News-Driven Return Reversals: Liquidity Provision Ahead of Earnings News

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Abstract

This study documents a six-fold increase in short-term return reversals during earnings announcements relative to non-announcement periods. Following prior research, we use reversals as a proxy for expected returns market makers demand for providing liquidity. Our findings suggest that market makers demand higher expected returns prior to earnings announcements because of increased inventory risks that stem from holding net positions through the release of anticipated earnings news. These findings indicate that increases in market makers' inventory risks result in reduced liquidity through a channel distinct from adverse selection risks and that pre-announcement demand for liquidity provision results in predictable variation in earnings announcement returns. We also use pre-announcement option prices to show that return reversals increase when there is greater expected volatility during earnings announcements. Collectively, our findings suggest that uncertainty regarding anticipated information events elicits predictable increases in expected returns to liquidity provision and that these increases significantly affect the dynamics and information content of market prices.

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1. Introduction

Many of the seminal works in classical asset pricing assume the absence of market frictions in the process that aggregates information into market prices. Under this assumption, theory predicts that market prices immediately reflect all available information. In reality, several market frictions significantly impact the efficiency and information content of market prices. This study focuses on the friction that arises from the need to locate a counterparty in order to complete a trade. Market makers typically mitigate this friction by matching would-be sellers with would-be buyers. When there is an imbalance between the quantities sought by buyers and sellers at a given price, market makers may absorb the order imbalance into their own account by serving as the trade counterparty. This practice is commonly known as liquidity provision.

Market makers are averse to providing liquidity.[1] This aversion reflects the fact that providing liquidity typically increases market makers' long or short positions, which can result in undesirable levels of inventory and increased net exposure to the risk of price fluctuations. Additionally, prior research shows that market makers manage small baskets of securities, rather than diversified portfolios, which makes them averse to idiosyncratic risks, and also have limited risk-bearing capacity because losses on positions may trigger margin requirements and/or internal risk controls that force market makers to lock in trading losses by closing losing positions (e.g., Naik and Yadav (2003), Comerton-Forde et al. (2010), and Nagel (2012)). Recognition of these risks results in market makers' demanding compensation for providing liquidity.

The compensation that market makers demand for providing liquidity varies with inventory risks, which reflect the risks of adverse movements in the price of their net positions. For a given net position, inventory risks increase when anticipated volatility rises due to greater potential for trading losses. Additionally, prior research shows that market makers

[1] Following Hendershott, Jones, and Menkveld (2011) and Nagel (2012), we use the term market makers to refer to the broad category of liquidity providers which includes, but is not limited to, officially designated marker makers as well as algorithmic traders, quantitative funds, and institutional traders.

can often take several days to unwind net positions (e.g., Madhavan and Smidt (1993), Jegadeesh and Titman (1995)). Thus, providing liquidity immediately prior to high volatility events increases inventory risks by raising the likelihood that market makers will be forced to hold excess inventories through the event window. Together, these factors motivate our central hypothesis that market makers increase expected returns for providing liquidity prior to anticipated information events. The goal of this paper is to show that anticipated information events elicit predictable increases in market makers' inventory risks that have an economically large impact on both liquidity and returns.

In this paper, we use earnings announcements as an example of information events and examine how the expected returns to liquidity provision change ahead of the announcements. We focus on earnings announcements because they are anticipated events that often trigger increases in return volatility, which allows us to study how market makers adjust liquidity provision in anticipation of both the timing and content of the announcement.

Prior research demonstrates that market makers extract price concessions from traders demanding immediate liquidity as compensation for incurring inventory risks.[2] Market makers extract price concessions by lowering midpoint quotes below fundamental value in response to sell order imbalances, and vice versa in response to buy order imbalances. By shifting midpoint quotes in the direction of order imbalances, market makers hope to avoid excess inventories by inducing offsetting orders. In the absence of induced offsetting orders, market makers capture price concessions by purchasing shares below fundamental value and selling shares above fundamental value. Through this process, order imbalances result in price concessions that affect the level, and thus the information content, of transaction prices.

As net buying/selling pressure subsides, market makers tend to unwind net positions toward targeted levels and transaction prices become less likely to reflect price concessions. The excess of price concessions when entering versus exiting a net position provides market

[2]See, for example, Ho and Stoll (1981), Campbell, Grossman, and Wang (1993), Llorente et al. (2002), Bao, Pan, and Wang (2011), and Nagel (2012) which theoretically demonstrate that risk-averse market makers demand price concessions when providing liquidity due to inventory holding costs associated with the risk of price fluctuations. We discuss these papers in more detail in Section 2.

makers with a positive expected return from providing liquidity, which manifests as a negative autocorrelation in returns (i.e., return reversals). This reversal pattern is formalized in the model of Nagel (2012), which shows that lagged returns signal market makers' inventory imbalances and that market makers capture return reversals as equilibrium compensation for incurring inventory risks. Following this line of research, we use return reversals as a proxy for the expected returns market makers demand for providing liquidity.

Several decades of research documents robust empirical evidence of return reversals in daily, weekly, and monthly calendar-time portfolios (see Section 2 for additional discussion). Our study differs from this prior research by examining the influence of inventory risks on return reversals ahead of anticipated information events, when the demand for immediate liquidity and risks of near-term volatility are likely to be high. We find that short-term return reversals increase enormously during earnings announcements, suggesting that spikes in inventory risks result in predictable changes to the autocorrelation of returns around anticipated information events.

Our findings indicate that inventory risks significantly increases prior to earnings announcements, which may be surprising in light of prior research that concludes the opposite. Krinsky and Lee (1996) empirically decomposes the components of the bid-ask spread using intra-day data and documents a decline in inventory risks as measured by the extent to which intra-day price movements reverse within 30-minute windows in the days prior to earnings announcements. These apparently differing conclusions can be reconciled by the fact that Krinsky and Lee (1996) examines intra-day inventory risks, whereas we measure return reversals accumulated over multiple days to highlight the influence of overnight inventory risks associated with holding net positions through the release of earnings news. Our finding suggests that overnight inventory risks not only increase prior to earnings announcements but also give rise to the concentration of return reversals during the announcements.

