Overnight post-earnings announcement drift and SEC Form 8-K disclosures

Work-in-progress

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Abstract

Companies reporting extreme quarterly earnings misses exhibit pronounced significant *overnight* drift *post*-announcement. We hypothesize that extreme earnings misses stimulate more intensive information acquisition throughout the reporting quarter, as those earnings announcements resolve a smaller fraction of information uncertainty. Using *post*-announcement SEC Form 8-K disclosures to proxy for additional material information, we show that information acquisition activities become more prevalent and substantial following extreme earnings misses. Concomitantly, the implied volatilities of these stocks remain elevated for much of the earnings quarter. Moreover, the incremental post-announcement Form 8-K information is unscheduled, mostly arriving overnight when market liquidity is low. These factors contribute to a higher overnight risk premium, and thus a pronounced average overnight drift *post*-earnings announcement.

JEL classification: G11, G12, G14, M41.

Keywords: Earnings miss; Earnings beat; Overnight PEAD; Information acquisition; SEC Form 8-K

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1. Introduction

More than half a century ago, Ball and Brown (1968) and Beaver (1968) launched what has become a prominent line of research into stock price reactions to earnings announcements. A specific thread in this line of inquiry concerns the predictability of equity returns following earnings announcements, commonly referred to as "post earnings announcement drift" (PEAD) in stock prices. In a recent review of the literature on PEAD, Martineau (2021, p.6) argued that "...price drifts following earnings announcements are generally absent [since the early 2000s]."[1] In this study, we contend that proclaiming the demise of post-announcement price drift is premature: while a significant drift may not be manifest in post-announcement close-to-close stock price changes, a pronounced and robust overnight PEAD, henceforth referred to as "OPEAD", has endured over the same period.

The finding of an OPEAD presents an intriguing and *à priori* plausible phenomenon. In recent years, overnight material corporate announcements have come to be the norm, with 95% of earnings announcements and 75% of SEC Form 8-K filings reported in after-market trading hours. At the same time, the context of the announcements has experienced a quite literal "night-and-day" metamorphosis over the last half-century, particularly in terms of the breadth, timing and accessibility of supplementary data and media coverage.

Figure 1 illuminates our key result by showing the average market-adjusted intraday and overnight *post*-earnings announcement returns over the sample period from October 1, 2004 to December 31, 2020.[2] Our sample consists of common stocks traded on NYSE, AMEX and

[1] There are differences of opinion, e.g. Fink (2021, p.9) concludes that: "...the PEAD, in one form or another, continues to exist despite highly publicized research and more than half a century of potential arbitrage activity."

[2] For clarity, the term "intraday return" used in this study refers to the open-to-close return or price difference between when the market opens at 09:30 U.S. Eastern Standard Time (EST) and when the market closes at 16:00

NASDAQ. The *x*-axis represents the trading days following the night when earnings are announced, with period $t = 0$ marking the announcement night. We partition the stocks into those with extremely bad unexpected earning news, i.e., "misses" (represented by the solid red line); those with extremely good unexpected earnings news, i.e., "beats" (represented by the solid green line); and the remaining announcers with "insignificant news surprises" (represented by the dashed-dotted lines in yellow, blue and black).

< Insert Figure 1 here >

Panel A of Figure 1 shows a discernible *overnight* post-announcement premium that persists throughout the quarter, especially for stocks reporting extreme earnings misses. In particular, these stocks exhibit an average overnight premium of 8.25 basis points over the event window of [+2, +61] days. Put differently, following an initial "gap down" in stock price on the announcement night, extremely bad earnings announcers consistently outperform the market by 8.25 basis points daily (or 8.25 x 260= 21.45% annualized) on average during after-market trading hours for the remainder of the quarter. Conversely, Panel B of Figure 1 shows that this post-announcement return premium disappears during regular trading hours, highlighting a distinct discrepancy in conditional premiums between night and day. This discrepancy is also consistent with Lou et al.'s (2019, 2022) finding of a "tug of war" between intraday and overnight returns. Furthermore, while stocks' reporting extreme earnings beats also exhibit superior performance to the market during night time, their average premium is considerably modest at only 2.33 basis points, while other announcers generally underperform the market across both intraday and overnight intervals.

EST. Conversely, the term "overnight returns" refers to the close-to-open return or pric change bewteen when the market closes at 16:00 EST on day *t*-1 and when the market opens at 09:30 EST on day *t*.

The significant average overnight premium *qua* OPEAD is robust across different sample periods and stock characteristics. Importantly, this pronounced OPEAD is unlikely to stem from a sluggish market reaction on the announcement night itself. Research by Gregoire and Martineau (2021), Christensen et al. (2023), and Jiang et al. (2012) supports such a conjecture, demonstrating that stock price responses take place fully and "at warp speed" during overnight trading on announcement night, thereby precluding the possibility of OPEAD resulting from a lag in market response.[3]

The distinct OPEAD associated with extreme earnings misses provides further insights on the recent literature that documents a significant unconditional premium in overnight returns; see Lachance (2018), Hendershott et al. (2020), Lou et al. (2019, 2022), Knuteson (2022), and Haghani et al. (2022), among others.[4] The finding of an unconditional premium in these studies suggests that random strategies which involves holding a long position overnight would have, on average, "made money" in the past. However, we show that a sizeable portion - nearly one-third - of the superior performance associated with the unconditional overnight return strategy is driven mainly by stocks reporting extreme earnings misses. This finding is economically significant, especially considering that announcers with extreme earnings misses constitute only a minor segment (approximately one-sixteenth) of all the sample announcers.

We contend that the pronounced quarterly OPEAD reflects a risk premium arising from informational uncertainty surrounding follow-up to earnings news. Following Patell and Wolfson

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[3] It is unlikely that options on the respective stocks drive this behavior. For example, Truong and Corrado (2014, p.161) "...find no significant difference in the immediate stock price response to earnings information announcements in samples split between firms with listed options and firms without listed options."

[4] Cliff et al. (2008, p.2) highlighted, about fifteen years prior, that "...average [abnormal] night returns... range from 2.82 basis points...to 4.76 basis points [7.05% to 11.9% annualized]." Cliff et al. further reported a persistent overnight premium on non-announcement nights that closely corresponds to our OPEADs. We show that for the earnings announcement events, OPEADs are positive but predominantly when conditioned on preceding extreme earnings misses.

(1979) and more recently Hann et al. (2019), we use option implied volatility (IV) to proxy for this uncertainty. For stocks reporting extreme earnings misses, the resolution of information uncertainty is significantly less than it is for other announcers, about half. The counterpart of this reduced resolution of information uncertainty is a higher demand *post*-earnings announcement for additional information as market participants seek further clarification[5]. As evidence to support this conjecture, we show that information acquisition in the form of "material events" reported in SEC Form 8-K filings over the remainder of the reporting quarter is significantly greater for stocks with extreme earnings misses. Moreover, the heightened information risk is reflected in the temporal pattern of the IVs over the quarterly earnings cycle: IVs peak in the weeks immediately following the announcement, before gradually returning to the pre-announcement level as the market's attention shifts from the recent announcement to the upcoming one.

The Form 8-K, serving as a proxy for post-announcement information acquisition, has two salient features: First, as with the earnings announcements themselves, a significant portion of 8-K filings (75.3%) are made after trading hours. Second, in contrast to earnings announcements, these filings are released at unscheduled days and time, as is typical with non-earnings related information dissemination. Since the market is relatively thin overnight, it is not surprising that the additional market-making risk could be priced in as a higher overnight bid-ask spread (Ciu and Gozluklu, 2021; Ben-Rephael et. al*.,* 2021; Boyarchenko et al, 2023). That is, the thinness in overnight markets contributes to the observed OPEAD premium and the increase in IVs.

[5] Phil Dolan pointed out to us that "Street wisdom" has it that if management is unable to "soften" an impending miss, say by accelerating revenues or manipulating accruals, then a miss portends bad news indeed! This asymmetry in incentives between those of a miss and of a beat in announcements would also explain the difference we see between uncertainty resolution for misses and for beats.

The remainder of this paper is structured as follows. Section 2 introduces the data sample. Section 3 reports the empirical evidence on OPEAD, while Section 4 explores the impact of OPEAD in terms of returns on various investment strategies. In Section 5, we show the presence of a typical quarterly cycle in stocks' implied volatilities in concert with that of the earnings announcements. Section 6 analyzes Form 8-K filings as a proxy for post-earnings-announcement information-acquisition, and in particular shows that there is an increase in 8-K frequency following extreme earnings misses. Section 7 discusses the risk to market makers stemming from the unscheduled arrival of information overnight, as exemplified by 8-K filings. Section 8 concludes the study.

2. Data and descriptive statistics

2.1 Data

We retrieve the data from five primary sources:

1. Center for Research in Security Prices (CRSP): Daily stock prices and returns, and number of shares outstanding;
2. COMPUSTAT: Quarterly earnings dates, and other accounting data required to estimate firm characteristics such as the book-to-market ratio;
3. Institutional Brokers' Estimate System (I/B/E/S): Quarterly earnings dates, number of analysts and analyst forecasts;
4. SEC EDGAR: Form 8-K filing and EDGAR log files;
5. OptionMetrics: Stock option implied volatility.

Following convention, we limit the analysis in this study to common stocks (with share codes 10 and 11) listed on the NYSE, AMEX and NASDAQ. We require that the stocks must

have a price per share greater than $1 at the end of quarter *q*, and a stock market capitalization exceeding $5 million. This selection criterion ensures that any notable overnight price drift we identify is not predominantly driven by small stocks, as previous research such as Bhushan (1994) and Chordia et al. (2009) showed to be the case for close-to-close price return drift. Following Lou et al. (2019), Hendershott et al. (2020), and Chan and Marsh (2022), close-to-close return, close-to-open (i.e., overnight) return and open-to-close (i.e., intraday) return in period *t* are related through the following specification:

$$R_t^{close-to-open} = \frac{(1 + R_t^{close-to-close})}{(1 + R_t^{open-to-close})} - 1, \quad (1)$$

where the close-to-close return is the holding period return provided in CRSP, and the open-to-close return is the change between the market closing price in period *t*-1, and the market opening price in period *t*. In line with Hendershott et al., (2020), we omit the stock return in period *t* if its absolute value exceeds 200%.

We merge COMPUSTAT quarterly earnings announcement dates (RDQ) with earnings dates retrieved from I/B/E/S, retaining the earnings only if COMPUSTAT's RDQ is within +/-1 day surrounding I/B/E/S earnings date. We omit a small number of earnings observations recorded on weekends and public holidays. In addition, we exclude a handful of earnings observations timestamped at 00:00:00, as these are likely recording errors in I/B/E/S (deHaan et. al., 2015). To alleviate issues related to stale stock prices and illiquidity, we follow Ben-Rephael et. al. (2017) and require each news announcement to have a minimum of two analysts following the respective stock on a quarterly basis. In line with Michaely et al. (2014) and deHaan et al. (2015), we assign news observations reported after the market has closed on earnings day *t* to overnight.

Following prior literature (see, e.g., Gregoire and Martineau, 2021), we compute the standardized unexpected earnings (SUE) as:

$$SUE_{i,t} = \frac{EPS_{i,t} - E_{t-1}[EPS_{i,t}]}{P_{i,t-5}}, \quad (1)$$

where $EPS_{i,t}$ refers to the quarterly earnings per share reported by firm i in period t, and $E_{t-1}[EPS_{i,t}]$ denotes the analysts' expectations of earnings per share, measured using the median consensus of all analyst forecasts obtained from I/B/E/S and issued over 90 days prior to the announcement date. We standardize the news surprise using the stock price five trading days prior to the news announcement.

