Accounting quality, information risk and implied volatility around earnings announcements

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Abstract

We examine the impact of accounting quality, used as a proxy for information risk, on the behavior of equity implied volatility around quarterly earnings announcements. Using US data during 1996-2010, we observe that lower (higher) accounting quality significantly relates to higher (lower) levels of implied volatility (IV) around announcements. Worse accounting quality is further associated with a significant increase in IV before announcements, and is found to relate to a larger resolution in IV after the announcement has taken place. We interpret our findings as indicative of information risk having a significant impact on implied volatility behavior around earnings announcements.

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Keywords: Accounting quality, accruals quality, information risk, earnings announcements, implied volatility, investor uncertainty.

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1. Introduction

Past research has associated earnings quality with idiosyncratic return volatility (Rajgopal and Venkatachalam, 2011). This is because uncertainty about the future profitability of firms is expected to influence their stock return volatility (Pastor and Veronesi, 2003; Wei and Zhang, 2003), while the quality of earnings has been considered as a proxy for so-called 'information risk' or 'information uncertainty'. This risk refers to the likelihood for firm-specific information important for investor decisions to be of poor quality (Francis et al., 2005), or the degree to which corporate value can be reasonably estimated by the most knowledgeable investors at an acceptable cost (Jiang et al., 2005). In this direction, Rajgopal and Venkatachalam (2011) distinguish between sources of uncertainty about the future profitability of firms i.e. uncertainty about future cash flows from an operating point of view, vs. information about future cash flows stemming from the quality of accounting information, and confirm that lower earnings quality is associated with higher idiosyncratic stock market volatility, even after controlling for volatility in firm operating performance.

In this paper, we examine the association between financial reporting quality, measured by assessing the quality of accounting accruals, and levels and changes in equity option implied volatility around quarterly earnings announcements. We employ accruals quality as a proxy for firm information risk, in accordance with past research (Francis et al., 2005; Ecker et al., 2006). This is because the quality of accruals is expected to inform investors about the mapping of accounting earnings into cash flows, and since investors value securities by assessing future cash flows (and their risk), poor accruals quality is expected to weaken this mapping and, as a result, increase information risk (Francis et al., 2005).

Unlike previous research, that investigates the association between information risk and stock return historic volatility (e.g. Rajgopal and Venkatachalam, 2011), this study focuses on stock return volatility as implied by the prices at which investors transact in the equity options market. Even though many studies hypothesize and conclude that more knowledgeable investors prefer to trade through the options market and that option market traders are more sophisticated than investors in the stock market (Diavatopoulos et al., 2012; Jin et al., 2012; Goodman et al., 2012), this is not the main reason that makes the association between accounting quality (hereafter AQ) and implied volatility an important one to investigate.

Equity implied volatility (hereafter IV) is a forward-looking measure of investor expectations about the risk and future economic performance of firms, and since the seminal work of Black (1975), it has been considered to reflect new information earlier than stock markets and to contribute greatly to price discovery.[1] It has been established as a good predictor of future stock returns and return volatility (Latane and Rendelman, 1976). As corporate earnings announcements are rich in information, the idiosyncratic risk associated with the reported information (proxied by the quality of the information provided) affects the expectations formation of market participants regarding the (overall, i.e. information *and* performance-related) future uncertainty of a firm's equity. This last one is manifested in the (annualized implied) volatility level at which market participants are willing to buy or sell a firm's stock, up to and including a future point in time. Earnings announcements represent a channel through which firms resolve idiosyncratic uncertainty about the value of their equity (Barth and So, 2011), and the quality of the accounting information disclosed makes understanding past and predicting future firm performance more or less difficult for outside investors, directly affecting the forward-looking, equity volatility estimate they attach (through trading) to a firm's stock shortly before or after its earnings are released.

We employ all US firms from Compustat that have equity options data on Ivy DB Option Metrics between 1996 and 2010, and testify that the negative and significant association between AQ and stock return variability observed by past research for longer time horizons (Rajgopal and Venkatachalam, 2011) also holds in the event study time window, i.e. around quarterly earnings announcements. Closer to the aim of this paper, by focusing on at-the-money (ATM), short-term (30-day) implied volatility (that should be the quickest to respond to new information released via earnings announcements, see for example Truong et al., 2012; Donders et al., 2000, and Beckers, 1981), we first testify that lower (higher) accounting quality is associated with significantly higher (lower) implied volatility in the days around quarterly earnings announcements. Much like in previous research, we also confirm a tendency for a sharp increase (resolution) in short-term, ATM implied volatility in the days immediately before (after) the earnings announcement day (see Truong et al., 2012; Whaley and Cheung, 1982; Donders and Vorst, 1996; Dubinsky and Johannes, 2005).

However we extend previous contributions, by further showing that the increase (decrease) in implied volatility immediately before (after) the quarterly earnings announcement day is more pronounced for firms whose information risk is high (as proxied by poor accounting quality). Poor (good) quality of quarterly accounting information is found to be associated with larger (smaller) changes in implied volatility around earnings announcements, and this finding is robust to the use of different proxies for accounting quality, different day windows surrounding the earnings announcement day and different implied volatility measures (from calls only, from puts only, calls and puts averaged or delta-interpolated). At the same time, this evidence is robust to isolating our sample for firms experiencing positive vs. negative earnings surprises, indicating that the effect of information risk on the behavior of

[1] For a recent review of the literature regarding the lead-lag relationship between option and spot markets see Ansi and Ouda (2009).

IV around earnings announcements is incremental to and distinct from the observed impact of good vs. bad news announcements observed by past research (Truong et al., 2012).

Furthermore, in order to completely isolate the effect of investor uncertainty about firms' expected economic performance, from uncertainty purely arising from the quality of accounting information, we construct twenty five (five-by-five, double-sorted) portfolios of mean implied volatility levels and changes around EA days, by sorting sample firms first on accounting quality metrics and then on historic volatility of operating cash flows (that serves as a control for firm performance uncertainty). Results indicate a clear and significant tendency of implied volatility levels to increase when operating performance volatility increases, and accounting quality deteriorates. Even after controlling for volatility in operating performance, our initial findings are confirmed in that one observes a significant trend for implied volatility to increase before EA as AQ decreases, while implied volatility is observed to significantly dissolve more for lower vs. higher AQ firms, after the announcement of earnings has taken place.

The main finding of this paper, that information risk, as proxied by poor quality of quarterly accounting information, is positively associated with more pronounced changes in implied volatility around earnings announcements, is further confirmed by panel regression estimation, which permits to explicitly control for the effect and significance of a number of factors possibly associated with implied volatility levels and changes, such as firm size, profitability, cash flow generation, leverage, stock market performance and historic volatility, variability of operating cash flows, firm-specific liquidity, and analyst following and forecasts.

It should be noted that past research has differentially examined the impact of good vs. bad operating performance news. (Truong et al., 2012 for earnings announcements; Rogers et al., 2009, for management forecasts) and has found that option markets do not uniformly respond to good vs. bad news or surprises. However, the focus of our study is on the impact of information risk (rather than performance risk) on option implied volatility. This is because, for example, a firm may be a poor performer, however, its financial statements may not pose difficulties and uncertainty with respect to forecasting its future prospects, no matter how poor those may be. In this way, the focus of this study is on the impact of information risk, for which accounting quality (i.e. the extent to which accounting accruals map and translate into cash flows, changes in revenues and tangible assets) is employed as a proxy, on option implied volatility levels and changes around earnings announcements (hereafter, EA), after controlling for firm performance, as well as volatility in operating performance. Moreover, we control for the impact of AQ on the behavior of IV around earnings announcement by simultaneously considering whether the firm in question experienced a positive or a negative earnings surprise among our robustness controls, so as to isolate the influence of information risk on IV behavior, from the (directional) impact of good vs. bad news about the firm, regarding the formation of IV expectations around earnings announcements.

Our findings suggest that the business and financial uncertainty surrounding the imminent announcement of a firm's quarterly earnings is significantly augmented by firm information uncertainty: even after controlling for business cash flow variability (or leverage or all other controls employed in our regression analysis), high information risk firms that release accounting information of poor quality have their equity options trade at higher implied volatilities and experience significant implied volatility run-ups up to the EA day, as investors and option market makers push implied volatilities and option premia up, unsure of both what to expect in terms of reported performance and of its mapping to future cash flows. In the same spirit, these firms experience more pronounced declines in volatility after the announcement, implying that market participants experience significantly greater reassurance, as they possibly faced significant uncertainty when making predictions on the content of the announcement. We consider that the direction of our findings conceptually confirms (in our case, for option markets) evidence by Zhang et al. (2013) on the relatively greater importance of public earnings announcements for firms with higher information risk.

Overall, we interpret our findings as indicative of information risk, proxied by earnings quality, having a significant impact on implied volatility dynamics around earnings announcements, in accordance with past research indicating that the quality of financial statement information significantly relates to idiosyncratic stock return volatility (Rajgopal and Venkatachalam, 2011). However, unlike stock market historic volatility, implied volatility determined in option markets is by definition forward looking: in other words, financial statements quality may have an effect on the determination of forward-looking expectations about future firm performance.

Our evidence points towards information risk significantly increasing implied volatility before EA and contributing to larger decreases after the event, indicating that option market participants are exceptionally unsure on what expectations to make about the announcement of earnings as AQ deteriorates, and experience a greater degree of 'relief' after the event, even after controlling for uncertainty about future earnings arising from purely performance-related reasons. To the best of our knowledge, our study is the second one to examine the impact of the quality of financial statement information on option market pricing, following Kim and Zhang (2013), who testify that the amount of opacity in earnings significantly contributes to the steepness of option-implied volatility smirks in individual equity options. In this regard, we consider that our evidence builds on research considering the relation between accounting-based information variables and market outcomes (Bhattacharya et al., 2012), by pointing towards a greater scope of impact of accounting quality, in the case of option markets in addition to equity markets. Finally, our findings provide further evidence that firm volatility pricing in option markets, in addition to equity markets, is affected by two sources of uncertainty about a firm's future economic performance: volatility about future cash flows as well as volatility of cash flows stemming from the quality of financial information (Rajgopal and Venkatachalam, 2011).

The rest of paper is organised as follows: Section 2 reviews in more detail the related literature which provides motive for this study and presents the research hypotheses that are tested. In Section 3, the methodology and the sample selection process are presented. Section 4 reports our empirical findings, while the last section concludes the paper.

2. Past research and development of hypotheses

Uncertainty about a firm's future operating performance is expected to positively affect the volatility of its market pricing. According to Barry and Brown (1984), securities for which relatively little information is available may be perceived as riskier, compared to securities with more information in place. Pastor and Veronesi (2003) argue that uncertainty regarding firm profitability affects stock return volatility, while Wei and Zhang (2003) find that firm profitability negatively correlates with idiosyncratic risk.

A number of studies have addressed the issue of whether information uncertainty about a firm's future performance is priced or not by market participants. With respect to whether this uncertainty is priced, Jiang et al. (2005) show that on average, high information uncertainty firms earn lower future returns, while Easley et al. (2002) get evidence showing that information risk is a determinant of asset returns and prices, and Easley and O'Hara (2004) find evidence on information asymmetry affecting a firm's cost of capital, suggesting that a firm's cost of capital is determined, in part at least, by corporate decisions unrelated to product market decisions. Despite the fact that there appears to exists no consensus in the literature regarding whether information uncertainty is (Easley and O'Hara, 2004; Lambert et al., 2007; Francis et al., 2005; Ecker et al., 2006) or is not (Core et al., 2008) a priced (or non-diversifiable) risk factor for the determination of stock returns, a possibly consistent finding throughout the literature is that both the cost of equity (Bhattacharya et al., 2003; Francis et al., 2004, 2005; Berger et al., 2012; Bhattacharya et al., 2012) and the cost debt (Bharath et al., 2008; Qi et al., 2010) increases with uncertainty in financial reporting.

The quality of financial reporting has been considered a proxy for information risk. In the presence of poor financial reporting quality, uncertainty about a firms future profitability is expected to be high (Rajgopal and Venkatachalam, 2011), while, in the same direction Lui et al. (2007) testify that analysts indeed view firms with lower earnings quality as riskier. This is because financial reporting quality has been considered a proxy for information risk (Francis et al., 2005; Ecker et al., 2006) or to quote Francis et al. (2005) information risk is increasing in 'the likelihood that firm-specific information that is pertinent to investor pricing decisions is of poor quality' (Francis et al., 2005). Francis et al. (2005), based on Dechow and Dichev (2002), make the assumption that cash flows represent the main element priced by investors, and they identify accruals quality as the measure of information risk associated with a firm's earnings. Under the assumption that investors value securities by estimating their future cash flows, they argue in favor of making use of a measure for information risk which will capture the information uncertainty in cash flows. Given that, accruals quality should inform investors about the predictability of the mapping of accounting earnings into cash flows, with poorer accruals quality weakening this mapping and increasing information risk (Francis et al., 2005). In a similar vein, Bhattacharya et al. (2012) consider that accounting quality, or earnings quality, represents a naturally interpreted measure of information risk and because of its direct link to cash flows, which is the presumed object of investors' interest.