We quantify the impact of anticipated information events on liquidity provision by contrasting reversal magnitudes during earnings announcements and non-announcement periods.

Specifically, we show that a long (short) position in firms whose returns strongly underperform (outperform) the market in the three-days prior to earnings announcements yields an average return of 145 basis points during the announcement window. By comparison, the average return to a comparable portfolio during non-announcement periods is 22 basis points, indicating that return reversals increase more than six-fold during earnings announcements. This effect is driven by increasingly positive returns of recent 'losers' and increasingly negative returns of recent 'winners' that are consistent with a sizable shift in liquidity as defined by Pastor and Stambaugh (2003) in the sense that order flow induces increasingly large price fluctuations prior to earnings news. Additionally, we plot reversal magnitudes in event-time and show that they gradually rise ahead of announcements and fall sharply immediately afterwards, which provides compelling evidence that anticipated information events elicits rapid shifts in the expected returns to liquidity provision.

A related literature in finance and accounting examine changes in liquidity around earnings announcements using more traditional liquidity proxies such as quoted spreads and depth. A shortcoming of these traditional proxies is that they reflect both adverse selection and inventory risks, which can simultaneously decrease liquidity but through distinct channels. An innovation of our paper is our focus on return reversals. This innovation is important because microstructure models show that adverse selection results in wider spreads but does not induce return reversals, aside from potentially exacerbating bid-ask bounce. Because adverse selection does not give rise to negative autocorrelation in returns, the use of reversals allows us to focus on the link between liquidity and inventory risks associated with the announcement. Specifically, the magnitude of return reversals isolates the expected return that market makers receive for providing liquidity, over and above compensation for adverse selection risk (Nagel (2012)). In focusing on expected returns to liquidity provision, our finding highlight increases in pre-announcement inventory risks as an alternative and complementary reason for decreases in liquidity prior to anticipated information events that are not attributable to adverse selection.

Additional tests confirm that the concentration of reversals during earnings announcements is robust to the use of midpoint and open-to-close returns, and skipping a day between return windows, which mitigate the influence of bid-ask bounce. Similarly, conditioning on share-turnover as a proxy for the amount of uninformed trade strengthens the disparity in reversal magnitudes across announcements and non-announcement periods. Additionally, we find no evidence that reversal magnitudes vary with proxies for asymmetric information. Specifically, we show that reversals are not concentrated among small firms or those with high probability of informed trade (PIN), which corroborates predictions from market microstructure models that return reversals are unlikely to be driven by adverse selection.

Finally, we provide evidence that expected returns to liquidity provision increase in inventory holding risks as measured by the level of volatility expected during the earnings announcement. Following Patell and Wolfson (1981), we use implied volatilities from pre-announcement option prices to measure the total anticipated volatility specific to the earnings announcement window. We show that return reversals are larger when there is greater volatility expected during the announcement, suggesting that market makers anticipate the level of uncertainty associated with information events and adjust expected returns to compensate themselves for varying levels of inventory risks.

The results of this paper have significant implications for several strands of research. First, a substantial literature spanning finance, economics, and accounting examines returns during earnings announcements as a means to understand a host of interrelated phenomenon including the information content of earnings, shocks to investor expectations, and whether investors misprice predictable variation in earnings. We show that predictable increases in return reversals have an economically large impact on realized returns during earnings announcements that are distinct from the market's reaction to earnings news. Thus, failing to control for these reversals confounds inferences based the magnitude of earnings announcement returns. Second, the results show that a substantial portion of short-term return reversals are concentrated around earnings announcements, which provides evidence that liquidity

providers' short-term demand curves are increasingly downward sloping prior to anticipated information events. Thus, studies examining whether short-term reversals reflect opportunities for arbitrage and those asserting behavioral explanations for reversal patterns need to account for predictable spikes in reversal magnitudes around earnings announcements. Finally, our findings relate to a vast literature examining the effect of firms' disclosures on liquidity. Whereas most of this literature focuses on the impact of disclosure on liquidity through the lens of adverse selection, our findings highlight inventory risks as an alternative channel through which firms' disclosures elicit intertemporal variation in liquidity by mitigating uncertainty regarding the timing and content of value relevant news.

The remainder of the paper is organized as follows. In Section 2, we discuss the related literature on return reversals, liquidity provision, and market frictions around earnings announcements. Section 3 discusses the methodology and describes the findings of our main empirical tests. Section 4 examines additional analyses and Section 5 concludes.

2. Relation to literature

Lo and MacKinlay (1988) and Conrad and Kaul (1988) were among the first studies to provide evidence that individual security returns are negatively autocorrelated. Subsequent work by Lehmann (1990) and Jegadeesh (1990) document significant profits, absent transaction cost considerations, from contrarian strategies exploiting the reversal of short-term returns. These studies provide evidence that a long position in stocks with recent extreme negative returns and a short position in stocks with recent extreme positive returns yield statistically significant portfolio returns. A substantial literature builds upon these findings by linking return reversals to various contributing factors such as liquidity (e.g., Avramov, Chordia, and Goyal (2006b) and Bao, Pan, and Wang (2011)), trading volume (e.g., Campbell, Grossman, and Wang (1993) and Llorente et al. (2002)), information transfers across related firms (e.g., Andrade, Chang, and Seasholes (2008)), trades across classes of investors (e.g., Griffin, Harris, and Topaloglu (2003)), financial crises (e.g., Krishnamurthy (2009) and

Khandani and Lo (2011)), and financial sector funding constraints (e.g., Hameed, Kang, and Viswanathan (2010) and Nagel (2012)). Collectively, this literature provides robust evidence that predictable return reversals are not an artifact of data snooping or sample biases.[3] Our study contributes to this literature by examining whether predictable increases in inventory risks result in the concentration of return reversals around anticipated information events. In a related study, Figelman (2007) looks for seasonality in monthly reversal strategies and finds that monthly return reversals are larger in months that firms announce earnings. Specifically, Figelman (2007) shows that monthly reversal strategies increase from 49 basis points in non-announcement months to 95 basis points in the month of an earnings announcement but does not explore the source of this change. By contrast, our study shows that short-window reversal strategies earn 145 basis points in the three days surrounding earnings announcements and provides evidence that larger reversals reflect increases in inventory risks associated with the announcement.