Consistent with Zhao (2017), He and Plumlee (2020) and Bochkay et al. (2023), we download 8-K filings from the SEC EDGAR database, and use central index keys (CIKs) to link the 8-K data to earnings data obtained from COMPUSTAT and I/B/E/S. In response to the Sarbanes-Oxley Act in late August 2004, the SEC mandated that all registered companies file Form 8-K within four business days for material events, and increased the list of 8-K reportable items from 12 to 22 - a figure that has since increased to 33 by 2024 (https://www.sec.gov/files/form8-k.pdf). Consequently our analysis begins in October 2004, as the 8-K items play a crucial role in our study, and it is conducted on a quarterly basis. The primary analysis extends until December 2020. However, for analyses involving EDGAR downloads, the sample period concludes in June 2017, coinciding with the latest available data on EDGAR usage and download frequency.

Our selection criteria for Form 8-K filings involve several steps. First, we discard observations with CIKs present in 8-K filings but absent in the earnings data (these include foreign-listed businesses). We retain a few earnings observations without a corresponding CIK link to 8-K filings, under the presumption that these announcers did not have relevant 8-K

materials events to report during our sample period. We then use regular expressions from Python's textual analysis programming package to extract specific items mentioned in the header section of each Form 8-K filing. Notice that a single Form 8-K may report multiple items, each of which we tag according to the item numbering provided at https://www.sec.gov/files/form8-k.pdf.

We source the options data from OptionMetrics, which provides, *inter alia*, end-of-day bid and ask prices, open interest, trading volume and implied volatilities. Prior studies (e.g., Gao et al., 2018) have highlighted that options data are extensive and noisy due to liquidity and market microstructure issues. As such, we follow conventions (see, e.g., Xing et al., 2010; Gao et al., 2018; Liu et al., 2022) and employ a multi-faceted filter to the daily options data. In particular, we remove options data with missing implied volatility, and discard options with zero open interest, or those with a bid or ask price of zero. The bid and ask prices must satisfy fundamental no-arbitrage boundaries.[6] In addition, we only consider at-the-money options which are typically most liquid. To be considered at-the-money, the option "moneyness" (defined as the strike price over the stock price) must range between 0.9 and 1.1. Finally, consistent with Roger et al. (2009), Bilings et al. (2015) and Hann et al. (2019), we calculate implied volatility (IV) for options with a 30-day maturity as the average IV of call and put options. The IVs of individual 30-day maturity options are interpolated using options with various strike prices and maturities. In unreported experiments, we examine IV using only call or put options, and extend our analysis to options with 60-day and 90-day maturities, and reach conclusions consistent with those reported here.

[6] These boundaries include ask price > bid price, stock price ≥ bid price (for call options), strike price ≥ bid price (for put options), ask price ≥ max[0, stock price - strike price] (for call options) and ask price ≥ max[0, strike price - stock price] (for put options).

2.2 Descriptive statistics

Our final sample contains 130,585 quarterly earnings announcements reported by 5,468 unique companies over the 2004-2020 period. The fractions of announcements with negative SUE (earnings misses), zero SUE and positive SUE (earnings beats) are 30.1 %, 7.3% and 62.6%, respectively. Panel A of Table 1 reports some summary statistics, showing that the average (median) SUE is -0.136% (0.056%). These estimates suggest that SUE are left-skewed, but firms are twice as likely to report an earnings beat as they are to report an earnings miss. Panel A also shows that, on average, stocks have a market capitalization and closing price of $8,937 million and $51.18 per quarter, respectively, with about seven analysts following it.

< Insert Table 1 here >

We assign quintile rankings of 0 to 4 to negative SUE, where Quintile 0 (Q0) encapsulates "extreme" observations with the largest earnings misses. Conversely, we follow the same quintile partitioning method and assign rankings of 6 to 10 to positive SUE, where Quintile 10 (Q10) represents the "extreme" group with the largest earnings beats. Earnings news with zero SUE is classified as Quintile 5 (Q5). We sort the earnings surprises in each quarter.[7] In particular, consistent with Bernard and Thomas (1990), Bhushan (1994), Bartov et al. (2000) and Livnat and Mendenhall (2006), we use the distribution of the SUE in the current quarter, instead of the previous quarter, when sorting the SUE. While this approach may introduce a degree of hindsight bias into the OPEAD analysis, it is worth noting that Bernard and Thomas (1990) show that the stock price drift is robust to this specific research design.

Table A.1 in the Appendix details the items extracted from the Form 8-K filings, along with their descriptions and disclosure frequencies, over the 2004-2020 sample period. In a result

[7] Our key result barely changes if we sort the earnings surprises over the entire sample period.

mirroring prior studies such as He and Plumlee (2020), Items 1.01, 2.02, 5.02, 7.01, 8.01 and 9.01 occupy the top six spots in terms of disclosure frequencies.

We use fifteen-minute intervals across the 24-hour cycle to display the timing of earnings announcements (Panel A) and 8-K acceptance times (Panel B) in Figure 2. Panel A highlights that nearly all earnings announcements in our sample (approximately 95%) occur outside regular trading hours, supporting the findings by Michaely et al. (2013). Similarly, in a finding that is consistent with Cunat and Groen-Xu (2017), Panel B shows that the majority (75.3%) of Form 8-Ks were filed, and accepted, at times outside regular trading hours, particularly within the first 90 minutes following the market's closure at 16:00.[8] Figure 3 presents the distribution of Form 8-K filings across the earnings reporting quarter, showing that, on average, Form 8-K filings are consistently released (approximately 1.30% of our sample filings each day) during the [+1, +61] event window.

< Insert Figure 2 here >

< Insert Figure 3 here >

Returning to Table 1, Panel B provides a summary of 8-K filings by earnings announcers within our sample on a quarterly basis. The data show an average of 3,049 companies making 20,675 Form 8-K filings each quarter. This translates to an average of 6.8 Form 8-K filings per company in each quarter, as shown in the "*# of 8Ks per filer*" row.

3. Extreme Earnings Surprises and Overnight Post-Earnings Announcement Drift (OPEAD)

3.1 OPEAD

[8] Given that the SEC EDGAR database excludes Form 8-K filing time, we assume that the acceptance time recorded by SEC is identical to the filing time.

In our study, the term "post-earnings announcement drift" (PEAD) refers to the average cumulative abnormal (market adjusted) stock returns following earnings announcements. Figure 4 highlights this drift by plotting the average cumulative buy-and-hold abnormal returns from t = -1 to t = +61 for overnight returns (Panel A), intraday returns (Panel B) and close-to-close returns (Panel C). Within each panel, we distinguish between announcements made by stocks with extreme earnings misses (Q0), extreme earnings beats (Q10), and other news surprises. The solid lines in Figure 4 represent the cumulative version of the stock return premium illustrated in Figure 1, where the shaded areas correspond to the 95% confidence intervals around the average drift.

< Insert Figure 4 here >

Panel A of Figure 4 shows a distinct OPEAD for announcers with extreme earnings misses (Q0). More specifically, the average cumulative overnight return increases significantly from -3% when an extreme earnings miss is reported at t=0 to approximately 5% at t=61, producing an almost 8% annualized price drift over the reporting quarter. The Q10 announcing group also displays a positive overnight return drift, albeit a more modest 3% (increasing from 3% at t=0 to 6% at t=61). Panel B of Figure 3 shows intraday PEAD. On average, stocks announcing extreme earnings misses (beats) experience a marginal negative (positive) intraday price drift over the reporting quarter *post* earnings announcement. In summary, the distinct *post*-announcement price drift occurs exclusively in overnight returns, particularly for stocks reporting extreme earnings misses.

3.2 Persistence and firm size effect

Martineau (2021) provides empirical evidence that the traditional PEAD, estimated using close-to-close returns, has weakened significantly between 1991 and 2010, and it nearly disappears thereafter. In a related strand of literature, Bhushan (1994) and Chordia et al. (2009) show that the persistent drift in close-to-close price returns is predominantly driven by small stocks. Therefore, concerns may arise about the persistence of the pronounced OPEAD following extreme earnings misses, and its robustness to the small-firm size effect.

< Insert Figure 5 here >

We use a two-pronged analysis to address the above concerns. First, we study the average abnormal return on a yearly basis from 2004 to 2022. The top and bottom panels of Figure 5 display the average annual estimates for overnight and intraday returns, respectively, with "*" and "#" indicating statistical significance at the 5% and 10% levels, respectively. Abnormal stock returns are averaged over the [+2, +61] event window (to avoid the earnings announcement price response over the [-1, +1] sample window), and annualized by 260. In the top row, Panel A shows that the annual mean overnight premium attributable to extreme earnings misses is consistently positive and statistically significant (at the 5% level in 16 out of 17 instances), with a time-series average of 21.17% per annum. This suggests that the sizeable OPEAD finding is persistent and not specific to the sample period.

Second, we repeat the full-sample analysis where the earnings disclosures are divided into those made by S&P500 firms and by other firms. This partitioning method ensures that our truncated earnings observations for the S&P500 group are devoid of small-firm size effect. The resampled S&P500 (non-S&P500) observations have an average of 12.4 (6.9) analyst followings, and an average share price of $70.97 ($45.76) and market capitalization of $34.36 billion ($1.97 billion) per quarter. Figure 6 presents the findings. Panel A shows that, for S&P500 firms, the

significant OPEAD for extreme negative earnings news observations continues to hold, albeit with a slightly lower positive drift of 4% (from -3% at t=0 to 1% at t= +61), whereas the overnight drifts of other earnings groups exhibit a downward trend.

< Insert Figure 6 here >

3.3 Busy earnings seasons and variation in stock price reactions

Chan and Marsh (2022) report a strong and positive linear relation between market betas and average stock returns during busy earnings season weeks when large influential firms disclose quarterly earnings announcements. This beta-return relation, however, remains flat in other weeks. Chan and Marsh (2022) attribute this finding to the clustering of crucial early information by large firms, influencing the pricing of securities. Bond et al. (2023) find that firms making earnings announcements in busy earnings weeks exhibit a stronger PEAD compared to those announcing in non-busy weeks.

In view of these findings, we partitioned our sample news observations into two groups: those reported early in busy earnings seasons, and those in other weeks. In a similar vein to Chan and Marsh (2022), we identify weeks within each reporting quarter q that have a minimum of fifty S&P500 announcers (i.e., one-tenth of S&P500 firms) and label them as "leading" earnings weeks. Unreported analysis (available upon request) shows that the significant magnitude of OPEAD is evident in both leading and non-leading weeks.

The market's response to a firm's earnings announcement could be influenced by concurrent "non-earnings news" about its stock, potentially leading to counter-intuitive stock price movements. For example, when Walgreens announced its fiscal earnings on January 3, 2024, the firm also reported "Shares of Walgreens closed 5% lower on Thursday after the

company reported fiscal first-quarter adjusted earnings and revenue that topped expectations, but cut its quarterly dividend nearly in half [with the CEO reiterating previous guidance]."[9] This case illustrates how the other news (here regarding dividends) can significantly impact the market's reaction to earnings announcements. To address such a potentially confounding event, we re-estimate the regression with a restricted sample of stocks where announced misses (beats) were included only if the overnight price response (for all news) was non-positive (non-negative). Unreported analysis shows that the significant OPEAD persists particularly for firms reporting extreme earnings misses.

