Option Prices Leading Equity Prices: Information Leakage or Superior Information Processing?

Wen Jin
Quantitative Management Associates
2 Gateway Plaza
Newark NJ 07102
973-367-5279
wen.jin@qmassociates.com

Joshua Livnat
Professor of Accounting
Stern School of Business Administration
New York University
10-76 K-MEC Hall
44 W. 4th St.
New York City, NY 10012
(212) 998–0022
jlivnat@stern.nyu.edu

Yuan Zhang
Assistant Professor of Accounting
Columbia Business School
611 Uris Hall
3022 Broadway
New York City, NY 10023
(212)-854-0159
yz2113@columbia.edu

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ABSTRACT

Recent evidence has shown that the option volatility skew can be used to predict future equity returns. This study investigates the two primary reasons for this predictability – information leakage or superior ability of option traders to assess the tail risk. We find that the option volatility skews prior to scheduled information events (i.e., earnings announcements and 10-K/10-Q filings) have higher ability to predict event returns than skews prior to other unscheduled corporate announcements (e.g., product or customer announcements), consistent with information leakage prior to the scheduled information events. On the other hand, we find that option volatility skews after the non-scheduled corporate announcements have higher ability to predict returns than skews after the scheduled information events. In addition, the predictive ability of post-event option volatility skews is significant when the firm experiences the most negative returns around the information events, which suggest option traders are better than equity traders at assessing the tail risk when uncertainty remains high after the arrival of information.

Key Words: Option Volatility Skews; Information Leakage; Superior Information Processing.

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1. Introduction

Prior research has shown that implied volatility at extreme strike prices is higher than options that are at-the-money (e.g., Rubinstein [1994]). This pattern is referred to as option volatility smirk or skew. A number of studies show that the option volatility skews at the index level predict market-level events (e.g., Bates [1991], Doran et al. [2007]). Prior research has also documented that at the firm level, the implied volatility skew (henceforth skew or option skew) has significant cross-sectional predictive power for future equity returns (e.g., Van Buskirk [2009], Xing et al. [2010]).

These studies generally suggest that option prices lead equity prices in reflecting (public or private) information. However, they do not explore the potential reasons for this superiority. There are two main possible reasons for this predictive ability: information leakage to option traders (i.e., option traders have private information and prefer to trade options to increase leverage) or the superiority of option traders in assessing the tail risk (i.e., the likelihood, timing, and magnitude of negative future events) based on public information available to both option and equity traders.[1] Understanding which of these reasons is responsible for the skew's predictive ability is important for our understanding of the price formation and efficiency of both the equity and the option markets. We examine this issue by focusing on the predictive ability of the volatility skews around significant corporate information events. If there is information leakage to option traders relative to equity traders ("information leakage hypothesis"), we expect to observe improved predictive ability of the skew immediately prior to the information events as

[1] Option traders are more focused on tail events because they have to price puts.

compared to a more dated skew. On the other hand, if option traders have a superior ability to process publicly available information than equity traders ("superior ability hypothesis"), after the corporate information events when the likelihood of private information is low, the volatility skew should predict future equity returns.

We focus on two types of corporate information events: scheduled and unscheduled. The scheduled events include quarterly preliminary earnings announcements and 10-K/10-Q form filings.[2] The unscheduled corporate announcements are announcements captured in the Key Developments database compiled by Capital IQ. We examine the predictive ability of the average volatility skew over three specific windows relative to the announcement date (day 0): days [-50, -11] (base window, Base), days [-10, -2] (pre-event window, Pre), and days [+1, +5] (post-event window, Post). We use the above volatility skews to predict announcement returns in [-1, +1], as well as drift returns in either [+2, 90] or [+6, 90].[3]

While Xing et al. [2010] suggest that both Base and Pre skew should be negatively associated with announcement returns, we assess the information leakage hypothesis by comparing the association of announcement returns with Base and Pre skew. If Pre skew is significantly associated with announcement returns after controlling for the Base skew, it is likely that some information is leaked to the option market during the Pre window. This reasons to focus on information retrieval immediately prior to the announcement.

We assess the superior ability hypothesis by associating the drift returns in the window [+6, +90] with the Post skew. After the corporate announcement, it is assumed that much of the

[2] We find that fewer than 20% (30%) of firms file their 10-Q (10-K) more than four days prior to the end of their allowed filing period. We also find that, similar to preliminary earnings release dates, about 90% (70%) of the firms tend to file their 10-Q (10-K) with very similar lags from their period-end. We define a similar lag if the current lag is within 7 days of the average lag in the most recent 3 quarters (years) for Form 10-Q (10-K) filings.

[3] For earnings announcements, the drift returns are measured through one day after the subsequent quarter's earnings announcement, if available, and 90 days otherwise.

uncertainty has been resolved and the Post skew should not be incrementally significant in predicting the drift returns beyond the Base and Pre skew unless option investors have superior ability to process the information just released. This predictive ability is expected to be particularly strong if there remains great uncertainty after the information release.

Our analyses for the earnings announcement sample and the 10-K/10-Q filing sample show that while the volatility skews over each of the Base and Pre windows have predictive ability for the abnormal returns around the information event, the predictive ability for the Base window is subsumed by the inclusion of the Pre window skew. The option skew over the Pre window relative to earnings announcements also predicts subsequent drift returns. Taken together, these results are consistent with the information leakage hypothesis, suggesting information leakage to option traders prior to these scheduled information events.

These analyses also yield another interesting finding that while the pre-event volatility skews predict earnings surprises at the earnings announcements (consistent with Xing et al. [2010]), they do not predict accruals at the 10-K/10-Q filings. This finding suggests that option market participants do not have superior access to, or do not make a special effort in collecting, accruals-related information.

In our analyses for the superior ability hypothesis with the earnings announcement sample and the 10-K/10-Q filing sample, we find that the post-event volatility skews generally have no predictive ability for the subsequent drift returns beyond the Pre and Base skews. In further analyses, we find that while the implied volatility of at-the-money call options, a proxy for the level of uncertainty, generally decreases after the earnings announcements, the decrease is of significantly lower magnitude for the most negative news than for the most positive news, suggesting that uncertainty resolves to a lesser degree for firms with the most negative news. To

the extent that option traders' superior ability is more likely to manifest when uncertainty remains high, we hypothesize and find that Post skew is indeed significantly associated with future returns for firms with the most negative news but not for those with the most positive news. While we do not find that the uncertainty decreases more significantly for firms with different levels of accruals around the filing of 10-K/10-Q forms, we do find significant predictive ability of Post skew for firms with highest accruals.

Earnings announcements and 10-K/10-Q filings are unique types of corporate information events because they are usually pre-scheduled and hence are highly anticipated and carefully scrutinized by investors. It is possible that option traders' relative information advantage and relative ability to process information with respect to equity traders may differ for other non-scheduled and less scrutinized events. To test for this possibility, we employ the Key Developments database compiled by Capital IQ. This database covers mostly unscheduled corporate information events such as SEC inquiries, expansions, reorganizations, client announcements, corporate guidance, dividends, M&A transactions, executive/board changes, litigations, labor relations, product announcements, and strategic alliances.[4]

For the information leakage hypothesis with the Key Developments sample, we find that only Pre skew, which is skew immediately prior to the corporate information events, is significantly and negatively correlated with event returns. Base skew has no significant association with event returns. Unlike the results with the earnings announcement sample, skews over neither Pre nor Base window predict drift returns starting immediately after the Key Developments events. These results suggest that while there is some information leakage for

[4] We omitted from the Key Developments database all announcements of earnings or sales, as well as announcements of future conference calls.

both types of information events, the information advantage of option traders is greater for earnings announcements than other non-scheduled corporate public information events.

For the superior ability hypothesis, we find that the Post skew after the Key Developments events are significantly and negatively correlated with the subsequent drift returns. These results, in contrast to the results of the earnings announcements and the 10-K/10-Q filings, suggest that option traders' superior ability to process and interpret public information relative to equity traders is stronger for non-schedule corporate information events, as this set of information events is often less anticipated, less structured, and more difficult to interpret. Consistent with the earnings announcement sample, we also find that the predictive ability of the Post skew is stronger for firms experiencing the most negative excess returns around the Key Developments events.