A related literature models how liquidity provision is shaped by market makers' inventories and incentives. In the models of Stoll (1978) and Grossman and Miller (1988), market makers provide liquidity by trading on their own account with investors who cannot immediately find a trade counterparty and, thus, liquidity provision can be thought of as the service of providing immediacy. Providing immediacy is costly because it increases the likelihood that the market maker will be forced to hold undesirable levels of inventory. Naik and Yadav (2003) and Comerton-Forde et al. (2010) point out that inventory risks are likely to affect liquidity provision because market making is decentralized such that individual market makers focus on the position risk of stocks in their individual portfolio rather than on positions held by other market makers, even those market makers working for the same employer. These studies show that market makers manage small baskets of securities, rather than diversified portfolios, which makes them averse to idiosyncratic inventory risks.

[3]Several studies raise doubts that return reversals reflect a violation of market efficiency that provides economic profits after accounting for transaction costs (e.g., Ball, Kothari, and Wasley (1995), Conrad, Gultekin, and Kaul (1997), and Avramov, Chordia, and Goyal (2006b)).

Prior research also provides empirical evidence that marker makers' existing inventory positions affect their willingness to supply liquidity. In the model of Madhavan and Smidt (1993), market makers set midpoint quotes below intrinsic values to attract buyers when inventories become large and, more generally, midpoints deviate from intrinsic value as long as inventory imbalances persist. Consistent with market makers' inventories affecting liquidity provision, Hansch, Naik, and Viswanathan (1998) and Reiss and Werner (1998) demonstrate that differences in inventories across market makers for the same stock determine which market maker will offer the best quoted price. Ready (1999) points out that market makers may respond to inventory risks by stepping out of the way of incoming orders rather than providing liquidity, which effectively raises the price concessions that traders must pay when seeking immediate liquidity.

Models by Ho and Stoll (1981), Amihud and Mendelson (1980), Ho and Stoll (1993), and Madhavan and Smidt (1993) show that market makers' inventory holding costs are increasing in the volatility of the stock's fundamental value and that they prefer to reduce positions when expected volatility increases. This is because net exposures and expected volatility together contribute to the potential for market makers to trigger internal risk controls or capital requirements following trading losses. Related work by Hansch, Naik, and Viswanathan (1998), Reiss and Werner (1998), and Madhavan and Smidt (2012) demonstrate that market makers mitigate risks associated with future volatility by gradually unwinding inventories toward targeted levels after accommodating imbalanced trade pressure. By gradually unwinding net long or short positions, market makers reduce the sensitivity of their portfolio to future volatility and transaction prices become less likely to reflect price concessions. The excess of price concessions when entering versus exiting a net position provides market makers with a positive expected return from providing liquidity, which manifests as negatively autocorrelated returns. Campbell, Grossman, and Wang (1993) provides a theoretical framework for these studies by modeling return reversals as reflecting compensation to risk-averse market makers for accommodating buying or selling trade pressure. Consistent

with this view, Nagel (2012) demonstrates that return reversals closely track the expected returns market makers earn for providing liquidity and that this relation holds in a model where price pressure originates from both informed and uninformed demand for immediacy.

Andrade, Chang, and Seasholes (2008) and Avramov, Chordia, and Goyal (2006a) document a strong positive relation between proprietary measures of market makers' inventory imbalances and the reversal of contemporaneous returns and thus provide empirical support for the use of return reversals as a proxy for the expected returns to liquidity provision. Similarly, Jegadeesh and Titman (1995) provides evidence that market makers set prices to control inventories and that this pricing strategy induces short-term return reversals. Our findings contribute to this literature by demonstrating that market makers are more reluctant to absorb order imbalances ahead of anticipated information events and expected returns to liquidity provision are increasing in uncertainty associated with the announcement.

In studying the drivers of time-variation in liquidity, our study relates to studies decomposing the components of bid-ask spreads. For example, Glosten and Harris (1988) and Huang and Stoll (1997) empirically identify components of the bid-ask spread by explicitly defining the adverse-selection component as the portion that does not reverse following changes to the direction of trade. In contrast, we measure return reversals accumulated over multiple days to highlight the influence overnight inventory risks associated with holding net positions through earnings announcements. Thus, our study differs from prior research that estimates transitory components of the bid-ask spread estimated from high frequency data, which are more likely to reflect intraday inventory imbalances. Our focus on overnight inventory risks, rather than intra-day risks, helps to reconcile our findings with Krinsky and Lee (1996) who study reversals estimated within 30-minute windows in the days prior to earnings announcements and conclude that inventory holding costs decline. Moreover, we show that pre-announcement prices trend in the direction of earnings news, which suggests that the adjustment of pre-announcement prices to earnings news reduces intra-day price reversals and thus may lower estimates of the inventory risk component of bid-ask spreads.

Our study uses earnings announcements as an example of anticipated information events to study how market makers adjust liquidity provision in anticipation of both the timing and content of the announcement. Our findings are thus related to the literature examining how liquidity changes surrounding earnings announcements (see Callahan, Lee, and Yohn (1997) for a review of this literature). Early studies showed no changes, but studies using more recent data find an effect. Whereas Morse and Ushman (1983) finds that bid-ask spreads do not significantly change around earnings announcements, Krinsky and Lee (1996) and Affleck-Graves, Callahan, and Chipalkatti (2002) find that the adverse selection component of the bid-ask spread increase prior to earnings announcements.