3.4 Regression analysis

So far, we have used event-study analyses to show a pronounced overnight price drift occurring throughout much of the earnings quarter, predominantly among firms reporting extreme earnings misses. A similar price drift, however, is absent in intraday returns. We now formalize the analysis using Fama-MacBeth's cross-sectional regression procedure.

To begin, for each quarter, we estimate the cross-sectional average cumulative (market-adjusted) abnormal overnight return ($CAR^{N}_{i,[2,61]}$), and intraday return ($CAR^{D}_{i,[2,61]}$), separately, for announcers categorized in different SUE groups.[10] Consistent with prior literature (see, e.g., Bhushan, 1994), our analysis specifically focuses on announcers at the extreme SUE groups: Q0 and Q1; and Q9 and Q10. The first two groups represent firms with extreme earnings misses, while the latter two correspond to firms with extreme earnings beats. Table 2 presents the time-series mean of the cross-sectional average $CAR^{N/D}_{i,[2,61]}$, with parenthesized time-series standard

[9] https://www.cnbc.com/2024/01/04/walgreens-wba-earnings-q1-2024.html

[10] The event window used to calculate the CAR estimate in this section begins on $t = +2$, thus deliberately excluding the substantial price reactions within the [-1, +1] interval that typically follow the earnings announcements on day t.

errors that are adjusted for serial correlation using the Newey-West estimator up to eight lags. The result reinforces the findings from earlier graphical analyses in showing the significant overnight return drift for firms in Q0, with a mean estimate equal to 8.080 (*t*-statistic = 3.12). In other words, firms reporting extreme earnings misses at *t*=0 earn an average of 8.08% in cumulative abnormal overnight returns in the 60 days following the announcement. In contrast, the magnitude of this overnight price drift is either muted, non-existent or negative for firms in other groups, and this pattern continues to hold for intraday returns.

Our next analysis entails estimating the following cross-sectional regressions separately for night and intraday returns conditional on earnings news surprises:

$$CAR^{N}_{i,[2,61]} = \alpha_0^N + \alpha_1^N DSUE_{i,t} + \epsilon^N_{i,t}, \qquad (3)$$

and

$$CAR^{D}_{i,[2,61]} = \alpha_0^D + \alpha_1^D DSUE_{i,t} + \epsilon^D_{i,t}, \qquad (4)$$

where, as defined earlier, $CAR^{N/D}_{i,[2,61]}$ is the night or intraday cumulative abnormal return of firm *i* over the 60-trading day window starting two days following earnings announcement. To account for concerns about outliers in earnings news surprises, and potential nonlinearities in the earnings news surprise-stock return relation, we follow Bernard and Thomas (1990), Bhushan (1994), Bartov et al. (2000), and Livnat and Mendenhall (2006) and use an "adjusted decile rank" for the standardized unexpected earnings (DSUE). Specifically, as before, negative SUEs are assigned quintile ranks from 0 to 4, positive SUEs receive ranks from 6 to 10, and zero SUEs are ranked 5 for each quarter. The DSUE is then normalized by 10, so that the adjusted DSUE ranges between 0 and 1. Thus, the intercept in Equations (3) and (4) represents the stock price response to extreme earnings misses, and the slope coefficient indicates the marginal response as we move from extreme earnings misses to extreme earnings beats.

< Insert Table 2 here >

Table 2 reports the results. For night returns, the slope of the adjusted DSUE variable is significantly negative at -2.136 (*t*-statistic = -2.29). This estimate suggests that a shift in earnings news surprise from extreme beats (with an adjusted DSUE ranking of 1) to extreme misses (with an adjusted DSUE ranking of 0) is associated with an economically significant increase in the 60-day CAR differential of 2.136%. The result differs markedly for intraday returns: the slope is positive at 1.461 (*t*-statistic = 3.80), indicating a positive relation between the drift in intraday returns and unexpected earnings news. When subtracting the estimated day slope coefficient from the night coefficient, the difference is -3.597, which is both economically and statistically significant (the *t*-statistic of the differences in mean with unequal variance is -4.80). Our documented inverse behavior of intraday excess returns conditional on the surprise earnings beats and misses, and the overnight abnormal returns is consistent with the "tug of war" between unconditional overnight and intraday returns documented by Lou et al. (2019, 2022).

We corroborate the Fama-MacBeth cross-sectional regression finding using the following panel regression:

$$CAR_{i,[2,61]}^{D/N} = \beta_0 + FEs + \beta_1 N_t + \beta_2 DSUE_t + \beta_3 N_t DSUE_t + \epsilon_{i,t}, \quad (5)$$

where $CAR^{D/N}_{i,[2,61]}$ is the day/night cumulative abnormal return measured over the 60-day event window, and N_t is a dichotomous variable equal to one for night returns, and zero for intraday returns. The key coefficient of interest is β_3, which explicitly captures the earnings news' impact on the night and intraday return differential. We include firm and year-quarter fixed effects (*FEs*) in all the panel regression tests to control for unobserved firm-specific factors and potential time trends, respectively. We also cluster standard errors by firm to account for cross-sectional correlations (Petersen, 2009).

< Insert Table 3 here >

Column (1) of Table 3 reports the result. Panel A shows that β_3 is equal to -3.734 (*t*-statistic = -6.88); this estimate is consistent with the -3.597 value implied by the Fama-MacBeth procedure reported in Table 3. At the same time, the estimated β_2 is 1.944 (*t*-statistic = 7.61); this estimate agrees with the Fama-MacBeth value of 1.461. When taken together, the panel regression Equation (5) suggests that a significant shift from the adjusted DSUE extreme category of 1 to the adjusted DSUE extreme category of 0 is associated with an economically significant increase in the 60-day CAR differential of 1.829%; this estimate is slightly below the 2.136% CAR differential estimated by the Fama-MacBeth method.

We now present evidence of a significant negative relation between news surprises and overnight price drifts when controlling for familiar firm characteristics such as firm size, book-to-market ratio and market beta, as defined in Appendix B. Column (2) of Table 3 presents the findings. As before, the primary focus is the β_3 coefficient. Note that the addition of control variables in the regression exerts a small marginal impact on the β_3 coefficient estimate, which is now equal to -2.952 (*t*-statistic = -5.38). In terms of the control variables and their interactions with the N_t dichotomous variable, the estimated coefficients on $N_t \times \ln(size)$ and $N_t \times mktbeta$ are -1.367 (*t*-statistic = -11.69) and 6.033 (*t*-statistic = 14.88), respectively. Conversely, the estimated coefficient on $N_t \times \ln(B/M)$ is statistically insignificant. These findings suggests that regardless of whether they are categorized as growth or value firms, smaller companies with a higher market exposure are associated with a stronger overnight price drift when they report earnings misses.

Having established that overnight (intraday) *post* announcement drifts have a significant negative (positive) relation with earnings news surprises, we proceed to compare the overnight

drift of firms reporting extreme earnings misses against that of other firms. This comparison is done using the following panel regression specification:

$$CAR^{N}_{i,[2,61]} = \beta_0 + FEs + \gamma Dummy_t + \Sigma_j \delta_j X_{i,j} + \epsilon_{i,t}, \quad (6)$$

where the *Dummy*$_t$ variable is equal to one for announcers reporting extreme earnings misses (i.e., these announcers are classified under an adjusted DSUE category of 0), and zero otherwise. By construction, we omit the DSUE independent variable from specification (6). The results, reported in Columns (3) and (4) of Table 3, both excluding and including control variables, are consistent with the findings from our earlier event-study analysis. The estimated coefficient γ is positive and statistically significant, suggesting that firms with extreme earnings misses are associated with a stronger overnight price drift for the duration of the earnings quarter.

4 Investment strategies

Prior studies have documented a higher average unconditional overnight return relative to intraday (Cliff et al., 2008; Boyarchenko et al., 2023). In this section, we show that the outperformance of a night-based investment strategy is predominantly driven by the returns of stocks reporting extreme earnings misses. When these announcements are excluded, the superior performance of the night-based strategy diminishes significantly.

< Insert Figure 7 here >

To begin, we replicate the findings of prior empirical research by comparing the growth of a $1 investment in various equally weighted portfolios, each beginning in October 2014. These investment strategies use overnight, intraday, and close-to-close returns, respectively, without conditioning on earnings news. Panel A of Figure 7 displays the cumulative log prices across these investment strategies. The unconditional overnight return strategy would have

produced a log price of 2.87 by the end of December 2020, markedly higher than the -0.07 terminal log price generated by the unconditional intraday return strategy.

We then partition the unconditional overnight investment method based on earnings news, dividing it into two distinct strategies: Strategy 1 entails an equally weighted investment in companies disclosing extreme earnings news, while Strategy 2 focuses on investment in the remaining announcers. In both cases, we avoid investing over the [-1, +1] event window to prevent bias, particularly against Strategy 1, as its returns react negatively to earnings miss disclosures over this timeframe. Panel B of Figure 7 displays the results for both Strategies 1 and 2, comparing them with the baseline unconditional overnight return strategy from Panel A. Strategy 1, which buys and holds stocks announcing extreme earnings misses, would have produced a 6.37 log price by the end of December 2020, in contrast to 1.81 for Strategy 2. Given that the terminal log price for the unconditional overnight strategy is 2.87, our analysis suggests that nearly a third (1 - 1.81/2.87 = 37%) of the outperformance observed in the unconditional overnight return strategy is driven by stocks reporting extreme earnings misses. This proportion of contribution (one-third) is economically significant especially given that the announcing stocks - those with extreme earnings misses - constitute a mere fraction (approximately one-sixteenth or 6.03%) of all sample announcers.

5 Option implied volatility over the quarterly earnings cycle

Empirical evidence, stemming from the seminal work of Patell and Wolfson (1979, 1981) and subsequently supported by studies by Rogers et al. (2009) and Hann et al. (2019), suggests a consistent and distinctive pattern in the behavior of options implied volatilities (IVs) surrounding scheduled earnings announcements. On average, IVs rise as the announcement date approaches,

reflecting increasing information uncertainty among investors, and this pattern is followed by a sharp decline in IVs thereafter. The post-announcement reduction in IVs is consistent with the resolution of information uncertainty due to the public release of financial and concomitant news. Beaver et al. (2018, 2020) find a significant drop in their U-statistic (analogous to stock price volatility) on the announcement day from its pre-announcement peak. Further analyses of the "earnings seasonality" in IVs are provided by Neururer and Riedl (2014), Smith and So (2022) and Dubinsky et al. (2023).

< Insert Figure 8 here >

In this section, we examine the dynamics of option IVs throughout the quarterly earnings cycle following the earnings news release. Figure 8 displays the average trajectories of 30-day option IVs for stocks grouped by varying degrees of earnings surprise, over the trading days within the quarterly earnings cycle. Specifically, Panel A plots the implied volatility on event day *t* relative to the implied volatility on event day -5, while Panel B presents the plots in terms of percentage (%) IV changes.[11]

Three notable observations emerge from the figure. First, consistent with the findings of Patell and Wolfson (1979, 1981), Rogers et al. (2009) and Hann et al. (2019), the average IVs of all the announcers slowly increase in the days leading up to the earnings news announcements, followed by a sharp decrease thereafter. The marked decline in the average IVs of the announcers, unconditional on the earnings news contents, is consistent with the resolution of *ex-ante* uncertainty following the dissemination of earnings-related information.[12]

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[11] An astute reader may notice that the red line in both panels of Figure 8 appears more "jagged" compared to other "smoother" colored lines. This distinction arises because the red line, representing average IVs of announcers reporting extreme earnings misses, is estimated from a relatively smaller sample of observations. As noted earlier in Section 2.2, earnings beats are twice as frequent as earnings misses.