In our final analyses, we examine a trading strategy that utilizes the predictive ability of volatility skews in combination with earnings surprises. Consistent with Xing et al. [2010], we show that a trading strategy that focuses on volatility skews generates significant abnormal calendar-time monthly returns. However, a trading strategy that utilizes both the PEAD (post-earnings announcement drift based on earnings surprises) and the option skew information yields significantly higher abnormal returns. This strategy assumes that an investor follows a PEAD-based strategy, but closes (or does not enter) a short position if the volatility skew at month-end (portfolio construction date) is at the bottom quartile, and closes (or does not enter) a long position if the volatility skew is in the top quartile at month-end. The abnormal return is about 1.3% monthly in univariate test, and about 0.99% monthly as captured by the intercept in the Fama-French (FF) five-factor model, compared to 1.0% monthly and FF intercept of 0.62%

respectively on the PEAD strategy alone. These results suggest that it is preferable to combine volatility skew information with information on firms' earnings surprises.

Our research contributes to the literature in several important ways. First, while prior studies provide evidence that option skews or activities in the option market predict future abnormal returns (e.g., Van Buskirk [2009], Truong [2010], Xing et al. [2010]), they do not specifically examine the reasons for such predictive ability. We provide evidence supporting both the information leakage hypothesis and the superior ability hypothesis for the predictive ability of the option skews. However, there is some evidence that the information leakage is greater for scheduled information events than for non-scheduled events, while the superior ability for processing information is more evident for non-scheduled events. In particular, the superior ability of the option traders to process public information and hence predict post-event returns is largely driven by cases where uncertainty remains high after the event. These results help us understand the differences between option traders and equity traders and how each of the two types of capital market participants obtains and processes information.

Second, this study has implications for equity investors. In spite of their possible information disadvantage or inferior ability to process public information relative to option traders as our evidence suggests, our results show that equity investors can use the information on volatility skews from the option market to predict returns subsequent to various corporate information events, which should improve market efficiency. In particular, our trading strategy analyses suggest that it is preferable to combine signals from both corporate fundamentals and option market. Finally, our results also have implications for regulators, who seek to preserve a "fair" and efficient capital market. Our results suggest possible information leakage to option

traders prior to public information events, leading to "unfair" information advantage to select capital market participants.

The remainder of the study proceeds as follows. Section 2 reviews related literature and describes our data and variable measures. Sections 3 and 4 present results based on the earnings announcement sample and the 10-K/10-Q filing sample respectively, and Section 5 presents results based on the Key Developments sample. Section 6 reports the results of trading strategy analyses. We conclude in Section 7.

2. Literature Review and Data

2.1 LITERATURE REVIEW

Option skews have been shown to predict returns in the stock market at both the index level and the firm level. For example, Bates [1991] shows that out-of-the-money index puts became unusually expensive relative to at-the-money calls in the year leading up to the 1987 stock market crash. Similarly, Doran et al. [2007] show that the index-level implied volatility distributions have information about market crashes. At the firm level, Xing et al. [2010] document that the implied volatility skew has significant cross-sectional predictive power for future equity returns. This predictability persists for at least six months, and firms with the steepest volatility smirks are those experiencing the worst earnings shocks in the following quarter. Van Buskirk [2009] finds that high skew is a significant predictor of whether firms will experience a significant drop in returns around earnings announcements, but this predictive ability does not extend to specific non-earnings disclosure events such as management earnings forecasts or dividend declarations.

Other studies have shown that other characteristics of the option market have implications for the equity market. For example, Ang et al. [2010] find that option volatilities have significant predictive power for the cross section of stock returns and vice versa, suggesting informed trading occurring in both asset markets. Focusing on trading volumes in the option market, Truong [2010] finds that stock prices of firms with a high level of options trading volume reflect future earnings information more and earlier than those of firms with a low level of options trading volume. Doran et al. [2010] show that information in option markets leads analyst recommendation changes as well. Taking option traders' predictive ability for equity returns as given, Billings and Jennings [2010] examine whether the anticipated information content of earnings announcements varies with various cross-sectional and time series characteristics that are expected to affect the strength of the returns-earnings association.

While these studies generally conclude that the option market leads the equity market, they do not investigate the underlying reasons for this pattern. In this study, we examine option volatility skews around major corporate information events and explore two non-exclusive hypotheses for the predictive ability of option skews: information leakage hypothesis and superior ability hypothesis. We also provide evidence on the incremental significance of using skews beyond the post-earnings-announcement drift to generate abnormal returns.

2.2 DATA AND VARIABLE MEASURES

Our data on implied volatility of options are obtained from the OptionMetrics historical option prices database. Our sample periods are from 1996 to October 2009 for the earnings announcement and 10-K/10-Q filing analyses and from 2002 to 2009 for the Key Developments events analyses. We identify for each day all options of a firm with an expiration date that is

between 10 and 60 days away. We include only options with positive open interest. We then select all the call options that have a delta in the range [0.4, 0.7], and choose the one closest to 0.5. Its implied volatility is the at-the-money (ATM) implied volatility. We then select all the put options that have a delta in the range [-0.15, -0.45], and choose the one closest to -0.3. Its implied volatility is the out-of-the-money (OOTM) implied volatility. The volatility skew is the implied volatility of the OOTM put option minus the implied volatility of the ATM call option.[5] The intuition of our measure of implied volatility skew is that when market participants expect a future negative event they will hedge by holding out-of-the-money puts. Thus, demand for these puts will increase, raising their prices and increasing the associated implied volatility relative to that of the at-the-money calls.

We have 67,947 quarterly observations for the earnings announcement sample, 59,265 observations for the 10-K/10-Q filing sample, and 224,347 observations for the Key Developments sample with both excess stock return and volatility skew information. For each of the information events that we examine, we first identify the event date (day 0). Specifically, our earnings announcement dates are obtained from Compustat, 10-K/10-K filing dates are obtained from S&P Filing Dates Database, and other corporate information event dates are obtained from the Key Developments data compiled by Capital IQ. We then measure the average skew over three windows: days [-50, -11] (base window, SKEWBASE), days [-10, -2] (pre-event window, SKEWPRE), and days [+1, +5] (post-event window, SKEWPOST). Our return information is obtained from CRSP. We attempt to predict announcement returns in [-1, +1] (event window, XRET), as well as drift returns either in [+2, 90] (first drift window, DRIFT1) or [+6, 90]

[5] If the implied volatility skew was negative, we set it to zero. This occurred in less than 25% of the observations, most likely due to the OOTM put option having a higher delta than the ATM call. We also used the bounds of [0.4, 0.6] for the ATM call and [-0.2, -0.4] for the OOTM put, with fewer than 10% of the observations having negative skew. The empirical results were stronger than those reported in the text, but with fewer observations.

(second drift window, DRIFT2). The second drift window starts at day +6 to allow reasonable time for the investors to process the information in the public announcements. We measure earnings surprises (SURP) as the actual earnings per share from IBES minus the mean analyst EPS forecast in the 90-day period prior to the earnings announcement[6], scaled by stock price at the prior month-end.[7] Figure 1 summarizes the timeline of our measurement windows.

Within each quarter we rank earnings surprise (SURP) and our volatility skew variables (SKEWBASE, SKEWPRE, and SKEWPOST) into quartiles. We assign the values -0.5, 0, 0, +0.5 to each of the four quartiles, respectively. The new ranked variables are labeled as RSUPR, RSKEWBASE, RSKEWPRE, and RSKEWPOST, respectively. These ranked variables capture the highest and lowest quartiles of the corresponding variables.

3. Empirical Results with the Earnings Announcement Sample

3.1 DESCRIPTIVE STATISTICS

Panel A of Table 1 presents descriptive statistics of our key variables for the earnings announcement sample. The average volatility skews over the base window, the pre-event window, and the post-event window are 0.039, 0.044, and 0.040 respectively. The corresponding medians are 0.028, 0.029, and 0.026 respectively. The volatility skew increases from the base window to the pre-event window, and then decreases once the earnings are announced. We also directly measure the average implied volatility of the ATM call option in the pre-event (IVOLPRE) and post-event (IVOLPOST) windows. Consistent with the descriptive statistics for the volatility skews, the average implied volatility decreases from 0.534 of the pre-

[6] We use only the most recent forecast for each analyst to calculate the mean.

[7] If analyst forecasts are unavailable, we use quarterly earnings-quarterly earnings 4 quarters ago, scaled by market value at the prior quarter-end. Since these are large firms which have options, the very vast majority have IBES forecasts.

announcement period to 0.513 of the post-announcement period. The median implied volatility also shows similar patterns.