A closely related paper is Lee, Mucklow, and Ready (1993) which uses intra-day data on market maker quotes to demonstrate that spreads widen and depths fall in short-windows prior to the release earnings news. Lee, Mucklow, and Ready (1993) also shows that the decrease in liquidity is related to the magnitude of the price reaction at the announcement, suggesting that market makers anticipate the magnitude of the impending news releases.

Our findings build upon these prior studies on changes in liquidity around information events by focusing on return reversals rather than traditional proxies for liquidity such as quoted spreads and depth. A shortcoming of these traditional proxies is that they capture adverse selection as well as the influence of inventory imperfections. In contrast, Glosten and Milgrom (1985) and Llorente et al. (2002) point out that return reversals are not attributable to adverse selection because adverse selection results in wider spreads but does not induce reversals in transaction prices, aside from potentially exacerbating bid-ask bounce. Instead, these models show that adverse selection tends to result in permanent price impacts. Hence, by focusing on return reversals, our analysis allows us to isolate the change in liquidity attributable to increased inventory risks rather than as compensation for incurring adverse selection risk. In doing so, we highlight how variation in inventory risks gives rise to predictable changes in the autocorrelation of returns and information content of prices around anticipated information events.

3. Empirical tests

3.1. Sample Selection

We construct the main dataset used in our analyses from three sources. We obtain price and return data from CRSP, firm fundamentals from Compustat, and option implied volatilities from OptionMetrics to calculate pre-announcement implied volatilities associated with the earnings announcement window.[4] We begin our analysis by examining quarterly earnings announcement dates reported in Compustat, though we also consider expected announcement dates in subsequent tests. To mitigate the influence of bid-ask bounce on our calculation of return reversals as noted in Roll (1984), we next eliminate firms with prices below $5 and employ alternative means of calculating returns. Our final sample consists of 107,039 earnings announcements spanning from 1996 to 2011.

Panel A of Table 1 contains descriptive statistics on the sample used throughout our main analyses. Because our main analyses examine return reversals during earnings announcements, our primary predictive variable is the pre-announcement return, PAR, defined as the cumulative market-adjusted return from t-4 to t-2 where t is the firm's quarterly earnings announcement date.[5] For our primary analyses, we measure pre-announcement returns over the three-day window from t-4 to t-2 for ease of comparison with the three-day earnings announcement window from t-1 to t+1, though we examine the robustness of our findings to alternative return specifications in subsequent tests. RET(-1,+1) reflects the market-adjusted announcement return from t-1 to t+1. SUE equals a firm's standardized unexpected earnings, calculated as realized EPS minus EPS from four-quarters ago, divided by its standard deviation over the prior eight quarters. SIZE and LBM are the log of market

[4] In untabulated results, we find qualitatively identical return reversals when removing the requirement that observations have option implied volatilities in the OptionMetrics database.

[5] Our main analyses focus on the returns during actual announcement dates, instead of expected announcement dates, because we are interested in understanding the source of predictable patterns in announcement returns, which are commonly the focus in studies of the market's reaction to earnings news. The use of actual announcements is well-suited for examining the compensation market makers receive for providing liquidity around information events but are likely to confound tests of whether such returns reflect market inefficiencies. See Section 4.2 for discussion of expected announcement dates.

capitalization and log of one plus the book-to-market ratio, respectively, where both are measured five days prior to the announcement. PRICE is the beginning of quarter share price. VLTY is the standard deviation of daily returns, and SP equals the bid-ask spread scaled by the midpoint quote calculated using the methodology in Corwin and Schultz (2012), where both variables are measured over the six months ending on t-10.

Panel B of Table 1 presents descriptive statistics across quintiles of PAR. Quintiles are formed each quarter using the distributional breakpoints from the prior calendar quarter, where higher (lower) values are assigned to quintile Q5 (Q1). Panel B demonstrates that the extreme quintiles of PAR (i.e., quintiles Q5 and Q1) consist of firms that are generally smaller, possess lower book-to-market ratios and share prices, and have higher volatility and relative spreads. These results suggest that pre-announcement price movements are concentrated among firms with poor information environments and larger trading frictions.

3.2. Announcement Window Return Reversals

In this section, we test our central hypothesis that anticipated information events elicit predictable changes to the autocorrelation of returns that are driven by increases in market makers' inventory risks. We are unable to directly observe market maker's inventory imbalances and thus, similar to studies of asymmetric information, we are unable to directly observe the underlying factor driving variation in liquidity and must instead make inferences based on observable market outcomes. Following Nagel (2012), we use market-adjusted returns in the pre-announcement period to proxy for market makers' inventory imbalances. Panel A of Table 2 contains time-series averages of various return metrics across quintiles of pre-announcement returns (PAR). Positive (negative) pre-announcement returns are consistent with market makers raising (lowering) prices in response to buy (sell) order imbalances and thus we expect to observe negative (positive) returns during the announcement that reflect the reversal of pre-announcement price concessions. Bolded values in Table 2 indicate that the reported value is significantly different from zero at the 5% level, which we calculate using the quarterly time-series spanning our 1996-2011 sample window.

The first column of Panel A shows that the pre-announcement return is fairly symmetric across the extreme quintiles of PAR and that they are reliably different than zero for all but the middle quintile. The second column shows that returns in the pre-announcement period reverse during the earnings announcement and that average announcement returns are monotonically decreasing across quintiles of PAR. Low PAR firms tend to earn 81 basis points during the announcement window and high PAR firms tend to lose 64 basis points.[6] The bottom row shows that the combined reversal return earned over the three-day announcement window is 145 basis points and significant at the 1% level. These findings indicate that return reversals have a statistically and economically significant impact on realized returns during earnings announcements and are thus related to a substantial literature that uses earnings announcement returns to study the information content of earnings (e.g., Ball and Brown (1968)), shocks to investor expectations (e.g., Hirshleifer, Lim, and Teoh (2009) and DellaVigna and Pollet (2009)), and whether investors misprice predictable variation in earnings (e.g., Sloan (1996), La Porta et al. (1997), and Piotroski and So (2012)). Our findings highlight the need to control for predictable increases in reversals during announcements to avoid confounding inferences based the magnitude of earnings announcement returns.

