statistic in our analyses. If the day -2 AIC exists when we do not have a day -1 AIC, then we use the day -2 statistic.[11]

In calculating the AICs, we anticipate that the market considers the likely influence of the impending earnings news on the firm's stock price and, as a result, prices the option to incorporate the possibility of a movement in stock price. Thus, a short-lived, at-the-money option might have a very low theoretical price using normal stock price volatility (i.e., volatility in a period of time without an earnings announcement). Yet, the implied volatility should elevate considerably for short-dated options with anticipated earnings announcements in the life of the option (our AIC sample of options). As noted by Patell and Wolfson (1981, Figure 5), the shortness of the option's life greatly exaggerates the implied annualized volatility. Because the standard deviation of analysts' forecasts increases with uncertainty about firms' earnings and has a positive correlation with *ex post* absolute earnings surprise (Barron et al., 1998; Burgstahler et al., 2002), we normalize the option price by STDEV. This allows us to obtain a ratio that reflects

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ex ante measure of earnings uncertainty. This methodological decision provides another reason that the scale of our measure is not economically meaningful or comparable in magnitude to other measures of information content. Yet, the choice does not affect the linear relations between the AIC and other economic variables.

[11] Nearly all of the 39,443 AICs are day -1 as opposed to day -2 calculations (in relation to the EA_DATE). Indeed, 39,343 of the 39,443 AICs are day -1 calculations. Of the 100 calculations that relate to day -2, the vast majority comes from the early years of OptionMetrics coverage (e.g., 71 of the 100 are from 1996).

the fact that for any given level of earnings volatility, the option price should increase with the elasticity of the market's response.

Confirming the existence of a relation between our *ex ante* measure of earnings volatility and an *ex post* measure of earnings surprise in our sample, we detect a statistically significant (beyond the 0.0001 level) correlation of 0.54 between STDEV and the absolute value of SURPRISE (measured as the difference between ACTUAL and MEANEST). Figure 2, Panel A illustrates this point by sorting our data into deciles based on SURPRISE and plotting the average SURPRISE and average STDEV for these 10 groups. Consistent with Kinney, Burgstahler and Martin (2002, Figure 3), we observe a linear pattern between STDEV and the absolute value of SURPRISE.

As we argue that option traders should anticipate the stock price response to an earnings release, we first investigate the degree of association between the AIC and two more traditional measures of the earnings-return relation. Because the AIC is a firm- and quarter-specific measure of the information content of earnings announcements, we cannot compare it directly with the traditional ERC from a pooled cross-sectional regression. Instead, we investigate the correlation between our metric and (1) a firm-specific ERC and (2) a firm- and quarter-specific ratio of the price change on the earnings announcement date deflated by SURPRISE. First, we estimate the firm-specific ERC following Teets and Wasley (1996). Specifically, we calculate a firm-specific ERC that we obtain from estimating the slope coefficient from a simple ordinary least squares regression of earnings surprises (relative to mean I/B/E/S forecast) normalized by stock price on announcement-day stock returns using the prior 20 quarters of data (with a minimum of 5 data points).[12] Second, for the firm- and quarter-specific measure of price change

[12] Consistent with our concerns regarding the comparability of a firm- and quarter-specific measure and a coefficient estimate obtained via a pooled regression, Teets and Wasley (1996) note that firm-specific ERC estimates assume the firm's ERC remains

per unit of earnings surprise, we divide the change in a stocks' price from close the day prior to the earnings announcement to close on the day earnings are released by SURPRISE.

Our next analyses investigate whether the AIC (an *ex ante* measure of informativeness) exhibits associations similar to those documented in the traditional information-content literature. Our initial tests address the question of whether we observe a nonlinear relation between the AIC and our earnings surprise proxy (STDEV), as suggested by the nonlinear relation between ERCs and earnings surprise observed by Freeman and Tse (1992). Then, because we hypothesize that the AIC should incorporate the *ex post* stock price reaction to an earnings release, we focus on determining whether AICs exhibit cross-sectional and time-series differences similar to those documented in extant work documenting the earnings-return relation.

Following prior research that examines the economic determinants of the earnings-return relation, we investigate the relation between AICs and fundamental economic and firm characteristics by estimating a regression based on the following model:

$$AIC_{t,i,j} = \gamma_0 + \gamma_1 MB_{t,i} + \gamma_2 \beta_{t,i} + \gamma_3 I_t + \gamma_4 \theta_i + \gamma_5 NUM_{t,i} + \varepsilon_t, \qquad (2)$$

where:

t	=	the time period index (now in relation to the firm quarter);
i	=	the index of individual firms;
j	=	the index of individual options;
$MB_{t,i}$	=	the end-of-prior-quarter ratio of market capitalization (Compustat Data Item No. 14 * Compustat Data Item No. 61) to book value of equity (Compustat Data Item No. 60);
$\beta_{t,i}$	=	systematic risk;
I_t	=	the end-of-prior-month U.S. Treasury 10-year interest rate;
θ_i	=	a measure of earnings persistence;
$NUM_{t,i}$	=	the number of analysts providing quarterly earnings forecasts on I/B/E/S when earnings are reported; and

constant across 20 quarters. As a result, they find that firm-specific ERCs, on average, differ substantially from those obtained from regressions that pool observations across both firms and time.

As summarized by Kothari (2001), past work examining the return-earnings relation identifies growth, systematic risk, interest rates, and persistence as the four main determinants of ERCs (Kormendi and Lipe, 1987; Collins and Kothari, 1989; and Easton and Zmijewski, 1989). Accordingly, we include measures of each construct in Equation 2 and use these studies to guide us in forming our predictions about the signs of the coefficients. As in Collins and Kothari (1989), we include a measure of the firm's growth opportunities (MB) with the expectation that if current earnings provide information about the firm's growth prospects, the price response will be greater (i.e., $\gamma_1 > 0$).[13] Relying on prior work that argues that greater non-diversifiable risk reduces the present value of the earnings innovations (Collins and Kothari, 1989; Easton and Zmijewski, 1989), we include β (measured as the beta value provided in the CRSP file from the previous calendar year) and predict a negative coefficient (i.e., $\gamma_2 < 0$). Following a similar "discount-rate" rationale and consistent with Collins and Kothari (1989), we also include the risk-free rate of interest (I) and expect to observe a negative temporal relation (i.e., $\gamma_3 < 0$). Consistent with the notion that more persistent earnings lead to larger price changes as shown in Kormendi and Lipe (1987) and Easton and Zmijewski (1989), we include a measure of persistence (θ) and expect to observe a positive coefficient (i.e., $\gamma_4 > 0$). As in Beaver, Lambert and Morse (1980) and Collins and Kothari (1989), θ equals one minus the estimated first-order moving average coefficient in a time series model.[14]

The inclusion of a proxy for the richness of firms' information environments (NUM) allows us to investigate whether/how the availability of predisclosure information affects the option market's sensitivity to earnings information. Prior work indicates that firms' information

[13] Because of the skewed distribution of this variable (particularly during our sample period), we include the natural log of MB in our regressions.
[14] Consistent with Collins and Kothari (1989), we estimate a single measure of earnings persistence using annual earnings over our sample period. Using a rolling, 20-quarter measure of persistence suggested by Easton and Zmijewski (1989) produces similar results.

environments affect the market's sensitivity to earnings information, perhaps via a "preemption" effect that increases the likelihood that prices lead earnings. Indeed, Atiase (1985) supplies evidence of an inverse relation between stock price volatility surrounding earnings announcements and firm size, suggesting that the increased availability of pre-disclosure information dampens the market response.[15] Consistent with this idea, Kothari and Sloan (1992) note that ERCs computed using short-window returns around earnings announcements might be biased downward because of the stock market's ability to impute earnings news from sources of information that are more timely than earnings. Although our metric is a volatility-sensitive measure of information content, our sample firms' information environments likely differ considerably less than those in prior studies (i.e., even our smallest firm enjoys active trade and an analyst following suggesting a rich informational environment). Thus, because volatility drives the AIC (which suggests a negative relation) and, at the same time, our sample firms are much more homogeneous in their information environments than are Atiase (1985), we make no prediction as to the expected sign of γ_5.[16]

Before estimating Equation 2, we must recognize that our sample period (dictated by the availability of OptionMetrics) includes what has become known as the Internet "Bubble" period. During this period, accounting research (e.g., Trueman, Wong, and Zhang, 2000; Demers and Lev, 2001; Hand, 2001; Trueman, Wong, and Zhang, 2003; and Xu, Magnan, and Andre, 2007) demonstrates that traditional valuation metrics weaken and/or non-traditional valuation metrics become useful. This consideration is particularly important given our research design, as option exchanges tend to list options on stocks with high price volatility (see Mayhew and Mihov,

[15] As his analysis requires only financial statement and stock return data, Atiase (1985)'s large and small firms differ substantially (i.e., his large firms are at least 20 times larger than his small firms).
[16] In addition, other ERC studies indicate that this relation may not manifest. For example, although Collins and Kothari (1989) find that the strength of the return-earnings relation varies with firm size, they show that the relation loses significance after other controls for differences in the information environment are considered.

2004) – a feature that Internet stocks likely exhibit. Consequently, we adjust our research design in order to take into account the uniqueness of our sample period by revising our regression equation to include the following terms:

$$AIC_{t,i,j} = \begin{array}{l} \gamma_0 + \gamma_1 D_{PBB} + \sum_{y=1997}^{y=2006} \gamma_y D_y + \gamma_2 MB_{t,i} + \gamma_3 MB_{t,i} * D_{PBB} + \gamma_4 \beta_{t,i} + \gamma_5 \beta_{t,i} * D_{PBB} \\ + \gamma_6 I_t + \gamma_7 I_t * D_{PBB} + \gamma_8 \theta_i + \gamma_9 \theta_i * D_{PBB} + \gamma_{10} NUM_{t,i} + \gamma_{11} NUM_{t,i} * D_{PBB} + \varepsilon_t \end{array} . \quad (3)$$

where:

D_{PBB}	=	a binary variable taking a value of 1 if the time period t is in a post-Bubble-Bust year and 0 otherwise;
D_y	=	a binary variable taking a value of 1 if the year equals y and 0 otherwise;

Because we anticipate that our variables of interest may behave differently during the "Bubble-Bust" period than in the "post-Bubble-Bust" period, we include an indicator variable (D_{PBB}) to control for these differences. We define the "Bubble-Bust" period as the time prior to March 2001, as this includes the "Bubble" period and allows one year past the Nasdaq stock market peak for the "Bust" part of the cycle.[17] Following Collins and Kothari (1989), we also include an indicator variable (D_y) to control for time-series effects not considered by the other variables (particularly D_{PBB}).