In this study, we extend prior evidence that financial reporting quality represents a measure of information risk with an increasing effect on stock market volatility (Rajgopal and Venkatachalam, 2011), and examine the impact of accounting quality on option-implied equity volatility levels and changes around quarterly earnings announcements. In this respect, we follow the criticism made by Rajgopal and Venkatachalam (2011), that neither Pastor and Veronesi (2003) nor Wei and Zhang (2003) distinguish between sources of increased uncertainty about firm profitability, in other words, uncertainty of cash flows as opposed to information uncertainty regarding future cash flows that stems from the quality of accounting information. To address this issue, we examine the impact of AQ on the behavior of implied volatility around earnings announcements by controlling for volatility in cash flows, in an effort to isolate the effect of the quality of accounting information on implied volatility. We consider that this approach is consistent with Zhang (2006), who defines information uncertainty, in terms of the ambiguity of the implications of new information for firm value, deriving from both the volatility of firm fundamentals *and* poor information.

There exist a number of studies which have examined the behavior of implied volatility around EA (Patell and Wolfson, 1979, 1981; Whaley and Cheung, 1982; Donders and Vorst, 1996; Donders et al., 2000; Acker, 2002; Truong et al., 2012) overall testifying a significant increase in implied volatility before EA, followed by a significant drop afterwards. Another very recent stream of research has examined the relation between information on firm fundamentals and option market pricing. Truong et al. (2012) examine the differential impact on the behavior of implied volatility around EA of good vs. bad news announcement and find that positive earnings surprises and positive profit announcements produce higher uncertainty resolution than negative surprises and loss announcements. Goodman et al. (2012) get evidence consistent with the options market not fully incorporating fundamental information into option prices, while Sridharan (2012) hypothesizes and finds that financial statement information (including the opacity of earnings) is informative regarding the prediction of future stock market volatility and is not completely incorporated in option implied volatility. Rogers et al. (2009) examine the impact of earnings forecasts made by the management on implied volatility, observing that volatility increases more following bad news than good news. Probably the study most closely related to our study is the one by Kim and Zhang (2013), who document a significant and positive relation between financial reporting opacity and the steepness of option-implied volatility smirks in individual equity options. This is the only study, to the best of our knowledge, which has linked the quality of financial information to an aspect of pricing performed in the options market, and providing thus evidence that this quality may very well have repercussion for option market pricing.

Implied volatility has been used to assess market uncertainty around news announcements by Truong et al. (2012), while Dubinsky and Johannes (2005) find strong evidence that uncertainty surrounding earnings plays a central role in determining option prices. In this respect, we expect that lower AQ should be associated with an increase in IV before the announcement, and a decrease after the event, following increased uncertainty about what to expect. This because, for example, better accounting information, which is the opposite to expect in the presence of poor accounting quality, may help investors to distinguish between good and bad investments, separate between good and bad managers, or strengthen the link between reported accounting earnings and unobservable economic earnings (Bhattacharya et al., 2003). In such a case, high information risk firms are expected to pose additional challenges with respect to adequately forecasting the content of the imminent EA for option market makers and investors, leading to stronger increase in implied volatility before the event, which should dissolve upon having concrete information after the event.

We consider that earnings announcements represent a good setting for the examination, given prior expectations and evidence on higher volatility around EA, in comparison to baseline volatility (Barth et al. 2011). Our focus is on levels of volatility around EA, as well as on changes in volatility, as the latter are expected to isolate the general response of options prices to earnings news, beyond the impact due to changes in the price of the stock of the underlying asset (Truong et al., 2012). In addition, implied volatility should change in anticipation of the size and direction of the approaching earnings announcement in the options market, making changes in implied moments possibly more informative than levels (Diavatopoulos et al., 2012).

At the same time, our focus on the formation of expectations of the option market, via the examination of changes in implied volatility, permits assessing forward, rather than backward-looking expectations of market participants, as a result of information risk. This is because the option market may be expected to be more forward-looking than the stock market, with changes in implied volatility to be representing changes in uncertainty expectations by market participants. At the same time, there exists evidence that implied equity volatilities are driven up by traders prior to earnings announcements (Diavatopoulos et al., 2012), while there appears to exist a consensus in the literature that option traders are very sophisticated investors (Goodman et al., 2012; Kim and Zhang, 2013), with empirical evidence supporting this conjecture and confirming that option market participants trade in advance of stock market investors (Xing et al., 2010; Jin et al., 2012; Diavatopoulos et al., 2012; Ang et al., 2012). In the same direction, Truong (2013) finds evidence that information which is considered relevant for future earnings prediction is incorporated into stock prices more quickly in the sub-sample of stocks that have equity options traded in the derivatives market.

The measure of AQ we employ is based on predictability of accruals to map into cash flow realizations, given that current accruals represent estimates of future cash flows, and that accruals quality is an inverse function of the precision of these estimates (Dhalihal et al., 2010, among others). However, we understand that accruals quality may not be an exhaustive proxy for the detection of information risk, but rather one of many potential ones (Core et al., 2008).

As a final note, in contrast to past research, the focus is not on the differential impact of good vs. bad news and earnings surprises on option pricing, but rather on the pricing of accounting quality by option markets around earnings announcements. Truong et al. (2012) examine the information content of good vs. bad news around EA and they testify that positive earnings surprises and positive profit announcements produce higher uncertainty resolution than negative surprises and loss announcements. In contrast, Rogers et al. (2009) predict and find that implied volatility increases more following bad news than good news following management earnings forecasts. In comparison to the above studies, we examine the association between firm accounting quality and implied volatility behavior around EA, where AQ is employed as a proxy of information risk, and measured by calculating the standard deviation of residuals of a regression model dedicated to capturing whether accruals successfully map into cash flows (Dechow and Dichev, 2002; Francis et al., 2005). In case a firm has consistently larger residuals, the standard deviation of this residuals is expected to be small, resulting in the firm to have relatively good accruals quality, as uncertainty regarding its accruals is low. For such a firm, accruals may map poorly into cash flows, but this should not be a reason for increased uncertainty, as this accrual behavior represents a rather predictable phenomenon (Francis et al., 2005; Demirkan et al., 2012). In this way, the measure of accruals quality we employ is expected to have an explicit focus on the easiness of making predictions by employing accounting numbers i.e. information risk. Nevertheless, we control for the impact of AQ on the behavior of IV around earnings announcement by simultaneously considering whether the firm in question experienced a positive or a negative earnings surprise, in an effort to isolate the impact of information risk on IV behavior from the directional impact of good vs. bad news about the firm on the formation of IV expectations around earnings announcements.

3. Sample selection and methodology

3.1 Methodology for the estimation of accounting quality

Following past research (Francis et al., 2005; Ecker et al., 2006; Srinidhi and Gul, 2007; Dhaliwal et al., 2010; Rajgopal and Venkatachalam, 2011, among others), we estimate accounting quality, based on Dechow and Dichev (2002), by assessing the quality of accruals. Accounting quality is, thus, measured by the extent to which working capital accruals map into current, past, and future cash flows, by looking at the properties of residuals from quarter/sector-specific regressions of changes in working capital accruals on lagged, current, and future cash flows from operations. This measurement of information risk through the estimation of accruals quality, is based on the presumption that information risk relates to the uncertainty or imprecision of information used or desired by investors to price securities (Francis et al., 2005). The underlying assumption is that investors price securities based on their assessments of future cash flows; therefore, there is need of a measure capturing the information uncertainty in cash flows (Francis et al., 2005).

Our base-case accruals quality measure, that is based on Dechow and Dichev (2002), by incorporating the McNichols (2002) modification (through the inclusion of a change in sales and a PP&E regressor in the basic Dechow and Dichev (2002) equation, following Francis et al., 2005 and Rajgopal and Venkatachalam, 2011, among others), is denoted AQ^{DD}. It is estimated as the 4-year (i.e. 16 quarters, from quarter t up to quarter $t-16$) standard deviation of firm i residuals from the following regression, that is estimated cross-sectionally every quarter t and for every industry with at least 20 firm-observations in a given quarter:

$$\Delta WC_{i,t} = a_0 + a_1 CFO_{i,t-1} + a_2 CFO_{i,t} + a_3 CFO_{i,t+1} + a_4 \Delta Sales_{i,t} + a_5 GPPE_{i,t} + e_{i,t} \quad (1)$$

where (Compustat item number in parentheses):

$\Delta WC_{i,t}$	=	Firm i's change in working capital between quarter $t-1$ and quarter t, calculated as $\Delta CA_{i,t} - \Delta CL_{i,t} - \Delta Cash_{i,t} + \Delta STD_{i,t}$;
$\Delta CA_{i,t}$	=	Firm i's change in current assets (#40) between quarter $t-1$ and quarter t;
$\Delta CL_{i,t}$	=	Firm i's change in current liabilities (#49) between quarter $t-1$ and quarter t;
$\Delta Cash_{i,t}$	=	Firm i's change in cash (#36) between quarter $t-1$ and quarter t;
$\Delta STD_{i,t}$	=	Firm i's change in short-term debt (#45) between quarter $t-1$ and quarter t;
$CFO_{i,t}$	=	Firm i's cash flow from operations (#108) in quarter t;
$\Delta Sales_{i,t}$	=	Firm i's change in sales (#2) between quarter $t-1$ and quarter t;
$GPPE_{i,t}$	=	Firm i's gross property, plant and equipment (#118) in quarter t.

The use of 4 years (16 quarters) of data in the estimation of the standard deviation of residuals from quarter/industry cross-sectional regressions follows from Francis et al. (2005). The Fama and French 49 industry classification is used to arrange firms into sectors for running the regressions. All regression variables (including the constant term) are scaled by total assets (#44), averaged between quarters $t-1$ and t. The way our base-case quality measure AQ^{DD} is estimated suggests that the higher the standard deviation of residuals is, the more uncertain (volatile) the mapping of accruals into cash flows, thus the lower the quality of information in accruals and the more 'informationally' risky the firm is.

The second accruals quality measure we employ is an interesting modification to the Dechow and Dichev (2002) and Francis et al. (2005) model, proposed and tested by Prakash (2009). This alternative measure, which we denote $AQ^{DD(P)}$, is again estimated as the 4-year (i.e. 16 quarters, from quarter t up to quarter $t-16$) standard deviation of firm i residuals from the following regression, that is estimated cross-sectionally every quarter t and for every industry with at least 20 firm-observations in a given quarter:

$$\begin{aligned} \Delta WC_{i,t} = a_0 + a_1 DLoss_{i,t} + a_2 CFO_{i,t-1} + a_3 CFO_{i,t-1} \times DLoss_{i,t} + a_4 CFO_{i,t} \\ + a_5 CFO_{i,t} \times DLoss_{i,t} + a_6 CFO_{i,t+1} \times DLoss_{i,t} + a_7 \Delta Sales_{i,t} + a_8 GPPE_{i,t} \\ + e_{i,t}, \end{aligned} \tag{2}$$

where all variables are as before, and $DLoss_{i,t}$ is a dummy variable equal to one if the earnings before extraordinary items (#2) of firm i in quarter t is negative, and zero otherwise. Compared to our base-case AQ^{DD}, this alternative measure includes a loss dummy variable and its cross-products with the cash flow variables. Since past research has indicated a different behavior of volatility when firms report good vs. bad news to the market (Truong et al., 2012; Rogers et al., 2009), to account for a possible influence of reporting losses in the measure of accruals quality that we use, we explicitly report throughout our study results that are also based on this modified measure suggested by Prakash (2009).

Before leaving this subsection a few notes are in order: First, some authors advocate the use of absolute residuals from regressions (1) and (2) (instead of the standard deviation of residuals) as a measure of accounting quality. For example, Srinidhi and Gul (2007) explicitly state that they need the accruals quality estimate on a firm year basis, and this way use the absolute value of the residual as their measure. However, in our case, we need a quality measure indicating the uncertainty according to which accruals are translated into cash flows, that also takes into account the history of the firm with respect to the efficiency of this process, thus the firm-specific, 16-quarter standard deviation of residuals was preferred to firm absolute residuals.

Second, a number of research papers have approached the estimation of accruals quality by making use of the Modified Jones model (Dechow et al., 1995) instead of the Dechow and Dichev (2002) one (see for example Rajgopal and Venkatachalam, 2011). We do use the Modified Jones model among our robustness controls, but not as the main proxy for information risk estimation, for reasons that will be immediately explained. According to the Dechow and Dichev (2002) approach, the unexplained portion of the variation in working capital accruals is considered to be an inverse measure of accruals quality, with a greater unexplained portion to imply poorer quality; however, their approach is limited to working capital accruals (Francis et al., 2005). As the application of the Dechow and Dichev (2002) methodology–when using total accruals–could be subject a significant limitation relating to the existence of long lags between non-current accruals and cash flow realizations (Francis et al. 2005, 302), we additionally estimate accounting quality based on the Modified Jones Model (Dechow et al. 1995) in the form of a robustness control.