The bolded values of RET(-1,+1) in Panel A of Table 2 also show that announcement returns are significantly positive only for the bottom three PAR quintiles, for which the pre-announcement return is negative. These findings are consistent with Johnson and So (2013) who argue that the well-documented tendency for stock prices to rise during earnings announcements reflects market makers asymmetrically raising the price of providing liquidity to seller orders prior to announcements.[7] The third and final columns of Panel A demonstrate that although there is some continuation of the reversal during the t+2 to t+5

[6] Larger reversals among low PAR firms are consistent with Comerton-Forde et al. (2010) who find that NYSE specialists have positive net positions 94% of the time (not specific to announcements) and suggests that market makers prefer to sell existing positions over increasing long positions ahead of announcements.

[7] In studying predictable return reversals, our findings also contribute to the literature on predictable earnings announcement returns. Several papers including Ball and Kothari (1991), Cohen et al. (2007), and Barber et al. (2013) document that equity returns are generally positive during announcements and that they are concentrated among smaller, more volatile firms where market makers' inventory holding costs, and thus expected returns to liquidity provision, are likely to be high.

window, the magnitudes drop significantly and become insignificant in the t+6 to t+8 window indicating that the return reversal is short-lived. The continuation of reversals past the announcement window is consistent with Madhavan and Smidt (1993) and Jegadeesh and Titman (1995) who find that market maker take multiple days to revert inventory imbalances toward targeted levels.

To compare the magnitude of announcement-window return reversals to those in non-announcement periods, we repeat the analysis from Panel A using a randomly selected 'pseudo-announcement' date in place of the actual announcement date, as depicted in the timeline in Figure 1. The timeline uses firms with a December 2nd earnings announcement date as an example, and ignores weekends and trading holidays, to illustrate the separation between actual and pseudo-announcement dates. Similar to Lee, Ready, and Seguin (1994) and Christie, Corwin, and Harris (2002), we calculate pseudo-announcement dates as a baseline period relative to actual announcement dates by subtracting a randomly selected number of trading days. We draw from a uniform distribution spanning 10 to 40 days to reduce the likelihood that returns surrounding pseudo-announcement date are influenced by the proximity to actual earnings announcement dates. Panel B contains time-series average returns, where all returns are measured relative to pseudo-announcement dates.[8]

The first column of Panel B contains returns in the three days prior to pseudo-announcements, which are similar to the magnitudes of pre-announcement returns shown in Panel A. The second column shows that the average reversal strategy return during pseudo-announcement dates is 21.8 basis points, which is statistically significant but less than one-sixth of the average from actual announcement dates. Panel C of Table 2 shows the difference in returns across actual and pseudo-announcement dates. Although the difference in pre-announcement returns for actual and pseudo-announcements is 34 basis points, the return reversal for actual announcements is over 120 basis points larger than for pseudo-announcements. The six-fold

[8]For example, if k denotes the pseudo-announcement date, PAR measures the market-adjusted return from k-4 to k-2. Additionally, for pseudo-announcements, we use the notation RET(X,Y) to indicate market-adjusted return from k+X to k+Y.

increase in reversals during actual announcements compared to pseudo-announcements is significant at the 1% level, suggesting that impending information events significantly shift market makers' willingness to provide liquidity and thus increase the expected returns that market makers demand ahead of anticipated information events.

Figure 2 captures one of the main results of the paper. The figure contains the time-series average three-day return reversal and 95% confidence interval from an event-time strategy that takes a short (long) position in firms with the highest (lowest) returns over the prior three-day window. The reported strategy return is centered on the date shown on the X-axis such that the reported quantity corresponding to day t reflects the three-day cumulative strategy return from t-1 to t+1 from a long position in the lowest quintile of returns from t-4 to t-2 and a short position in the highest quintile of returns from t-4 to t-2. Consistent with the findings in Table 2, Figure 2 highlights a stark contrast in reversal magnitudes during earnings announcement dates relative to non-announcement periods.

Moreover, Figure 2 highlights a pattern of gradually increasing reversals leading up to the announcement suggesting that market makers increase expected returns in anticipation of information leakage, and thus potential volatility, ahead of the announcement date. Finally, the figure also demonstrates that reversals fall precipitously following the announcement suggesting that market makers drastically reduce the premium for liquidity provision immediately following the resolution of uncertainty associated with the announcement. The contrast of the pre-announcement ascent and post-announcement decent provides compelling evidence of the influence of anticipated information events on market makers' inventory risks. Thus, studies weighing behavioral explanations for reversal patterns should consider how their explanations reconcile with predictable spikes and declines in reversal magnitudes around earnings announcements (e.g., Subrahmanyam (2005), and Da, Liu, and Schaumberg (2013)). Additionally, our results suggest that prices become increasingly sensitive to order flow ahead of announcements and thus highlights a sizable shift in common metrics for liquidity (Pastor and Stambaugh (2003)). Hence, these results strongly caution against

the use of non-event-based measures of liquidity when examining the profitability of trades placed ahead of anticipated information events (e.g., Barron, Harris, and Stanford (2005)).

Related evidence in Figure 3 shows the rolling three-day average returns to the long- and short-legs of the reversal strategy (i.e., portfolios of 'winners' and 'losers' sorted by their returns over the prior three-days) in event-time. The difference in returns across the two portfolios equals the reversal strategy return in Figure 2 and shows that both portfolios earn more extreme returns during announcements relative to non-announcement periods. Figure 3 also shows that the difference in returns across recent winners and losers peaks on day t+1 rather than t, which demonstrates that the peak reversal occurs when the pre-announcement return is measured from t-3 to t-1 and the reversal is measured from t to t+2, consistent with market makers inventory risks and expected returns increasing in the proximity to information events. Additionally, the difference in returns to recent winners versus losers changes sign immediately after the announcement, which is consistent with findings from the literature on post-earnings announcement drift that show a gradual drift in prices in the direction of the earnings news. This finding motivates us to control for the influence of earnings news on the announcement return in subsequent tests discussed below.