[12] After remaining relatively stable for a trading month following the announcement, IVs for all news surprise groups gradually climb back to a common level as the end of the earnings quarter *q* approaches, and the next quarter

Second, in a result echoing the findings of Isakov and Perignon (2001), and Truong et al. (2012), we observe a marked discrepancy in the magnitude of the average decline in IVs immediately following earnings news release and contingent upon the news content. In particular, stocks that report extreme earnings misses (represented by the red line in Figure 8), experience a relatively modest drop in IV - approximately 4.5% from the IV level on day -5. In contrast, the drop in IV for stocks disclosing extreme earnings beats (depicted by the green line) is twice as large, at about 9%, relative to day -5. The smaller drop in IV for firms with extreme earnings misses suggests a lower degree of resolution of the information uncertainty that existed prior to the announcement, in comparison with that of firms disclosing other degrees of earnings surprise.

The third finding constitutes preliminary evidence as to plausible factors driving the pronounced overnight premium over the quarterly earnings cycle following the announcements of extreme earnings misses. Figure 8 shows that in the periods following earnings news releases, the spread in IVs between announcers with extreme misses and those of other earnings surprises is most notable in the initial 20-30 trading days following the earnings announcements. This IV spread gradually diminishes as the next quarterly earnings announcement date approaches. Such a trend in the IV spread is consistent with heightened analyst activity (both buy-side and the issue of sell-side research notes), increased media coverage, and what Gallagher et al. (2010) describe as "interpretive trading" - speculative trading ("discovery") that is typically observed during the initial weeks following announcements. During this period, there is arguably an undercurrent of belief on Wall Street that corporate insiders may attempt to influence the

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q+1 announcement draws near. This observation aligns with the findings of Patell and Wolfson (1979, 1981) who pointed out that the expected temporal pattern when volatility during earnings announcement exceeds its average on non-announcement days. For example, the 30-day IV begins to incorporate the higher expected announcement-time volatility when we are within 30 calendar days of the next announcement. For a more comprehensive treatment, we refer readers to Smith and So (2022) and Dubinsky et al. (2023).

narrative surrounding negative news through active guidance. The flurry of these all this "action" typically peaks soon after the earnings announcement.

The IV pattern observed in Figure 8 could seemingly conflict with Erhard's (2023) findings: Erhard contends that the risks associated with stock announcements increase with the time elapsed since the last information disclosure. However, extreme earnings misses typically result in a demand for additional clarifying information, thus prolonging the period (of information acquisition) until potentially just prior to the next earnings announcement. As a result, the risk of subsequent disclosure in the first 20-30 trading days after a firm reporting extreme earnings miss is higher, a pattern that is consistent with the IV behavior that we observe in Figure 8. In the next section, we shift our attention towards better understanding this post-earnings information acquisition process, focusing on the release of Form 8-Ks.

6. Post-Earnings Announcement Information Acquisition: Form 8-Ks

The empirical evidence presented above suggests an increasing trend in stock volatilities, as measured by IVs, throughout the earnings quarter. This observed IV pattern reflects an "earnings seasonality" which plausibly manifests itself in post-announcement return premiums that compensate for the associated risk. The next question is whether the exposure to risk, or specific aspects of it, might explain the OPEAD that seems especially pronounced following extreme earnings misses. If this conditional risk arises from a shift in information uncertainty following extreme earnings misses that prompts additional information acquisition effort, is there concrete evidence of such efforts? To address this question, we consider the disclosures in *post*-earnings announcement 8-K reports as indicative of subsequent material event information following the earnings surprise. A notable example would be an extreme earnings miss that

raises the previously unexpected prospect of possible executive management changes (and concomitant 8-K filing) "further down the road."

< Insert Figure 9 here >

To begin, Figure 9 plots the average daily abnormal overnight return over the [+2, +61] event window unconditional on earnings news contents. As before, we exclude the [-1, +1] event window to avoid any distortion of post-announcement return behavior by immediate price reactions to earnings announcements. Panel A shows the average daily abnormal (market-adjusted) overnight return on nights without an 8-K disclosure, while Panel B is an analogous plot for stocks disclosing at least one material event in Form 8-K at night *t*. We focus on filings made between 16:00 at period *t* and 9:30am at period *t*+1, and exclude filings made within regular trading hours at period *t* since they would predominantly influence the intraday return. We conduct statistical tests to evaluate whether the abnormal returns in Panel B are significantly different from zero, where significance at the 5% and 10% levels respectively is indicated by "*" and "#".

Figure 9 reveals a stark difference in stock market reaction between nights with 8-K events, and nights without 8-K events. On average, the overnight market reacts positively (and in a few instances, statistically significantly) to 8-K events filed overnight, and negatively when there is no overnight filing.

< Insert Figure 10 here >

Figure 10 displays the frequency of Form 8-K filings across various rankings of prior earnings announcement surprises, ranging from those with extreme earnings misses at the top to those with extreme earnings beats at the bottom. Panel A, positioned on the left, shows the total number of filings, while Panel B, located on the right, illustrates the average frequency of Form

8-K filings per prior earnings announcement surprise. The figure shows a clear pattern: stocks with extreme earnings misses consistently filed the most Form 8-Ks in the ensuing post-earnings announcement quarter, surpassing even those with extreme earnings beats. The time-series average of 0.0372 of a Form 8-K filed each night/day *t* per earnings announcement by the extreme earnings miss group, is for example 12.7% higher than the average of 0.0330 for the most extreme earnings beats. This disparity indicates the increased level of disclosure of material information following extreme earnings misses, suggesting a heightened level of investor scrutiny and information demand in the aftermath of such earnings news.

< Insert Figure 11 here >

We now break down the average post announcement return across all stocks in Figure 9 into the average return conditional on the magnitude of earnings surprise, ranging from the quintile of stocks making extreme earnings misses to the quintile of those with extreme earnings beats. The results are depicted in Figure 11. Following the Figure 9 format, Panel A on the left of Figure 11 shows the average daily abnormal overnight return on nights without an 8-K disclosure, while Panel B displays the results for stocks disclosing at least one Form 8-K at night *t*. Panel B also includes the statistical test for significance of the respective average daily abnormal stock return as denoted by the "*" and "#" markers.

From the top row in Figure 11, we see that the positive abnormal stock return for stocks announcing extreme earnings misses on day $t = 0$ is relatively muted when there was no 8-K filing on day *t* throughout the quarter. In sharp contrast, it becomes economically and statistically significant in multiple instances when those stocks also make 8-K filings throughout the quarter.

7. Unscheduled Overnight Information and Market-Making Risk

Our analysis shows that stocks which fall significantly short of quarterly earnings forecasts exhibit an increased frequency of subsequent 8-K disclosures of a material event. Moreover, 75.3% of these unscheduled Form 8-Ks filings occur overnight, a period when market liquidity is thin. It is widely recognized that trading costs are higher in such thinly traded market. The current literature provides three key pieces of evidence as to why trading costs are elevated in such situations.

First, Ben-Rephael et. al. (2021), using data on both retail and institutional trading directly for Form 8-K filings, show that "retail investors ... trade in the same direction as the filing information and cause price pressure [while] institutional investors appear to trade against the retail investors, profiting from providing liquidity" (p. 3). The authors don't distinguish between overnight and next-day trading. But traders' conventional view is that retail liquidity in the thin quote-driven overnight market is particularly costly and conversely that the provision of liquidity is profitable to institutional market makers. We could say that there is instead "more attention" paid to order flow on prescheduled announcement nights, though the attention is rational, not "behavioral" in any significant sense. A thin market means a higher risk and presumably premium pricing for market-makers who supply liquidity to absorb imbalances in order flow as investors trade out of their prior-to-announcement positions[13] given the information in the announcement.

Second is the Cui and Gozluklu (2021) evidence for filings of Form 4 for insider trades. Those filings, 58% of which are after-hours and unscheduled like 8-K filings, convey information about the risks of carrying positions around after-hours 8-K filings. The authors

[13] It can be cost-effective to hedge overnight market risk for an individual announcement using E-Mini futures contracts.

report that there is a return premium at filing time, i.e., abnormal returns are higher in after-hours trading, especially for insider sales announcements.[14]

Third, Boyarchenko et al. (2023) show that imbalances in E-mini-S&P futures contract buy and sell volume at end of trading day likewise result in overnight return premiums on the positions that are consequently carried overnight, particularly in the 02:00EST to 03:00EST hour when European trading begins.

8. Conclusion

We document a positive and significant *post*-earnings-announcement drift in overnight equity returns, in particular for stocks reporting extreme misses. We believe that the significantly higher return can ultimately be traced to the smaller fraction of pre-announcement uncertainty about earnings and concomitant news that is resolved in the case of stocks with the extreme misses. Using 8-K event filings as a proxy for additional and material information revealed *post* announcement, we confirm that the rate of those filings is higher following the near misses. Since most 8-Ks are filed overnight and retail investors tend to first receive the information at that time, the *post* announcement returns occur overnight, especially so because the 8-K filings are not pre-scheduled, and the overnight markets are particularly thin in that circumstance. As a result, market-maker risk and trading costs are commensurately higher then.

We show that the average *post*-earnings announcement returns accord with a quarterly "seasonal" pattern in implied volatility for the extreme miss announcements, where that pattern reflects additional information seeking engendered by the miss. As such, the risk associated with

[14] It is worth noting that their result is stated as: "...for announcements during AHT, the event day returns are calculated using the next day's closing price relative to the closing price before AHT begins," which looks like it might conflate the announcement overnight return with the next day's intra-day return.

"information uncertainty" can potentially explain the higher OPEADs without appealing to *ad hoc* alternatives like a sluggish response in stock price on announcement night (which thus "spills over" to the higher post-earnings-announcement returns as investors come to pay full attention).

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Table 1: Descriptive statistics

This table reports some descriptive statistics. In Panel A, *SUE* represents the standardized unexpected earnings estimate per quarter, *analyst followings* indicates the number of analysts following a firm per quarter, *firm size* denotes market capitalization per quarrter, and *stock price* refers to the quarterly share price. In Panel B, *# of filers* is the count of unique firms disclosing Form 8-K filings, and *# of 8Ks* represents the total number of Form 8-K files reported to the SEC. The sample period covers from October 2004 to December 2020.

	Mean	Stdev	Pctile 25	Pctile 50	Pctile 75
Panel A					
SUE (%)	-0.136	11.35	-0.052	0.056	0.228
Analyst followings	7.3	5.7	3.0	5.0	10.0
Firm size ($ bil)	8.94	34.39	0.50	1.53	5.02
Stock price	51.18	1126.07	13.36	26.30	47.01
Panel B					
# of filers	3049.1	228.0	3019	3060	3117
# of 8Ks	20675.1	2705.2	19790	20573	22192
# of 8Ks per firm	6.8	4.8	4	6	9

Table 2: Fama-MacBeth regression

This table reports estimates from the Fama-MacBeth regression of cumulative (market adjusted) abnormal returns over the 60-day event window starting two days after the earnings announcement date on the decile rank of SUE (DSUE) variable. Estimates are measured separately during the day (from open-to-close), and during the night (from close-to-open). The parenthesized standard errors are adjusted for serial correlations using the Newey-West estimator up to 8 lags. The last row reports the difference between the night estimates and day estimates, with the squared brackets denote the corresponding *t*-statistics. *, **, and *** represent significance levels at 10%, 5% and 1%, respectively. The sample period is October 2004 to December 2020.