The effect of the Bubble on our information content metric (AIC) is unclear. The fact that traditional valuation measures (presumably including accounting earnings) became less relevant to the market during the bubble suggests that traditional ERCs might well have experienced a decline in magnitude. Conversely, it seems possible that market participants' ability to anticipate how the stock market was likely to react to an earnings announcement and the magnitude of such a reaction declined substantively during this period as well. The increased uncertainty of exactly what metrics the market was using to value equities might lead the

[17] In the next section, we provide evidence that our variables of interest exhibit differences across the sub-periods.

option's market to build in additional volatility surrounding earnings releases. Thus, it is unclear whether we would anticipate a heightened or a dampened AIC during the early years of our sample period.

The remaining variables in Equation 3 represent our cross-sectional and inter-temporal variables of interest. We gather these additional cross-sectional and time-series data required to estimate Equation 3 from Compustat and CRSP then merge this dataset with the AIC sample.[18] As shown in Panel C of Table 1, this process provides a "CS sample" of 30,641 options on 2,757 unique firms. We now have 14,907 unique firm-quarters of data, averaging approximately 1,355 per year during our 11-year sample period. Panel B of Figure 2 confirms that the previously anticipated correlation between STDEV and SURPRISE holds in this subset of the AIC sample.

Finally, just as we foresee the richness of firms' information environments having an effect on the option market's anticipation of the informativeness of earnings, we also expect that ownership structure might influence the extent to which the option market anticipates earnings-induced trade. Extant research demonstrates that firms with higher levels of institutional ownership experience more trading volume and greater return volatility surrounding earnings releases (Potter, 1992; Kim, Krinsky, and Lee, 1997; and Lang and McNichols, 2007). Following this literature, we hypothesize that this increased level of trading activity by institutional investors results in an increase in the option market's allowance for the earnings-induced volatility, after controlling for other factors found to influence the return-earnings relation. Furthermore, as noted in Bushee and Noe (2000) and Bushee (2001), institutions differ with regard to their willingness (and ability) to trade in the short run. Because transient investors have the most intensive portfolio turnover and are the most likely to trade on earnings news, we expect that traders anticipate an increased stock-price sensitivity to the earnings release for firms

[18] Please refer to the Appendix for a complete list of the variables we use in this analysis.

that are expected (based on ownership structure) to experience more intense trading. Thus, we expect that ownership by transient investors has the most extreme effect on AICs.[19]

To explore this notion, we next test whether the AIC is sensitive to both levels of and changes in the firm's ownership structure. Using institutional ownership data from Thompson Reuters, we re-estimate Equation 3 including a measure of the fraction of the firm held by institutional owners (%OWN) and predict a positive coefficient. Because we expect this association to be particularly strong for institutions with a demonstrated willingness (or ability) to trade intensely at earnings releases, additional estimations investigate the differential impact of transient institutional ownership (%TRAN) after controlling for the other types of institutional ownership based on the classification coding described in Bushee and Noe (2000) and Bushee (2001). Then, to further isolate the impact of the presence of sophisticated investors known to trade actively based on earnings information, we exploit the frequent measurability of the AIC in order to study the influence of firm- and quarter-specific *changes* in ownership structure.

4. Analyses and results

Univariate statistics

Panel A of Table 2 reports the results of a univariate analysis of AICs and the other variables of interest for the AIC (larger) sample. We document considerable variability in the firm- and quarter-specific measure of the option market's allowance for earnings-induced volatility. The standard deviation of the AIC is quite large relative to its mean. Using the

[19] Jiambalvo, Rajgopal, and Venkatachalam (2002) examine the relation between investor sophistication (as measured by institutional ownership) and the extent to which current stock prices reflect future earnings. They find that prices lead earnings to a greater extent as institutional ownership increases, which suggests a dampened market response on the earnings announcement date. In contrast, our analysis focuses on the anticipated sensitivity of the market's response to earnings information (both current and future period data) and the anticipated influence of intense trading by institutional investors – while controlling for the richness of firms' information environments and earnings persistence (as well as other previously-documented determinants of the elasticity of the market's response to earnings news). Further, our changes design allows us to speak to the impact that increases/decreases in sophisticated following has on the elasticity of the market's anticipated response.

definition of the AIC we conclude that the average option price is $5.91. By construction, the AIC is positively correlated with IVOL and negatively correlated with STDEV.

In Panel B of Table 2, we report similar analyses of the smaller sample that has the requisite cross-sectional data. We first note that requiring CRSP and Compustat data significantly reduces the number of extreme AICs but has little effect on the median and that the mean earnings surprise, the mean implied volatility, and mean standard deviation of analyst forecasts are relatively unchanged in the smaller sample. Not surprisingly, however, requiring cross-sectional data results in a larger mean number of analysts following the firm. The average β is close to one and the average firm has a market value that is about four and one-half times its book value. Recall, θ is one minus the estimated first-order moving average coefficient in a MA(1) time series model. Following Collins and Kothari (1989, footnote 23), we subtract θ from one in order to ensure that the persistence parameter is positive. Using the mean AIC and STDEV, we impute a mean option price of $3.59. The correlation matrix again reports that the AIC is negatively associated with STDEV and positively associated with IVOL by construction. In contrast to the findings of Atiase (1985), AIC is positively associated with NUM. Consistent with the literature summarized in Kothari (2001), earnings persistence is positively associated with AIC and the market-to-book ratio is positively associated with the AIC. Inconsistent with theory, the firm's systematic risk and risk-free interest rates are positively correlated with AIC. Finally, it is important to note that even at a univariate level, we observe the hypothesized positive correlation between the AIC and institutional ownership.

Correlation between the AIC and the ex post stock market sensitivity to earnings surprise

In our next set of tests, we explore the extent to which option traders seem to anticipate the sensitivity of the stock market to earnings news by examining the correlation between our *ex* *ante* information content metric and *ex post* measures of stock market behavior. As described in the previous section, our univariate comparisons are limited to observing the correlation between the firm- and quarter-specific AIC and (1) a firm-specific ERC that we obtain from estimating the slope coefficient from a simple ordinary least squares regression of earnings surprises normalized by stock price on announcement-day stock returns using the prior 20 quarters of data (following Teets and Wasley, 1996) and (2) the announcement day stock price response per unit of earnings surprise (RESPONSE). As shown in Panel A of Table 3, we observe that the correlation between the firm- and quarter-specific AIC and a firm-specific ERC is about 0.15 (statistically significant at the 0.001 level). We suspect the pooled nature of the ERC regressions introduces substantial measurement error because it assumes that a firm's earnings-return relation remains constant for the previous 20 quarters. Consistent with this claim, we find the correlation climbs to over 31% when we average both AICs and ERCs within industries using either DNUM or the Fama-French Industries and in excess of 53% when using SIC codes.

In Panel B of Table 3, we examine the correlation between the AIC and a firm- and quarter-specific measure of the announcement-day stock price response per unit of earnings surprise (relative to the mean I/B/E/S forecast), RESPONSE. The variable RESPONSE is quite noisy; nearly 45% of the individual firm-quarter ratios are negative. As a negative RESPONSE is not economically logical (a positive earnings surprise is viewed as bad news by the market or a negative surprise as good news), we do not simply report the AIC-RESPONSE correlation (it is quite low). One modification is to focus on only the positive firm-quarter RESPONSE ratios, ie., those that make economic sense. In that case, the AIC-RESPONSE correlation is a statistically significant (at the 0.0001 confidence level) 0.47 for the large sample and 0.42 for the smaller sample. (Interestingly, the correlation between the AIC and the negative RESPONSE measures is of the same magnitude as the correlation with the positive RESPONSEs, only negative.) Alternatively, we can focus our attention on the relation between the AIC and the sensitivity of stock price to earnings surprise by taking the absolute value of RESPONSE before computing the correlation between it and AIC. In that case, the correlation is a statistically significant (again at the 0.0001 level) 47% for the AIC sample and 41% for the CS sample. This suggests that large AICs are correlated with extreme stock price movements per unit of earnings surprise, which is consistent with the claim that option market traders are, on average, able to anticipate the sensitivity of the *ex post* stock prices to earnings news.

Nonlinearity of AICs

Prior research documents that traditional ERCs are not linear in earnings surprise. Specifically, Freeman and Tse (1992) document an s-shaped relation between stock price change and earnings surprise. That is, the marginal stock price reaction to greater absolute surprises decreases as the surprise increases. We illustrate that this nonlinearity between option price (our numerator) and our earnings uncertainty proxy, the standard deviation of analysts' earnings forecasts (our denominator), holds in our sample in Figure 3. Panel A (B) of Figure 3 plots the data using the AIC (CS) sample. To produce the figures, we normalize STDEV and OPTPRC by the underlying stock's price the day prior to the earnings announcement and form normalized STDEV deciles. Consistent with Freeman and Tse (1992), the scatter plot suggests that the AIC:STDEV relation is nonlinear. That is, the AIC increases at a decreasing rate as our earnings surprise proxy (i.e., STDEV) increases.

The importance of the Internet Bubble

Before reporting the results of our estimation of regression Equation 2, we pause to consider the influence of the Internet "Bubble" period. To analyze the effect of the Bubble on our data, we report tests of the difference in means and medians for our variables of interest across the Bubble-Bust period and the post-Bubble-Bust period in Table 4. Using the larger sample of observations for which we have an AIC, we note that the mean (median) AIC in the post-Bubble-Bust period is about two-thirds (three-fourths) of the Bubble-Bust level. These differences are due to a 10-point drop in IVOL that is significant at beyond the 0.01 level. This implies that option traders anticipated a heightened volatility of stock price movements surrounding earnings releases during the Bubble. Likewise, the means and medians of SURPRISE, STDEV, NUM, and IVOL differ in the two sub-periods. The same conclusions hold when we examine the sample requiring the cross-sectional variables. In addition, each of the cross-sectional variables of interest (θ, β, MB, and I – median only for MB) differs in the two sub-periods. Taken collectively, the results presented in Panels A and B of Table 4 signal the need to control for the influence of the Bubble-Bust period in our multiple regressions.

Cross-sectional and inter-temporal analysis of AICs

In Table 5, we report the results of estimating regression Equation 3. We present the results of four specifications of the regression model. The differences among the specifications stem from the inclusion of year dummy variables and the sample period employed. Specifications (1) and (3) include year binary variables, while specifications (2) and (4) do not. The first two specifications use all years of data. The final two specifications use only 2002 through 2006 (the post-Bubble-Bust period) data.