Figure 4 provides the average reversal strategy return during earnings announcements for each calendar quarter in the sample. The average return is positive for 58 out of the 64 calendar quarters and positively skewed. Reversal strategy returns appear more pronounced in the first half of sample, which may reflect the evolution of market microstructure, shifts in the types of traded firms, and/or changes to the composition of liquidity providers such as increased involvement from high-frequency traders that attempt to avoid overnight holding inventories (Brogaard, Hendershott, and Riordan (2013)). While disentangling these potential explanations is beyond the scope of this paper, the figure demonstrates that the average return remains economical significant throughout the 1996-2011 sample window. Additionally, consistent with Nagel (2012), Figure 4 shows that reversal returns are largest during the collapse of the tech bubble and during the financial crises, suggesting that market makers

demand higher expected returns for providing liquidity in periods of market turmoil when market makers have limited access to capital to fund net positions.

Table 3 examines the robustness of the return reversals documented in Table 2 when using three alternative definitions of returns. One alternative explanation for the evidence of predictable announcement returns is that they are inflated by bid-ask bounce (Kaul and Nimalendran (1990)). To mitigate this concern, we repeat our analyses using open-to-close returns, midpoint-to-midpoint returns, and close-to-close returns after skipping one trading day between the pre-announcement and announcement windows. Open-to-Close indicates returns in a given window from the opening price on the first day of the window to the closing price on the last day of the window. Specifically, OPAR measures open-to-close returns from t-4 to t-2 and ORET measures open-to-close returns from t-1 to t+1. Midpoint-to-Midpoint returns are defined analogously using the midpoint of the closing bid and ask quotes in CRSP following Nagel (2012). MPAR measures midpoint-to-midpoint returns from t-4 to t-2 and MRET measures midpoint-to-midpoint returns from t-1 to t+1. Additionally, Close-to-Close, 1-Day Skip indicates the use of standard returns reported in CRSP while measuring pre-announcement returns from t-5 to t-3 and announcement window returns from t-1 to t+1. We implement the three alternative measures of returns for both actual and pseudo-announcements. The average reversal strategy return exceeds 100 basis points for each of the three implementations. More importantly, across each implementation, reversal strategy returns during actual announcements are at least five-fold of those corresponding to pseudo-announcements. These results indicate that the level and increase of return reversals during announcements are not sensitive to a particular specification or window of returns. In the remaining analyses, we use close-to-close returns to link our findings to the extant literature that examines the market's reaction to news during earnings announcements.

In the last two columns in Table 3, we report reversal magnitudes after weighting observations by share turnover, where turnover is measured as total volume in the pre-announcement period scaled by total shares outstanding. Several studies show that reversal magnitudes in-

crease when conditioning upon share turnover because higher turnover tends to indicate greater uninformed trade (e.g., Campbell, Grossman, and Wang (1993), Llorente et al. (2002), and Avramov, Chordia, and Goyal (2006b)). Consistent with these prior studies, we find that conditioning upon share turnover increases the magnitudes of return reversals. Interestingly, we find no evidence that the magnitudes of pseudo-announcement reversals increase when weighting observations by the level share turnover prior to pseudo-announcements, indicating that conditioning upon share turnover only strengthens the disparity in reversal magnitudes across announcement and non-announcement periods.

Table 4 contains results from regressing announcement returns on quintiles of PAR and additional variables that allows us to control for risk proxies and the content of the earnings news. We use quintiles in our regressions to mitigate the influence of intertemporal shifts in the distributions of our variables across quarters. Additionally, we scale the quintile values to range from zero to one, which allows us to interpret the regression coefficient as the average difference in returns across the highest and lowest quintile of a given variable. We report t-statistics, shown in parentheses, based on standard errors that are two-way clustered by firm and quarter to mitigate cross-sectional and time-series correlations in the residuals. The PAR coefficient in column (1) is significantly negative (t-statistic = -6.35) indicating a negative autocorrelation in returns at earnings announcements. The PAR coefficient in column (1) also indicates that the average difference in announcement returns across highest and lowest PAR quintiles is 116 basis points, which is consistent with the magnitude of reversal strategy returns shown in Tables 2 and 3. Columns (2) through (4) demonstrate that the relation between PAR and announcement-window returns is distinct from return momentum and robust to standard risk controls including size, book-to-market ratios, and historical CAPM betas estimated using daily data from the past year.

Column (5) of Table 4 demonstrates that PAR remains significant after controlling for earnings surprises measured contemporaneously with the announcement, indicating that pre-announcement demand for liquidity gives rise to predictable announcement returns that are

distinct from the market's reaction to the announced earnings news. The magnitude of the PAR coefficient is roughly 44% (=1.24/2.82) the size of the SUE coefficient, which not only attests to the economic significance of the reversal but also underscores the need to control for the influence of reversals in studies examining the market's reaction to earnings news. Moreover, these findings provide evidence of predictable return reversals after controlling for proxies for earnings news and are thus related to prior research documenting increases in the prices of securities added to major stock indices, where the increases are driven by shifts in demand for shares by index funds that are likely orthogonal to news about the added firms' cash flows (e.g., Shleifer (1986) and Kaul, Mehrotra, and Morck (2000)). Our results corroborate the findings of these studies that liquidity providers' short-term demand curves are downward sloping and extends these findings by showing that prices are particularly sensitive to changes in the demand for liquidity prior to anticipated information events.

Finally, the interaction effect in column (6) of Table 4 shows that reversals were larger prior to quote decimalizations, enacted on April 9th of 2001, which is consistent with prior studies documenting increased liquidity following the change toward a continuous range of permitted price quotes (e.g., Nagel (2012)). More importantly, column (6) demonstrates that reversals remain economic and statistically significant following decimalization.