The use of this last approach, in order to measure accounting quality does not suffer from the same limitations as the Dechow and Dichev (2002) when total accruals are used, however, the Modified Jones model identifies accruals as abnormal if they are not explained by a very specific and limited set of fundamentals i.e. PP&E and changes in revenues, resulting in a less direct link to information risk (Francis et al. 2005). For the reasons stated above, we argue that the Dechow and Dichev (2002) model, also employed by other research on the quality of accruals (Francis et al., 2005; Ecker et al., 2006), constitutes the accruals quality proxy which most efficiently captures information risk about how a firm's true economic performance is going to evolve, by not expressing accruals as a function of a limited set of firm fundamentals. Therefore, our main results are based on the measurement of accruals quality according to the Dechow and Dichev (2002) methodology (with the McNichols, 2002, modification), while we complement our analysis with the use of the Modified Jones model (following Rajgopal and Venkatachalam, 2011, but applied to quarterly data), in order to affront the abovementioned limitation of the Dechow and Dichev (2002) approach.

This way, we report results for this model in the paper, as well as for its modification including a loss dummy based on Prakash (2009). Still, in order to ensure that our findings are not driven by the method employed to estimate accruals quality, we estimate and test additional model specifications (including the Modified Jones model) proposed in the literature, as described in our 'robustness tests' section 4.3.

Finally, it should be noted that the majority of studies estimating accruals quality by assessing the efficiency of mapping of accruals into cash flows has made use of annual data,[2] with the exception of Dhaliwal et al. (2010) and Prakash (2009). Our study estimates the impact of accounting quality on the behavior of implied volatility around earnings announcements, which occur on a quarterly basis. In this respect, we need a measure of accounting quality estimated at quarterly intervals. Prakash (2009) estimates accounting quality through the standard deviation of residuals stemming from quarter/sector-

[2] In the majority of cases, by making use of the standard deviation of Dechow and Dichev (2002) type regressions computed by estimating cross-sectional (rather than time-series) regressions e.g. Francis et al. (2005), Rajgopal and Venkatachalam (2011).

specific cross-sectional regressions (see equation 2). On the other hand, Dhaliwal et al. (2010) measure accounting quality by computing the standard deviation of residuals estimated from firm-specific, time-series regressions using quarterly data. We follow the approach employed by Prakash (2009), in an effort to explicitly focus on deviations of the mapping of accruals with reference to the industry, for a given firm. Nonetheless, we have repeated our analysis using accruals quality measures that follow the time-series approach of Dhaliwal et al. (2010); see our robustness tests section 4.3 for details.

3.2 Sample selection and description

The sample consists of US firms with common stocks traded on the NYSE, AMEX, and NASDAQ that have equity options data on the Ivy DB OptionMetrics database between 1996 and 2010, for which at least one of our accounting quality metrics (summarized in Sections 3.1 and 4.3) can be computed for one quarter with data from Standard and Poor's Compustat.[3] Data for earnings announcement dates have been extracted from Compustat (item mnemonic RDQ) while data on daily market returns were complemented from CRSP.

We use equity options implied volatility as a proxy for market participant's forward-looking view of uncertainty regarding the underlying stock. These are readily available on a daily basis from the Ivy DB OptionMetrics Standardized Options dataset, for both calls and puts that are closest-to-the-money, with maturities ranging from 30 days to 730 days. As in previous research, we focus on the shortest maturity (that is the quickest to respond to new information released via earnings announcements, see for example Truong et al., 2012; Donders et al., 2000 and also Goodman et al., 2012; Goyal and Seratto, 2009), and use both the average of call and put implied volatility (Truong et al., 2012) and the linearly delta-interpolated implied volatility of calls and puts (Mixon, 2009) to derive our two main proxies for ATM short-term equity implied volatility.[4]

Our sample selection requirements leads us to an initial sample of 5,051 firms, following truncation performed to all the variables employed for the estimation of our accounting quality metrics. Following this initial sample selection process, observations employed in subsequent analyses are data-dependent. Table 1 reports summary statistics for our sample of firm-year observations between 1996Q1 and 2010Q4.[5] We denote σ_τ a firm's delta-interpolated, at-the-money, 30-day implied volatility on day τ relative to the firm's quarterly earnings announcement date (day 0), while $\Delta\sigma_{[x,y]}$ stands for the

[3] January 1996 is the first month for which options data are available on Ivy DB OptionMetrics.
[4] Since both the call and the put implied volatilities from Ivy are close-to-the-money, the average and delta-interpolated implied volatilities are almost indistinguishable (average correlation coefficient 0.91). Unless otherwise stated, throughout the paper we report results using the interpolated implied volatility; results are unaffected by the use of average, call-only or put-only implied volatility (see section 4.3).
[5] The first quarter for which data is used for the calculation of accounting and market-based variables is actually Quarter 4 of year 1995, and the final one is Q3 of 2010, given that the announcement of earnings for relevant quarters is matched to option volatility attributes pertaining to calendar years 1996-2010.

difference $\sigma_x - \sigma_y$, which we calculate for 10 and 1-day windows around the event of earnings announcement. The table also reports descriptive statistics for a number of control variables that are used later on in regressions (see Appendix A for the definition and estimation details of all control variables).

Insert Table 1 about here.

We observe from Table 1 that earnings announcements represent indeed investor-reassuring events when it comes to the behavior of implied volatility, as volatility presents positive mean and median changes from 10 days before the event until the day of the announcement, however, volatility changes after the announcement are negative. The same applies for time windows that include days both before and after the event i.e. [-1, +1] and [-10, +10] day windows. However, mean and median changes in volatility one day before the event until the EA are negative, indicating that relevant information has probably been incorporated into volatility behavior very close to the event. This evidence confirms past research (Truong et al., 2012, among others) on earnings announcements representing events rich of information for investors, leading to volatility run-ups before earnings announcements and declines after the event. We finally report on Table 1 summary descriptive statistics for the main accounting quality proxies employed in our study, and we observe that AQ^{DD} *and* $AQDD^{(P),}$ exhibit a similar behavior in terms of descriptive statistics.

4. Empirical findings

4.1 Portfolio analysis

In order to investigate whether accounting quality is associated with implied volatility levels and changes around quarterly earnings announcement days, we first conduct standard portfolio analysis. At this point, past research has hypothesized and empirically testified that deteriorating earnings quality is associated with higher idiosyncratic *stock market* return volatility at the cross-sectional level, when measuring stock return volatility on a yearly basis (making use of monthly variances of risk-adjusted returns, Rajgopal and Benkatachalam, 2011). However, information risk, as proxied by accruals (earnings quality) refers to the difficulty of mapping accounting earnings into cash flows. This definition could be considered to refer to information risk with a longer run time horizon, at the same time when changes in implied volatility around earnings announcements examined by this study refer to information risk with a shorter term horizon. To address the issue of whether AQ also proxies for short-term information risk around earnings announcements, we begin our analysis by verifying whether previous findings on an association between accruals quality and stock market reaction at the cross-section (Rajgopal and Venkatachalam, 2011) also hold in the event study context, as the latter is the empirical context employed by our study for option markets, and therefore investigate stock price changes (in absolute terms) according to portfolios of AQ around quarterly earnings announcements.[6]

Table 2 reports (in Panel A) portfolio means of absolute stock returns $|R_\tau| = |\ln S_\tau - \ln S_{\tau-1}|$ on day τ relative to the sample firms' quarterly earnings announcement date (day 0), and means of absolute stock returns $|R_{[x,y]}| = |\ln S_x - \ln S_y|$ over trading day intervals *[x,y]* relative to the sample firms' quarterly earnings announcement date (in Panel B), over quarters 1996Q1 to 2010Q4, constructed for 10 accounting quality portfolios. Portfolios are formed each quarter on the basis of the accounting quality metrics *AQ*. Portfolio 1 consists of the firms with the lowest value for the accounting quality metric (i.e. good accounting quality) in all sample quarters, while Portfolio 10 consists of the firms with the highest value for the accounting quality metric (i.e. poor accounting quality) in all sample quarters. We observe from Table 2, Panels A and B, that AQ has a differentiating impact on absolute stock market reaction around earnings announcements. Lower (higher) AQ is significantly associated with larger (lower) absolute returns for days and time intervals around the earnings announcement event. This evidence confirms that findings by Rajgopal and Venkatachalam (2011) on historic stock price volatility also hold in the EA event study context, indicating that accruals quality serves as a proxy for short-term information risk around earnings announcements.

Insert Table 2 about here.

Table 3 continues by reporting for the same portfolios the means of at-the-money, short-term implied volatility σ_τ on day 0, -1, -10, +1, and +10 relative to the sample firms' quarterly earnings announcement date (day 0), over quarters 1996Q1 to 2010Q4. Table 3, Panel A, reports mean values of implied volatility for all firms that belong to a certain AQ decile across all sample quarters.

In order to control whether our hypothesis on AQ differentiating the behavior of IV around EA is related to hypotheses made by previous research on a differentiating impact of good vs. bad news on the IV behavior around the announcement (Truong et al., 2012), we repeat the same portfolio analysis for two distinct sub-samples: one consisting of firms experiencing positive earnings surprises in any given quarter and one consisting of firms experiencing negative earnings surprises. As in Truong et al. (2012), we calculate standardized unexpected earnings based on analyst forecasts (SUEAF) as actual earnings minus expected earnings (proxied by the most recent relative to the earnings announcement day median of analysts' forecasts), scaled by the end of quarter stock price, i.e.

$$SUEAF_{i,q} = (EIBES_{i,q} - FIBES_{i,q})/P_{i,q}$$

where:

[6] We are grateful to an anonymous reviewer for suggesting we should address this subtle point.

$EIBES_{i,q}$ = actual earnings per share reported in IBES for stock *i* in quarter, *q*;

$FIBES_{i,q}$ = median of all latest analysts' earnings per share forecasts before the earnings announcement for stock *i* in quarter, *q*;

$P_{i,q}$ = stock price for stock *i* at the end of quarter, q.

As in Truong et al. (2012), firms are classified into two sub-samples, one with $SUEAF_{i,q} \geq 0$ and one with $SUEAF_{i,q} < 0$. Mean implied volatilities for the two sub-sample firms that belong to a certain AQ decile are reported in Panel B of Table 3. In both panels of the Table, the reported *t-stat* and *p-val* refer to the test (under the null hypothesis) that the means of portfolios 10 and 1 are equal.

Insert Table 3 about here.

Findings from Table 3 Panel A clearly indicate a statistically significant tendency of implied volatility levels to increase as accounting quality decreases i.e. when both of our reported accruals quality proxies increase in value, indicating deterioration in accounting quality, regardless of whether firms have experienced a positive or negative earnings surprise (Table 3 Panel B). The observed trend is an almost linear increase as we move from portfolio 1 (highest AQ) to portfolio 10 (lowest AQ), for all time windows employed, while differences in mean volatility levels between the bottom and top portfolio are strongly statistically significant.

We then report on Table 4 portfolio means of at-the-money, short-term implied volatility changes $\Delta\sigma_{[x,y]} = \sigma_x - \sigma_y$ over trading day intervals *[x,y]* relative to the sample firms' quarterly earnings announcement date (day 0), over our sample period, for the same 10 accounting quality portfolios. Again, in Table 4 Panel A, we report mean values for average volatility metrics for all firms, while in Panel B, we repeat our analysis (for the AQ^{DD} metric only, for brevity) for the $SUEAF_{i,q} \geq 0$ and the $SUEAF_{i,q} < 0$ sub-samples.

Insert Table about 4 here.

We observe from Table 4 Panel A a statistically significant trend for implied volatility to increase as AQ deteriorates before earnings announcements, for the 10 day window before the event. This result is also generally consistent for the 1 day window as well, although relevant patterns are not so smooth for AQ portfolios 1 to 4. At the same time, implied volatility is found to more strongly resolve as AQ worsens after the event, again for both 1 and 10 day post-event windows. All trends observed in Panel A are almost in every case confirmed for firms experiencing positive and negative earnings surprises in Table 4 Panel B, indicating that information risk results in distinct behavior patterns for IV around earnings announcement, regardless of whether good vs. bad news are reported. Overall, earnings announcements are observed to have a decreasing influence on volatility as AQ deteriorates, judging from differences in implied volatility changes between high and low AQ portfolios for time windows surrounding the event (-1,+1 days and -10, +10 days).

As the almost-linear association between information risk (accounting quality) and implied volatility around EA days that we observe in Tables 3 and 4 (regardless of whether firms reported good or bad news about their earnings to market participants) could be partly due to business risk (economic performance), and in order to completely isolate the effect of investor uncertainty about firms' expected economic performance, from uncertainty solely arising from the quality of accounting information and its effect on the ability of investors to make predictions about the future course of firms, we proceed to perform a two-sort portfolio analysis. Each sample quarter we construct 25 portfolios using quintiles of (a) firms' accounting quality metrics and (b) the volatility of operating cash flows. The latter serves as a control for firm performance uncertainty and is in line with Huang (2009) that uses cash flow from operations as a proxy for the firm's economic earnings, as accounting earnings may underestimate the variability in operational profit due to earnings smoothing. Moreover, we choose the *volatility* of operating cash flows as our control as past research has linked firm stock market volatility with firm quality (see Walkshausl, 2013). This performance uncertainty control, denoted $Vol[SAdj.(CFO/TA)_{i,t}]$, is calculated as the standard deviation of quarterly, seasonally adjusted cash flows over the past 4 years (16 quarters), scaled by total assets as of quarter *t*.[7]

Double-sorting portfolio results for AQ^{DD} are reported on Table 5, while relevant results for the other AQ metrics are also calculated in the form of robustness controls, but are not tabulated in the paper (they are available upon request). For each portfolio every quarter *t*, we record its mean implied volatility for days 0 (Table 4 - Panel A), -10 (Panel B), +10 (Panel C), as well as change in implied volatility between days [-1, +1] (Panel D), [0, -10] (Panel E) and [+10, 0] (Panel F), with reference to the sample firms' quarterly earnings announcement date (day 0).