The AIC of a firm with a high potential earnings growth rate (i.e., high MB) is hypothesized to be greater than that for a firm with a low rate. Our results support this hypothesis. The Bubble-Bust period regression coefficient for MB (γ_2) is significantly greater than zero. This effect is dampened in the post-Bubble-Bust period (i.e., γ_3 is negative), but the combined coefficient (i.e., $\gamma_2 + \gamma_3$) applicable to the post-period is reliably positive. Likewise, option traders for a firm with large earnings persistence (i.e., a large θ), should expect large changes in share price for a given earnings surprise. That is, we hypothesize that γ_8 is positive. This is not what we find in the Bubble-Bust period. Yet, the post-period coefficient (γ_9) is positive and of sufficient size to swamp γ_8. This suggests that earnings persistence is not related to the option market's anticipation of earnings releases as expected in the Bubble-Bust period, but is related as expected in the post-period. The firm's required rate of return is hypothesized to be negatively related to the AIC. Assuming the Capital Asset Pricing Model determines the firm's required rate of return, the earnings-related volatility should be muted for firms with large levels of systematic risk and when riskless interest rates are high. Our evidence is consistent with the hypothesized riskless interest rate effect in the Bubble-Bust period, but only in the third specification of the model in the post-Bubble period and then only with a marginally significant p-value of 0.0567 for a two-tailed test. The evidence of the effect of the firm's systematic risk levels is not consistent with theory in the Bubble-Bust period. Our estimate of γ_4 is significantly positive (the unexpected sign). There is some evidence that the β-effect is consistent with theory in the post-Bubble-Bust period, as the estimate of γ_4 is significantly negative and the combined coefficient is significantly negative in both the second and fourth specifications (p-values of 0.0612 and 0.0069 for two-tailed tests). We note that Collins and Kothari (1989) do not consistently detect a significant effect for β.

Because firms' information environments affect the market's sensitivity to earnings information, perhaps via a "preemption" effect (Atiase, 1985), the inclusion of NUM offers the opportunity to explore the role that the increased availability of predisclosure information plays in the option market's setting. As shown in Table 4, we find the coefficient on NUM is significantly positive in both periods, which runs counter to the dampened volatility effect observed by Atiase (1985). Thus, in our sample of actively followed firms, the option market allows for a more significant earnings-related price response as the information environment becomes more robust.

The numerator of the AIC (i.e., the price of an option expiring soon after an impending earnings announcement) reflects the level of normal implied volatility as well as the anticipated earnings-induced spike in volatility. This suggests that cross-sectional variation in our metric may stem, in part, from variation in the stock's everyday volatility, as opposed to the incremental volatility associated with the earnings announcement. Yet, we expect the incremental value reflected in the option price associated with the earnings-induced volatility spike dominates the value reflected in the option price associated with the normal volatility level – particularly given our focus on short-dated, ATM options that should trade for very little absent the anticipation of earnings news. Nonetheless, in additional (untabulated) tests we control for the extent to which everyday volatility may drive the observed cross-sectional and time-series variation in the AIC. Specifically, we re-estimate each of the four regression specifications reported in Table 5 with the inclusion of a measure of the option's implied volatility from up to 60 days (depending upon data availability) prior to the EA_DATE, where the average (median) distance between the EA_DATE and this measure of pre-announcement volatility (IVOL_PRE) equals 41 (39) days. With the inclusion of IVOL_PRE in the regression equation, none of the observed relations change. Not surprisingly, IVOL_PRE exhibits a significantly positive relation to the AIC and its inclusion increases the adjusted R^2 in each specification.

The AIC's sensitivity to firms' institutional ownership

We examine the relation between AIC and institutional ownership in Table 6 after controlling for the economic variables influencing the return-earnings relation and the richness of the firm's information environment. In Panel A, we report the results of re-estimating Equation 3 after including the fraction of the firm held by institutional investors as recorded by Thompson Reuters (%OWN). The first two specifications represent an analysis of the cross-sectional association between levels of %OWN and AIC; we include year fixed effects in model (1), but not in model (2). The previous documented cross-sectional and inter-temporal results are robust to the inclusion of %OWN in the regression equation. In addition, we observe that the coefficient associated with institutional ownership is significantly positive for both sub-periods. This suggests that the option market builds in an increased stock-price sensitivity to the upcoming earnings announcement for those firms that are likely to be subjected to more intense institutional trading. The third specification in Panel A presents a regression of first differences of variables that change from quarter to quarter (i.e., AIC, MB, I, NUM, and %OWN).[20] Changes in AICs are positively associated with changes in the market-to-book ratio, the level of the firm's beta in the Bubble-Bust period, changes in the riskless interest rate, and changes in the number of analysts during the Bubble-Bust period and negatively related to the level of beta in the post-Bubble-Bust period. Of more interest here, changes in %OWN are positively correlated with changes in the AIC. Thus, regardless of whether we examine cross-sectional levels of the AIC or changes in the AIC, we find that larger levels of institutional ownership are associated with greater anticipated volatility. This is consistent with the claim that the more intense trading activity of institutional traders is reflected in option prices surrounding earnings announcements.

[20] The firm's β is assessed annually and the firm's persistence parameter is estimated over the entire eleven-year sample period.

In Panel B of Table 6, we report the results of the marginal effect of transient ownership on the AIC. To categorize our institutional owners as transient, dedicated, or quasi-indexers, we use data supplied to us by Brian Bushee. To update his sample period to ours, we assume that investor types remain the same over the time period from the end of his sample period (i.e., 2004) to the end of ours (i.e., 2006). To assess the marginal impact of transient investors, we break %OWN into three variables; %TRAN that represents the fraction of the firm owned by transient investors, %DED that equals the fraction of the firm held by dedicated investors, and %QIX that is the fraction of the firm held by quasi-indexers. As described in Bushee and Noe (2000) and Bushee (2001), both %DED and %QIX include institutions that trade less frequently.

In Panel B of Table 6, we report the results of two levels regressions (one with year effects and one without) and one changes regression. The statistically significant effects noted in Panel A for MB, BETA, I, THETA and NUM (with the exception of the NUM-effect in the changes regression) are maintained when dividing institutional ownership into its component parts. In the Bubble-Bust period, the %TRAN coefficient estimate is significantly positive and the %QIX coefficient is significantly negative. In the post-Bubble-Bust period, the coefficient estimate for the transient owners is significantly positive. Thus, more transient institutional ownership is associated with an increased anticipation of stock-price volatility. The size of the regression coefficient on the %TRAN is significantly greater (results not reported, but at the 0.02 level or beyond) than the coefficients on the other two types of investors in either sub-period. Thus, highlighting the importance of Bushee (2001)'s classifications, we find that transient investors drive the positive association between institutional ownership and anticipated volatility. Tangentially, it is interesting to note that the size of the coefficient estimate for %TRAN significantly decreases in the post-Bubble-Bust period. Not surprisingly, during that particularly volatile period, transient investors appear to have had a substantial effect in the option market.

Summary of findings

This paper draws on and contributes to research documenting the informational value of accounting earnings as well as literature studying the option market's role in the price discovery process in order to examine how investors' anticipation of earnings-induced stock price volatility affects trading behavior in the option market. In so doing, it offers researchers an *ex ante*, option-market-based measure of the informativeness of firms' earnings announcements that varies cross-sectionally and inter-temporally depending upon traders' anticipation of the strength of the return-earnings relation, the firm's information environment, and investors' willingness/ability to trade aggressively based on earnings information. In addition to documenting that option prices are sensitive to the firm and economic variables the extant earnings-information-content literature documents affect contemporaneous stock price responses to earnings innovations, our results suggest that option traders anticipate a larger potential stock-price response to earnings releases when there is more pre-announcement private information production/attention and when the firm's ownership is more inclined to trade.

Atiase (1985), Collins, Kothari, and Rayburn (1987), and Collins and Kothari (1992) support the proposition that larger firms' reporting systems supply investors with data allowing stock prices to anticipate information in earnings releases and dampen the reaction to earnings news. Yet, for a sample of widely followed firms, we find that option markets build-in a greater earnings-related stock price reaction per unit of earnings uncertainty for firms with more pre-announcement information production (a larger analyst following) than when lesser amounts of pre-announcement information are present. Perhaps this is due to a belief that, should many analysts be wrong, the stock price reaction will be exaggerated relative to situations when only a few analysts are wrong. Perhaps it is because more analysts means more brokerage firms inducing more trade. Likewise, finding that the AIC is larger, on average, during the Internet Bubble than afterwards suggests that our metric responds to more than just the valuation relevance of current-period earnings, as accounting earnings (a traditional valuation variable) have been shown to be less relevant during the Bubble period. Finally, we find direct evidence that the anticipated stock price reaction to an earnings release is greater if there is a higher fractional ownership of sophisticated investors willing and able to trade on information contained in earnings releases.

As with all empirical research, one must be cautious about interpreting results and extrapolating our conclusions to firms not included in our sample. The data requirements for computing the AICs are somewhat restrictive, which biases our sample toward larger firms with sufficient trading interest and stock price volatility to attract the attention of option exchanges and financial analysts. Thus, it would be difficult to extend our findings to small firms without analyst coverage. It is important to note, however, that the nature of I/B/E/S coverage and OptionMetrics coverage often leads to the exclusion of similar firms. That is, firms for which we do not observe sufficient analyst following are frequently the same firms that do not have traded options. Consequently, traditional measures of information content (e.g., ERCs) calculated using analyst forecast data likely suffer a similar degree of restriction due to data availability. We also must recognize that the AIC undoubtedly measures the anticipated information content of earnings with error. For example, as in any event study, the option's price might be affected by information events other than earnings that the market anticipates occurring before the option's expiration. Our focus on soon-to-expire options mitigates this concern to some degree. Further moderating this concern is the knowledge that for this information to add noise to our calculation, it must be non-earnings related, yet value-relevant, information that option traders can anticipate, but to which they cannot attach an expected sign.

5. Conclusions and future work

We develop an *ex ante* measure of the information content of earnings announcements that allows us to estimate the stock market's response to news in upcoming earnings releases. Our measure, the AIC, exploits a powerful setting in the option market in order to separate the magnitude of the stock market's reaction to earnings information from earnings uncertainty. Our results suggest that option traders anticipate the sensitivity of stock prices to earnings information and they do so in a way that recognizes cross-sectional and time-series differences in the strength of the link between returns and earnings. In particular, we find the AIC positively correlates with the magnitude of the *ex post* stock market sensitivity to unexpected earnings. In further tests, we document that the AIC increases with earnings persistence, firm growth prospects, the richness of firms' information environments and the presence of sophisticated ownership structures and decreases with anticipated discount rates. This paper sheds light on whether and how information content manifests in the option market and, in so doing, it introduces several opportunities for future study.

As our analysis of the sensitivity of the AIC to changes in ownership structure demonstrates, the frequent measurability and firm- and quarter-specific nature of the AIC allows researchers to more precisely examine changes in the link between returns and earnings. In addition to the benefits associated with data availability and firm- and quarter-specificity, other features of the option-market setting supply new avenues for potential research. First, the *ex ante* nature of the AIC affords researchers the opportunity to investigate whether the market anticipates or reacts to the event of interest. Second, the existence of multiple options that vary across three dimensions (i.e., puts versus calls, strike prices, and expiration dates) introduces additional research opportunities beyond those attributes of the AIC that allow for more powerful event studies. For example, do accounting choices have different short-term and longer-term effects on the informativeness of earnings? Options with differing expiration dates allow research on this question. Do firms' accounting choices impart an asymmetry in the strength of the link between returns and earnings? With puts and calls available, a researcher can address such questions. Finally, should it be of interest to assess the distribution of expected future stock prices, researchers can examine options with varying strike prices.