To summarize the results up to this point, we provide evidence suggesting that anticipated information events elicit predictable increases in market makers' inventory risks that have an economically significant impact on both liquidity and returns. Specifically, we show that reversals increase more than six-fold during announcements relative to non-announcement periods and that reversal magnitudes gradually rise ahead of announcements and fall sharply immediately after announcements. Taken together, these findings highlight a general pattern consistent with market makers demanding higher expected returns for providing liquidity prior to earnings announcements, which stem from increased inventory risks associated with the release of anticipated earnings news. In the following sections, we extend these findings by examining cross-sectional determinants of variation in reversal magnitudes.

4. Additional Analyses

4.1. Adverse Selection Risk

Prior research documenting changes in liquidity around earnings announcements tends to attribute decreased liquidity to increases in adverse selection risks. Thus, it is natural to question whether increases in return reversals during earnings announcements result from adverse selection risks, despite theoretical predictions to the contrary. To address this question empirically, Table 5 examines the announcement return reversals after partitioning the sample by two commonly used proxies for asymmetric information: firm size and the probability of informed trade (PIN). We condition on these proxies because asymmetric information is a necessary condition for, and contributing factor to, adverse selection risks. Thus, if return reversals at earnings announcements are driven by adverse selection risk, we would expect to see larger reversals among small firms and the subsample of firms with high PIN (i.e., the subsamples where asymmetric information is likely to be highest). Panel A of Table 5 conditions on firms' size and Panel B conditions on PIN estimated over the quarter prior to the earnings announcement.[9] Across both proxies, we find no evidence that reversal magnitudes are significantly larger for firms with high levels of asymmetric information, which casts significant doubt on concerns that our findings are driven by adverse selection risks.

4.2. Expected Announcement Dates

Our primary analyses use Compustat announcement dates to help explain predictable variation in liquidity and returns that are commonly the focus of research on earnings announcements. Additionally, we interpret reversal strategy returns as reflecting equilibrium compensation rather than arbitrage opportunities, and thus the paper's broader conclusions are less likely to be confounded by look-ahead bias with respect to announcement dates. However, a potential benefit of examining reversal returns around expected, rather than actual, announcement dates is that they allow us to gauge how reversals are affected by the

[9]Quarterly data on the probability of informed trade (PIN) was graciously provided by Stephen Brown as calculated in Brown, Hillegeist, and Lo (2004).

market's ability to anticipate the information event. An important caveat, however, is that the market's expectations are difficult to measure and thus measures of expected announcement dates potentially introduce measurement errors into our analyses. With that caveat in mind, Table 6 examines returns to reversal strategies around expected announcement dates.

To construct Table 6, we calculate expected earnings announcement dates for each firm/fiscal quarter by calculating the historical median number of trading days between a firm's actual announcement date and the date of the most recent fiscal quarter end, where the median is calculated for the same fiscal quarter over the prior ten years. For each firm/fiscal quarter, we then add the historically estimated median number of trading days to the most recent fiscal quarter end to arrive at the expected announcement date.[10]

Table 6 reports announcement return averages across early, on-time, and late announcements, where on-time announcements are those whose actual announcement occurs within one day of the expected date. Similarly, early (late) announcements are those that occur more than one day before (after) the actual announcement date. The pooled sample average reversal corresponding to expected announcement dates remains statistically and economically significant at 65 basis points but is considerably lower than the 145 basis point reversal corresponding to actual announcement dates in Table 2. The second column of Table 6 indicates that the lower pooled mean is driven by the absence of reversals during early announcement dates, consistent with market makers failing to charge higher expected returns for liquidity provision ahead of information events when the event is unanticipated. The table also shows that return reversals are largest for on-time announcements when the actual and expected date coincide, which reinforces the importance of information events being anticipated. Finally, the final column of Table 6 shows that reversals are smaller for late announcements, which suggests that the delayed release of earnings news may signal the content of the announcement and thus reduce uncertainty and inventory risks.

[10] An alternative source of expected announcement dates may be obtained from news outlets such as the Wall Street Journal Earnings Calendar. Using a similar approach, Cohen et al. (2007) report that expected announcement dates align well with those reported in the Earnings Calendar.

4.3. Pre-Announcement Returns and Earnings News

Do pre-announcement returns predict earnings news? Such a relation would be consistent with a substantial literature documenting the tendency for prices to lead earnings news while also shedding light on the information content of pre-announcement returns (e.g., Beaver (1968), Bernard and Thomas (1990), and Kaniel et al. (2012)). To address this question, Table 7 contains results from regressing two earnings surprise measures, SUE and SURPRISE, on quintiles of PAR and additional firm characteristics. SUE is measured as in previous tables and SURPRISE equals the actual EPS number reported in the IBES unadjusted summary file minus the last consensus forecast available immediately prior to the announcement, and scaled by beginning of quarter price.

In Table 7, the significantly positive PAR coefficient in columns (1) through (3) demonstrate that pre-announcement returns predict the sign and magnitude of SUEs. This relation is robust to inclusion of standard controls for firm size, book-to-market ratios, and return momentum. We also control for lagged accruals from the prior quarter, ACC, defined as the difference between net income and cash flow from operations, and scaled by total assets. We include ACC as a control because Sloan (1996) finds that large accruals tend to signal lower future earnings. We also control for the earnings surprise from the prior quarter, Past-SURPRISE, because Bernard and Thomas (1990) demonstrates that there is positive serial correlation in quarterly earnings surprises. Columns (4) through (6) provide qualitatively similar results when using analyst-based earning surprises, SURPRISE, as the dependent variable. Together, the results of Table 7 demonstrate that pre-announcement prices lead earnings news, which suggests a parallel between our setting and the model of Nagel (2012) in which market makers provide liquidity by accommodating price pressure from both informed and uninformed traders.