Insert Table 5 about here.

Findings from Table 5 first indicate a tendency of implied volatility levels to significantly increase when operating performance volatility increases, and AQ deteriorates. In other words, increases in the volatility of operating performance are observed to significantly associate with higher options volatility levels for days 0, +10, and -10 (Panels A, B, and C) around the event, but at the same time, lower accounting quality *also* significantly relates to higher implied volatility levels, with the portfolio with the highest performance volatility/lowest accounting quality to be exhibiting highest volatility levels. Regarding changes in implied volatility (Panels D-F), we first observe a significant tendency of volatility to increase (decrease) before EA as operating performance volatility increases (decreases),

[7] The seasonal adjustment is performed (following the recommendation of Dhaliwal et al., 2010) by subtracting from the variable its mean value calculated over corresponding quarters during a four-year (16 quarter) period prior to any given quarter. See also Appendix A for more details.

and a trend for implied volatility to decrease (increase) as operating performance volatility increases (decreases) after EA. This way, high levels of volatility in operating performance are associated with increases (or lower decreases) in volatility before EA events, and stronger decreases after EA, indicating that EA probably provide greater reassurance for investors for high operating volatility firms, as volatility increases tend to be stronger before the event and decreases are found to be larger after the event for these firms. This result is observed to hold for almost all event time windows, and almost in every case, for all CFO volatility portfolios for a given level of the AQ metric.

More importantly, even after controlling for volatility in operating performance, we observe a significant trend for implied volatility to increase 10 days before EA as AQ decreases (Panel E), while implied volatility is observed to significantly decrease more for lower vs. higher AQ firms, for the next 10 days after the announcement of earnings has taken place (see Panel F). This result is observed to hold in terms of statistical significance for most CFO volatility portfolios, for a given level of operating performance volatility, as AQ deteriorates. Interestingly, when comparing in terms of statistical significance volatility changes the lowest CFO volatility/highest AQ portfolio to the highest CFO volatility/lowest AQ portfolio, differences are always significant for all Panels D to F of Table 5, indicating that a high difficulty to make predictions, which expected to be the case in the presence of high operating volatility and low AQ, is associated with a stronger increase in volatility before the EA event and a stronger dissolution of implied volatility after the event, and vice versa.

We consider that findings from Tables 3-5 indicate that investors are exceptionally unsure of what to expect with respect to earnings announcements of low AQ (i.e. high information risk) firms, which justifies a stronger increase in volatility before EA for low AQ firms, even when controlling for a possible influence of operating performance uncertainty on option implied volatility. However, given increased uncertainty for the content of EA for low AQ firms, there is observed a stronger resolution of volatility for these firms after the event, indicating that a highly uncertain event provided rich informational content especially in the case of firms for which investors most needed such information, that is high information risk firms. At this point, we do not consider that our findings come into any contrast with findings by Truong et al. (2012) that positive earnings surprises and positive profit announcements produce higher uncertainty resolution (or reduction in implied volatility) than negative surprises and loss announcements, a fact they interpret as an indication that non-profitable firms already bear a substantially higher risk than profitable firms, leading to earnings news having a lower impact on their risk profile. This is because in our case, the topic of interest is the ability or easiness to make predictions about firm performance based on information extracted from financial statements, with predictions to be possibly good or bad, rather than the impact of positive or negative profitability or relevant news and earnings surprises on implied volatility, and we make sure to control for a possible association between uncertainty about cash flow performance and implied volatility levels and changes around EA. Still, we consider that our findings complement and extend Truong et al. (2012), as our evidence is consistent wit information risk having an effect on the behavior of IV around EA regardless of the impact of good vs. bad news announcements and surprises on IV (Truong et al., 2012).

4.2 Regression analysis

Our next step is to employ regression analysis in order to examine the impact of AQ on implied volatility levels and charges around EA, given that this form of analysis simultaneously permits controlling for a number of factors with a possible impact on implied volatility levels and changes. We therefore estimate the following panel regression on our sample firms over quarters 1996Q1 to 2010Q4:

$$\sigma_{\tau,i,t} \ \ or \ \ \Delta\sigma_{[x,y],i,t} = \beta_0 + \beta_1 AQ_{i,t}^{j} + \beta_2 Log\left(Sales_{i,t}\right) + \beta_3 Lev_{i,t} + \beta_4\left(IBEI_{i,t}/TA_{i,t}\right) + \\ +\beta_5 SAdj\left(CFO_{i,t}/TA_{i,t}\right) + \beta_6\left(BV_{i,t}/MV_{i,t}\right) + \beta_7 Vol\left[SAdj\left(CFO_{i,t}/TA_{i,t}\right)\right] + \beta_8 StockRetVol_{i,t} + \\ \beta_9 BHStockRet_{i,t} + \beta_{10} SAdj.\left(SGR_{i,t}\right) + \sum_q \sum_r \gamma_{q,r} D_{q,r} + e_i \qquad (3)$$

The dependent variables are (a) $\sigma_{\tau,i,t}$: the at-the-money, short-term implied volatility of firm i in quarter t on day τ (0, -1, +1, -10, +10) relative to the firm's quarter t earnings announcement date (day 0), and (b) $\Delta\sigma_{[x,y],i,t}$: the change in at-the-money, short-term implied volatility of firm i in quarter t over a trading day interval of $[x, y]$ days relative to the firm's quarter t earnings announcement date (day 0). The time windows employed are [-1, 0], [-1, +1], [0, +1], [-10, 0], [-10, +10], and [0, +10]. The estimation results using quarter and year dummies and heteroskedasticity and autocorrelation robust standard errors are summarized in Tables 6 and 7, respectively.

The independent variables $AQ_{i,t}^{j}$ stand for the accounting quality metrics outlined in Section 3.1 and all other independent variables are as in Tables 1 and Appendix A. The variables $D_{q,r}$ are quarter, year and industry dummies that have been included in various alternative specifications of the regression. All independent variables are as of quarter t. The selection of regressors is based on previous studies examining the impact of AQ on idiosyncratic stock return volatility (Rajgopal and Venkatachalam, 2011), as well as studies on accounting determinants of option market pricing (Sridharan, 2012; Goodman et al., 2012), while seasonal adjustment for CFO and sales growth when using quarterly data follows from Dhaliwal et al. (2010).

Insert Table 6 about here.

Findings from Table 6 confirm evidence from Tables 3-5 and indicate that lower accounting quality, or higher standard deviation in residuals showing the consistency of the mapping of earnings into cash flows, is positively associated with levels of implied volatility around EA events. This result is observed to hold for alternative definitions of accounting quality, for the day of the event and also +1, -1 and +10, -10 days before the announcement, and exhibit very strong statistical significance at 1% level, as well as economic significance, every single time. With respect to the behavior of the rest of regressors, past (historic) stock market volatility $StockRetVol_{i,t}$ is observed to positively and significantly relate to the level of implied option volatility around EA, as one would intuitively expect, while past stock buy-and-hold returns $BHStockRet_{i,t}$ are found to have a negatively significant effect, indicating that poorer market performers will tend to exhibit higher implied volatility in the options market. Finally, higher amounts of leverage $Lev_{i,t}$, lower sales accomplished $Log(Sales_{i,t})$ and higher $BV_{i,t}/MV_{i,t}$ ratios are found to contribute positively to implied option volatility levels around EA, which is consistent with high leverage, smaller revenues and size, and firm growth to be considered as factors contributing to equity risk.

As far as changes in implied volatility $\Delta\sigma_{[x,y]}$ around the EA day are concerned, we observe from Table 7 for both the AQ proxies which are reported that lower accounting quality (indicated by higher values of the AQ metric) significantly (at 5% level) contribute to run-ups in implied volatility in the 10 days preceding EA dates, and vice versa. The same applies for changes in implied volatility 1 day before the event, although in this case the result is not statistically significant, a possible indication that relevant information has already been incorporated into changes in implied volatility, after controlling for a number of factors with a possible effect on implied volatility. At the same time, confirming findings from Tables 3-5, lower accounting quality is significantly negatively associated with changes in implied volatility after the EA has taken place, for the next 1 to 10 days after the event, and the same applies for the effect of AQ on option volatility overall around the event, in the case of time windows (+1, -1) and (+10, -10). With respect to the behavior of the rest of regressors, there is observed a mild differentiation in their sign and significance depending on whether the dependent variable accounts for volatility changes before or after the EA event, with leverage, size, stock market and CFO volatility to appear as the variables with the stronger significance.[8]

Insert Table 7 about here.

As a whole, findings from Tables 6 and 7 confirm evidence from Tables 3, 4 and 5, indicating that even after controlling for a number of factors with a possible impact on volatility levels and changes, including volatility in operating performance (a) lower accounting quality- or higher information risk- is positively associated with higher levels of implied volatility around EA, and vice versa, and (b) lower (higher) AQ is significantly associated with higher (lower) increases in implied volatility before EA, and stronger decreases in volatility after the event. However, after controlling for a number of factors able to affect implied volatility, AQ is not observed to significantly relate to changes in implied volatility 1 day before the event, indicating incorporation of relevant information into implied volatility change behavior. This evidence is consistent with higher information risk contributing to option market

[8] Equation (3) has also been estimated with the inclusion of industry dummy variables according to 2-digit SIC codes, with no qualitative changes in the findings (untabulated results).

investor uncertainty around EA, with stronger increases in volatility before the event and higher dissolution afterwards, and is conceptually consistent with relevant evidence on the effect of AQ on idiosyncratic stock market return volatility (Rajgopal and Venkatachalam, 2011). We consider evidence on AQ not significantly relating to changes in implied volatility 1 day before the event as indicative of significant option market trader efficiency, as it provides signs of information incorporation shortly *before* EA have taken place.

4.3 Robustness Controls

At several instances throughout the paper we refer to alternative measures of accounting quality, as well as to additional tests, that have been used to examine the robustness of our findings. None of them significantly affects the quality and direction of the findings, and we briefly describe them in this paragraph for completeness. One alterative accounting quality measure we employ follows from Dhaliwal et al. (2010) and it is based on estimating equation (1) again, but in a time-series sense (not cross-sectionally): i.e. for each firm separately, starting at the current quarter and going back 48 quarters (12 years). The measure for quarter *t* comprises of the standard deviation of the firm-specific residuals from this time-series estimation. Another alternative quality measure employed is identical to the estimation procedure of Prakash (2009), with the variable $CFO_{i,t+1}$ added as a standalone regressor in equation (2). Finally we also employ the accounting quality measure in Rajgopal and Venkatachalam (2011) that it is based on the modified Jones model (Dechow et al., 1995). It is estimated as the absolute value of firm i residuals from the following regression, that is estimated cross-sectionally every quarter t and for every industry with at least 20 firm-observations in a given quarter:

$$\Delta WC_{i,t} - QDAE_{i,t} = \gamma_0 + \gamma_1\left(\Delta Sales_{i,t} - \Delta AR_{i,t}\right) + \gamma_2 GPPE_{i,t} + e_{i,t}$$

where all variables as before and:

$\Delta AR_{i,t}$	=	Firm i's change in accounts receivables (#2) between quarter $t-1$ and quarter t;
$QDAE_{i,t}$	=	Firm i's quarterly depreciation and amortization expense (#5) in quarter t.

All regression variables in the above equation (including the constant term) are scaled by total assets, averaged between quarters $t-1$ and t.

Moreover, the empirical elaboration of the paper has been repeated by making use of average call and put, instead of interpolated call and put, 30-day ATM implied volatility, as well as with using only the call and only the put volatilities separately, with no qualitative changes in the direction of the analysis. Moreover, using the natural logarithm of implied volatility levels or their log-differences does not alter the direction of portfolio and regression results.

Results have also been repeated with the use of annual, instead of quarterly data, and remain qualitatively similar. Despite the fact that Kim and Zhang (2013), who, to the best of our knowledge, have produced the only study examining the pricing of accounting information quality by option markets, have made use of annual data, we follow previous research on option market reaction to EA (Truong et al., 2012; Diavatopoulos et al., 2012) and report results using quarterly data, given that this is the actual and most frequent time window for the announcement of earnings.