References

Amin, K. and C. Lee. 1997. Option trading and earnings news dissemination. Contemporary Accounting Research 14: 153-192.

Atiase, R. 1985. Predisclosure information, firm capitalization, and security price behavior around earnings announcements. *Journal of Accounting Research*: 21-36.

Bagnoli, M., W. Kross, and S. Watts. 2002. The information in management's expected earnings report data: a day late, a penny short. *Journal of Accounting Research*: 1275-1296.

Ball, R., and P. Brown. 1968. An empirical evaluation of accounting income numbers. *Journal of Accounting Research* 6: 159-178.

Balsam, S., J. Krishnan, J.S. Yang. 2003. Auditor industry specialization and earnings quality. *Auditing: A Journal of Practice and Theory* 22(2): 71-97.

Barron, O., O. Kim, S. Lim, and D. Stevens. 1998. Using analysts' forecasts to measure properties of analysts' information environment. *The Accounting Review* 73: 421-433.

Beaver, B. 1968. The information content of annual earnings announcements. *Journal of Accounting Research*: 67-92.

Beaver, W., R. Clarke, and W. Wright. 1979. The association between unsystematic security returns and the magnitude of earnings forecast errors. *Journal of Accounting Research* 17: 316-340.

Beaver, W., R. Lambert, and D. Morse. 1980. The information content of security prices. *Journal of Accounting and Economics* 2: 3-28.

Black, F., and M. Scholes. 1973. The pricing of options and corporate liabilities. *Journal of Political Economy* 81: 637-654.

Bushee, B. 2001. Do institutional investors prefer near-term earnings over long-run value? *Contemporary Accounting Research* 18: 207-246.

Bushee, B. and C. Noe. 2000. Corporate disclosure practices, institutional investors, and stock return volatility. *Journal of Accounting Research*: 171-202.

Chambers, A., and S. Penman. 1984. Timeliness of reporting and the stock price reaction to earnings announcements. *Journal of Accounting Research* 22: 21-47.

Collins, D., S. P. Kothari, and J. Rayburn. 1987. Firm size and the information content of prices with respect to earnings. *Journal of Accounting and Economics* 9: 111-138.

Collins, D., and S. P. Kothari. 1989. An analysis of intertemporal and cross-sectional determinants of the earnings response coefficient. *Journal of Accounting and Economics* 11: 143-181.

Cremers, M., and D. Weinbaum. 2010. Deviations from put call parity and stock return predictability, *Journal of Financial and Quantitative Analysis* 45: 335-367.

Demers, E., and B. Lev. 2001. A rude awakening: Internet shakeout in 2000. *Review of Accounting Studies* 6: 331-349.

Easton, P., and M. Zmijewski. 1989. Cross-sectional variation in the stock market response to accounting earnings announcements. *Journal of Accounting and Economics* 11: 117-141.

Fleming, J., B. Ostdiek, and R. Whaley. 1996. Trading costs and the relative rates of price discovery in stock, futures, and option markets. *Journal of Futures Markets* 16: 353-387.

Freeman, R., and S. Tse. 1992. A nonlinear model of security price responses to unexpected earnings. *Journal of Accounting Research* 30: 185-209.

Hackenbrack, K. and C. Hogan. 2002. Market response to earnings surprises conditional on reasons for an auditor change. *Contemporary Accounting Research* 19: 195-223.

Hand, J. 2001. The role of book incomes, web traffic, and supply and demand in the pricing of U.S. internet stocks. *European Finance Review* 5: 295-317.

Imhoff, E., and G. Lobo. 1992. The effect of ex ante earnings uncertainty on earnings response coefficients. *The Accounting Review* 67: 427-439.

Jiambalvo, J., S. Rajgopal, and M. Venkatachalam. 2002. Institutional ownership and the extent to which stock prices reflect future earnings. *Contemporary Accounting Research*: 117-45.

Kim, J., I. Krinsky, and J. Lee. 1997. Institutional holdings and trading volume reactions to quarterly earnings announcements. *Journal of Accounting, Auditing and Finance* 12: 1-14.

Kinney, W., D. Burgstahler, and R. Martin. 2002. Earnings surprise 'materiality' as measured by stock returns. *Journal of Accounting Research* 40: 1297-1329.

Kormendi, R., and R. Lipe. 1987. Earnings innovations, earnings persistence, and stock returns. *Journal of Business* 60: 323-345.

Kothari, S.P. 2001. Capital markets research in accounting. *Journal of Accounting and Economics* 31: 105-231.

Kothari, S.P., and R. Sloan. 1992. Information in prices about future earnings: Implications for earnings response coefficients. *Journal of Accounting and Economics* 14: 143-171.

Lang, M. and M. McNichols. 1997. Institutional trading and corporate performance. *Working paper*.

Manaster, S. and R. Rendleman. 1982. Option prices as predictors of equilibrium stock prices. *Journal of Finance* 37: 1043-1057.

May, R. G. 1971. The influence of quarterly earnings announcements on investor decisions as reflected in common stock price changes. *Journal of Accounting Research* 9: 119-163.

Mayhew, S., and V. Mihov. 2004. How do exchanges select stocks for option listing. *Journal of Finance* 59: 447-471.

Moreland, K. 1995. Criticisms of auditors and the association between earnings and returns of client firms. *Auditing: A Journal of Practice and Theory* 14 (Spring): 94-104.

Ni, S., J. Pan, and A. Poteshman. 2008. Volatility information trading in the option market. *Journal of Finance* 63: 1959-1092.

Patell, J., and M. Wolfson. 1979. Anticipated information releases reflected in call option prices. *Journal of Accounting and Economics* 1: 117-140.

Patell, J., and M. Wolfson. 1981. The ex ante and ex post price effects of quarterly earnings announcements reflected in option and stock prices. *Journal of Accounting Research* 19: 434-458.

Payne, J., and W. Thomas. 2003. The implications of using stock-split adjusted I/B/E/S data in empirical research. *The Accounting Review* 78: 1049-1067.

Potter, G. 1992. Accounting earnings announcements, institutional investor concentration and common stock returns. *Journal of Accounting Research* 30: 146-155.

Schmalensee, R., and R. Trippi. 1978. Common stock volatility expectations implied by option premia. *Journal of Finance* 33: 129-147.

Skinner, D. 1990. Options markets and the information content of accounting earnings releases. *Journal of Accounting and Economics* 13: 191-211.

Teets, W., and C. Wasley. 1996. Estimating earnings response coefficients: pooled versus firm-specific models. *Journal of Accounting and Economics* 21: 279-295.

Teoh, S. and T. Wong. 1993. Perceived auditor quality and the earnings response coefficient. *The Accounting Review* 68 (April): 346-366.

Trueman, B., F. Wong, and X Zhang. 2000. The eyeballs have it: searching for the value in Internet stocks. *Journal of Accounting Research* 38: 137-162.

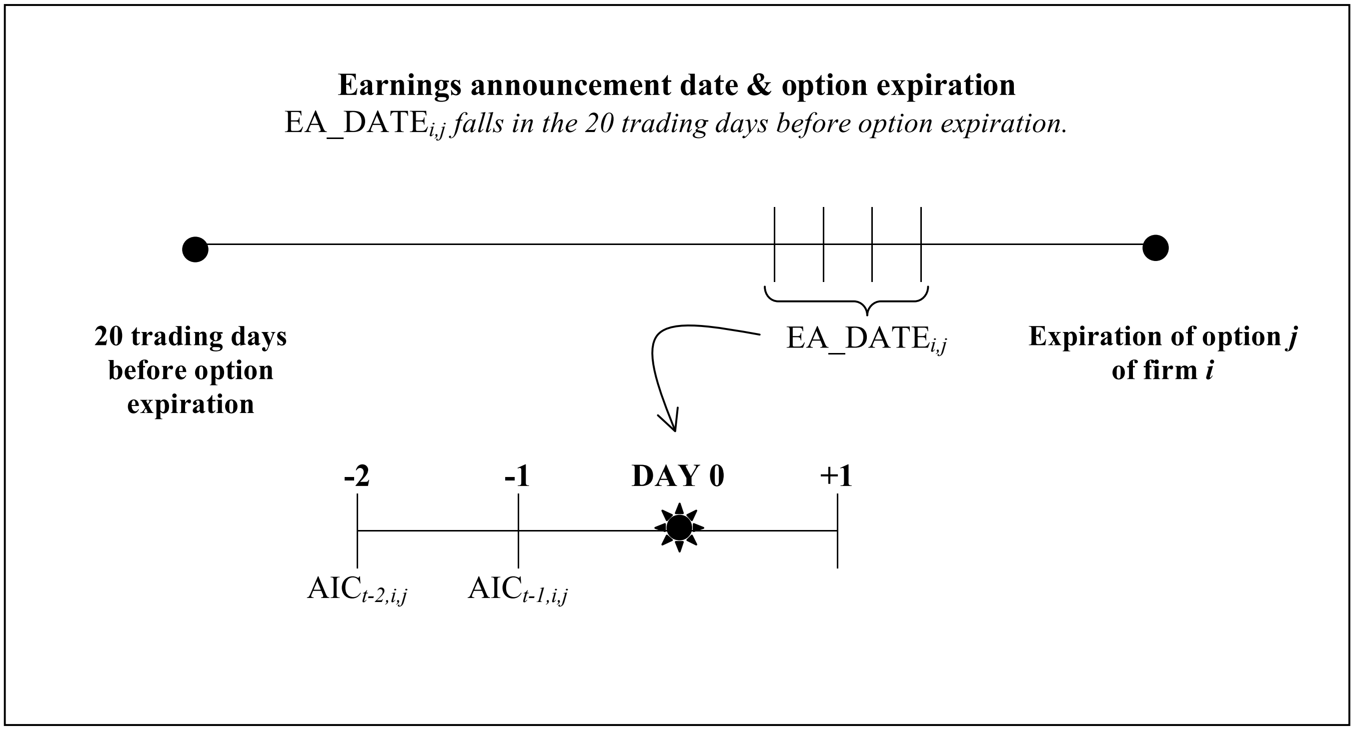
Trueman, B., F. Wong, and X. Zhang. 2003. Anomalous stock returns around Internet firms' earnings announcements. *Journal of Accounting and Economics* 34: 249-271.

Xing, Y., X. Zhang, and R. Zhao. 2009. What does individual option volatility smirk tell us about future equity returns?" forthcoming *Journal of Financial and Quantitative Analysis*.

Xu, B., M. Magnan, and P. Andre. 2007. The stock market valuation of R&D information in biotech firms. *Contemporary Accounting Research* 24: 1291-1318.