Returns (%) over	Intercept	DSUE	Avg. R^2 (%)
Night	0.238	-2.136	0.21
	(0.580)	(0.932)**	
Day	0.202	1.461	0.28
	(0.580)*	(0.384)***	
Night - Day	0.036	-3.597	
	[0.071]	[-4.796]***	

Table 3: Panel regression

Columns (1) and (2) report estimates from the panel regression Equation (5) of cumulative (market adjusted) abnormal returns over the 60-day event window starting two days after the earnings announcement date. N_t is a deterministic variable equal to 1 if it is night return, and 0 if it is intraday return. Column (1) reports the result without firm control variables, and Column (2) reports the results controlling for familiar firm characteristics. Columns (3) and (4) report estimates from panel regression Equation (6), without and with control variables, respectively. The parenthesized standard errors are clustered at the firm level. *, **, and *** represent significance levels at 10%, 5% and 1%, respectively. The sample period is October 2004 to December 2020.

	(1)		(2)		(3)		(4)	
Intercept	-0.148	(0.191)	51.31	(2.799)***	-1.498	(0.048)***	63.06	(5.357)***
N_t	0.235	(0.382)	11.71	(1.946)***				
DSUE	1.944	(0.255)***	1.519	(0.248)***				
N_t × *DSUE*	-3.734	(0.543)***	-2.952	(0.548)***				
ln(*size*)			-3.418	(0.185)***			-4.604	(0.370)***
N_t × ln(*size*)			-1.367	(0.117)***			-2.156	(0.780)***
ln(*BTM*)			1.511	(0.663)**			-0.996	(0.992)
N_t × ln(*BTM*)			6.033	(0.405)***			13.56	(4.407)***
Mktbeta			-2.359	(0.205)***			1.682	(0.366)***
N_t × *Mktbeta*			6.033	(0.405)***			6.235	(1.888)***
RetMonth			0.016	(0.008)*			-0.057	(0.019)***
N_t × *RetMonth*			-0.140	(0.026)***			-0.459	(0.117)***
RetYear			-0.002	(0.002)			0.011	(0.003)***
N_t × *RetYear*			0.007	(0.003)***			-0.006	(0.007)
Dummy					5.544	(0.845)***	14.779	(8.10)*
Year-qtr FE	Yes		Yes		Yes		Yes	
Firm FE	Yes		Yes		Yes		Yes	
R^2 (%)	0.21		1.80		0.16		1.80	

Figure 1: Overnight and intraday premiums

The figure shows the average daily market-adjusted returns (expressed in percentages) for those reporting extreme earnings misses (red line), those reporting extreme earnings beats (green line), and other non-extreme earnings surprises (orange, black and blue dashed lines). We require each news announcement to have at least two analyst followings. Panel A shows the premiums after-market trading hours, and Panel B shows the premiums during regular trading hours. The vertical line at $t = 0$ denotes earnings announcement day. To facilitate readability, the x-axes in both panels are restricted to [-1, +61], and the y-axes are limited to [-0.20%, +0.20%]. The sample period covers from October 2004 to December 2020.

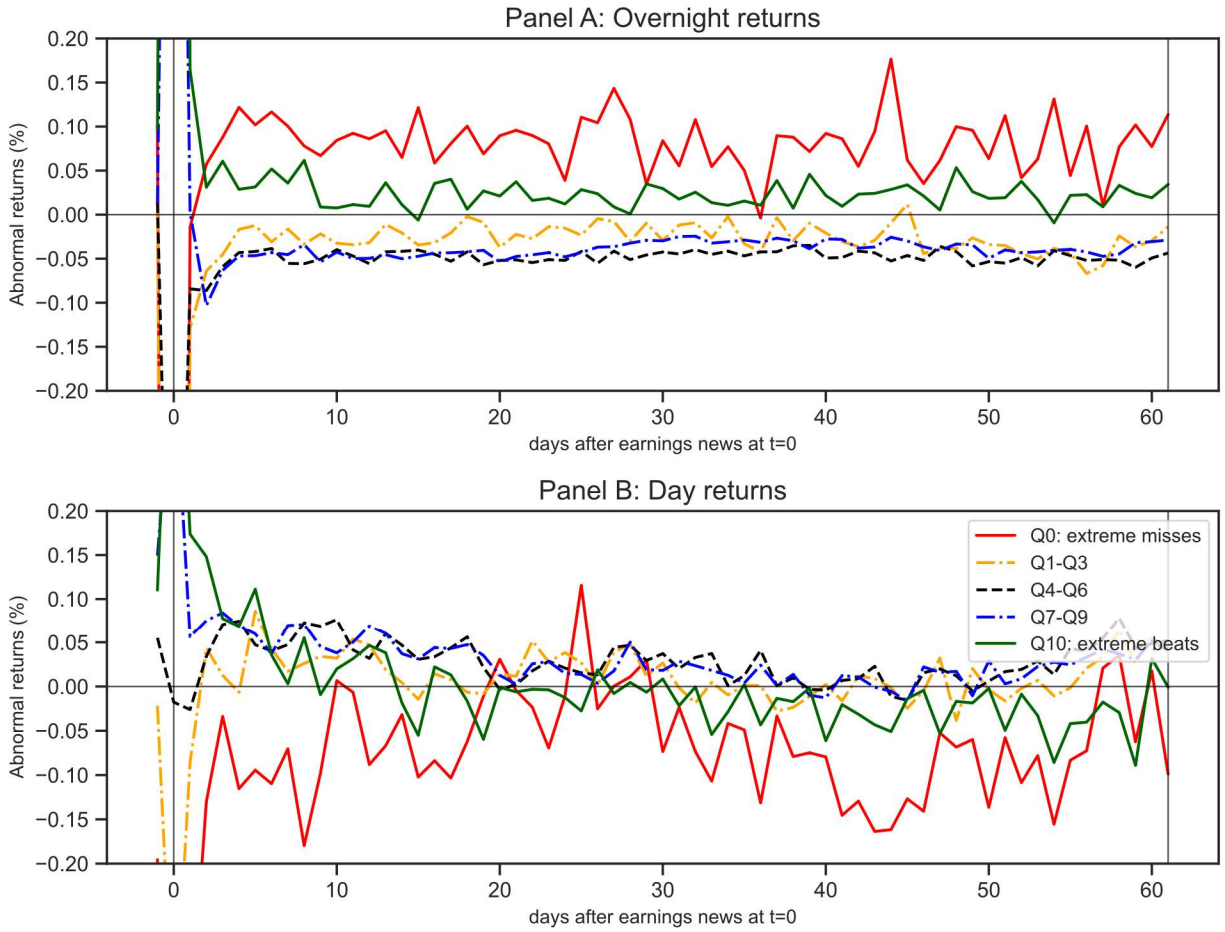
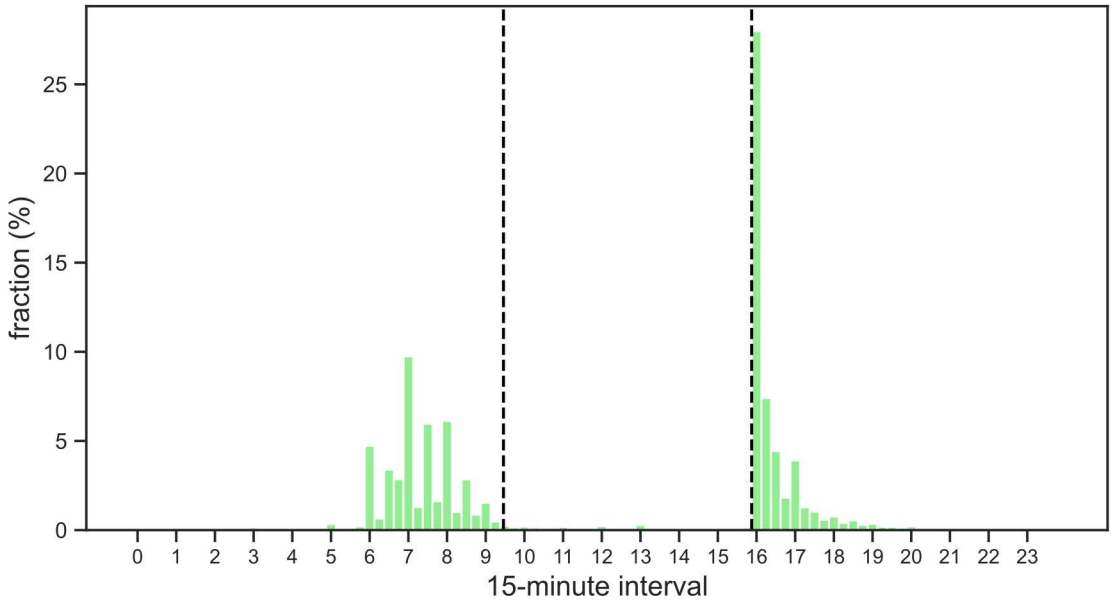


Figure 2: Earnings announcement time and Form 8-K acceptance time

Panels A and B display the distribution of earnings announcement time and Form 8-K acceptance time, respectively. The two vertical dashed lines in each panel denote the market opening time at 09:30, and the market closing time at 16:00, respectively. The sample period covers from October 2004 to December 2020.

Panel A: Distribution of earnings announcement time



Panel B: Distribution of Form 8-K acceptance time

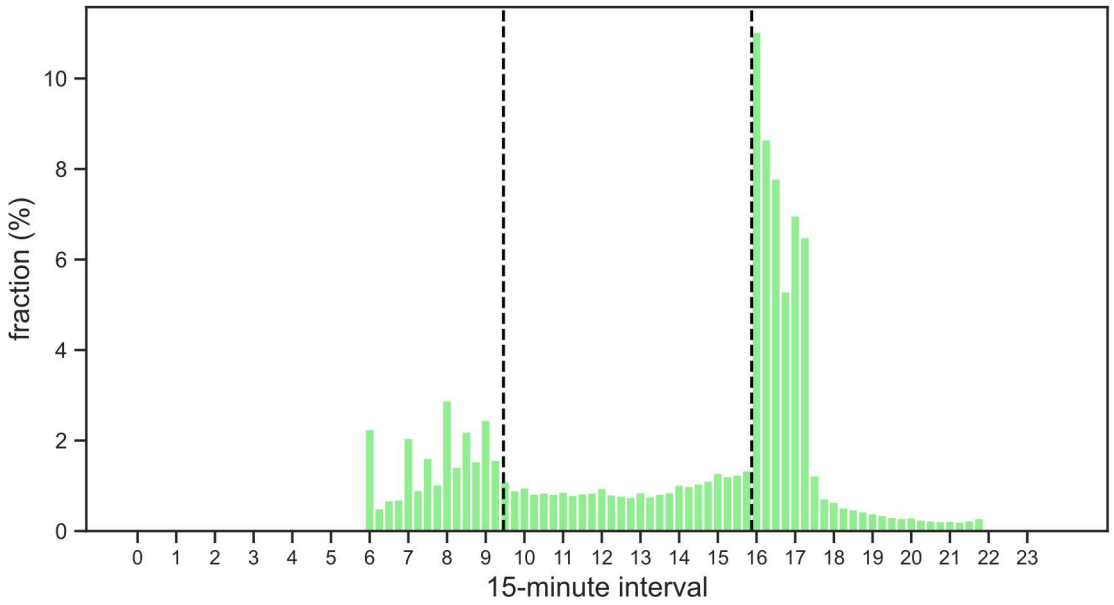


Figure 3: Distribution of disclosure-driven items and event-driven items

The figure displays the distribution of fraction of Form 8-K filing made over the earnings reporting quarter. The average of filing fraction across the [+1, +61] event window is 1.30 percent (given by the red horizontal line). The sample period covers from October 2004 to December 2020.