The average earnings surprise is 0.04% of stock prices and the median is 0.03%. The average accruals, which is measured as the earnings minus operating cash flows disclosed in the preliminary earnings release, deflated by total assets at the beginning of the quarter, is -1.67% and the median is -1.45%. The average excess returns[8] around the earnings announcements are 0.21% and the median is 0.17%. The post-earnings announcement drift has a mean of -0.17% and a median of -1.12%. The alternative drift (which starts at day 6 relative to the earnings announcement) measure has similar means and medians.

Panel B presents the correlation matrix. Consistent with prior evidence of the post-earnings announcement drift (e.g., Ball and Brown [1968]), the earnings announcement short window excess return, XRET is significantly and positively correlated with the two drift variables. Also consistent with prior research, XRET is significantly positively correlated with the ranked earnings surprise (RSURP). XRET is significantly negatively correlated with the accruals information (RACC). XRET is significantly negatively correlated with the volatility skews over the base window as well as the pre-event window. This evidence is consistent with our prediction that the volatility skews predict negative returns around the earnings announcements, which has also been shown in Van Buskirk [2009]. Accruals information is significantly negatively correlated with the drift returns, consistent with Sloan [1996]. Finally, the skew variables over the base window, the pre-event window, and the post-event window are all significantly negatively correlated with the two drift variables (DRIFT1, DRFIT2), suggesting

[8] All excess returns in this study are buy-and-hold returns over the designated window minus a buy-and-hold return on a portfolio of stocks with similar size (market value of equity, 2 groups), book to market ratio (3 groups) and 12-month momentum (3 groups), similar to Daniel, Grinblatt, Titman, and Wermers [1997].

that the volatility skews are also able to predict long-term stock returns subsequent to the earnings announcements.

3.2 THE PREDICTIVE ABILITY OF PRE-ANNOUNCEMENT OPTION SKEWS

We present our regression analyses of the predictive ability of pre-announcement volatility skews in Table 2. We run our regressions by quarter and report Fama-MacBeth estimates based on these quarterly regressions. In Panel A, we first examine how the skew variables predict earnings surprises (SURP). The results show that both RSKEWBASE and RSKEWPRE have significant predictive ability for the earnings surprises, whether they are the sole predictor in the model or they are both included in the same regression.[9] In general, the coefficient on RSKEWPRE is smaller in magnitude than that on RSKEWBASE.

Panel B reports the predictive ability of our skew variables for XRET, the excess returns in the short window around the earnings announcements. When we use RSKEWBASE and RSKEWPRE to predict XRET separately, the coefficients on each of these skew variables are significantly negative, although the coefficient on RSKEWPRE (-0.0062) has a considerably higher magnitude than that on RSKEWBASE (-0.0040). When we include both skew variables in one regression, RSKEWBASE actually becomes insignificant while RSKEWPRE remains highly significant (coefficient = -0.0056), suggesting the predictive ability of the skew immediately prior to the earnings announcements dominates that of the earlier skew. Finally, we also include the rank variable of the earnings announcements (RSURP). It should be noted that

[9] It is intuitive to assume that the implied volatility skew is correlated, among other things, with the firm's underlying earnings volatility (Van Buskirk [2009]). Thus, it makes sense to use a measure of "abnormal" skews in the analysis, such as a change variable or a scaled variable, in order to control for underlying firm characteristic. This is accomplished in our study by using both the Base and Pre skew in predicting earnings surprises and future returns. We also used the volatility skew scaled by the implied volatility of ATM call options, and obtain results that are qualitatively similar to those in the text.

the earnings surprise is not known prior to the earnings announcements. We include it only to examine whether the option skews have predictive ability beyond what can be explained by the earnings surprises. We continue to find a significantly negative coefficient on RSKEWPRE and an insignificant coefficient on RSKEWBASE.

In addition to predicting event returns, we also examine how the pre-announcement option skews predict long-term drift returns subsequent to the earnings announcements (DRIFT1). The results are presented in Panel C of Table 2. We first regress DRIFT1 on the rank of the earnings surprises. Inconsistent with prior research, the coefficient on RSURP is insignificant. One possible explanation for this inconsistency is that our sample firms are mostly large firms, as firms with option trading activities are more likely to be large. Prior research has shown that the post-earnings announcement drift is largely non-existent for larger firms (Foster et al. [1984]). Once we add option volatility skew variables, the results show that option skews over the pre-event window (RSKEWPRE) significantly predict the drift returns. This predictive ability is not subsumed by the inclusion of skews over the base window, returns over the event window, or accruals information if provided along with the earnings announcements.

Overall, Table 2 shows that option skew immediately prior to the earnings announcements has predictive ability for both the event returns and the subsequent drift returns and that its predictive ability dominates that of option skew from a more dated period. These results are consistent with the information leakage explanation for option prices leading stock prices.

3.3 THE PREDICTIVE ABILITY OF POST-ANNOUNCEMENT OPTION SKEWS

We next examine the predictive ability of option skews after the earnings announcements (RSKEWPOST) for subsequent drift returns (DRIFT2). Since this analysis focuses on the option skews after the information becomes public, evidence of predictive ability is more likely to reflect the superiority of option traders relative to equity traders in assessing the tail risk (i.e., the existence, likelihood, and magnitude of negative future events) based on public information.

We report the results in Table 3. In contrast to the results with option skews prior to the earnings announcements in Table 2, in general, RSKEWPOST has no predictive ability for subsequent drift returns in a number of model specifications. In these specifications, the few variables that have predictive ability for DRIFT2 include pre-event skews (RSKEWPRE), event excess returns (XRET), and accounting accruals information available at the earnings announcements (RACC).

One possible explanation for the lack of predictive ability of RSKEWPOST for subsequent excess returns is that given the high visibility of the earnings announcements, equity traders pay high scrutiny to the earnings announcements and they spend rich resources in processing and analyzing the information therein. Thus, option traders have limited superiority than equity traders on average. However, in cases where uncertainty remains relatively high after the announcements, option traders may still have superior ability in processing and interpreting the information than equity traders.

To test for this prediction, we analyze the differential predictive ability of RSKEWPOST for portfolios with different uncertainty levels. Hong, Lim, and Stein [2000] show that equity investors have greater difficulty in processing bad news than good news and that negative information only diffuses gradually among the investing public. Accordingly, we classify our

sample into three equal-sized portfolios based on the earnings surprises (SURP) and examine the predictive ability of RSKEWPOST for each of the portfolios.

In Panel B of Table 3, we examine the average changes of the implied volatilities of at-the-money call options around the earnings announcements for each of the three portfolios. We use the implied volatility of ATM call options to measure the general uncertainty level of a firm. Consistent with expectations, the average change in the implied volatility for the full sample is negative (-0.032). More importantly, there is a monotonic pattern across the three portfolios. For the portfolio with the lowest earnings surprises (the most negative), the average surprise is -0.008 and the average change in implied volatility is -0.024. In contrast, for the portfolio with the highest earnings surprises, the average surprise is 0.007 and the average volatility change is substantially lower at -0.038. The difference in the changes of the implied volatilities between these two portfolios is significant at less than 0.01 level. These results suggest that the uncertainty resolves to a lesser extent for firms experiencing the most negative news than for firms experiencing the most positive news, consistent with Hong et al. [2000].

In Panel C we analyze the predictive ability of RSKEWPOST for each of these three portfolios. Consistent with expectations (but in contrast to the average results in Panel A), for the portfolio with the lowest earnings surprises, RSKEWPOST is significantly and negatively correlated with DRIFT2 at the 0.01 or 0.05 levels, depending on model specifications.[10] This suggests that option traders do exhibit superior ability in assessing tail risks for this particular group of firms. On the other hand, the RSKEWPOST continue to have no predictive ability for the other two earnings surprise portfolios.

[10] We do not include the earnings surprise variable because it is our conditioning variable. We do not include accrual variable because including it will significantly decrease our sample size for each portfolio.

Taken together, the results in Section 3 suggest that for the earnings announcement sample, there is robust evidence of information leakage in the option market. While on average option traders show limited superior ability to interpret the earnings announcement information, their superiority is evident when the earnings announcements convey negative news which is associated with a relatively high remaining uncertainty after the earnings announcements.

4. Empirical Results with the 10-K/10-Q Filing Sample

4.1 DESCRIPTIVE STATISTICS

We also examine option volatility skews around the filings of 10-K/10-Q forms. In Panel A of Table 4 we present descriptive statistics of this sample. The average volatility skews increase from 0.040 to 0.042 before the filings and decrease to 0.038 after the filings, although the magnitude of the change is smaller than that around the earnings announcements. The change in implied volatility around the filings, however, is negligible. The mean (median) earnings surprise is -0.01 (0.04%), and the mean (median) accruals is -1.43% (-1.18%). We also report descriptive statistics of the returns over various windows around the filings.