APPENDIX Variable definitions and data sources		
OPTPRICE	= the average of the best, or highest, closing bid price and the best, or lowest, closing ask price across all exchanges on which the option trades (i.e., [BEST_BID+BEST_OFFER]÷2).	**OptionMetrics**
PRICE	= the closing price of the security; if missing, then OptionMetrics takes the average of the closing bid and ask prices.	
STRIKE	= the strike price of the option.	
EX_DATE	= the expiration date of the option.	
IVOL	= the calculated implied volatility of the option. (OptionMetrics does not calculate this for options with non-standard settlement.)	
MONEYNESS (M)	= PRICE ÷ STRIKE for call options; STRIKE ÷ PRICE for put options.	
EA_DATE	= the report date of earnings as reported by I/B/E/S.	**I/B/E/S**
SURPRISE	= ACTUAL - MEANEST, where ACTUAL equals the actual value of EPS and the MEANEST equals the mean estimate of analysts' forecasts of current quarter EPS.	
STDEV	= the standard deviation of analysts' forecasts.	
NUMEST (NUM)	= the number of estimates.	
AIC	= OPTPRICE ÷ STDEV.	**OptionMetrics & I/B/E/S**
D_{PBB}	= 1 if the observation is in the post-Bubble-Bust timeframe; 0 otherwise. March of 2001 marks the start of the post-Bubble-Bust timeframe in our sample period.	**Compustat & CRSP**
MKT_BK (MB)	= the ratio of the market capitalization to book value of equity (i.e., Compustat DATA14 times Compustat DATA61 divided by Compustat DATA60).	
BETA (β)	= systematic risk as measured by the prior year-end BETAV from CRSP.	
INT_RATE (I)	= the 10-year, U.S. Treasury long-term interest rate for the end of the prior month.	
THETA (θ)	= a measure of earnings persistence, θ equals one minus the estimated first-order moving average coefficient in a time series model.	
YEAR (D_y)	= a binary variable that takes the value of 1 if the year equals y; 0 otherwise.	
%OWN	= the shares held at the end of the quarter by institutional owners divided by the shares outstanding at the end of the quarter. We code the types of institutional ownership – transient (%TRAN), dedicated (%DED), and quasi-index (%QIX) – using classification coding described in Bushee and Noe (2000) and Bushee (2001).	**Thomson Reuters**
RESPONSE	= the announcement day stock price response ÷ SURPRISE.	**CRSP & I/B/E/S**

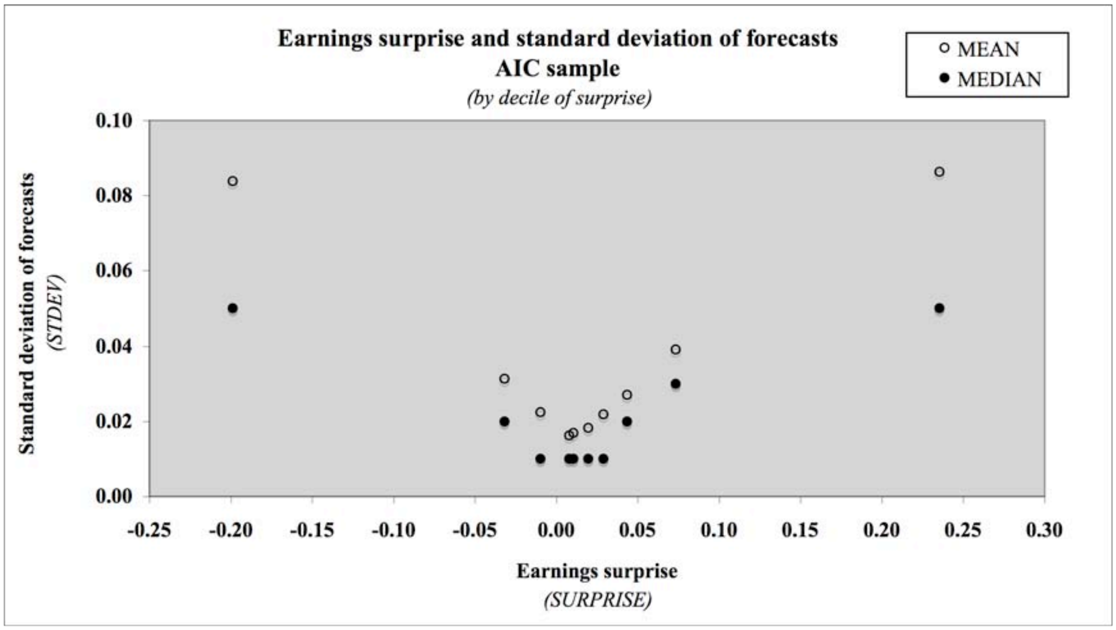
FIGURE 1
Timeline of earnings announcement date in relation to option expiration



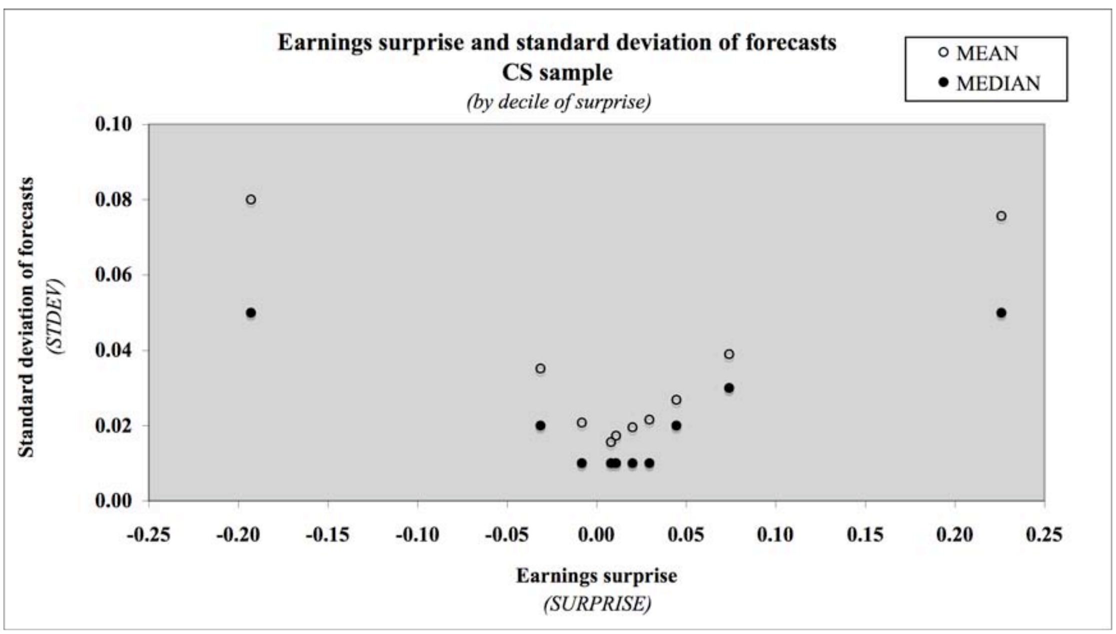
We limit our analysis to options nearing expiration by collecting data for all traded options on individual common stocks beginning four weeks (typically 20 trading days) prior to the option expiration date from OptionMetrics. We merge the OptionMetrics dataset with an I/B/E/S dataset to obtain the initial sample of firm-quarters with available option and analyst forecast data. When merging the two datasets, we require that an earnings announcement date (EA_DATE) fall within the four weeks of option data collected from OptionMetrics. Thus, all retained merged datasets contain a series of option and stock price data that covers the period of time surrounding an EA_DATE. As indicated in the lower timeline, we calculate an AIC for observations occurring one or two days before the EA_DATE. We only calculate one AIC for each unique option associated with a particular EA_DATE. Specifically, if we calculate an AIC for option *j* on firm *i* on day -1, then we do not calculate an AIC on day -2. Please see the Appendix for variable definitions.

FIGURE 2
The relation between earnings surprise and standard deviation of forecasts

Panel A – AIC sample (n=39,443)



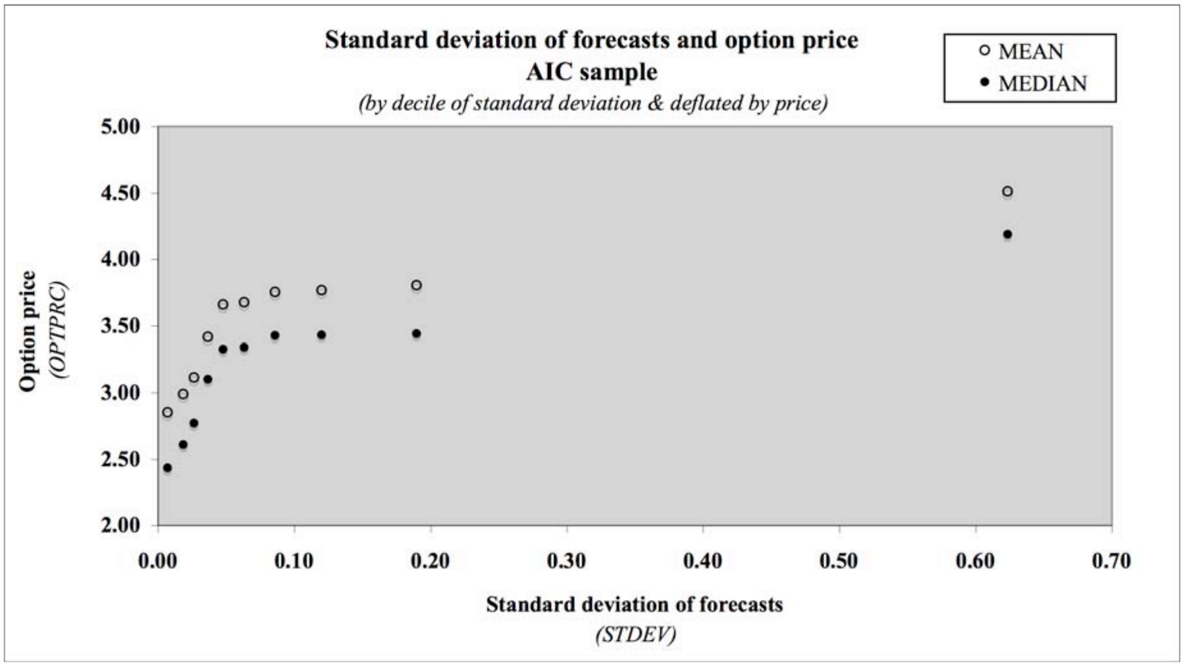
Panel B – CS sample (n=30,641)



Kinney, Burgstahler and Martin (2002, Figure 3) suggest that STDEV offers a good *ex ante* proxy of earnings surprise. Confirming the existence of a relation in our sample, we detect a statistically significant (beyond the 0.0001 level) correlation of 0.54 between STDEV and the absolute value of SURPRISE for the sample of firms with option and analyst forecast data (the AIC sample). This figure illustrates this point by sorting our data into deciles based on SURPRISE and plotting the average SURPRISE and average STDEV for these 10 groups. Consistent with Kinney, Burgstahler and Martin (2002), we observe a linear pattern between STDEV and absolute SURPRISE. Panel B confirms that the correlation holds in the subset of firms with Compustat and CRSP data the (CS sample). Please see the Appendix for variable definitions.