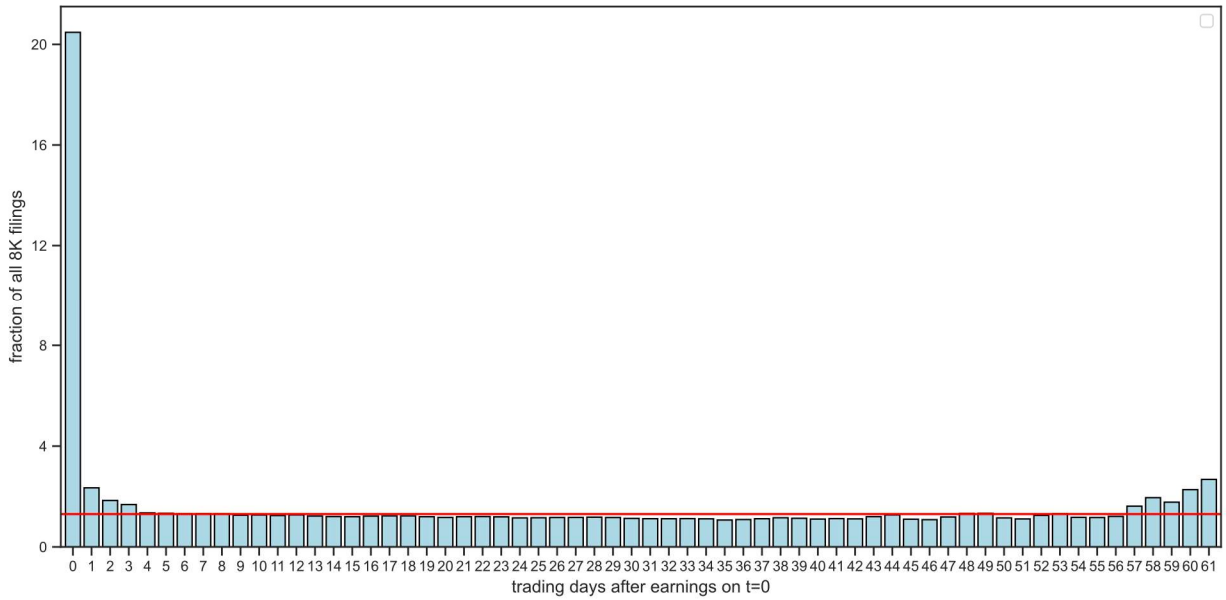


Figure 4: Overnight and intraday price drifts

The figure shows the average daily cumulative returns (expressed in percentages) for extreme earnings misses, extreme earnings beats and other non-extreme earnings surprises over the full sample period. The shaded area corresponds to 95% confidence interval surrounding the average price drift line. We require each stock making an earnings announcement to have at least two analyst following it. Panel A shows the price drifts after-market trading hours (i.e., OPEAD), and Panel B shows the price drifts during intraday or regular trading hours (i.e., DPEAD). The vertical line at $t = 0$ denotes earnings announcement. Each panel of the figure plots the price drift over the [-1, +61] event window. The sample period covers from October 2004 to December 2020.

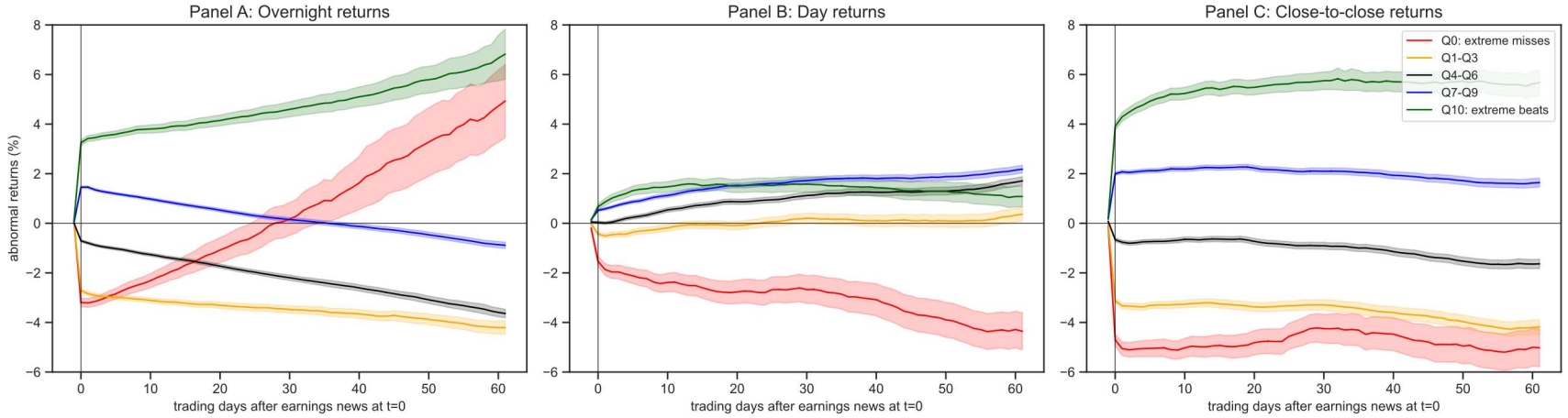


Figure 5: Mean annual premium, sorted by years

The figure shows the mean annual premium (%) associated with overnight returns (upper row) and intraday returns (lower row) across a spectrum of firms, ranging from those characterized by extreme earnings misses (Panel A) to those with extreme earnings beats (Panel E). In each panel, the mean premium is calculated by averaging the stock return in excess of the market return over the [+2, +61] event window, and annualized by 260, on a yearly basis. The sample period covers from October 2004 to December 2020. The mean return finding shown in the panels for 2004 is calculated by averaging stock abnormal returns over a three-month period from October 2004 to December 2004. The "*" and "#" markers indicate statistical significances at the 5% and 10% levels, respectively.

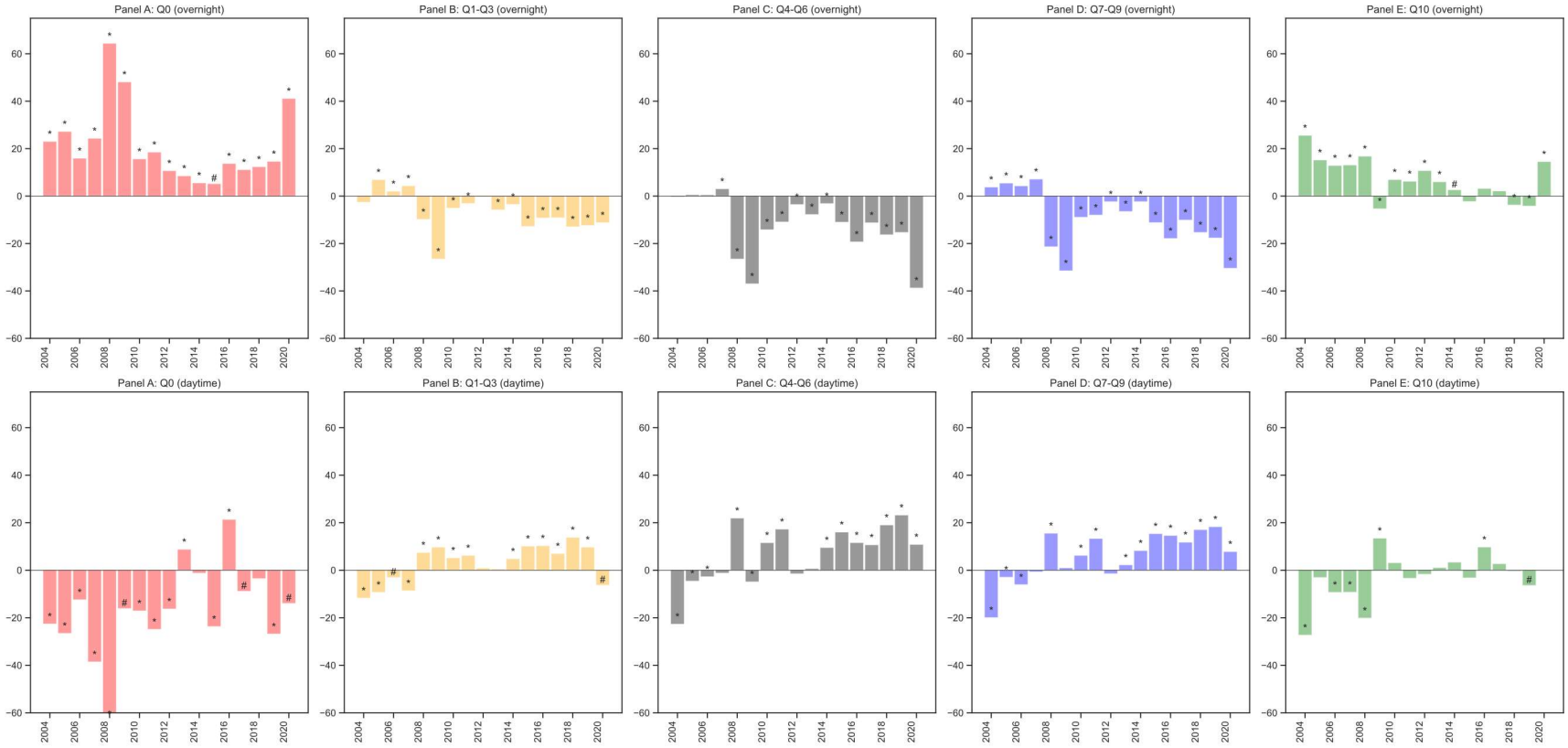


Figure 6: Overnight price drifts for S&P500 firms and other firms

The figure shows the average daily cumulative overnight returns (expressed in percentages) for extreme earnings misses, extreme earnings beats and other earnings surprises disclosed by S&P500 firms (Panel A) and other firms (Panel B). The shaded area corresponds to 95% confidence interval surrounding the average price drift line. We require each stock making an earnings announcement to have at least two analyst following it. The vertical line at $t = 0$ denotes earnings announcement. Each panel of the figure plots the price drift over the [-1, +61] event window. The sample period covers from October 2004 to December 2020.