Portfolio results (summarized in Tables 3-5) are qualitatively similar if the medians, instead of the means of implied volatility levels/changes are computed. Finally, regression results for equation (3) are robust to including a firm-specific liquidity regressor as computed as in Ng (2011), as well as including controls for analyst forecast dispersion (standard deviation of the most recent to the announcement analyst forecasts) and coverage (logarithm of number of most recent forecasts with reference to EA) from IBES, with no qualitative changes in the direction of the analysis. The inclusion of controls for analyst forecast attributes is consistent with relevant controls employed by past research (in our case, Rajgopal and Venkatachalam. 2011). However, the inclusion of controls for liquidity and analyst forecast attributes significantly reduced the number of usable observations for equation (3). We, therefore, report results without the variables in question in this version of the paper, and refer to relevant (untabulated) results in the form of robustness controls (which are available upon request). Results for equation (3) are also robust to a number of different estimation methods, including Fama McBeth (1973), employing firm fixed effects, as well as using GLS instead of OLS by clustering standard errors according to 2-digit SIC code and firm.

5. Conclusions

Uncertainty about the future economic performance of firms is expected to influence their stock return volatility (Pastor and Veronesi, 2003; Wei and Zhang, 2003), at the same time when the quality of earnings has been considered as a proxy for information risk, or the likelihood for firm-specific information important for investor decisions to be of poor quality (Francis et al., 2005). In this study, we examine the association between financial reporting quality, measured by assessing the quality of accounting accruals, and levels and changes in implied volatility around quarterly earnings announcements in option markets. We make use of accounting accruals as a proxy for firm information risk, in accordance with past research (Francis et al., 2005; Ecker et al., 2006), given that because the quality of accruals is expected to inform investors about the mapping of accounting earnings into cash flows, with poor accruals quality to be expected to weaken this mapping and, consequently, increase information risk (Francis et al., 2005). We also base our analysis on Rajgopal and Venkatachalam (2011), by distinguishing between sources of uncertainty about the future profitability of firms, or uncertainty about future cash flows from an operating point of view, vs. information about future cash flows stemming from the quality of accounting information.

We use all US firms from Compustat with option data in Optionmetrics between 1996-2010 and first observe that lower (higher) accounting quality is associated with significantly higher (lower) implied volatility in the days around quarterly earnings announcements. We also observe that worse accounting quality is associated with a significant increase in implied volatility in a ten-to one-day window before quarterly earnings announcements, while worse (better) accounting quality is found to relate to a larger decrease or resolution in implied volatility for the next one to ten days after the announcement event. At the same time, our evidence is robust to repeating our analyses for firms experiencing positive vs. negative earnings surprises, which is considered to be indicative of information risk having an effect on the behavior of IV which is both incremental and distinct from the observed directional impact of good vs. bad news announcements testified by past research (Truong et al., 2012). In order to completely isolate the effect of investor uncertainty about firms' expected economic performance, from uncertainty purely arising from the quality of accounting information, we additionally construct five-by-five portfolios of mean levels and changes in implied volatility around EA, according to volatility of operating cash flows and AQ metrics. We first observe a tendency of implied volatility levels to increase when operating performance volatility increases, and as AQ deteriorates. In this case, for changes in implied volatility, even after controlling for volatility in operating performance, we find a significant trend for implied volatility to increase before EA as AQ decreases, while implied volatility is observed to significantly dissolve more for lower vs. higher AQ firms, after the announcement of earnings has taken place. Our portfolio results are confirmed by regression analysis, permitting to explicitly control for the significance of the influence of a number of factors with a possible impact on implied volatility levels and changes e.g. firm size, profitability, cash flow generation, leverage, stock market performance and volatility, volatility of operating cash flows, as well as firm-specific liquidity, and analyst forecast characteristics.

Our evidence is indicative of market participants experiencing significantly stronger uncertainty before EA for low accounting quality firms, which is translated into significantly stronger increases in implied volatility before EA as AQ deteriorates, as they are unsure of what to expect in terms of the upcoming reporting of accounting performance, At the same time, low accounting quality is associated with a significantly larger resolution in volatility after EA, implying that market participants experience significantly greater reassurance because of the announcement of earnings explicitly for low AQ firms.

Our findings are interpreted as indicative of information risk, for which the quality of accounting accruals is used as a proxy, having a significant impact on the determination of the behavior of implied volatility around earnings announcements. This evidence is in accordance with past research testifying that the quality of financial statement information significantly relates to idiosyncratic stock return volatility in the stock markets (Rajgopal and Venkatachalam, 2011); however, in contrast to stock market volatility, option implied volatility is expected to be forward looking. In this way, the quality of accounting information reported in financial statements is observed to have repercussions for the determination of forward-looking expectations about future firm performance by market participants.

As a whole, our findings are consistent with information risk (stemming from the quality of earnings) making market participants exceptionally unsure on what expectations to make about the content of earnings announcements as AQ deteriorates, and experiencing a greater degree of 'relief' after the announcement has taken place, even after controlling for uncertainty about future earnings because of performance-related reasons. Our first study complements the study by Kim and Zhang (2013), which, to the best of our knowledge, is the first one to examine the association between financial statement information quality and option market pricing, by highlighting for the first time the association between accounting quality and option market implied volatility. In addition, we consider that our evidence builds on research considering the relation between accounting-based information variables and market outcomes (Bhattacharya et al., 2012), by providing evidence on the full impact of accounting quality, in the case of option markets in addition to equity markets. Finally, our findings provide evidence that firm pricing volatility even in the case of the option markets is affected by two sources of uncertainty about future economic performance: volatility about future cash flows and volatility of cash flows arising from the quality of financial information (Rajgopal and Venkatachalam, 2011), with option market traders to be observed to trade slightly before this information has been officially disseminated in upcoming earnings announcements.

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Appendix A: Definitions of control variables used

This Appendix summarizes the definitions of the control variables used in the study (Table 1), with the exception of variables used in AQ estimation (described in Section 3.2) and provides details of their calculation.

Financial Variable	Description	Compustat/CRSP item calculation
Log TA	Natural logarithm of quarterly Total assets in million dollars	Log(#44)
Log Sales	Natural logarithm of quarterly Sales in million dollars	Log(#2)
SGR	Percentage growth in sales from quarter t-1 to quarter t.	$(\#2)_t - (\#2)_{t-1}/(\#2)_{t-1}$
SAdj.(SGR)	Percentage growth in seasonally adjusted sales from quarter t-1 to quarter t. Following Dhaliwal et al. (2010), to control for seasonality in sales, we subtract from the variable their mean values calculated over corresponding quarters during a five-year period prior to a quarter (e.g. going back to year 1991 for 1996).	$(\text{SAdj. }\#2)_t - (\text{SAdj. }\#2)_{t-1}/(\text{SAdj.}\#2)_{t-1}$
LTLev	Quarterly Long Term Debt, divided by quarterly Total Assets	#51/#44
Lev	Quarterly Total Debt, divided by quarterly Total Assets	(#51+#45)/#44
CFO/TA	Quarterly Cash Flow from Operations, divided by quarterly Total Assets	#108/#44
SAdj.(CFO/TA)	Seasonally adjusted quarterly Cash Flow from Operations, divided by quarterly Total Assets. Following Dhaliwal et al. (2010), to control for seasonality in cash flow from operations, we subtract from the variable their mean values calculated over corresponding quarters during a five-year period prior to a quarter (e.g. going back to year 1991 for 1996).	(SAdj.#108)/#44
Vol[SAdj.(CFO/TA)]	Volatility of seasonally adjusted CFO, or standard deviation of quarterly seasonally adjusted cash flows over the past 4 years (16 quarters), scaled by quarterly total assets as of quarter t.	$(\text{StDev of SAdj.}\#108)/\#44_t$
IBEI/TA	Quarterly net Income before extraordinary items, divided by quarterly Total Assets	#8/#44
StockRetVol	Volatility of stock returns, or annualized historic volatility of firm daily stock returns over a whole calendar year ending on the firm's quarter end day.	CRSP item: Retx, or returns excluding dividends
BH-StockRet	Monthly buy-and-hold firm stock return over a whole calendar year ending on the firm's quarter end day.	CRSP item: Ret, or returns including dividend returns

Log MVE	Natural logarithm of quarterly market value of equity as of the last day of the fiscal quarter, (calculated as closing stock price at fiscal quarter-end times number of shares outstanding)	Log (PRCCM*#61)
BV /MV	Quarterly book value of equity divided by Market value of equity at the end of the fiscal quarter (calculated as closing stock price at fiscal quarter-end times number of shares outstanding)	#59/(PRCCM*#61)

Table 1: This table reports summary statistics for the sample of firm-year observations. The sample consists of firm with common stocks traded on the NYSE, AMEX, and NASDAQ, that have equity options data on the Ivy OptionMetrics database, for which at least one of our accounting quality metrics (summarized in Sections 3.2 and 4.3) can be computed for one quarter with data from Compustat between 1996 (Quarter 1) and 2011 (Quarter 1). Variable σ_τ stands for a firm's at-the-money, 30-day implied volatility on day τ relative to the firm's quarterly earnings announcement date (day 0). The implied volatility is calculated by 'delta-interpolating' between the implied volatility of the closest-to-the money 30-day call and put options available on day τ. $\Delta\sigma_{[x,y]}$ stands for the difference $\sigma_x - \sigma_y$. *LogTA* and *LogSales* stand for the natural logarithm of firm total assets and sales respectively. *SGR* and *SAdj.(SGR)* are the quarterly sales growth and the seasonally-adjusted quarterly sales growth over the last 16 quarters (4 years) respectively. *Lev* and *LTLev* stand for leverage and long-term leverage respectively. *CFO/TA* and *IBEI/TA* are cash flows from operations and income before extraordinary items, both scaled by total assets. *SAdj.(CFO/TA)* and *Vol[SAdj.(CFO/TA)]* stand respectively for seasonally-adjusted cash flows from operations over total assets and its volatility (standard deviation) over the last 16 quarters (4 years). *StockRetVol* is the annualized historic volatility of firm daily stock returns over a whole calendar year ending on the firm's quarter end day. *BH-StockRet* stands for the monthly buy-and-hold firm stock return over a whole calendar year ending on the firm's quarter end day. *BV/MV* is the market-to-book ratio and *MVE* stands for the market value of equity. Accounting quality measures are as outlined in Section 3.1. The calculation of all control variables is summarized in Appendix A.

Variables	No. Obs.	Q1	Mean	Median	Q3	St. Dev.	Min.	Max.
Implied Volatility								
σ_0	23,393	0.3425	0.5252	0.4665	0.6522	0.2463	0.1443	1.8495
σ_{+1}	23,207	0.3307	0.5065	0.4471	0.6283	0.2370	0.1441	1.7842
σ_{-1}	23,239	0.3506	0.5300	0.4731	0.6546	0.2421	0.1440	2.0059
σ_{+10}	22,979	0.3276	0.4979	0.4398	0.6178	0.2307	0.1414	1.9722
σ_{-10}	23,096	0.3396	0.5165	0.4592	0.6412	0.2381	0.1499	1.8607
$\Delta\sigma_{[0,-1]}$	23,060	-0.0256	-0.0058	-0.0028	0.0146	0.0526	-0.4180	0.7908
$\Delta\sigma_{[+1,-1]}$	22,978	-0.0505	-0.0239	-0.0155	0.0061	0.0628	-0.6468	0.5589
$\Delta\sigma_{[+1,0]}$	23,012	-0.0332	-0.0180	-0.0074	0.0062	0.0540	-0.7155	0.3659
$\Delta\sigma_{[0,-10]}$	23,024	-0.0308	0.0081	0.0025	0.0400	0.0822	-0.6024	0.7895
$\Delta\sigma_{[+10,-10]}$	22,774	-0.0603	-0.0185	-0.0154	0.0222	0.0902	-0.7381	0.9165
$\Delta\sigma_{[+10,0]}$	22,871	-0.0589	-0.0262	-0.0172	0.0125	0.0818	-0.7282	0.7031
Control Variables								
Log TA	23,356	6.2448	7.2017	7.1384	8.1693	1.4932	2.0762	11.6271
Log Sales	23,393	4.7045	5.6547	5.6776	6.7313	1.6378	-2.5257	9.9281
SGR	23,198	-0.0415	0.0423	0.0262	0.1018	0.2085	-0.7676	3.1545
SAdj.(SGR)	20,912	-0.2290	-0.0192	-0.0086	0.1936	1.1116	-13.3373	12.1565
LTLev	22,286	0.0986	0.2346	0.2167	0.3334	0.1729	0.0001	1.0733
Lev	23,393	0.1180	0.2566	0.2431	0.3621	0.1792	0.0003	1.1603
CFO/TA	23,251	0.0105	0.0487	0.0449	0.0919	0.0862	-1.1241	0.3980
SAdj.(CFO/TA)	20,474	-0.0086	0.0162	0.0128	0.0404	0.0581	-0.5048	0.4824
Vol[SAdj.(CFO/TA)]	20,482	0.0177	0.0361	0.0269	0.0425	0.0357	0.0010	0.9945
IBEI/TA	23,393	0.0019	0.2586	0.0144	0.0336	1.7949	-36.7582	64.2445
StockRetVol	23,100	0.3197	0.5054	0.4393	0.6338	0.2549	0.1092	2.1328
BH-StockRet	22,930	0.7952	1.1697	1.0675	1.3750	0.6619	0.0240	9.4167
Log MVE	23,140	6.2712	7.2591	7.1628	8.1455	1.4225	2.8527	11.6608
BV /MV	23,393	0.2386	0.4786	0.3970	0.6198	0.3967	-2.2499	6.8097
Accounting Quality								
AQ^{DD}	23,393	0.0548	0.1073	0.0802	0.1290	0.0821	0.0057	0.7641
$AQ^{DD(P)}$	23,393	0.0542	0.1057	0.0795	0.1271	0.0805	0.0071	0.7935

Table 2: The Table reports portfolio means of absolute stock returns $|R_\tau| = |\ln S_\tau - \ln S_{\tau-1}|$ on day τ relative to the sample firms' quarterly earnings announcement date (day 0) (Panel A), and means of absolute stock returns $|R_{[x,y]}| = |\ln S_x - \ln S_y|$ over trading day intervals *[x,y]* relative to the sample firms' quarterly earnings announcement date (Panel B), over quarters 1996Q1 to 2010Q4, computed for 10 accounting quality portfolios. Portfolios are formed each quarter on the basis of the accounting quality metrics outlined in Section 3.1. Portfolio 1 consists of the firms with the lowest accounting quality metric (i.e. good accounting quality) in all sample quarters, while Portfolio 10 consists of the firms with the highest accounting quality metric (i.e. poor accounting quality) in all sample quarters. *t-stat* and *p-val* refer to the test (under the null hypothesis) that the means of portfolios 10 and 1 are equal. An *, **, *** indicates that the null is rejected at the 10%, 5% and 1% significance level respectively.