Panel B reports the correlation matrix. The excess returns around the filing of periodic financial reports (XRET) are positively correlated with ranks of earnings surprises (RSURP) and negatively correlated with ranks of accruals (RACC). The event returns are generally negatively correlated with subsequent drift returns, although the magnitude of the correlation is small. Accruals are significantly negatively correlated with subsequent drift returns (DRIFT1 and DRIFT2) as well, consistent with Sloan [1996]. XRET is negatively correlated with the volatility skews over the base window and the pre-event window, again consistent with prediction that the volatility skews predict negative event returns. Finally, in general, the volatility skews over the

base, pre-event, or post-event windows are generally insignificantly correlated with the two drift returns.

4.2 THE PREDICTIVE ABILITY OF PRE-FILING OPTION SKEWS

Table 5 presents our regression analyses of the predictive ability of pre-filing volatility skews. As in Section 3, we run our regressions by quarter and report Fama-MacBeth [1973] estimates. In Panel A, we first examine how the skew variables predict accruals. In general, the volatility skews in either the base window or the pre-event window have no predictive ability for accruals, in contrast to the results in Table 2 which show significant predictive ability for earnings surprises. This result suggests that option market participants do not have superior access to, or do not make a special effort in collecting, accruals-related information.

In Panel B we report regression results on the predictive ability of pre-event skews for event excess returns. We present various model specifications that include different combinations of skews variables and fundamental variables. In general, volatility skew over the base window does not predict event returns, while that over the pre-event window does. This result suggests that in the periods leading up to the arrival of significant information from scheduled events, the option market potentially has access to information that is not available to equity market participants, consistent with information leakage. Earnings surprises generally do not predict event returns, while accruals are significantly (at 0.10 level) and negatively correlated with the event excess returns.

We continue to examine the predictive ability of the pre-event volatility skews for long-term drift returns subsequent to the filings of 10-K/10-Q forms (DRIFT1) in Panel C of Table 5. Consistent with evidence in Table 4 Panel B, these skews generally have no predictive ability for

the post-event drift returns. The coefficients on accruals, however, are always significantly negative.

4.3 THE PREDICTIVE ABILITY OF POST-FILING OPTION SKEWS

As with the earnings announcement sample, we next examine the predictive ability of option skews after the filings of 10-K/10-Q forms (RSKEWPOST) for subsequent drift returns (DRIFT2). The results are presented in Panel A of Table 6. Again consistent with the results for the earnings announcement sample, RSKEWPOST generally has no predictive ability for DRIFT2 across all specifications. As in Table 5, the only variable that is consistently significant is RACC, suggesting firms with higher accruals generally have significantly lower excess returns subsequently, consistent with Sloan [1996].

In Panels B and C of Table 6, we classify our sample into three equal-sized portfolios based on the magnitude of the accruals and perform sub-sample analyses. Panel B reports descriptive statistics on accruals and implied volatilities for each of the three portfolios. The implied volatilities are higher for portfolios with extreme accruals. While they decrease after the filing of the 10-K/10-Q forms in general, the decreases are small in magnitude, compared to those reported in Panel B of Table 3 for the earnings announcement sample. Furthermore, the difference between the portfolio with lowest accruals and that with highest accruals is not statistically significant.

Panel C reports the regression results for the each of the three portfolios. While the volatility skews over the base, pre-event, and post-event windows continue to have no predictive ability for DRIFT2 for the portfolios with low and medium accruals, for the portfolio with high accruals, the coefficient on RSKEWPOST is significantly negative, suggesting that the post-

event volatility skews have predictive ability for subsequent excess returns only for firms with high accruals. To the extent that firms with high accruals continue to have high uncertainty after the filing of the financial statements, this result is consistent with the result in Section 3 that option traders tend to exhibit superior ability to predict drift returns for firms with high uncertainty after the arrival of information.

To summarize, Section 4 presents results that are largely consistent with Section 3, showing that for 10-K/10-Q filings, pre-event skews predict event returns, while post-event skews have insignificant predictive ability for subsequent drift returns with the exception for firms with high accruals. These results are consistent with option market participants having information advantage before the filing of periodic financial reports relative to the equity market participants, but limited superior ability to process information in these financial reports.

5. Empirical Results with the Key Developments Sample

5.1 DESCRIPTIVE STATISTICS

Earnings announcements and 10-K/10-Q filings are usually pre-scheduled and highly anticipated by investors. Thus, it is possible that option traders are more likely to seek out and retrieve information before pre-scheduled announcements, relative to other non-scheduled events. On the other hand, because of their high visibility and intense information content, earnings announcements often receive considerable attention from equity market participants. Thus, it is also possible that option traders have limited advantage in interpreting the information in earnings announcements or periodic financial reports than other less anticipated and more difficult-to-interpret information events, such as executive turnovers or mergers and acquisitions.

It then becomes interesting to examine the predictive ability of option volatility skews around these non-scheduled information events.

Accordingly, we examine the option skews around the corporate information events covered by the Key Developments database compiled by Capital IQ. This database covers mostly unscheduled corporate information events such as SEC inquiries, expansions, reorganizations, client announcements, corporate guidance, dividends, M&A transactions, executive/board changes, litigations, labor relations, product announcements, and strategic alliances, with the largest number of announcements related to firms' products and customers.

We report in Panel A of Table 7 descriptive statistics of the excess returns, drift returns, and option volatility skews around the Key Developments events. The option volatility skews have a mean of 0.036, 0.037 and 0.037 respectively over the base window, pre-event window, and the post-event window respectively. The medians are 0.026, 0.024, and 0.024 respectively. On average, the event excess returns are -0.04% and the medians are -0.05%. The first drift returns have a mean of -0.32% and a median of -0.88%, while the second drift returns have a mean of -0.29% and a median of -0.81%%.

In comparison to the descriptive statistics in Table 1 for the option skews around the earnings announcements, there are a few different patterns. First, the option skews around the Key Developments events are generally smaller than the earnings announcements. Second, the option skews generally stay flat around the Key Developments events. In contrast, the option skews increase considerably before the earnings announcements, and drop considerably after the announcements. This is consistent with market participants who attempt to uncover new information ahead of the scheduled preliminary earnings announcement, but less so for the unscheduled announcements in the Key Developments database.

Panel B of Table 7 reports the correlation matrix of key variables used in this section. Among the return variables, event returns (XRET) are negatively correlated with drift returns (DRIFT1 or DRIFT2), although the magnitude of the correlations are very low (about 1.7%). Both RSKEWPRE and RSKEWBASE are negatively correlated with the return variables. On the other hand, RSKEWPOST is positively correlated with event returns and negatively correlated with drift returns. The skew variables at the three different points of time are all positively correlated with each other.

5.2 THE PREDICTIVE ABILITY OF PRE-EVENT OPTION SKEWS

Table 8 reports regression analyses of the predictive ability of volatility skews prior to the Key Developments events. Panel A examines how skews prior to the events predict the event returns (XRET). As shown in the panel, only the skews immediately prior to the event (i.e., RSKEWPRE) predicts the event returns and the significance level is only at the 0.10, while the skews over the base window (i.e., RSKEWBASE) has no predictive ability for the event returns.

Panel B of Table 8 focuses on the predictive ability of skews prior to the events for long-term drift returns measured immediately after the announcement (DRIFT1). In contrast to the results for earnings announcements reported in Panel C of Table 2, neither of the two skews prior to the events predict the drift returns. Further, the event return itself also has no predictive ability for the subsequent drift returns, suggesting little price continuation after the events covered by the Key Developments data. This implies that contrary to the typical drift in returns after earnings announcements that may be caused by underreaction to the serial autocorrelation of earnings surprises (e.g., Bernard and Thomas [1990]), for other events reported in the Key Developments database there is no such serial autocorrelation.

Overall, the results in Table 8 provide some support for the information leakage hypothesis with the Key Developments sample. However, in general, the results are not as strong as those for the earnings announcement sample presented in Table 2. In particular, the option volatility skews prior to the events only predict the event returns but not long-term returns. This difference in strength of the results suggest that option investors are more likely to seek out private information prior to the earnings announcements than other unscheduled, less anticipated corporate information events.