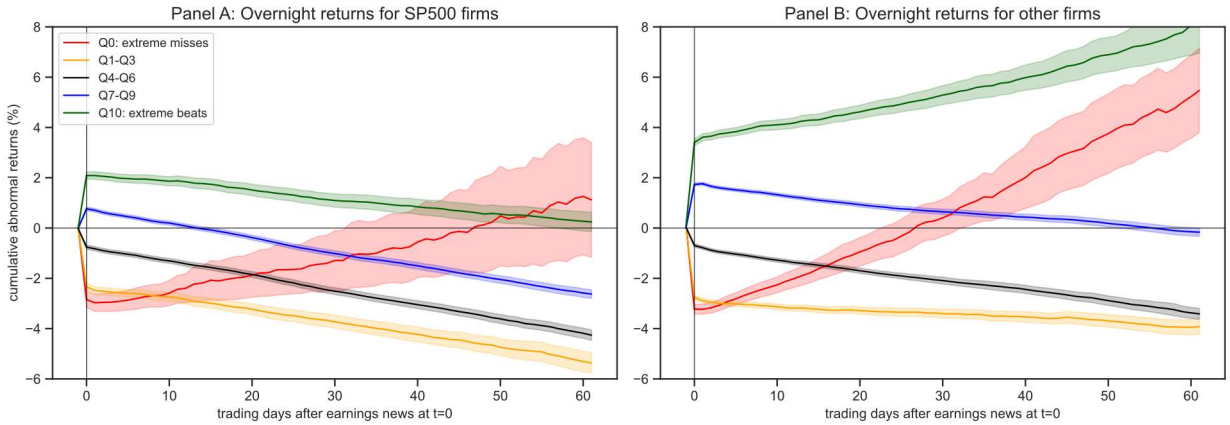
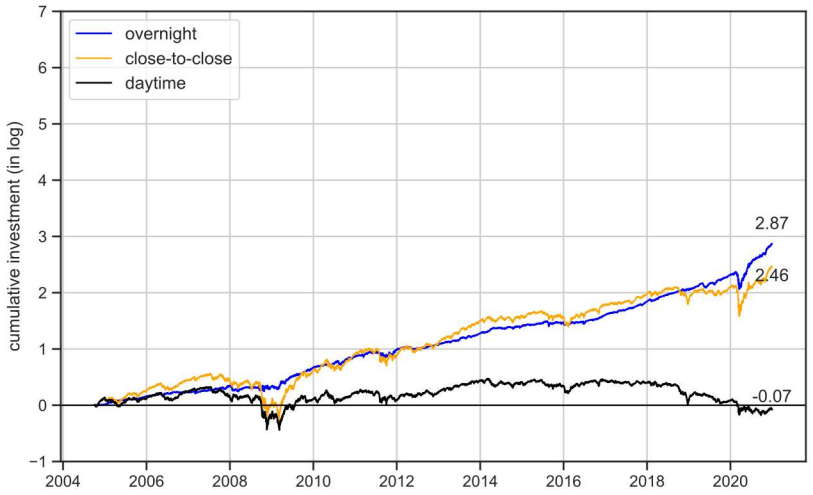


Figure 7: Cumulative returns of a $1 investment

The figure shows time-series of cumulative returns for a $1 investment using various equally-weighted trading strategies, each beginning in October 2004. Panel A shows various investment strategies unconditional on earnings news. The blue, orange, and black lines represent strategies of investing using overnight returns, close-to-close returns and intraday returns. Panel B shows two distinct strategies of investing using overnight returns: one is by investing in stocks with extreme earnings misses (red line), and the other for other announcers (purple line). For reference, the panel also includes the unconditional strategy (blue line) that invests using overnight returns. To facilitate comparison, the cumulative investment outputs are presented in log form, and the y-axis is both panels is restricted between -1 and +7. The sample period covers from October 2004 to December 2020.

Panel A: Unconditional investment strategies



Panel B: Conditional investment strategies

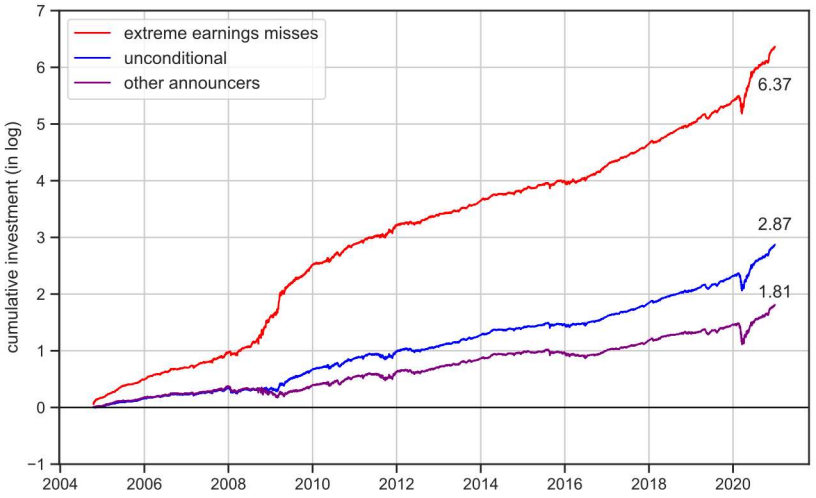


Figure 8: Option implied volatility

The figure shows the pattern of option implied volatility over the [-5, +61] event window. Each line represents the average implied volatility of firms reporting extreme earnings misses (red line), firms reporting extreme earnings beats (green line), and firms reporting non-extreme earnings surprises (orange, black and blue lines). Panel A plots the implied volatility on event day *t* relative to the implied volatility on event day -5, and Panel B presents the plots in terms of percentage (%) changes. The sample period covers from October 2004 to December 2020.

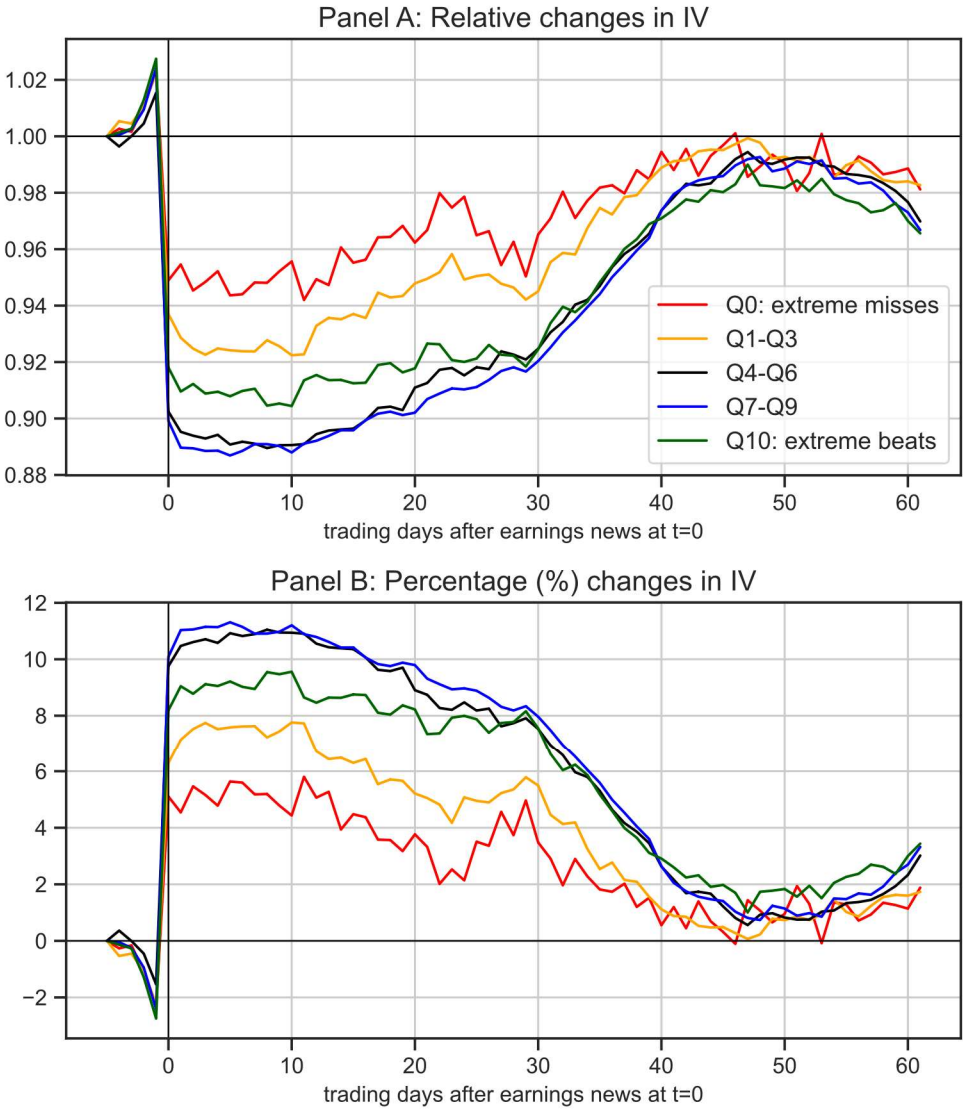


Figure 9: Average daily abnormal overnight return (unconditional on earnings news)

The figure shows the average daily abnormal overnight return unconditional on earnings news announcements. The average premium is calculated by averaging the stock return in excess of the market return over the [+2, +61] event window. Panel A shows the result when there was no Form 8-K disclosure on day *t*, while Panel B displays the results when there was at least one Form 8-K disclosed overnight. The dashed horizontal line in Panel B is the average estimate over the event window. The sample period covers from October 2004 to December 2020. The "*" and "#" markers in Panel B indicate statistical significances at the 5% and 10% levels, respectively.

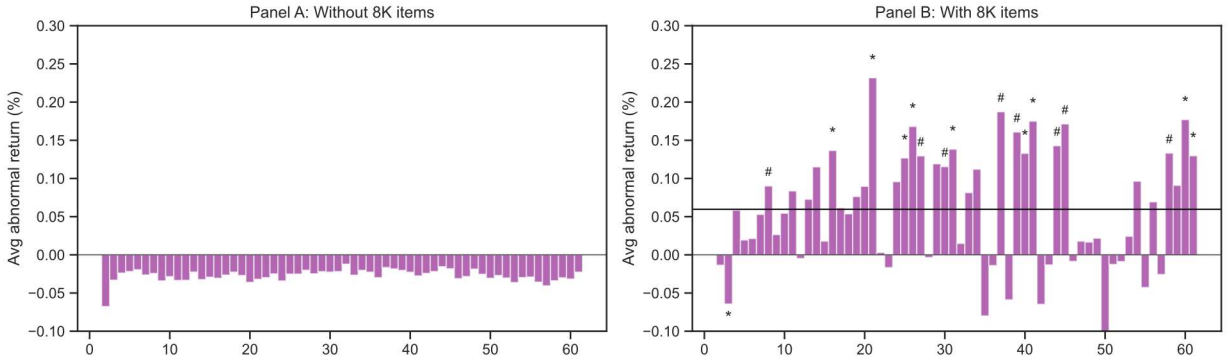


Figure 10: Frequency of Form 8-K filings on day t (conditional on earnings news)

The figure shows the frequency of Form 8-K filings across a spectrum of firms, ranging from those characterized by extreme earnings misses (top row) to those with extreme earnings beats (bottom row). Panel A shows the number of 8-K filings, while Panel B displays the filing frequency per earnings news announcements. The dashed horizontal line in each row in Panel B is the average estimate over the event window. The sample period covers October 2004 to December 2020.