FIGURE 3
Nonlinearity

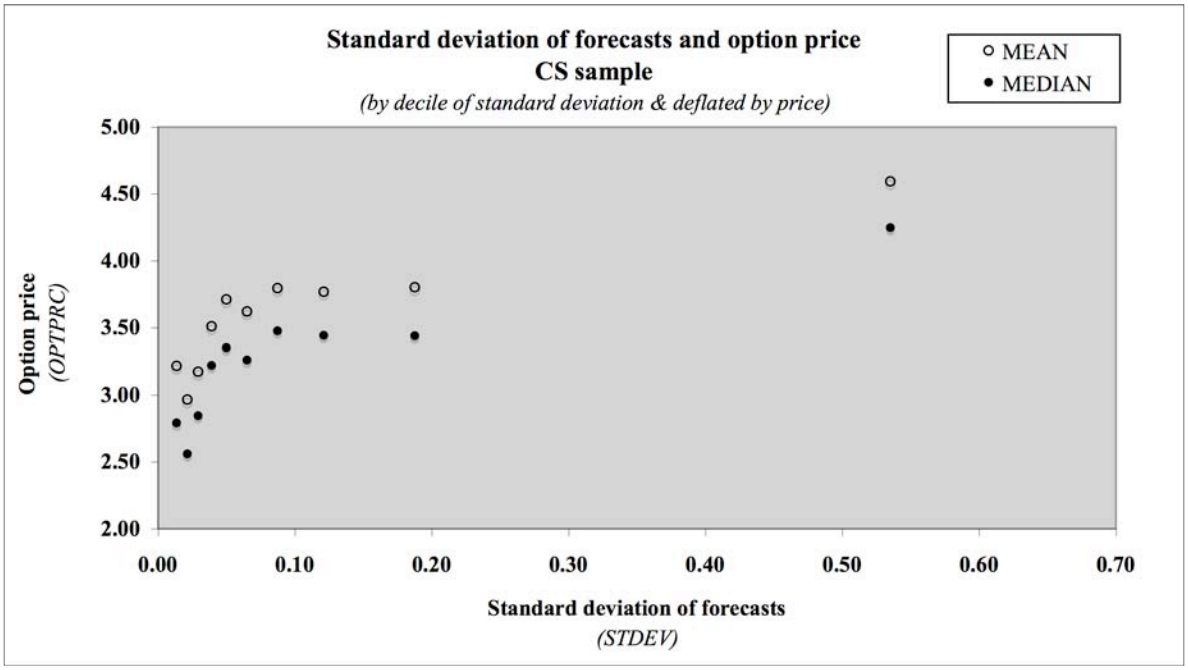
Panel A – AIC sample (n=39,443)



Freeman and Tse (1992) find that stock returns change rapidly as earnings surprise moves in either direction from zero, but that this sensitivity decreases for large absolute surprise. This figure illustrates that this nonlinearity holds in our sample. Panel A plots data using the sample of firms with options and analyst forecast data (the AIC sample). As in Freeman and Tse (1992), we divide the SURPRISE and the associated stock price change by the price of a share of the firm's common stock before the earnings report. We sort our observations by normalized surprise and form normalized-surprise deciles. We then compute the mean normalized price movement (return) and mean normalized surprise for each of the deciles and produce a scatter plot. For consistency, we normalize STDEV and OPTPRC by the underlying stock's price the day prior to the earnings announcement and form normalized STDEV deciles; we then multiply these calculations by 100 and report the results above. Please see the Appendix for variable definitions.

FIGURE 3 (concluded)
Nonlinearity

Panel B – CS sample (n=30,641)



Freeman and Tse (1992) find that stock returns change rapidly as earnings surprise moves in either direction from zero, but that this sensitivity decreases for large absolute surprise. This figure illustrates that this nonlinearity holds in our sample. Panel B plots data using the sample of firms with option, analyst forecast, and Compustat and CRSP data (the CS sample). As in Freeman and Tse (1992), we divide the SURPRISE and the associated stock price change by the price of a share of the firm's common stock before the earnings report. We sort our observations by normalized surprise and form normalized-surprise deciles. We then compute the mean normalized price movement (return) and mean normalized surprise for each of the deciles and produce a scatter plot. For consistency, we normalize STDEV and OPTPRC by the underlying stock's price the day prior to the earnings announcement and form normalized STDEV deciles. Please see the Appendix for variable definitions.

TABLE 1
Sample selection

Panel A – Observations obtained from the intersection of OptionMetrics and I/B/E/S

	Intersection of OptionMetrics and I/B/E/S data			
Year	# of obs.	Unique firm-quarters	Unique firms	Unique options
Total observations	**12,746,036**	**55,936**	**4,363**	**651,811**
1996	489,569	4,109	1,433	31,315
1997	952,473	4,972	1,752	52,403
1998	1,113,447	5,678	2,002	58,754
1999	1,208,943	6,025	2,084	67,880
2000	1,555,374	5,168	1,840	88,894
2001	1,372,569	5,089	1,773	74,259
2002	1,259,046	5,445	1,876	67,113
2003	1,106,498	5,194	1,801	57,908
2004	1,309,563	5,936	1,994	70,291
2005	1,402,263	6,343	2,159	74,469
2006	976,291	4,269	1,525	51,569
Average per year	**1,158,731**	**5,293**	**1,840**	**63,169**

In order to estimate AICs, we require option pricing data and analyst forecast data. We obtain daily historical option prices and implied volatilities along with the option characteristics (strike prices, expiration dates, and put-call indicators) for individual equity options and these options' underlying-stock prices from Ivy DB OptionMetrics. We limit our analysis to options nearing expiration by collecting data for all traded options on individual common stocks beginning four weeks (typically 20 trading days) prior to the option expiration date (EX_DATE). We obtain analyst forecast data from the summary files of I/B/E/S International, Inc. The initial sample of data retrieved from I/B/E/S focuses on forecasts of current-quarter primary earnings per share for U.S. firms covered by at least two analysts. The restriction on the number of analysts allows us to have both a mean estimate (MEANEST) and a standard deviation of analysts' forecasts (STDEV). We remove observations with missing actual reported values or missing report dates of actual earnings values. We merge the OptionMetrics and I/B/E/S datasets to obtain the initial sample of firm-quarters with available option and analyst forecast data. When merging the two datasets, we require that an earnings announcement date fall within the four weeks of option data collected from OptionMetrics. Thus, all retained merged datasets contain a series of option and stock price data that covers the period of time surrounding an earnings announcement date. We increase the power of our tests by restricting the dataset to observations for which we expect the impending earnings news to most significantly affect the price of the option (OPTPRC). To accomplish this, we compute the "moneyness" (M) of the option by comparing the option's strike price (STRIKE) to the underlying stock's closing price (PRICE). Specifically, we calculate M for call (put) options as PRICE (STRIKE) divided by STRIKE (PRICE). We then limit our analysis to at-the-money options by focusing on observations where M falls between 0.95 and 1.05. Finally, OptionMetrics does not compute implied volatility for options with non-standard settlement arrangements. Because the non-standard settlement may affect the option price in ways that add noise to our calculations, we remove observations with missing implied volatility measures. We gather the additional cross-sectional and time-series data required to conduct additional analyses from Compustat and CRSP. Please see the Appendix for variable definitions.

TABLE 1 (continued)
Sample selection

Panel B – Observations with requisite data for computation of AICs ("AIC sample")

		AIC data		
Year	# of obs.	Unique firm-quarters	Unique firms	Unique options
Total observations	**39,443**	**18,214**	**3,327**	**39,443**
1996	1,846	1,028	688	1,846
1997	4,464	1,483	935	4,464
1998	3,084	1,489	985	3,084
1999	2,671	1,312	870	2,671
2000	3,481	1,622	1,007	3,481
2001	3,910	1,592	968	3,910
2002	3,123	1,565	965	3,123
2003	3,225	1,619	943	3,225
2004	3,754	1,820	1,043	3,754
2005	5,164	2,468	1,342	5,164
2006	4,721	2,216	1,211	4,721
Average per year	**3,586**	**1,656**	**996**	**3,586**

In order to estimate AICs, we require option pricing data and analyst forecast data. We obtain daily historical option prices and implied volatilities along with the option characteristics (strike prices, expiration dates, and put-call indicators) for individual equity options and these options' underlying-stock prices from Ivy DB OptionMetrics. We limit our analysis to options nearing expiration by collecting data for all traded options on individual common stocks beginning four weeks (typically 20 trading days) prior to the option expiration date (EX_DATE). We obtain analyst forecast data from the summary files of I/B/E/S International, Inc. The initial sample of data retrieved from I/B/E/S focuses on forecasts of current-quarter primary earnings per share for U.S. firms covered by at least two analysts. The restriction on the number of analysts allows us to have both a mean estimate (MEANEST) and a standard deviation of analysts' forecasts (STDEV). We remove observations with missing actual reported values or missing report dates of actual earnings values. We merge the OptionMetrics and I/B/E/S datasets to obtain the initial sample of firm-quarters with available option and analyst forecast data. When merging the two datasets, we require that an earnings announcement date fall within the four weeks of option data collected from OptionMetrics. Thus, all retained merged datasets contain a series of option and stock price data that covers the period of time surrounding an earnings announcement date. We increase the power of our tests by restricting the dataset to observations for which we expect the impending earnings news to most significantly affect the price of the option (OPTPRC). To accomplish this, we compute the "moneyness" (M) of the option by comparing the option's strike price (STRIKE) to the underlying stock's closing price (PRICE). Specifically, we calculate M for call (put) options as PRICE (STRIKE) divided by STRIKE (PRICE). We then limit our analysis to at-the-money options by focusing on observations where M falls between 0.95 and 1.05. Finally, OptionMetrics does not compute implied volatility for options with non-standard settlement arrangements. Because the non-standard settlement may affect the option price in ways that add noise to our calculations, we remove observations with missing implied volatility measures. We gather the additional cross-sectional and time-series data required to conduct additional analyses from Compustat and CRSP. Please see the Appendix for variable definitions.