5.3 THE PREDICTIVE ABILITY OF POST-EVENT OPTION SKEWS

Table 9 examines how post-event option skews (RSKEWPOST) predict the second drift measure which starts from day 6 after the event (DRIFT2). Panel A is based on the full sample. The results show that the option skews post the Key Developments events have significant predictive ability for this drift, while the two skews prior to the information events (over the pre-event and the base window, respectively) have no predictive ability for the drift. This result is different from the analyses for the earnings announcement sample reported in Table 3 or the 10-K/10-Q filing sample reported in Table 6, where post-event skews have no predictive ability for subsequent drift returns. We interpret this result as suggesting that on average, option traders have superior ability to process information in the Key Developments events relative to the equity traders but little superior ability to process information in the earnings announcements. One possible reason is equity investors pay significant attention to the highly visible and information intensive earnings announcements or periodic filings and hence are better able to process and interpret the information therein than the information in other less-anticipated and less-structured events such as those covered in the Key Developments database.

Finally, as with the earnings announcement sample, we also classify our Key Developments sample into three equal-sized portfolios based on the presumed direction of the news. As we do not have a measure of surprises for these Key Developments events, we use the excess returns around the event window to form our portfolios. In Panel B of Table 9, we report the mean changes in implied volatilities of at-the-money call options for each of the portfolios. Consistent with the earnings announcement results, on average, the implied volatilities decrease after the information events, although the magnitude (-0.005) is substantially smaller than the average change in implied volatilities around the earnings announcements (-0.032). More interestingly, for firms experiencing the most negative excess returns around the event, their implied volatilities actually increase by 0.008. In contrast, for the other two portfolios, the average implied volatilities decrease by 0.003 and 0.019 respectively. The difference in the average changes in implied volatilities of ATM call options is statistically significant at the 0.01 levels between the portfolios with the highest and the lowest event excess returns. These descriptive statistics again confirm the prediction that uncertainty remains relatively high after bad news than after good news.

Panel C of Table 9 reports regression analyses of the predictive ability of the RSKEWPOST for the subsequent drift returns (DRIFT2) for each of the three portfolios. Again consistent with the results in Table 3 for the earnings announcement sample, the coefficient on RSKEWPOST is negative and statistically significant for the portfolio with the most negative excess returns around the event but insignificant for the portfolio with the most positive excess returns. The coefficient is also significantly negative for the portfolio with medium event excess returns. The skews over the pre-event and the base window are generally insignificant in predicting DRIFT2 when RSKEWPOST is included in the model.

To summarize, in this sub-section we present results supporting the superior ability hypothesis for the option market relative to the equity market with the Key Developments sample. We further find that the predictive ability of post-event option skews for subsequent drift is primarily driven by firms experiencing low excess returns around the event, consistent with option traders having the most advantage in terms of information processing when uncertainty remains relatively high.

6. Trading Strategy Analyses: Calendar Time Returns

Finally, we examine whether equity market participants can earn excess returns from trading strategies that utilize signals from the option market about volatility skews. While Xing et al. [2010] show that the volatility skew has significant cross-sectional predictive power for future equity returns and can earn significant excess calendar time returns, it is not clear from their study whether the predictive power is additive to known anomalies, particularly the post-earnings announcement drift ("PEAD") anomaly. The PEAD anomaly is relevant because Xing et al. [2001] suggest that the predictive ability of the option skews for subsequent returns is due to the predictive ability for future earnings surprises.

We first replicate the PEAD strategy with all observations with earnings surprises and returns information. Specifically, at the end of each calendar month, we rank all the earnings surprises that occur within the last three months. We then hold long (short) positions in the top (bottom) decile. We also replicate the analyses in Xing et al. [2010] by constructing a trading strategy ("SKEW") that uses volatility skew information alone. At the end of each calendar month, we rank firms with option volatility skew data into quartiles and hold long (short) positions in the top (bottom) quartile. Finally, we employ a trading strategy ("COMBINED" that

combines information on both option skews and earnings surprises. This strategy is essentially the same as the PEAD strategy. However, we do not hold a long (short) position if a firm is in the top (bottom) skew quartile. For all these trading strategies, the holding period is also one month, after which the portfolio is rebalanced.

The results are presented in Table 10. Panel A reports univariate test results. The PEAD strategy on average earns a monthly excess return of about 1%, consistent with Ball and Brown [1968] and Bernard and Thomas [1990]. On the other hand, the SKEW strategy on average earns a monthly excess return of about 1.2%, consistent with Xing et al. [2010] that a trading strategy that focuses on volatility skews generates significant abnormal calendar-time monthly returns. The COMBINED strategy that utilizes information on both the earnings surprises and signals from the option market earns an average monthly excess return of about 1.3%. The excess returns from the COMBINED strategy are significantly higher than those from the PEAD strategy. This suggests that the SKEW strategy is additive to the PEAD strategy and that utilizing information on option volatility skews increases the excess returns one can earn from the PEAD strategy.

Panel B reports the Fama-French five-factor regression analyses. The dependent variable is average monthly raw returns from the corresponding trading strategy minus the risk free rate. Information on the five factors as well as the risk free rate is obtained from Kenneth French's website. The results are largely consistent with those reported in Panel A. Specifically, the alphas reported for the three strategies are 0.62%, 0.83%, and 0.99% respectively. Again, the COMBINED trading strategy yields the highest risk-adjusted returns among the three strategies, suggesting that it is preferable to combine information in volatility skews with information on firms' earnings surprises.

7. Conclusions

Recent evidence has shown that the option volatility skew can be used to predict future equity returns. In this study, we investigate the two primary reasons for this predictability – information leakage or superior ability of option traders to assess the tail risk. Using option volatility skew around earnings announcements and other corporate information events, we present evidence that supports both explanations. Specifically, we find that the predictive ability of option skews increases in the days immediately prior to the information events, suggesting information leakage. After the information is released and hence there is less likelihood of private information, we find the option skew continues to predict long-term drift returns, consistent with option traders having superior ability to process public information relative to equity investors.

While our results support both explanations for option prices leading stock prices in general, we find stronger evidence of information leakage prior to the earnings announcements and 10-K/10-Q filings than other non-scheduled corporate information events, and stronger evidence of superior ability to process information in the non-scheduled corporate information events than information in earnings announcements or periodic financial filings. For both earnings announcements and non-scheduled information events, we find higher significant predictive ability of the post-event option skews when firms experience the most negative news and hence the level of uncertainty remains high. Finally, we show that the excess returns one can earn from trading strategies that utilize the volatility skew information is additive to the excess returns from the PEAD strategy. These results help us understand the differences between option traders and equity traders and how each of the two types of capital market participants obtains and processes information.

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APPENDIX A
Variable Definitions

SKEW	Implied volatility of the out-of-the-money (OOTM) put option minus the implied volatility of the at-the-money ATM call option. We select all call options that have a delta in the range [0.4, 0.7], and choose the one closest to 0.5. Its implied volatility is the ATM implied volatility. We then select all put options that have a delta in the range [-0.15, -0.45], and choose the one closest to -0.3. Its implied volatility is the OOTM implied volatility.
SKEWBASE	Average of SKEW over days [-50, -11] relative to the event day.
SKEWPRE	Average of SKEW over days [-10, -2] relative to the event day.
SKEWPOST	Average of SKEW over days [+1, +5] relative to the event day.
IVOLPRE	Average implied volatility of the ATM call option over days [-10, -2] relative to the event day.
IVOLPOST	Average implied volatility of the ATM call option over days [+1, +5] relative to the event day.
SURP	Earnings per share from IBES minus the mean analyst EPS forecast in the 90-day period prior to the earnings announcement, scaled by stock price at the prior month-end.
ACC	Earnings minus operating cash flows disclosed in the preliminary earnings release (for the earnings announcement sample analyses) or 10-K/10-Q filing (for the filing sample analyses), deflated by average total assets during the quarter.
XRET	Excess return over days [-1, +1] relative to the event day. Excess returns are buy and hold returns on the security minus a buy and hold return on a portfolio of securities matched by size (2 groups), Book/Market (3 groups) and momentum (3 groups).
DRIFT1	Excess return over days [+2, +90] relative to the event day.
DRIFT2	Excess return over days [+6, +90] relative to the event day.