Panel A: Absolute one-day stock return levels relative to sample firms' quarterly earnings announcement date (day 0)

Absolute Stock Return Means of Acc. Quality Portfolios	Quarterly portfolio formation based on: Accounting Quality metric AQ^{DD} (Dechow and Dichev, 2002)					Accounting Quality metric $AQ^{DD(P)}$ (Prakash, 2009)				
	$\lvert R_0\rvert$	$\lvert R_{-1}\rvert$	$\lvert R_{-10}\rvert$	$\lvert R_{+1}\rvert$	$\lvert R_{+10}\rvert$	$\lvert R_0\rvert$	$\lvert R_{-1}\rvert$	$\lvert R_{-10}\rvert$	$\lvert R_{+1}\rvert$	$\lvert R_{+10}\rvert$
1-Highest Acc. Quality	0.0300	0.0209	0.0195	0.0308	0.0185	0.0295	0.0201	0.0190	0.0296	0.0178
2	0.0331	0.0212	0.0200	0.0336	0.0185	0.0333	0.0217	0.0200	0.0335	0.0190
3	0.0346	0.0227	0.0219	0.0359	0.0199	0.0347	0.0229	0.0221	0.0369	0.0196
4	0.0378	0.0247	0.0225	0.0381	0.0205	0.0369	0.0238	0.0222	0.0373	0.0205
5	0.0379	0.0248	0.0232	0.0408	0.0220	0.0385	0.0253	0.0234	0.0401	0.0223
6	0.0395	0.0265	0.0249	0.0428	0.0236	0.0399	0.0264	0.0245	0.0424	0.0235
7	0.0410	0.0279	0.0260	0.0455	0.0241	0.0409	0.0281	0.0270	0.0480	0.0248
8	0.0427	0.0302	0.0288	0.0497	0.0269	0.0432	0.0306	0.0285	0.0488	0.0269
9	0.0467	0.0329	0.0311	0.0554	0.0299	0.0464	0.0329	0.0313	0.0556	0.0297
10-Lowest Acc. Quality	0.0462	0.0365	0.0338	0.0550	0.0317	0.0462	0.0365	0.0337	0.0552	0.0317
t-stat (Portf. 10 – Portf. 1)	19.6***	25.6***	22.7***	27.6***	24.7***	20.3***	27.2***	23.6***	27.7***	26.5***
p-val (Portf. 10 – Portf. 1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B: Absolute stock returns relative to sample firms' quarterly earnings announcement date (day 0)

Absolute Stock Return Means of Acc. Quality Portfolios	Quarterly portfolio formation based on Accounting Quality metric AQ^{DD} (Dechow and Dichev, 2002)						Accounting Quality metric $AQ^{DD(P)}$ (Prakash, 2009)					
	$\lvert R_{[+1,-1]}\rvert$	$\lvert R_{[+10,-10]}\rvert$	$\lvert R_{[0,-1]}\rvert$	$\lvert R_{[0,-10]}\rvert$	$\lvert R_{[+1,0]}\rvert$	$\lvert R_{[+10,0]}\rvert$	$\lvert R_{[+1,-1]}\rvert$	$\lvert R_{[+10,-10]}\rvert$	$\lvert R_{[0,-1]}\rvert$	$\lvert R_{[0,-10]}\rvert$	$\lvert R_{[+1,0]}\rvert$	$\lvert R_{[+10,0]}\rvert$
1-Highest Acc. Quality	0.0478	0.0967	0.0353	0.0657	0.0439	0.0742	0.0475	0.0936	0.0354	0.0642	0.0432	0.0723
2	0.0531	0.1009	0.0385	0.0698	0.0490	0.0795	0.0538	0.1027	0.0391	0.0712	0.0494	0.0799
3	0.0568	0.1077	0.0410	0.0753	0.0521	0.0823	0.0569	0.1100	0.0406	0.0760	0.0525	0.0842
4	0.0601	0.1146	0.0434	0.0797	0.0552	0.0890	0.0588	0.1123	0.0421	0.0775	0.0544	0.0869
5	0.0617	0.1180	0.0438	0.0809	0.0573	0.0925	0.0615	0.1173	0.0441	0.0798	0.0567	0.0920
6	0.0641	0.1248	0.0462	0.0849	0.0593	0.0963	0.0642	0.1255	0.0463	0.0858	0.0599	0.0985
7	0.0675	0.1302	0.0475	0.0894	0.0622	0.1018	0.0677	0.1329	0.0474	0.0914	0.0625	0.1015
8	0.0710	0.1418	0.0496	0.0978	0.0654	0.1071	0.0718	0.1409	0.0508	0.0972	0.0658	0.1076
9	0.0762	0.1527	0.0530	0.1039	0.0698	0.1174	0.0762	0.1519	0.0529	0.1043	0.0696	0.1168
10-Lowest Acc. Quality	0.0761	0.1602	0.0549	0.1093	0.0681	0.1218	0.0761	0.1608	0.0545	0.1092	0.0683	0.1223
t-stat (Portf. 10 – Portf. 1)	22.9***	25.9***	20.2***	25.1***	21.5***	25.0***	22.7***	27.5***	20.1***	26.0***	21.7***	26.1***
p-val (Portf. 10 – Portf. 1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 3: The Table reports portfolio means of at-the-money, 30-day implied volatility σ_τ on day τ relative to the sample firms' quarterly earnings announcement date (day 0), over quarters 1996Q1 to 2010Q4, constructed for 10 accounting quality portfolios. Portfolios are formed each quarter on the basis of the accounting quality metrics outlined in Section 3.1. Portfolio 1 consists of the firms with the lowest accounting quality metric (i.e. good accounting quality) in all sample quarters, while Portfolio 10 consists of the firms with the highest accounting quality metric (i.e. poor accounting quality) in all sample quarters. *t-stat* and *p-val* refer to the test (under the null hypothesis) that the means of portfolios 10 and 1 are equal. In Panel A, we report mean values for average volatility metrics for all firms, while in Panel B, we repeat our analysis (for the AQ^{DD} AQ metric only, for reasons of brevity) for firm-year observations with positive and negative earnings surprises (SUEAF) as defined in Section 4.1. An *, **, *** indicates that the null is rejected at the 10%, 5% and 1% significance level respectively.

Panel A: All sample firms

Implied Volatility Means of Acc. Quality Portfolios	Quarterly portfolio formation based on: Accounting Quality metric AQ^{DD} (Dechow and Dichev, 2002)					Accounting Quality metric $AQ^{DD(P)}$ (Prakash, 2009)				
	σ_0	σ_{-1}	σ_{-10}	σ_{+1}	σ_{+10}	σ_0	σ_{-1}	σ_{-10}	σ_{+1}	σ_{+10}
1-Highest Acc. Quality	0.4276	0.4329	0.4255	0.4164	0.4105	0.4201	0.4247	0.4162	0.4088	0.4029
2	0.4447	0.4528	0.4379	0.4300	0.4237	0.4436	0.4515	0.4380	0.4297	0.4229
3	0.4613	0.4684	0.4545	0.4456	0.4366	0.4727	0.4800	0.4664	0.4567	0.4494
4	0.4911	0.4975	0.4819	0.4737	0.4644	0.4843	0.4921	0.4753	0.4669	0.4562
5	0.5073	0.5147	0.4981	0.4895	0.4786	0.5032	0.5114	0.4968	0.4854	0.4758
6	0.5291	0.5363	0.5224	0.5102	0.5003	0.5338	0.5408	0.5248	0.5149	0.5042
7	0.5577	0.5636	0.5466	0.5356	0.5245	0.5637	0.5679	0.5522	0.5410	0.5321
8	0.6005	0.6044	0.5882	0.5768	0.5658	0.5976	0.6026	0.5861	0.5745	0.5629
9	0.6565	0.6597	0.6440	0.6297	0.6186	0.6593	0.6618	0.6447	0.6321	0.6184
10-Lowest Acc. Quality	0.7237	0.7226	0.7056	0.6953	0.6825	0.7214	0.7204	0.7044	0.6931	0.6810
t-stat (Portf. 10 – Portf. 1)	64.0***	63.1***	62.2***	61.6***	61.3***	65.2***	64.5***	64.2***	62.8***	62.6***
p-val (Portf. 10 – Portf. 1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B: Firms with positive and negative earnings surprises (SUEAF)

Implied Volatility Means of Acc. Quality Portfolios	Quarterly portfolio formation based on Accounting Quality metric AQ^{DD} (Dechow and Dichev, 2002)									
	Bad news: SUEAF < 0					Good news: SUEAF ≥ 0				
	σ_{0}	σ_{-1}	σ_{-10}	σ_{+1}	σ_{+10}	σ_{0}	σ_{-1}	σ_{-10}	σ_{+1}	σ_{+10}
1-Highest Acc. Quality	0.4524	0.4580	0.4525	0.4405	0.4380	0.4231	0.4289	0.4206	0.4096	0.4034
2	0.4689	0.4775	0.4586	0.4570	0.4507	0.4395	0.4463	0.4300	0.4231	0.4162
3	0.4943	0.5006	0.4831	0.4796	0.4716	0.4439	0.4505	0.4393	0.4266	0.4182
4	0.5223	0.5269	0.5158	0.5075	0.4962	0.4725	0.4781	0.4606	0.4522	0.4428
5	0.5403	0.5459	0.5328	0.5265	0.5171	0.4945	0.5005	0.4852	0.4725	0.4625
6	0.5665	0.5690	0.5505	0.5475	0.5271	0.5028	0.5118	0.4990	0.4831	0.4749
7	0.5731	0.5835	0.5643	0.5660	0.5533	0.5283	0.5374	0.5178	0.5011	0.4924
8	0.6163	0.6142	0.5988	0.5925	0.5858	0.5777	0.5819	0.5642	0.5496	0.5393
9	0.6772	0.6821	0.6635	0.6609	0.6418	0.6238	0.6279	0.6102	0.5932	0.5821
10-Lowest Acc. Quality	0.7355	0.7350	0.7139	0.7116	0.7005	0.6913	0.6911	0.6690	0.6544	0.6420
t-stat (Portf. 10 – Portf. 1)	24.3***	23.6***	23.0***	23.6***	23.2***	38.6***	37.8***	36.8***	35.9***	36.1***
p-val (Portf. 10 – Portf. 1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 4: The Table reports portfolio means of at-the-money, 30-day implied volatility changes $\Delta\sigma_{[x,y]} = \sigma_x - \sigma_y$ over trading day intervals *[x,y]* relative to the sample firms' quarterly earnings announcement date (day 0), over quarters 1996Q1 to 2010Q4, constructed for 10 accounting quality portfolios. Portfolios are formed each quarter on the basis of the accounting quality metrics outlined in Section 3.1. Portfolio 1 consists of the firms with the lowest accounting quality metric (i.e. good accounting quality) in all sample quarters, while Portfolio 10 consists of the firms with the highest accounting quality metric (i.e. poor accounting quality) in all sample quarters. *t-stat* and *p-val* refer to the test (under the null hypothesis) that the means of portfolios 10 and 1 are equal. In Panel A, we report mean values for average volatility metrics for all firms, while in Panel B, we repeat our analysis (for the AQ^{DD} AQ metric only, for reasons of brevity) for firm-year observations with positive and negative earnings surprises SUEAF as defined in Section 4.1. An *, **, *** indicates that the null is rejected at the 10%, 5% and 1% significance level respectively.