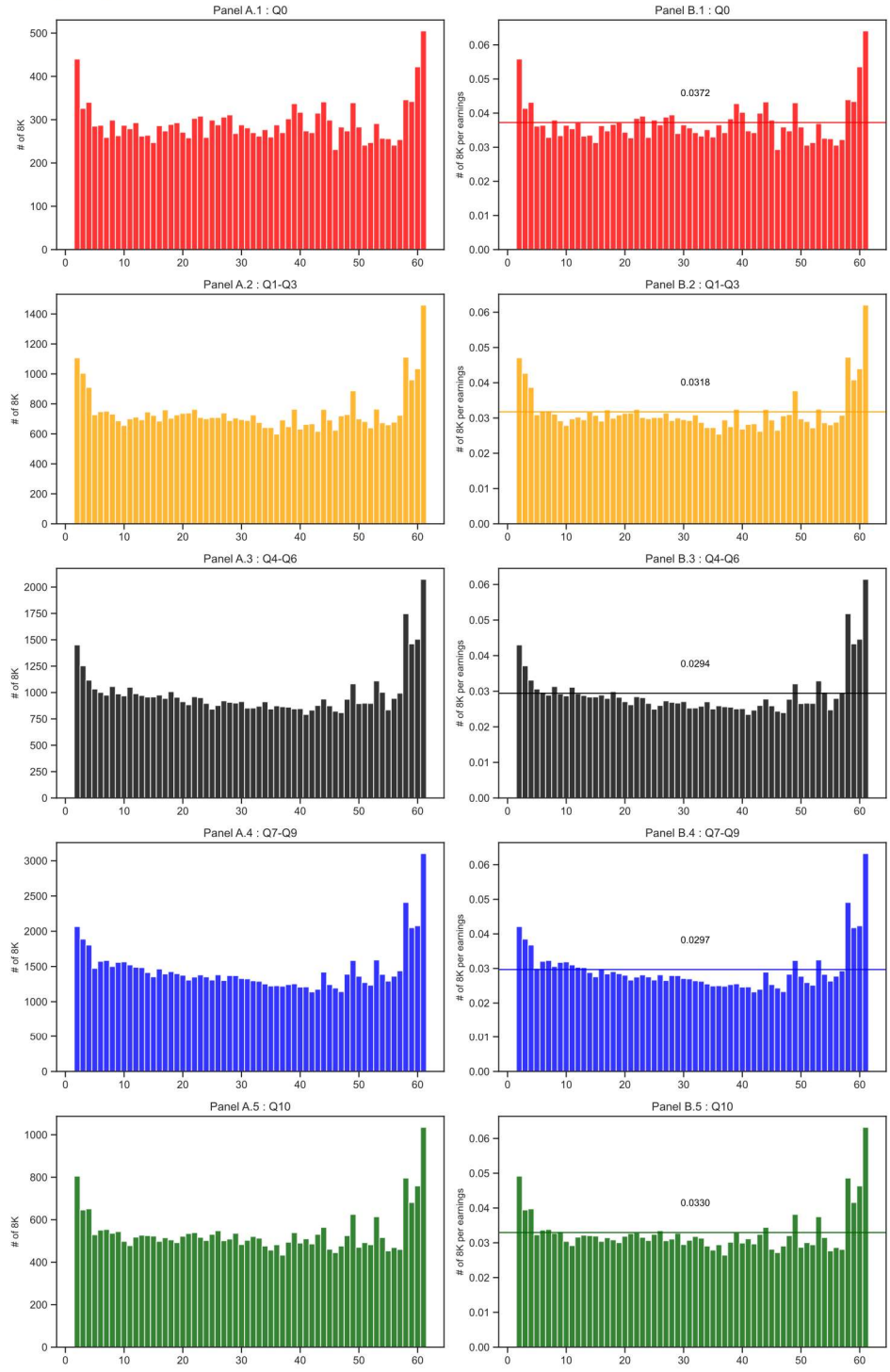


Figure 11: Average daily abnormal overnight return (conditional on earnings news)

The figure shows the average daily abnormal overnight return across a spectrum of firms, ranging from those characterized by extreme earnings misses (top row) to those with extreme earnings beats (bottom row). The average premium is calculated by averaging the stock return in excess of the market return over the [+2, +61] event window. Panel A shows the result when there was no Form 8-K disclosure on day *t*, while Panel B displays the results when there was at least one Form 8-K disclosed overnight. The dashed horizontal line in each row in Panel B is the average estimate over the event window. The sample period covers from October 2004 to December 2020. The "*" and "#" markers in Panel B indicate statistical significances at the 5% and 10% levels, respectively.

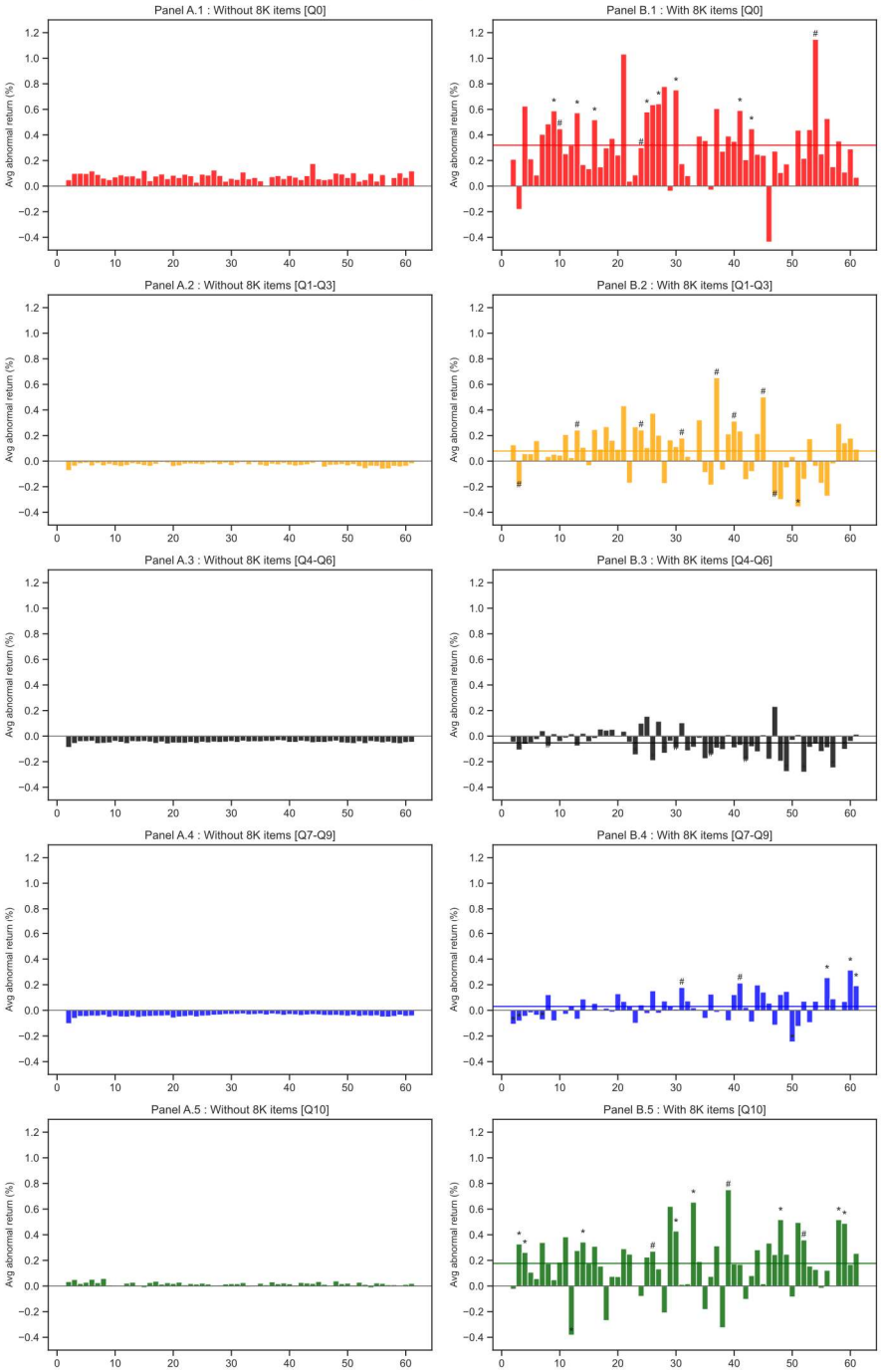


Table 1A: 8-K file description

The table provides a description and counts of all the items found in Form 8-K filed by earnings announcers in our sample. The sample period is between October 2004 and December 2020.

Item	Description	count	%
1.01	**Entry into a material definitive agreement**	**101512**	**7.439**
1.02	Termination of a material definitive agreement	9926	0.727
1.03	Bankruptcy or receivership	208	0.015
1.04	Mine safety - reporting of shutdowns and patterns of violations	140	0.01
2.01	Completion of acquisition or disposition of assets	11902	0.872
2.02	**Results of operations and financial condition**	**203502**	**14.913**
2.03	Creation of a direct financial obligation or an obligation under an off-balance sheet arrangement of a registrant	29601	2.169
2.04	Triggering events that accelerate or increase a direct financial obligation or an obligation under an off-balance sheet arrangement	1172	0.086
2.05	Cost associated with exit or disposal activities	4189	0.307
2.06	Material impairments	1877	0.138
3.01	Notice of delisting or failure to satisfy a continued listing rule or standard; transfer of listing	6935	0.508
3.02	Unregistered sales of equity securities	12423	0.91
3.03	Material modifications to rights of security holders	7216	0.529
4.01	Changes in registrant's certifying accountant	3289	0.241
4.02	Non-reliance on previously issued financial statements or a related audit report or completed interim review	1852	0.136
5.01	Changes in control of registrant	2681	0.196
5.02	**Departure of directors or certain officers; election of directors; appointment of certain officers & compensatory arrangements of certain officers**	**121902**	**8.934**
5.03	Amendments to articles of incorporation or bylaws; change in fiscal year	20710	1.518
5.04	Temporary suspension of trading under registrant's employee benefit plans	910	0.067
5.05	Amendments to the registrant's code of ethics, or waiver of a provision of the code of ethics	1149	0.084
5.06	Change in shell company status	151	0.011
5.07	Submission of matters to a vote of security holders	33821	2.479
5.08	Shareholder nominations pursuant to exchange act rule 14a-11	341	0.025
6.02	Change of servicer or trustee	4	0
6.03	Change in credit enhancement or other external support	2	0
6.04	Failure to make a required distribution	3	0
6.05	Securities act updating disclosure	5	0
7.01	**Regulation FD disclosure**	**124919**	**9.155**
8.01	**Other events**	**158563**	**11.62**
9.01	**Financial statements and exhibits**	**503644**	**36.909**

Table 2A: Variable definitions

Variables of interest

$CAR^{N/D}_{i,[2,61]}$	Night or day cumulative market-adjusted abnormal return of firm *i* over the 60-day event window starting two days after the earnings announcement date
$SUE_{i,t}$	Standardized unexpected earnings of firm *i* on date *t*
$DSUE_{i,t}$	Decile rank of $SUE_{i,t}$

Control variables

$Size_i$	Total market value of firm *i* in the month prior to earnings announcement date
BTM_i	Book-to-market value of firm *i* estimated at the end of the previous quarter
$RetMonth_i$	Market-adjusted buy-and-hold return for firm *i* for the month prior to earnings announcement date
$RetYear_i$	Market-adjusted buy-and-hold return for firm *i* for the months [-12, -1] prior to earnings announcement date
$Mktbeta_i$	Market beta of firm *i*, estimated by regressing daily close-to-close returns against market returns over 12 months prior to earnings announcement date, with no less than 6 months of daily returns.