FIGURE 1: Timeline of Events and Measurement Windows

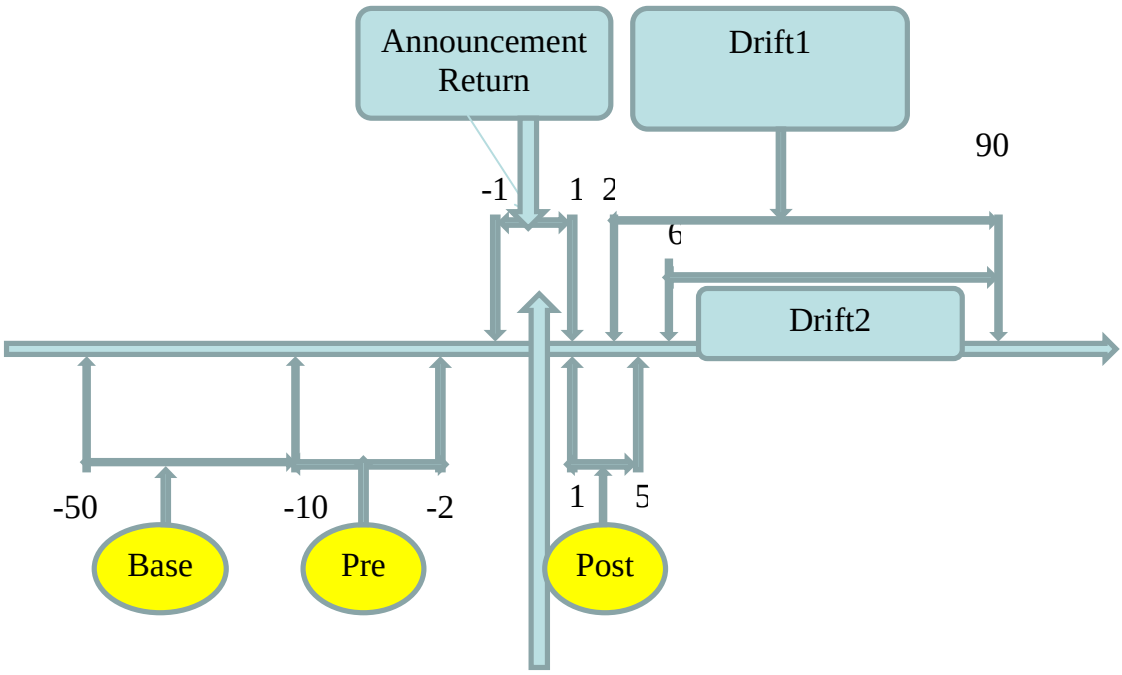

TABLE 1
Description of the Earnings Announcement Sample

Panel A: Descriptive Statistics

Variable	N	Mean	10th	25th	Median	75th	90th
SKEWBASE	65276	0.039	0.008	0.016	0.028	0.048	0.077
SKEWPRE	67947	0.044	0.002	0.012	0.029	0.056	0.097
SKEWPOST	55963	0.040	0.001	0.011	0.026	0.050	0.087
IVOLPRE	67947	0.534	0.268	0.354	0.482	0.662	0.866
IVOLPOST	55963	0.513	0.262	0.341	0.459	0.632	0.834
SURP	67947	0.000	-0.004	0.000	0.000	0.002	0.005
ACC	14900	-0.017	-0.053	-0.030	-0.015	0.000	0.018
XRET	67947	0.002	-0.099	-0.042	0.002	0.047	0.104
DRIFT1	67947	-0.002	-0.272	-0.129	-0.011	0.107	0.252
DRIFT2	67916	-0.001	-0.251	-0.120	-0.010	0.100	0.238

Panel B: Correlation Matrix

Variable	XRET	DRIFT1	DRIFT2	RSURP	RACC	RSKEWPRE	RSKEWBASE
DRIFT1	0.032						
DRIFT2	0.022	0.887					
RSURP	0.162	0.010	0.003 (0.372)				
RACC	-0.029	-0.047	-0.042	0.061			
RSKEWPRE	-0.021	-0.016	-0.016	-0.023	-0.012 (0.147)		
RSKEWBASE	-0.014	-0.014	-0.011	-0.028	-0.014 (0.095)	0.349	
RSKEWPOST	0.023	-0.008 (0.066)	-0.012	-0.015	-0.020 (0.025)	0.245	0.251

See Appendix A for variable definitions. In Panel B, all correlations are significant at 0.01 levels unless the p-values are specifically indicated in the parentheses. Variables indicated by R are the underlying variables, sorted quarterly into four groups, with the ranks of -0.5 assigned to the lowest quartile, 0 to the middle quartiles and +0.5 to the top quartile.

TABLE 2
Predictive Ability of Option Skews before the Earnings Announcements

Panel A: Predicting Earnings Surprises (Dep Var is SURP, N=56)

Variable	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	-0.0002	-0.78	-0.0002	-0.81	-0.0002	-0.80
RSKEWBASE	-0.0014	-2.62***			-0.0011	-2.26**
RSKEWPRE			-0.0012	-2.59**	-0.0008	-1.90*
R^2	0.0028	4.52***	0.0018	6.79***	0.0042	6.22***

Panel B: Predicting Event Returns (Dep Var is XRET, N=56)

Variable	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	0.0025	3.28***	0.0024	3.15***	0.0024	3.25***	0.0022	2.96***
RSKEWBASE	-0.0040	-3.00***			-0.0020	-1.57	-0.0012	-0.98
RSKEWPRE			-0.0062	-5.56***	-0.0056	-5.43***	-0.0048	-5.12***
RSURP							0.0621	17.56***
R^2	0.0015	6.60***	0.0016	5.91***	0.0027	8.96***	0.0307	8.71***

Panel C: Predicting Drift Returns (Dep Var is DRIFT1, N=56)

Variable	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate
Intercept	-0.0015	-0.0015	-0.0014	-0.0016	-0.0034	-0.0042
RSURP	0.0089	0.0080	0.0076	0.0027	0.0039	-0.0066
RSKEWPRE		-0.0122**	-0.0096**	-0.0090**	-0.0269**	-0.0218*
RSKEWBASE			-0.0067	-0.0068	-0.0051	-0.0090
XRET				0.0944***		0.1308***
RACC					-0.0417***	-0.0398***
R^2	0.0029***	0.0057***	0.0080***	0.0137***	0.0703***	0.0864***

This table reports Fama-MacBeth (1973) mean estimates based on quarterly regressions. See Appendix A for variable definitions. Variables indicated by R are the underlying variables, sorted quarterly into four groups, with the ranks of -0.5 assigned to the lowest quartile, 0 to the middle quartiles and +0.5 to the top quartile. The last two columns of Panel C are based on 52 quarterly regressions, because of insufficient number of firms with available net operating cash flow reported in the preliminary earnings announcement. ***, **, and * indicate significance levels of 0.01, 0.05, and 0.10 respectively.

TABLE 3
Predictive Ability of Option Skews after the Earnings Announcements

Panel A: Predicting Drift Returns (Dep Var is DRIFT2, N=56)

Variable	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate
Intercept	-0.0017	-0.0018	-0.0017	-0.0015	-0.0016	-0.0021	-0.0014	-0.0012
RSURP	0.0130*		0.0123	0.0121	0.0117	0.0074	-0.0077	-0.0136
RSKEWPOST		-0.0078	-0.0075		-0.0050	-0.0056	-0.0097	-0.0092
RSKEWPRE				-0.0109**	-0.0094**	-0.0087**	-0.0176	-0.0162
RSKEWBASE					-0.0001	-0.0001	0.0082	0.0091
XRET						0.0837***		0.1418***
RACC							-0.0224**	-0.0207*
R^2	0.0027***	0.0030***	0.0056***	0.0059***	0.0109***	0.0166***	0.0862***	0.1043***

Panel B: Changes in Implied Volatilities around the Earnings Announcements Conditional on Earnings Surprises

Portfolio	N	Mean SURP	Mean IVOLPRE	Mean IVOLPOST	Mean Change
Low SURP	17827	-0.008	0.565	0.541	-0.024
Medium SURP	19660	0	0.497	0.463	-0.033
High SUPR	18476	0.007	0.576	0.538	-0.038
All	55963	0	0.545	0.513	-0.032

Panel C: Predicting Drift Returns conditional on Earnings Surprises (Dep Var is DRIFT2, N=56)

Variable	Estimate	t-stat	Estimate	t-stat
Low SURP Portfolio				
Intercept	-0.0041	-0.74	-0.0010	-0.18
RSKEWPOST	-0.0214	-2.81***	-0.0154	-1.98**
RSKEWBASE			-0.0121	-1.90*
RSKEWPRE			-0.0117	-1.84*
XRET			0.0955	2.66***
R^2	0.0062	5.32***	0.0262	9.83
Medium SURP Portfolio				
Intercept	0.0003	0.07	-0.0008	-0.19
RSKEWPOST	0.0003	0.05	0.0008	0.15
RSKEWBASE			0.0001	0.01
RSKEWPRE			0.0010	0.13
XRET			0.1102	3.45***
R^2	0.0044	5.47***	0.0273	8.59***
High SURP Portfolio				
Intercept	-0.0018	-0.34	-0.0033	-0.65
RSKEWPOST	-0.0002	-0.02	0.0009	0.12
RSKEWBASE			0.0067	1.04
RSKEWPRE			-0.0107	-1.66
XRET			0.0660	1.97**
R^2	0.0061	6.92***	0.0225	9.15

Panel A and Panel C report Fama-MacBeth mean estimates based on 56 quarterly regressions. The dependent variable is DRIFT2. Panel B reports mean changes from IVOLPRE to IVOLPOST around the earnings announcements for three equal-sized portfolios based on earnings surprises (SURP). See Appendix A for variable definitions. Variables indicated by R are the underlying variables, sorted quarterly into four groups, with the ranks of -0.5 assigned to the lowest quartile, 0 to the middle quartiles and +0.5 to the top quartile. ***, **, and * indicate significance levels of 0.01, 0.05, and 0.10 respectively.