Panel A: All sample firms

Implied Volatility Change Means of Acc. Quality Portfolios	Quarterly portfolio formation based on											
	Accounting Quality metric AQ^{DD} (Dechow and Dichev, 2002)						Accounting Quality metric $AQ^{DD(P)}$ (Prakash, 2009)					
	$\Delta\sigma_{[+1,-1]}$	$\Delta\sigma_{[+10,-10]}$	$\Delta\sigma_{[0,-1]}$	$\Delta\sigma_{[0,-10]}$	$\Delta\sigma_{[+1,0]}$	$\Delta\sigma_{[+10,0]}$	$\Delta\sigma_{[+1,-1]}$	$\Delta\sigma_{[+10,-10]}$	$\Delta\sigma_{[0,-1]}$	$\Delta\sigma_{[0,-10]}$	$\Delta\sigma_{[+1,0]}$	$\Delta\sigma_{[+10,0]}$
1-Highest Acc. Quality	-0.0173	-0.0151	-0.0056	0.0030	-0.0117	-0.0182	-0.0171	-0.0148	-0.0054	0.0034	-0.0116	-0.0182
2	-0.0218	-0.0151	-0.0077	0.0057	-0.0141	-0.0210	-0.0215	-0.0153	-0.0077	0.0048	-0.0139	-0.0206
3	-0.0243	-0.0178	-0.0079	0.0051	-0.0158	-0.0237	-0.0237	-0.0176	-0.0076	0.0057	-0.0161	-0.0236
4	-0.0235	-0.0177	-0.0070	0.0089	-0.0165	-0.0245	-0.0247	-0.0190	-0.0076	0.0078	-0.0167	-0.0258
5	-0.0264	-0.0186	-0.0068	0.0100	-0.0197	-0.0289	-0.0261	-0.0179	-0.0079	0.0097	-0.0188	-0.0268
6	-0.0268	-0.0219	-0.0066	0.0083	-0.0198	-0.0295	-0.0269	-0.0217	-0.0064	0.0078	-0.0199	-0.0291
7	-0.0272	-0.0222	-0.0057	0.0092	-0.0217	-0.0315	-0.0272	-0.0211	-0.0050	0.0106	-0.0224	-0.0313
8	-0.0294	-0.0224	-0.0049	0.0108	-0.0233	-0.0334	-0.0290	-0.0229	-0.0050	0.0114	-0.0227	-0.0348
9	-0.0274	-0.0242	-0.0027	0.0141	-0.0244	-0.0367	-0.0278	-0.0248	-0.0028	0.0140	-0.0247	-0.0375
10-Lowest Acc. Quality	-0.0274	-0.0268	-0.0009	0.0137	-0.0259	-0.0410	-0.0273	-0.0267	-0.0005	0.0136	-0.0260	-0.0406
t-stat (Portf. 10 – Portf. 1)	-7.81***	-5.75***	4.53***	6.02***	-12.3***	-12.7***	-7.87***	-5.90***	4.63***	5.71***	-12.4***	-12.6***
p-val (Portf. 10 – Portf. 1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B: Firms with positive and negative earnings surprises (SUEAF)

Implied Volatility Change Means of Acc. Quality Portfolios	Quarterly portfolio formation based on Accounting Quality metric AQ^{DD} (Dechow and Dichev, 2002)											
	Bad news: SUEAF < 0						Good news: SUEAF ≥ 0					
	$\Delta\sigma_{[+1,-1]}$	$\Delta\sigma_{[+10,-10]}$	$\Delta\sigma_{[0,-1]}$	$\Delta\sigma_{[0,-10]}$	$\Delta\sigma_{[+1,0]}$	$\Delta\sigma_{[+10,0]}$	$\Delta\sigma_{[+1,-1]}$	$\Delta\sigma_{[+10,-10]}$	$\Delta\sigma_{[0,-1]}$	$\Delta\sigma_{[0,-10]}$	$\Delta\sigma_{[+1,0]}$	$\Delta\sigma_{[+10,0]}$
1-Highest Acc. Quality	-0.0147	-0.0116	-0.0061	0.0044	-0.0101	-0.0141	-0.0205	-0.0167	-0.0064	0.0026	-0.0145	-0.0195
2	-0.0171	-0.0112	-0.0054	0.0051	-0.0122	-0.0163	-0.0242	-0.0155	-0.0078	0.0076	-0.0160	-0.0232
3	-0.0190	-0.0139	-0.0053	0.0054	-0.0150	-0.0224	-0.0255	-0.0190	-0.0088	0.0052	-0.0175	-0.0253
4	-0.0200	-0.0145	-0.0061	0.0112	-0.0137	-0.0239	-0.0270	-0.0196	-0.0075	0.0090	-0.0190	-0.0261
5	-0.0208	-0.0170	-0.0050	0.0149	-0.0160	-0.0258	-0.0292	-0.0196	-0.0074	0.0103	-0.0216	-0.0305
6	-0.0196	-0.0188	0.0011	0.0141	-0.0208	-0.0317	-0.0293	-0.0265	-0.0075	0.0057	-0.0222	-0.0316
7	-0.0177	-0.0172	-0.0019	0.0097	-0.0141	-0.0272	-0.0347	-0.0277	-0.0095	0.0077	-0.0249	-0.0351
8	-0.0219	-0.0092	-0.0022	0.0166	-0.0174	-0.0265	-0.0357	-0.0270	-0.0066	0.0106	-0.0283	-0.0384
9	-0.0139	-0.0181	-0.0006	0.0155	-0.0152	-0.0314	-0.0346	-0.0292	-0.0040	0.0137	-0.0289	-0.0406
10-Lowest Acc. Quality	-0.0214	-0.0183	-0.0001	0.0185	-0.0207	-0.0344	-0.0353	-0.0281	-0.0007	0.0182	-0.0335	-0.0484
t-stat (Portf. 10 – Portf. 1)	-2.12**	-1.34	2.26**	3.12***	-3.72***	-4.42***	-7.25***	-3.87***	3.55***	5.84***	-10.4***	-10.8***
p-val (Portf. 10 – Portf. 1)	0.0345	0.1819	0.0238	0.0018	0.0002	0.0000	0.0000	0.0001	0.0004	0.0000	0.0000	0.0000

Table 5: Each year we construct 25 portfolios using quintiles of (a) *Vol[SAdj.(CFO/TA)$_{i,t}$]*, the standard deviation of quarterly, seasonally adjusted cash flows over the past 4 years (16 quarters), scaled by total assets as of quarter *t*, that serves as a control for firm performance uncertainty and (b) the accounting quality metrics outlined in Section 3.1. For reasons of brevity, only results of $AQ^{DD}_{i,t}$, are reported. For each portfolio every quarter *t*, we record its mean at-the-money, short-term implied volatility for day 0 (Panel A), -10 (Panel B), +10 (Panel C), as well as change in implied volatility between days [-1, +1] (Panel D), [0, -10] (Panel E), [+10,0] (Panel F), [0, -1] (Panel G), and finally [+1, 0] (Panel H), with reference to the sample firms' quarterly earnings announcement date (day 0). An *, **, *** indicates that the null is rejected at the 10%, 5% and 1% significance level respectively.

Panel A: Means of σ_0		Portfolios of *Vol[SAdj.(CFO/TA)$_{i,t}$]* 1-Lowest	2	3	4	5-Highest	Mean Differences Portfolios 5 and 1
Portfolios of $AQ^{DD}_{i,t}$	1-Highest Acc. Q.	0.3793[a]	0.4062	0.4230	0.4772	0.5858	0.2065*** (27.30)
	2	0.3982	0.4165	0.4542	0.5242	0.6181	0.2200*** (29.44)
	3	0.4323	0.4492	0.4963	0.5493	0.6373	0.2050*** (27.66)
	4	0.4418	0.4918	0.5295	0.5723	0.6711	0.2293*** (30.97)
	5-Lowest Acc. Q.	0.4971	0.5535	0.5965	0.6260	0.7631[b]	0.2660*** (33.53)
	Mean Differences Portfolios 5 and 1	0.1178*** (17.87)	0.1473*** (20.86)	0.1735*** (23.17)	0.1488*** (18.70)	0.1773*** (20.23)	Mean Differences Portfolios b and a 0.3838*** (52.47)

Panel B: Means of σ_{-10}		Portfolios of *Vol[SAdj.(CFO/TA)$_{i,t}$]* 1-Lowest	2	3	4	5-Highest	Mean Differences Portfolios 5 and 1
Portfolios of $AQ^{DD}_{i,t}$	1-Highest Acc. Q.	0.3789[a]	0.4041	0.4179	0.4674	0.5747	0.1958*** (26.39)
	2	0.3915	0.4100	0.4484	0.5150	0.6030	0.2115*** (29.51)
	3	0.4254	0.4439	0.4889	0.5378	0.6238	0.1984*** (27.78)
	4	0.4399	0.4828	0.5219	0.5574	0.6624	0.2224*** (30.84)
	5-Lowest Acc. Q.	0.4918	0.5425	0.5822	0.6185	0.7463[b]	0.2545*** (32.88)
	Mean Differences Portfolios 5 and 1	0.1129*** (17.52)	0.1384*** (19.95)	0.1643*** (22.21)	0.1512*** (19.53)	0.1716*** (20.02)	Mean Differences Portfolios b and a 0.3674*** (50.86)

Panel C: Means of σ_{+10}		Portfolios of *Vol[SAdj.(CFO/TA)$_{i,t}$]* 1-Lowest	2	3	4	5-Highest	Mean Differences Portfolios 5 and 1
Portfolios of $AQ^{DD}_{i,t}$	1-Highest Acc. Q.	0.3690[a]	0.3949	0.4032	0.4475	0.5532	0.1843*** (25.24)
	2	0.3792	0.3936	0.4270	0.4892	0.5793	0.2001*** (28.66)
	3	0.4111	0.4225	0.4667	0.5167	0.6006	0.1895*** (27.12)
	4	0.4241	0.4638	0.4969	0.5375	0.6313	0.2073*** (29.55)
	5-Lowest Acc. Q.	0.4693	0.5187	0.5618	0.5948	0.7300[b]	0.2607*** (34.29)
	Mean Differences Portfolios 5 and 1	0.1003*** (16.10)	0.1237*** (18.48)	0.1586*** (21.71)	0.1473*** (19.48)	0.1768*** (20.79)	Mean Differences Portfolios b and a 0.3610*** (49.62)

Panel D: Means of $\Delta\sigma_{[+1,-1]}$		Portfolios of $Vol[SAdj.(CFO/TA)_{i,t}]$ 1-Lowest	2	3	4	5-Highest	H_0: Equal Means Portfolios 5 and 1
Portfolios of $AQ^{DD}_{i,t}$	1-Highest Acc. Q.	-0.0164[a]	-0.0192	-0.0221	-0.0280	-0.0269	-0.0104*** (-5.09)
	2	-0.0195	-0.0240	-0.0242	-0.0263	-0.0292	-0.0096*** (-4.58)
	3	-0.0191	-0.0264	-0.0267	-0.0312	-0.0309	-0.0118*** (-5.48)
	4	-0.0211	-0.0272	-0.0302	-0.0317	-0.0271	-0.0060*** (-2.70)
	5-Lowest Acc. Q.	-0.0241	-0.0273	-0.0321	-0.0285	-0.0239[b]	0.0002 (0.09)
	H_0: Equal Means Portfolios 5 and 1	-0.0076*** (-3.97)	-0.0081*** (-4.15)	-0.0100*** (-4.56)	-0.0006 (-0.26)	0.0030 (1.25)	H_0: Equal Means Portfolios b and a -0.0074*** (-3.33)

Panel E: Means of $\Delta\sigma_{[0,-10]}$		Portfolios of $Vol[SAdj.(CFO/TA)_{i,t}]$ 1-Lowest	2	3	4	5-Highest	H_0: Equal Means Portfolios 5 and 1
Portfolios of $AQ^{DD}_{i,t}$	1-Highest Acc. Q.	0.0005[a]	0.0017	0.0055	0.0070	0.0112	0.0107*** (3.89)
	2	0.0043	0.0058	0.0042	0.0095	0.0145	0.0103*** (3.71)
	3	0.0054	0.0046	0.0085	0.0090	0.0146	0.0091*** (3.07)
	4	0.0021	0.0084	0.0118	0.0135	0.0090	0.0068** (2.39)
	5-Lowest Acc. Q.	0.0059	0.0119	0.0123	0.0094	0.0110[b]	0.0051* (1.89)
	H_0: Equal Means Portfolios 5 and 1	0.0053** (2.05)	0.0102*** (3.71)	0.0068** (2.43)	0.0025 (0.85)	-0.0002 (-0.07)	H_0: Equal Means Portfolios b and a 0.0104*** (3.53)

Panel F: Means of $\Delta\sigma_{[+10,0]}$		Portfolios of $Vol[SAdj.(CFO/TA)_{i,t}]$ 1-Lowest	2	3	4	5-Highest	H_0: Equal Means Portfolios 5 and 1
Portfolios of $AQ^{DD}_{i,t}$	1-Highest Acc. Q.	-0.0138[a]	-0.0120	-0.0204	-0.0270	-0.0346	-0.0209*** (-7.50)
	2	-0.0196	-0.0218	-0.0247	-0.0358	-0.0392	-0.0197*** (-6.70)
	3	-0.0202	-0.0260	-0.0298	-0.0316	-0.0395	-0.0194*** (-6.81)
	4	-0.0207	-0.0294	-0.0324	-0.0366	-0.0386	-0.0179*** (-6.03)
	5-Lowest Acc. Q.	-0.0241	-0.0311	-0.0341	-0.0313	-0.0348[b]	-0.0107*** (-3.31)
	H_0: Equal Means Portfolios 5 and 1	-0.0104*** (-3.98)	-0.0191*** (-7.15)	-0.0136*** (-4.89)	-0.0043 (-1.47)	-0.0002 (-0.05)	H_0: Equal Means Portfolios b and a -0.0211*** (-6.86)