TABLE 1 (concluded)
Sample selection

Panel C – Observations with requisite data for cross-sectional regressions ("CS sample")

	Intersection of AIC data and cross-sectional data			
Year	# of obs.	Unique firm-quarters	Unique firms	Unique options
Total observations	**30,641**	**14,907**	**2,757**	**30,641**
1996	1,528	860	573	1,528
1997	2,504	1,208	768	2,504
1998	2,464	1,193	805	2,460
1999	2,193	1,076	721	2,191
2000	2,817	1,314	812	2,817
2001	2,827	1,382	846	2,827
2002	2,727	1,367	843	2,727
2003	1,875	934	545	1,875
2004	3,288	1,589	916	3,288
2005	4,497	2,149	1,157	4,497
2006	3,921	1,835	1,025	3,921
Average per year	**2,786**	**1,355**	**819**	**2,785**

In order to estimate AICs, we require option pricing data and analyst forecast data. We obtain daily historical option prices and implied volatilities along with the option characteristics (strike prices, expiration dates, and put-call indicators) for individual equity options and these options' underlying-stock prices from Ivy DB OptionMetrics. We limit our analysis to options nearing expiration by collecting data for all traded options on individual common stocks beginning four weeks (typically 20 trading days) prior to the option expiration date (EX_DATE). We obtain analyst forecast data from the summary files of I/B/E/S International, Inc. The initial sample of data retrieved from I/B/E/S focuses on forecasts of current-quarter primary earnings per share for U.S. firms covered by at least two analysts. The restriction on the number of analysts allows us to have both a mean estimate (MEANEST) and a standard deviation of analysts' forecasts (STDEV). We remove observations with missing actual reported values or missing report dates of actual earnings values. We merge the OptionMetrics and I/B/E/S datasets to obtain the initial sample of firm-quarters with available option and analyst forecast data. When merging the two datasets, we require that an earnings announcement date fall within the four weeks of option data collected from OptionMetrics. Thus, all retained merged datasets contain a series of option and stock price data that covers the period of time surrounding an earnings announcement date. We increase the power of our tests by restricting the dataset to observations for which we expect the impending earnings news to most significantly affect the price of the option (OPTPRC). To accomplish this, we compute the "moneyness" (M) of the option by comparing the option's strike price (STRIKE) to the underlying stock's closing price (PRICE). Specifically, we calculate M for call (put) options as PRICE (STRIKE) divided by STRIKE (PRICE). We then limit our analysis to at-the-money options by focusing on observations where M falls between 0.95 and 1.05. Finally, OptionMetrics does not compute implied volatility for options with non-standard settlement arrangements. Because the non-standard settlement may affect the option price in ways that add noise to our calculations, we remove observations with missing implied volatility measures. We gather the additional cross-sectional and time-series data required to conduct additional analyses from Compustat and CRSP. Please see the Appendix for variable definitions.

TABLE 2
Distributional properties and associations of AICs

Panel A – AIC sample (n=39,443): firms with option and analyst forecast data

	Descriptive statistics						
	Mean	*Median*	*Std. Dev.*	*5%*	*25%*	*75%*	*95%*
AIC	147.69	55.00	370.94	5.63	21.88	125.00	512.50
SURPRISE	0.02	0.02	0.20	(0.11)	(0.01)	0.04	0.16
STDEV	0.04	0.02	0.08	0.01	0.01	0.04	0.12
NUM	9.76	8.00	6.50	2.00	5.00	13.00	23.00
IVOL	0.49	0.41	0.30	0.19	0.29	0.59	1.05

	Spearman correlations			
	SURPRISE	**STDEV**	**NUM**	**IVOL**
AIC	-0.0012	***-0.7042***	-0.0056	***0.1109***
SURPRISE		***0.0909***	***0.0848***	***-0.0233***
STDEV			***0.0244***	***-0.0540***
NUM				***-0.0243***

We present significant correlations (at the 1% level) in bold face and italics. Please see the Appendix for variable definitions.

TABLE 2 (concluded)
Distributional properties and associations of AICs

Panel B – CS sample (n=30,641): firms with option, analyst forecast, Compustat and CRSP data

	Descriptive statistics						
	Mean	*Median*	*Std. Dev.*	*5%*	*25%*	*75%*	*95%*
AIC	89.74	52.50	124.62	5.83	21.88	112.50	289.58
SURPRISE	0.02	0.02	0.15	(0.11)	(0.01)	0.04	0.16
STDEV	0.04	0.02	0.06	0.01	0.01	0.04	0.11
NUM	10.40	9.00	6.51	2.00	5.00	14.00	23.00
IVOL	0.50	0.42	0.31	0.19	0.30	0.61	1.08
THETA	1.31	1.31	0.26	0.88	1.13	1.49	1.72
BETA	1.03	0.97	0.55	0.22	0.66	1.33	2.04
MB	4.46	2.61	63.91	1.03	1.76	4.20	10.87
I	4.98	4.79	0.88	3.78	4.34	5.70	6.59
%OWN	0.69	0.71	0.22	0.28	0.56	0.84	0.99

	Spearman correlations								
	SURP	**STDEV**	**NUM**	**IVOL**	**θ**	**β**	**MB**	**I**	**%OWN**
AIC	***0.0225***	***-0.6897***	***0.1295***	***0.1848***	***0.0220***	***0.0615***	***0.3432***	***0.0821***	***0.0824***
SURPRISE		***0.0764***	***0.0498***	***-0.0447***	***0.0263***	***0.0458***	***0.0307***	***-0.0873***	***0.0793***
STDEV			***-0.0549***	***-0.1045***	***0.0208***	***0.0383***	***-0.2487***	***-0.0272***	-0.0009
NUM				***-0.0849***	***0.0622***	***0.1194***	***0.1484***	***-0.1153***	***0.1500***
IVOL					***0.0538***	***0.2003***	***0.1535***	***0.1890***	***-0.0569***
THETA						***0.0983***	-0.0004	***-0.0273***	-0.0127
BETA							***0.0494***	***-0.0961***	***0.1411***
MB								***0.0549***	***-0.0302***
I									***-0.2735***

We present significant correlations (at the 1% level) in bold face and italics. Please see the Appendix for variable definitions.

TABLE 3

Correlation between the AIC and the ex post stock market sensitivity to earnings surprise

Panel A – Spearman Correlations between AICs and firm-specific ERCs and between AICs and averages of firm-specific ERCs by firm and by industry in order to address measurement error in the firm-specific ERC.

	Sample	# of Obs.	AIC:ERC correlation	Confidence level
Without averaging	AIC	33,111	**0.1512**	**<.0001**
	CS	28,078	**0.1501**	**<.0001**
Averaging variable:				
CUSIP	AIC	2,860	**0.1824**	**<.0001**
	CS	2,495	**0.1815**	**<.0001**
Fama-French	AIC	49	**0.3194**	**0.0253**
	CS	49	**0.3467**	**0.0147**
DNUM	AIC	360	**0.3423**	**<.0001**
	CS	355	**0.3101**	**<.0001**
SIC	AIC	65	**0.5800**	**<.0001**
	CS	65	**0.5359**	**<.0001**

Please see the Appendix for variable definitions.

TABLE 3 (concluded)

Correlation between the AIC and the ex post stock market sensitivity to earnings surprise

Panel B – Partitioning based on the sign of RESPONSE to reduce the effect of measurement error

AIC Sample (n = 39,443)

	# of Obs.	Absolute value of RESPONSE	AIC	Positive RESPONSE	Negative RESPONSE
Absolute value of RESPONSE	39,443	1	***0.47421***	N/A	N/A
AIC	39,443		1	***0.46771***	***-0.49911***
Positive RESPONSE	20,816			1	N/A
Negative RESPONSE	17,611				1

CS Sample (n = 30,641)

	# of Obs.	Absolute value of RESPONSE	AIC	Positive RESPONSE	Negative RESPONSE
Absolute value of RESPONSE	30,641	1	***0.4051***	N/A	N/A
AIC	30,641		1	***0.4217***	***-0.40544***
Positive RESPONSE	16,496			1	N/A
Negative RESPONSE	13,359				1

We present significant correlations (at the 1% level) in bold face and italics. Please see the Appendix for variable definitions.

TABLE 4
Distributional properties of AICs in the Bubble-Bust and post-Bubble-Bust periods

Panel A – AIC sample: firms with option and analyst forecast data

	Bubble-Bust period (n=16,357)			Post-Bubble-Bust period (n=23,086)			Tests of differences	
	Mean	*Median*	*Std. Dev.*	*Mean*	*Median*	*Std. Dev.*	*Mean*	*Median*
AIC	215.95	67.19	484.54	99.33	47.50	251.20	***	***
SURPRISE	0.01	0.01	0.16	0.02	0.02	0.22	***	***
STDEV	0.03	0.02	0.08	0.04	0.02	0.08	***	***
NUM	8.53	7.00	5.99	10.63	9.00	6.71	***	***
IVOL	0.55	0.45	0.34	0.45	0.38	0.27	***	***

Panel B – CS sample: firms with option, analyst forecast, Compustat, and CRSP data.

	Bubble-Bust period (n=12,224)			Post-Bubble-Bust period (n=18,417)			Tests of differences	
	Mean	*Median*	*Std. Dev.*	*Mean*	*Median*	*Std. Dev.*	*Mean*	*Median*
AIC	113.51	60.94	166.99	73.96	47.50	81.89	***	***
SURPRISE	0.01	0.01	0.13	0.02	0.02	0.16	***	***
STDEV	0.03	0.02	0.05	0.04	0.02	0.06	***	***
NUM	9.35	8.00	6.12	11.09	10.00	6.67	***	***
IVOL	0.57	0.48	0.34	0.45	0.38	0.27	***	***
THETA	1.29	1.30	0.26	1.31	1.31	0.26	***	***
BETA	0.96	0.89	0.57	1.08	1.01	0.54	***	***
MB	4.66	2.75	27.95	4.33	2.54	79.23		***
I	5.83	5.92	0.60	4.41	4.35	0.49	***	***

***, **, * denote instances where the characteristic of the post-Bubble-Bust period sample differs significantly from the Bubble-Bust period sample at the 1%, 5%, and 10% level, respectively, for two-tailed tests. March of 2001 marks the start of the post-Bubble-Bust timeframe in our sample period. Accordingly, the Bubble-Bust period includes observations from January of 1996 through February of 2001 and the post-Bubble-Bust period includes observations from March of 2001 through December of 2006. Please see the Appendix for variable definitions.