TABLE 4
Description of the 10-K/10-Q Filing Sample

Panel A: Descriptive Statistics

Variable	N	Mean	10th	25th	Median	75th	90th
SKEWBASE	57335	0.040	0.009	0.017	0.029	0.049	0.078
SKEWPRE	59265	0.042	0.002	0.012	0.028	0.053	0.092
SKEWPOST	47852	0.038	0.000	0.009	0.024	0.048	0.083
IVOLPRE	59265	0.515	0.264	0.344	0.464	0.635	0.836
IVOLPOST	47852	0.516	0.268	0.347	0.464	0.635	0.832
SURP	59265	-0.000	-0.003	0.000	0.000	0.002	0.005
ACC	59265	-0.014	-0.054	-0.029	-0.012	0.004	0.026
XRET	59265	0.005	-0.097	-0.040	0.004	0.051	0.110
DRIFT1	59265	0.001	-0.266	-0.128	-0.009	0.111	0.256
DRIFT2	59056	-0.002	-0.256	-0.127	-0.012	0.104	0.245

Panel B: Correlation Matrix

Variable	XRET	DRIFT1	DRIFT2	RSURP	RACC	RSKEWPRE	RSKEWBASE
XDRIFT1	-0.015						
XDRIFT2	-0.010	0.969					
	(0.015)						
RSUPR	0.069	0.009	0.006				
		(0.025)	(0.154)				
RACC	-0.014	-0.034	-0.029	0.067			
RSKEWPRE	-0.016	0.000	0.003	-0.016	0.002		
		(0.937)	(0.471)		(0.595)		
RSKEWBASE	-0.012	-0.004	-0.001	-0.02086	-0.010	0.327	
		(0.352)	(0.819)		(0.020)		
RSKEWPOST	0.008	-0.002	-0.008	-0.004	-0.010	0.288	0.254
	(0.068)	(0.594)	(0.096)	(0.392)	(0.023)		

See Appendix A for variable definitions. In Panel B, all correlations are significant at 0.01 levels unless the p-values are specifically indicated in the parentheses. Variables indicated by R are the underlying variables, sorted quarterly into four groups, with the ranks of -0.5 assigned to the lowest quartile, 0 to the middle quartiles and +0.5 to the top quartile.

TABLE 5
Predictive Ability of Option Skews before the Filing of 10-K/Q Forms

Panel A: Predicting Accruals (Dep Var is ACC, N=55)

Variable	Est.	t-stat	Est.	t-stat	Est.	t-stat	Est.	t-stat
Intercept	-0.0134	-17.58***	-0.0134	-17.41***	-0.0134	-17.49***	-0.0135	-17.51***
RSKEWBASE	-0.0012	-1.05			-0.0014	-1.13	-0.0011	-0.87
RSKEWPRE			0.0002	0.22	0.0006	0.62	0.0008	0.81
RSURP							0.0231	11.32***
R^2	0.0034	3.83***	0.0021	5.73***	0.0053	5.74***	0.0164	9.20***

Panel B: Predicting Event Returns (Dep Var is XRET, N=55)

Variable	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	-0.0014	-3.21***	-0.0015	-3.25***	-0.0014	-3.25***
RSKEWBASE	-0.0011	-0.97			-0.0001	-0.07
RSKEWPRE			-0.0027	-3.08***	-0.0028	-3.66***
R^2	0.0032	5.43***	0.0023	4.15	0.0049	6.20***

Variable	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	-0.0015	-3.37***	-0.0014	-3.22***	-0.0015	-3.34***
RSKEWBASE	0.0000	0.00	-0.0001	-0.10	0.0000	-0.03
RSKEWPRE	-0.0027	-3.59***	-0.0028	-3.66***	-0.0027	-3.59***
RSURP	0.0018	1.21			0.0020	1.35
RACC			-0.0019	-1.79*	-0.0021	-1.93*
R^2	0.0068	8.29***	0.0072	6.72***	0.0092	8.04***

Panel C: Predicting Drift Returns (Dep Var is DRIFT1, N=55)

Variable	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	-0.0061	-1.49	-0.0061	-1.49	-0.0060	-1.46	-0.0059	-1.44	-0.0058	-1.43
RSKEWBASE					-0.0023	-0.37	-0.0021	-0.34	-0.0021	-0.34
RSKEWPRE			-0.0024	-0.50	-0.0018	-0.43	-0.0017	-0.41	-0.0014	-0.33
RSURP									0.0084	0.90
RACC	-0.0295	-6.32***	-0.0296	-6.31***	-0.0297	-6.32***	-0.0297	-6.41***	-0.0299	-6.32***
XRET							0.0066	0.34	0.0054	0.29
R^2	0.0038	6.73***	0.0063	8.51***	0.0093	12.26***	0.0122	11.85***	0.0153	13.78***

This table reports Fama-MacBeth (1973) mean estimates based on quarterly regressions. See Appendix A for variable definitions. Variables indicated by R are the underlying variables, sorted quarterly into four groups, with the ranks of -0.5 assigned to the lowest quartile, 0 to the middle quartiles and +0.5 to the top quartile. ***, **, and * indicate significance levels of 0.01, 0.05, and 0.10 respectively.

TABLE 6
Predictive Ability of Option Skews after the Filing of 10-K/Q Forms

Panel A: Predicting DRIFT2 (Dep Var is DRIFT2, N=55)

Variable	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	-0.0042	-1.00	-0.0043	-1.01	-0.0043	-1.00	-0.0042	-0.98	-0.0042	-1.00
RSKEWBASE							0.0012	0.16	0.0015	0.20
RSKEWPRE							0.0008	0.16	0.0009	0.19
RSKEWPOST			-0.0049	-0.98	-0.0052	-1.05	-0.0062	-1.21	-0.0060	-1.19
SURP									0.0064	0.74
ACC	-0.0207	-3.62***			-0.0205	-3.61***	-0.0204	-3.54***	-0.0204	-3.57***
XRET									0.0070	0.34
R^2	0.0039	5.37***	0.0030	5.95***	0.0069	8.77***	0.0129	11.13***	0.0192	12.72***

Panel B: Changes in Implied Volatilities around the Filing Conditional on Accruals

Portfolio	N	Mean ACC	Mean IVOLPRE	Mean IVOLPOST	Mean Change
Low ACC	10347	-0.056	0.568	0.565	-0.003
Medium ACC	10524	-0.012	0.501	0.500	-0.002
High ACC	10877	0.025	0.551	0.549	-0.002
All	31748	-0.014	0.540	0.538	-0.002

Panel C: Predicting DRIFT2 conditional on Accruals (Dep Var is DRIFT2, N=55)

	Low ACC		Medium ACC		High ACC	
Variable	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**
Intercept	0.0049	1.01	-0.0009	-0.22	-0.0159	-3.16***
RSKEWPOST	-0.0057	-0.82	-0.0015	-0.17	-0.0132	-1.99**
RSKEWBASE	0.0126	1.23	-0.0007	-0.07	-0.0056	-0.53
RSKEWPRE	0.0014	0.15	0.0006	0.08	-0.0007	-0.07
XRET	0.0020	0.06	0.0283	0.74	-0.0068	-0.23
R^2	0.0299	10.89***	0.0355	9.42***	0.0302	9.88***

Panel A and Panel C report Fama-MacBeth mean estimates based on 55 quarterly regressions. The dependent variable is DRIFT2. Panel B reports mean changes from IVOLPRE to IVOLPOST around the filing of the 10-K/10-Q forms for three equal-sized portfolios based on the magnitude of accruals (ACC). See Appendix A for variable definitions. Variables indicated by R are the underlying variables, sorted quarterly into four groups, with the ranks of -0.5 assigned to the lowest quartile, 0 to the middle quartiles and +0.5 to the top quartile. ***, **, and * indicate significance levels of 0.01, 0.05, and 0.10 respectively.