Table 6: The Table reports a sub-sample of the estimation results of the panel regression

$$\sigma_{\tau,i,t} = \beta_0 + \beta_1 AQ^j_{i,t} + \beta_2 Log(Sales_{i,t}) + \beta_3 Lev_i + \beta_4 (IBEI_{i,t}/TA_{i,t}) + \beta_5 SAdj(CFO_{i,t}/TA_{i,t}) + \beta_6 (BV_{i,t}/MV_{i,t}) + \beta_7 Vol[SAdj(CFO_{i,t}/TA_{i,t})] + \beta_8 StockRetVol_{i,t} + \beta_9 BHStockRet_{i,t} + \beta_{10} SAdj.(SGR_{i,t}) + \sum_q \sum_r \gamma_{q,r} D_{q,r} + e_i.$$

The regression is estimated on sample firms over quarters 1996Q1 to 2011Q1 using quarter and year dummies and heteroskedasticity-robust standard errors. The dependent variable $\sigma_{\tau,i,t}$ is the at-the-money, 30-day implied volatility of firm i in quarter t on day τ relative to the firm's quarter t earnings announcement date (day 0). The independent variables $AQ^j_{i,t}$ stand for the accounting quality metrics outlined in Section 3.1. All other independent variables are as in Appendix A. The variables $D_{q,r}$ are quarter, year and industry dummies that have been included in various alternative specifications of the regression. All independent variables are as of quarter t, t-stats are reported in parentheses and p-values in square brackets. An *, ** and *** indicates statistical significance at the 10%, 5% and 1% level respectively.

Variable	$\sigma_{0,i,t}$	$\sigma_{-1,i,t}$	$\sigma_{-10,i,t}$	$\sigma_{+1,i,t}$	$\sigma_{+10,i,t}$	$\sigma_{0,i,t}$	$\sigma_{-1,i,t}$	$\sigma_{-10,i,t}$	$\sigma_{+1,i,t}$	$\sigma_{+10,i,t}$
Intercept	0.212***	0.202***	0.205***	0.216***	0.214***	0.212***	0.202***	0.204***	0.216***	0.214***
	(24.47)	(23.82)	(24.67)	(26.32)	(26.32)	(24.51)	(23.85)	(24.68)	(26.33)	(26.35)
$AQ^{DD}_{i,t}$	0.170***	0.172***	0.152***	0.136***	0.123***					
	(9.85)	(10.11)	(9.47)	(8.39)	(7.71)					
$AQ^{DD(P)}_{i,t}$						0.173***	0.174***	0.156***	0.140***	0.124***
						(9.80)	(10.02)	(9.50)	(8.46)	(7.63)
$Log\ Sales_{i,t}$	-0.017***	-0.015***	-0.015***	-0.018***	-0.018***	-0.017***	-0.015***	-0.015***	-0.018***	-0.018***
	(-21.41)	(-18.24)	(-19.37)	(-23.66)	(-23.05)	(-21.38)	(-18.21)	(-19.32)	(-23.61)	(-23.06)
$SAdj.(SGR)_{i,t}$	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(1.29)	(1.28)	(1.50)	(1.36)	(0.65)	(1.30)	(1.29)	(1.51)	(1.37)	(0.66)
$Lev_{i,t}$	0.018***	0.018***	0.032***	0.042***	0.048***	0.018***	0.018***	0.031***	0.041***	0.048***
	(2.94)	(2.99)	(5.44)	(7.03)	(8.14)	(2.88)	(2.92)	(5.37)	(6.97)	(8.09)
$(IBEI/TA)_{i,t}$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.62)	(-0.85)	(-0.15)	(-0.87)	(-0.64)	(-0.60)	(-0.83)	(-0.13)	(-0.85)	(-0.62)
$SAdj.(CFO/TA)_{i,t}$	-0.074***	-0.057***	-0.053***	-0.082***	-0.103***	-0.074***	-0.057***	-0.053***	-0.082***	-0.103***
	(-3.57)	(-2.83)	(-2.70)	(-4.26)	(-5.24)	(-3.58)	(-2.84)	(-2.71)	(-4.27)	(-5.26)
$(BV/MV)_{i,t}$	0.033***	0.034***	0.037***	0.040***	0.044***	0.033***	0.035***	0.037***	0.040***	0.044***
	(8.51)	(8.91)	(9.64)	(10.50)	(11.74)	(8.53)	(8.93)	(9.67)	(10.53)	(11.74)
$Vol[SAdj.(CFO/TA)_{i,t}]$	0.271***	0.331***	0.278***	0.310***	0.368***	0.273***	0.333***	0.279***	0.311***	0.370***
	(6.25)	(7.45)	(6.33)	(7.21)	(7.89)	(6.29)	(7.50)	(6.36)	(7.25)	(7.94)
$StockRetVol_{i,t}$	0.670***	0.672***	0.665***	0.632***	0.616***	0.670***	0.672***	0.665***	0.632***	0.616***
	(79.22)	(79.80)	(79.04)	(78.27)	(77.88)	(79.05)	(79.64)	(78.87)	(78.10)	(77.73)

BH-StockRet$_{i,t}$	-0.000	-0.002	-0.008***	-0.002	0.005**	-0.000	-0.002	-0.008***	-0.002	0.005**
	(-0.09)	(-0.86)	(-3.85)	(-0.70)	(2.30)	(-0.09)	(-0.85)	(-3.85)	(-0.70)	(2.30)
Year and Quarter Dummies	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
Adjusted R^2	0.690	0.694	0.714	0.702	0.694	0.690	0.694	0.714	0.702	0.694
F	950.84***	950.68***	1042.2***	1036.1***	1028.5***	951.47***	951.81***	1043.9***	1037.9***	1028.9***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
No. Obs.	19,063	19,056	18,981	19,018	18,854	19,063	19,056	18,981	19,018	18,854

Table 7: The Table reports a sub-sample of the estimation results of the panel regression

$$\Delta\sigma_{[x,y],i,t} = \beta_0 + \beta_1 AQ_{i,t}^{j} + \beta_2 Log(Sales_{i,t}) + \beta_3 Lev_i + \beta_4 (IBEI_{i,t}/TA_{i,t}) + \beta_5 SAdj(CFO_{i,t}/TA_{i,t}) + \beta_6 (BV_{i,t}/MV_{i,t}) + \beta_7 Vol[SAdj(CFO_{i,t}/TA_{i,t})] + \beta_8 StockRetVol_{i,t} + \beta_9 BHStockRet_{i,t} + \beta_{10} SAdj.(SGR_{i,t}) + \sum_q \sum_r \gamma_{q,r} D_{q,r} + e_i.$$

The regression is estimated on sample firms over quarters 1996Q1 to 2011Q1 using quarter and year dummies and heteroskedasticity-robust standard errors. The dependent variable $\Delta\sigma_{[x,y],i,t}$ is the change in at-the-money, 30-day implied volatility of firm i in quarter t over a trading day interval of $[x, y]$ days relative to the firm's quarter t earnings announcement date (day 0). The independent variables $AQ_{i,t}^{j}$ stand for the accounting quality metrics outlined in Section 3.1. All other independent variables are as in Appendix A. The variables $D_{q,r}$ are quarter, year and industry dummies that have been included in various alternative specifications of the regression. All independent variables are as of quarter t, t-stats are reported in parentheses and p-values in square brackets. An *, ** and *** indicates statistical significance at the 10%, 5% and 1% level respectively.

Variable	$\Delta\sigma_{[+1,-1]}$	$\Delta\sigma_{[+10,-10]}$	$\Delta\sigma_{[0,-1]}$	$\Delta\sigma_{[0,-10]}$	$\Delta\sigma_{[+1,0]}$	$\Delta\sigma_{[+10,0]}$	$\Delta\sigma_{[+1,-1]}$	$\Delta\sigma_{[+10,-10]}$	$\Delta\sigma_{[0,-1]}$	$\Delta\sigma_{[0,-10]}$	$\Delta\sigma_{[+1,0]}$	$\Delta\sigma_{[+10,0]}$
Intercept	0.011***	0.004	0.011***	0.007	-0.002	-0.003	0.011***	0.004	0.011***	0.007	-0.002	
	(2.90)	(0.68)	(3.56)	(1.36)	(-0.66)	(-0.60)	(2.84)	(0.70)	(3.54)	(1.36)	(-0.71)	
$AQ^{DD}{}_{i,t}$	-0.028***	-0.027**	0.003	0.020**	-0.033***	-0.051***						
	(-3.81)	(-2.56)	(0.57)	(2.07)	(-4.74)	(-5.19)						
$AQ^{DD(P)}{}_{i,t}$							-0.027***	-0.029***	0.004	0.021**	-0.032***	-0.053***
							(-3.58)	(-2.62)	(0.63)	(2.07)	(-4.56)	(-5.31)
$Log\ Sales_{i,t}$	-0.003***	-0.002***	-0.003***	-0.002***	-0.001*	-0.001	-0.003***	-0.002***	-0.003***	-0.002***	-0.001*	-0.001
	(-9.30)	(-4.62)	(-9.13)	(-3.98)	(-1.85)	(-1.10)	(-9.24)	(-4.64)	(-9.10)	(-3.97)	(-1.81)	(-1.15)
$SAdj.(SGR)_{i,t}$	-0.000	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.000	-0.000	-0.000
	(-0.72)	(-0.20)	(0.30)	(-0.48)	(-0.92)	(-0.49)	(-0.73)	(-0.21)	(0.30)	(-0.47)	(-0.93)	(-0.49)
$Lev_{i,t}$	0.016***	0.014***	-0.001	-0.015***	0.020***	0.030***	0.016***	0.014***	-0.001	-0.015***	0.020***	0.030***
	(5.78)	(3.53)	(-0.31)	(-4.09)	(8.40)	(8.33)	(5.80)	(3.55)	(-0.31)	(-4.10)	(8.42)	(8.36)
$(IBEI/TA)_{i,t}$	-0.000	-0.000	-0.000	-0.001*	0.000	0.000	-0.000	-0.000	-0.000	-0.001*	0.000	0.000
	(-0.17)	(-0.53)	(-1.44)	(-1.81)	(0.45)	(1.01)	(-0.18)	(-0.54)	(-1.44)	(-1.80)	(0.44)	(1.00)
$SAdj.(CFO/TA)_{i,t}$	-0.027***	-0.041***	-0.014*	-0.017	-0.017**	-0.021*	-0.027***	-0.041***	-0.014*	-0.018	-0.017**	-0.021*
	(-2.94)	(-2.92)	(-1.70)	(-1.41)	(-2.06)	(-1.75)	(-2.93)	(-2.92)	(-1.70)	(-1.41)	(-2.05)	(-1.75)
$(BV/MV)_{i,t}$	0.006***	0.006**	-0.001	-0.006***	0.007***	0.011***	0.006***	0.006**	-0.001	-0.006***	0.007***	0.011***
	(3.78)	(2.59)	(-1.05)	(-2.84)	(5.38)	(5.40)	(3.80)	(2.58)	(-1.04)	(-2.84)	(5.40)	(5.38)
$Vol[SAdj.(CFO/TA)_{i,t}]$	-0.017	0.085***	-0.039***	-0.011	0.051***	0.071***	-0.018	0.085***	-0.040***	-0.011	0.050***	0.071***
	(-0.86)	(2.96)	(-2.62)	(-0.50)	(3.51)	(2.91)	(-0.90)	(2.97)	(-2.63)	(-0.50)	(3.46)	(2.91)
$StockRetVol_{i,t}$	-0.037***	-0.045***	-0.005*	0.005	-0.034***	-0.047***	-0.037***	-0.045***	-0.005*	0.005	-0.034***	-0.046***
	(-11.81)	(-9.47)	(-1.85)	(1.13)	(-12.56)	(-11.14)	(-11.82)	(-9.43)	(-1.86)	(1.12)	(-12.56)	(-11.09)

BHStockRet$_{i,t}$	-0.000	0.012***	0.000	0.006***	-0.000	0.005***	-0.000	0.012***	0.000	0.006***	-0.000	0.005***
	(-0.08)	(8.33)	(0.56)	(4.93)	(-0.16)	(3.85)	(-0.08)	(8.33)	(0.56)	(4.93)	(-0.16)	(3.85)
Year and Quarter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.068	0.059	0.024	0.032	0.047	0.041	0.068	0.059	0.024	0.032	0.047	0.041
F	50.18***	43.46***	15.43***	20.45***	31.78***	28.39***	50.00***	43.51***	15.43***	20.44***	31.64***	28.41***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
No. Obs.	18,944	18,778	18,983	18,952	18,934	18,807	18,944	18,778	18,983	18,952	18,934	18,807