TABLE 5
Cross-sectional regressions of Anticipated Information Content (AIC)

$$AIC_{t,i,j} = \begin{aligned} &\gamma_0 + \gamma_1 D_{PBB} + \sum_{y=1997}^{y=2006} \gamma_y D_y + \gamma_2 MB_{t,i} + \gamma_3 MB_{t,i} * D_{PBB} + \gamma_4 \beta_{t,i} + \gamma_5 \beta_{t,i} * D_{PBB} \\ &+ \gamma_6 I_t + \gamma_7 I_t * D_{PBB} + \gamma_8 \theta_i + \gamma_9 \theta_i * D_{PBB} + \gamma_{10} NUM_{t,i} + \gamma_{11} NUM_{t,i} * D_{PBB} + \varepsilon_t \end{aligned}.$$

Variable	*Pred.*	*(1) Est.*	*(1) p-value*		*(2) Est.*	*(2) p-value*		*(3) Est.*	*(3) p-value*		*(4) Est.*	*(4) p-value*	
Intercept		30.308	0.1329		**35.092**	**0.0025**	**	**50.622**	**<.0001**	***	-7.856	0.2116	
D_{PBB}		-36.515	0.0843		**-42.948**	**0.0036**	***	--			--		
Year effects		Yes			No			Yes			No		
MB	+	**63.516**	**<.0001**	***	**67.141**	**<.0001**	***						
MB*D_{PBB}		**-35.307**	**<.0001**	***	**-39.449**	**<.0001**	***						
MB+ MB*D_{PBB}	+	**28.209**	**<.0001**	***	**27.692**	**<.0001**	***	**28.210**	**<.0001**	***	**27.692**	**<.0001**	***
β	-	**49.973**	**<.0001**	***	**40.154**	**<.0001**	***						
β* D_{PBB}		**-49.669**	**<.0001**	***	**-43.133**	**<.0001**	***						
β+β* D_{PBB}	-	0.304	0.8507		**-2.979**	**0.0612**	*	0.303	0.7855		**-2.979**	**0.0069**	***
I	-	**-10.993**	**0.0002**	***	**-9.561**	**<.0001**	***						
I*D_{PBB}		**7.698**	**0.0470**	**	**16.302**	**<.0001**	***						
I+ I*D_{PBB}	-	-3.295	0.1808		**6.741**	**0.0001**	***	**-3.295**	**0.0567**	*	**6.742**	**<.0001**	***
θ	+	**-14.542**	**0.0002**	***	**-6.837**	**0.0885**	*						
θ*D_{PBB}		**28.190**	**<.0001**	***	**21.080**	**<.0001**	***						
θ+θ*D_{PBB}	+	**13.648**	**<.0001**	***	**14.243**	**<.0001**	***	**13.648**	**<.0001**	***	**14.242**	**<.0001**	***
NUM	?	**2.298**	**<.0001**	***	**3.017**	**<.0001**	***						
NUM*D_{PBB}		**-1.504**	**<.0001**	***	**-2.265**	**<.0001**	***						
NUM+ NUM*D_{PBB}	?	**0.794**	**<.0001**	***	**0.752**	**<.0001**	***	**0.794**	**<.0001**	***	**0.752**	**<.0001**	***
N		30,142			30,142			18,167			18,167		
Adj. R^2		0.1948			0.1625			0.0755			0.0654		

***, **, * denote significance at the 1%, 5%, and 10% level, respectively, for two-tailed tests. The first two specifications use all observations from 1996 through 2006 and the last two specifications use only observations from March 2001 through 2006. Please see the Appendix for variable definitions.

TABLE 6 – Panel A
The Anticipated Information Content (AIC's) sensitivity to firms' institutional ownership

$$AIC_{t,i,j} = \begin{aligned} &\gamma_0 + \gamma_1 D_{PBB} + \sum_{y=1997}^{y=2006} \gamma_y D_y + \gamma_2 MB_{t,i} + \gamma_3 MB_{t,i} * D_{PBB} \\ &+\gamma_4 \beta_{t,i} + \gamma_5 \beta_{t,i} * D_{PBB} + \gamma_6 I_t + \gamma_7 I_t * D_{PBB} + \gamma_8 \theta_i + \gamma_9 \theta_i * D_{PBB} \\ &+\gamma_{10} NUM_{t,i} + \gamma_{11} NUM_{t,i} * D_{PBB} + \gamma_{12} \%OWN_{t,i} + \gamma_{13} \%OWN_{t,i} * D_{PBB} + \varepsilon_t \end{aligned} .$$

		(1) – Levels			*(2) – Levels*			*(3) – Changes*		
Variable	***Pred.***	***Est.***	***p-value***		***Est.***	***p-value***		***Est.***	***p-value***	
Intercept		-0.644	0.9748		4.034	0.7374		**-13.041**	**0.0468**	**
D_{PBB}		-32.821	0.1276		**-43.103**	**0.0050**	***	**25.071**	**0.0007**	***
Year effects		Yes			No			Yes		
MB	+	**65.012**	**<.0001**	***	**68.795**	**<.0001**	***	**49.687**	**<.0001**	***
MB*D_{PBB}		**-36.628**	**<.0001**	***	**-41.037**	**<.0001**	***	**-16.350**	**<.0001**	***
MB+ MB*D_{PBB}	+	**28.384**	**<.0001**	***	**27.758**	**<.0001**	***	**33.337**	**<.0001**	***
β	-	**50.035**	**<.0001**	***	**40.228**	**<.0001**	***	**6.132**	**0.0017**	***
β* D_{PBB}		**-51.802**	**<.0001**	***	**-45.644**	**<.0001**	***	**-10.166**	**<.0001**	***
β+β* D_{PBB}	-	-1.767	0.2757		**-5.416**	**0.0008**	***	**-4.034**	**0.0113**	**
I	-	**-10.908**	**0.0003**	**	**-9.819**	**<.0001**	***	**12.927**	**<.0001**	***
I*D_{PBB}		**7.398**	**0.0562**	*	**17.319**	**<.0001**	***	-3.381	0.1669	
I+ I*D_{PBB}	-	-3.510	0.1540		**7.500**	**<.0001**	***	**9.546**	**<.0001**	***
θ	+	**-13.087**	**0.0009**	***	-5.220	0.1941		-2.766	0.4968	
θ*D_{PBB}		**26.439**	**<.0001**	***	**19.395**	**0.0002**	***	2.439	0.6345	
θ+θ*D_{PBB}	+	**13.352**	**<.0001**	***	**14.175**	**<.0001**	***	-0.327	0.9166	
NUM	?	**2.001**	**<.0001**	***	**2.695**	**<.0001**	***	**1.644**	**<.0001**	***
NUM*D_{PBB}		**-1.311**	**<.0001**	***	**-2.039**	**<.0001**	***	**-1.514**	**0.0005**	***
NUM+ NUM*D_{PBB}	?	**0.697**	**<.0001**	***	**0.656**	**<.0001**	***	0.130	0.6832	
%OWN	+	**48.965**	**<.0001**	***	**52.507**	**<.0001**	***	**25.071**	**0.0007**	***
%OWN*D_{PBB}		0.908	0.8891		-9.736	0.1408		-1.499	0.8908	
%OWN+%OWN*D_{PBB}	+	**49.873**	**<.0001**	***	**42.771**	**<.0001**	***	**23.572**	**0.0034**	***
N		29,959			29,959			27,143		
Adj. R^2		0.2016			0.1687			0.0367		

***, **, * denote significance at the 1%, 5%, and 10% level, respectively, for two-tailed tests. In the third specification, we take first differences of all variables that can change from quarter to quarter. That includes: AIC, MB, I, NUM, IVOL, and %OWN. Please see the Appendix for variable definitions.

TABLE 6 – Panel B (with Bushee Classifications)
The Anticipated Information Content (AIC's) sensitivity to firms' institutional ownership

Variable	*Pred.*	*(1) – Levels* *Est.*	*p-value*		*(2) – Levels* *Est.*	*p-value*		*(3) – Changes* *Est.*	*p-value*	
Intercept		-35.769	0.1571		6.750	0.6640		-7.691	0.3041	
D_{PBB}		-2.834	0.9122		-24.524	0.2014		-11.402	0.2391	
Year effects		Yes			No			Yes		
MB	+	**55.316**	**<.0001**	***	**57.436**	**<.0001**	***	**40.186**	**<.0001**	***
$MB*D_{PBB}$		**-28.106**	**<.0001**	***	**-30.973**	**<.0001**	***	-1.233	0.7707	
$MB+ MB*D_{PBB}$	+	**27.210**	**<.0001**	***	**26.463**	**<.0001**	***	**38.953**	**<.0001**	***
β	-	**45.386**	**<.0001**	***	**33.574**	**<.0001**	***	**4.591**	**0.0421**	**
$\beta * D_{PBB}$		**-44.690**	**<.0001**	***	**-36.045**	**<.0001**	***	**-9.349**	**0.0022**	***
$\beta+\beta * D_{PBB}$	-	0.696	0.7391		-2.471	0.2378		**4.758**	**0.0200**	**
I	-	-2.993	0.4268		-6.534	0.0044		**22.165**	**<.0001**	***
$I*D_{PBB}$		-0.096	0.9835		**10.100**	**0.0010**	***	**-12.902**	**0.0001**	***
$I+ I*D_{PBB}$	-	-3.089	0.2619		**3.566**	**0.0805**	*	**9.263**	**<.0001**	***
θ	+	**-13.610**	**0.0020**	***	-6.997	0.1176		-3.389	0.4715	
$\theta*D_{PBB}$		**18.726**	**0.0014**	***	**13.942**	**0.0190**	**	1.494	0.8048	
$\theta+\theta*D_{PBB}$	+	5.116	0.1850		**6.945**	**0.0765**	*	-1.895	0.6174	
NUM	?	**2.955**	**<.0001**	***	**3.538**	**<.0001**	***	**1.976**	**<.0001**	***
$NUM*D_{PBB}$		**-1.969**	**<.0001**	***	**-2.683**	**<.0001**	***	**-2.381**	**<.0001**	***
$NUM+ NUM*D_{PBB}$	?	**0.986**	**<.0001**	***	**0.855**	**<.0001**	***	-0.405	0.3346	
%TRAN	+	**210.385**	**<.0001**	***	**282.953**	**<.0001**	***	**155.766**	**<.0001**	***
$\%TRAN*D_{PBB}$		**-122.747**	**<.0001**	***	**-172.171**	**<.0001**	***	**-109.197**	**<.0001**	***
$\%TRAN+\%TRAN*D_{PBB}$	+	**87.638**	**<.0001**	***	**110.782**	**<.0001**	***	**46.569**	**0.0025**	***
%DED	+	**48.291**	**<.0001**	***	-4.971	0.6210		**-59.608**	**0.0018**	***
$\%DED*D_{PBB}$		**-49.986**	**0.0027**	**	25.229	0.1243		**81.100**	**0.0113**	**
$\%DED+\%DED*D_{PBB}$	+	-1.695	0.8964		20.258	0.1153		21.492	0.4023	
%QIX	+	**-61.315**	**<.0001**	***	**-69.939**	**<.0001**	***	-18.687	0.2649	
$\%QIX*D_{PBB}$		**106.619**	**<.0001**	***	**69.209**	**<.0001**	***	27.857	0.2347	
$\%QIX+\%QIX*D_{PBB}$	+	**45.304**	**<.0001**	***	-0.730	0.9260		9.170	0.5757	
N		23,663			23,663			20,210		
Adj. R^2		0.2135			0.1857			0.0311		

***, **, * denote significance at the 1%, 5%, and 10% level, respectively, for two-tailed tests. In the third specification, we take first differences of all variables that can change from quarter to quarter. That includes: AIC, MB, I, NUM, IVOL, %TRAN, %DED, and %QIX. Please see the Appendix for variable definitions.