TABLE 7
Description of the Key Developments Sample

Panel A: Description Statistics

Variable	N	Mean	10th	25th	Median	75th	90th
SKEWPRE	224347	0.0366	0.0019	0.0103	0.0237	0.0451	0.0783
SKEWBASE	219621	0.0361	0.0079	0.0151	0.0256	0.0436	0.0718
SKEWPOST	187245	0.0367	0.0004	0.0094	0.0239	0.0464	0.0813
XRET	224347	-0.0004	-0.0455	-0.0192	-0.0005	0.0192	0.0464
DRIFT1	219167	-0.0032	-0.2153	-0.1038	-0.0088	0.0856	0.2009
DRIFT2	219162	-0.0029	-0.2103	-0.1008	-0.0081	0.0841	0.1963

Panel B: Correlation Matrix

Variable	XRET	DRIFT1	DRIFT2	RSKEWPRE	RSKEWBASE	RSKEWPOST
DRIFT1	-0.018					
DRIFT2	-0.017	0.961				
RSKEWPRE	-0.008	-0.014	-0.013			
RSKEWBASE	-0.008	-0.017	-0.017	0.348		
RSKEWPOST	0.013	-0.014	-0.016	0.316	0.271	

See Appendix A for variable definitions. In Panel B, all correlations are significant at 0.01 levels. Variables indicated by R are the underlying variables, sorted quarterly into four groups, with the ranks of -0.5 assigned to the lowest quartile, 0 to the middle quartiles and +0.5 to the top quartile.

TABLE 8
The Predictive Ability of Option Skews before the Key Developments Events

Panel A: Predicting Event Returns (Dep Var is XRET, N=94)

Variable	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	-0.0005	-1.75*	-0.0005	-1.75*	-0.0005	-1.75*
RSKEWPRE	-0.0012	-2.14**			-0.0010	-1.97*
RSKEWBASE			-0.0011	-1.54	-0.0008	-1.09
R^2	0.0012	7.74***	0.0017	6.38***	0.0026	9.2***

Panel B: Predicting Drift Returns DRIFT1 (Dep Var is DRIFT1, N=94)

Variable	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	-0.0021	-0.76	-0.0021	-0.76	-0.0021	-0.76	-0.0022	-0.78
RSKEWPRE	-0.0047	-1.00			-0.0025	-0.76	-0.0026	-0.81
RSKEWBASE			-0.0070	-1.21	-0.0059	-1.18	-0.0052	-1.04
XRET							-0.0140	-0.53
R^2	0.0052	7.18***	0.0081	7.91***	0.0105	8.77***	0.0143	10.68***

This table reports Fama-MacBeth mean estimates based on 94 monthly regressions. See Appendix A for variable definitions. Variables indicated by R are the underlying variables, sorted quarterly into four groups, with the ranks of -0.5 assigned to the lowest quartile, 0 to the middle quartiles and +0.5 to the top quartile. ***, **, and * indicate significance levels of 0.01, 0.05, and 0.10 respectively.

TABLE 9

The Predictive Ability of Option Skews after the Key Developments Events

Panel A: Predicting DRIFT2 (Dep Var is DRIFT 2, N=94)

Variable	Estimate	t-stat	Estimate	t-stat
Intercept	0.0011	0.47	0.0000	-0.01
RSKEWPOST	-0.0023	-1.96*	-0.0016	-2.17**
RSKEWPRE			-0.0013	-0.44
RSKEWBASE			-0.0043	-0.92
XRET			-0.0022	-0.08
R^2	0.0039	7.19***	0.0158	11.57***

Panel B: Decay in implied volatilities around the Key Developments events conditional on XRET

Portfolio	N	Mean XRET	Mean IVOLPRE	Mean IVOLPOST	Mean Change
Low XRET	71954	-0.053	0.474	0.481	0.008
Medium XRET	75521	0	0.384	0.385	-0.003
High XRET	74443	0.052	0.467	0.454	-0.019
All	221918	0	0.441	0.439	-0.005

Panel C: Predicting DRIFT2 conditional on XRET (Dep Var is DRIFT 2, N=94)

Variable	Estimate	t-stat	Estimate	t-stat
Low XRET Portfolio				
Intercept	0.0053	1.58	0.0052	1.35
RSKEWPOST	-0.0033	-2.57***	-0.0029	-2.52***
RSKEWBASE			-0.0038	-0.64
RSKEWPRE			-0.0032	-0.77
R^2	0.0047	6.16***	0.0162	10.48***
Medium XRET Portfolio				
Intercept	0.0003	0.14	-0.0010	-0.47
RSKEWPOST	-0.0030	-2.58***	-0.0023	-2.62***
RSKEWBASE			-0.0069	-1.64*
RSKEWPRE			0.0005	0.18
R^2	0.0059	8.02***	0.0153	10.83***
High XRET Portfolio				
Intercept	-0.0005	-0.15	-0.0019	-0.59
RSKEWPOST	-0.0019	-1.39	-0.0009	-0.90
RSKEWBASE			-0.0053	-1.10
RSKEWPRE			-0.0031	-0.86
R^2	0.0046	7.23***	0.0135	8.80***

Panel A and Panel C report Fama-MacBeth mean estimates based on 94 monthly regressions. Panel B reports mean changes from IVOLPRE to IVOLPOST around the Key Developments events for three equal-sized portfolios based on XRET. See Appendix A for variable definitions. Variables indicated by R are the underlying variables, sorted quarterly into four groups, with the ranks of -0.5 assigned to the lowest quartile, 0 to the middle quartiles and +0.5 to the top quartile. ***, **, and * indicate significance levels of 0.01, 0.05, and 0.10 respectively.

TABLE 10
Analyses of Trading Strategy

Panel A: Univariate Tests

Strategy	**PEAD (1)**			**SKEW (2)**			**Combined (3)**		
	N	RET	XRET	N	RET	XRET	N	RET	XRET
Low	248	-0.008	0.006	48	-0.001	0.008	213	-0.007	0.007
High	250	0.017	0.004	31	0.014	0.003	192	0.020	0.006
High-Low		0.009	0.010		0.013	0.012		0.013	0.013
t-value		3.90***	4.68***		3.97***	3.75**		5.51**	6.19**
Diff. from (1)					0.004	0.002		0.004	0.004
t-stat					0.97	0.48		6.28***	5.70***

Panel B: Regression Tests (DEP VAR is monthly raw return – risk free rate; N=166)

Strategy	**PEAD (1)**		**SKEW (2)**		**Combined (3)**	
Variable	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**
Intercept	0.0062	2.70***	0.0083	2.42**	0.0099	4.17***
Rm-Rf	0.0147	0.30	-0.1746	-2.35**	-0.0275	-0.54
HML	-0.1779	-2.68***	0.1581	1.59	-0.1596	-2.34**
SMB	-0.2395	-3.89***	-0.1344	-1.45	-0.2087	-3.28***
Momentum	0.2347	5.97***	0.0948	1.61*	0.2199	5.45***
Short-term Reversal	0.0228	0.53	0.1085	1.68*	0.0380	0.86
R^2	24.83%		10.48%		22.02%	

The PEAD strategy ranks all the earnings surprises that occur within the last three months before the month-end, and holds long (short) positions in the top (bottom) decile. The SKEW strategy ranks firms with option volatility skew data into quartiles, and holds long (short) positions in the top (bottom) quartile. The COMBINED strategy takes the same position as the PEAD strategy, except that it does not hold a long (short) position if a firm is in the top (bottom) skew quartile. All strategies rebalance their portfolios at the end of each calendar month and the holding period is one month. In Panel A, RET is raw return and XRET is RET minus corresponding return on a portfolio of securities matched by size (2 groups), Book/Market (3 groups) and momentum (3 groups). Panel B runs Fama-French five factor model based on 166 monthly observations, where the factors are obtained from Kenneth French's website. The dependent variable is the monthly raw return from the corresponding trading strategy minus the risk free rate.