Our findings in Tables 2 and 7 together suggest that informed agents trade in the direction of earnings news but also tend to lose money during the announcement. Thus, it may be initially puzzling why informed traders would systematically offer price concessions

in exchange for immediacy ahead of earnings announcements. These findings are consistent with results from prior studies that establish differences in investment horizons across informed traders, who are more likely to be long-term focused, and market makers, who are more likely to be short-term focused. For example, Hasbrouck and Sofianos (1993) examines the trades of NYSE specialists and finds that they are good short-term traders but undistinguished long-term speculators. Campbell, Ramadorai, and Schwartz (2009) finds that daily institutional trading negatively predicts near-term returns, consistent with institutions demanding liquidity, but positively predicts longer-term returns. Additionally, Gutierrez Jr and Kelley (2008) find that although extreme weekly returns reverse in the next week, they subsequently continue in the direction of the initial return and offset the reversal over the follow the next 52 weeks. Consistent with these interpretations, untabulated results show no significant differences in returns across the extreme PAR portfolios over the 52 weeks beginning on the first day of the announcement window, indicating that the costs of immediacy are offset over long windows following the announcement.

4.4. Conditioning on Proxies for Inventory Risks

The above results document a robust pattern of return reversals that are concentrated at earnings announcements. Our analyses are motivated by the idea that market makers have limited risk-bearing capacity and are driven to limit net exposure to volatility and inventory risks. Thus, we hypothesize that market makers demand higher expected returns for providing liquidity ahead of earnings announcements when there is greater uncertainty regarding the market's reaction to earnings news.

To test this hypotheses, we use an *ex ante* measure of uncertainty associated with earnings announcements as implied by pre-announcement option prices. Following Patell and Wolfson (1981), we calculate implied announcement volatility, IAV, as the total announcement-specific volatility implied by option prices. Specifically, we use the implied volatilities of two at-the-money standardized options measured five trading-days apart to separate the components of volatility attributable to the announcement versus non-announcement periods,

where option prices are measured in the t-4 to t-2 window (See Appendix A for more details on the calculation of IAV).

There are two primary factors that motivate the Patell and Wolfson (1981) approach. The first is that it relies on market-based measures of expected volatility as reflected in traded option prices and thus approximates investors expectations during the pre-announcement window. Second, it uses the change in implied volatility to isolate the component of anticipated volatility directly associated with the impending announcement, which helps to identify near-term risks that are likely to influence market makers' willingness to providing liquidity ahead of the announcement.

To test the relation between anticipated announcement volatility and expected returns to liquidity provision, we examine the magnitude of return reversals after conditioning on IAV. Panel A of Table 8 presents time-series average announcement-window returns after independently double-sorting observations into quintiles of PAR and IAV. Consistent with our hypothesis, the bottom row of Table 8 shows that the average reversal equals 96 basis points (t-statistic = 4.37) among the lowest IAV quintile, whereas the average reversal equals 217 basis points (t-statistic = 5.49) among high IAV firms. The time-series average difference between high and low IAV quintiles is 121 basis points (t-statistic = 3.20), which is consistent with market makers demanding higher expected returns for providing liquidity ahead of announcements that pose greater inventory risks.

Figure 5 plots average three-day return reversal for each day relative to the earnings announcement after conditioning on the level of volatility anticipated at the announcement. The left (right) panel contains the event-time plot of average reversal magnitudes among firm-quarters in the high (low) IAV quintile. The plot graphically depicts how the dynamics of return reversals vary with the level of uncertainty underlying the announcement. Specifically, Figure 5 demonstrates that changes in return reversals during earnings announcements relative to non-announcement periods are more pronounced when market participants expect a larger increase in volatility associated with the information event.

To examine the robustness of the link between inventory risks and reversal magnitudes, Panels B and C of Table 8 examines the magnitudes of return reversals when conditioning on alternative proxies for inventory risks. Specifically, Panel B uses the level of implied volatility (IV) from a thirty-day standardized option during the pre-announcement period and Panel C uses the firm's historical absolute market-adjusted return (HR) during its most recent quarterly earnings announcement. Higher levels of both IV and HR signal a higher likelihood of extreme price movements during the impending announcement and thus corresponds to greater inventory risks. In both Panels B and C, the bottom row shows that reversal magnitudes during announcements are monotonically increasing across portfolios of both IV and HR, indicating that the positive link between reversal magnitudes and inventory risk is robust to alternative proxies.

Additionally, to mitigate concerns that the results in Panels A through C are driven by the fact that our the inventory risk proxies measure time-invariant characteristics corresponding to the cost of providing liquidity in a given firm (i.e., that are not associated with the announcement), we conducted analogous tests of return reversals around pseudo-announcements, where IAV and IV are measured prior to pseudo-announcements. In untabulated results, we find no significant relation between our inventory risk proxies and reversal magnitudes around pseudo-announcements, indicating the pricing of inventory risks is more pronounced ahead of anticipated information events.

Taken together, the findings in Table 8 suggest that market makers anticipate the level of uncertainty associated with information events and adjust expected returns to compensate themselves for variation in the level and timing of risks. Because the level of uncertainty associated with an earnings announcement is likely a function of the reporting firm's disclosures, our findings relate to prior research on the link between disclosure and liquidity (e.g., Amihud and Mendelson (1986), Diamond and Verrecchia (1991), and Easley and O'Hara (2004)). Whereas most empirical tests of these theories focus on the impact of disclosure on liquidity through the lens of adverse selection (see Healy and Palepu (2001) and Beyer et al.

(2010) for reviews of this literature), our findings emphasize inventory risks as an alternative and complementary channel through which firms' disclosures elicit significant variation in liquidity around earnings announcements by mitigating uncertainty regarding the timing and content of value relevant news releases. Our finding suggests that overnight inventory risks significantly increase prior to earnings announcements and thus reduce liquidity by making prices more sensitive to net order flows.

4.5. Untabulated Results

A few additional robustness checks are worth mentioning. First, to mitigate the influence of differences in volume prior to actual and pseudo-announcements on our tests of reversal magnitudes, we also partitioned our sample based on whether volume prior to actual announcements was higher, equal to, or lower than the volume prior to pseudo-announcements. We find that reversal magnitudes during actual announcements remain significantly larger than those during pseudo-announcements among all of these sample partitions, where the difference ranges from three- to seven-fold. Second, we separate the sample by the firm's primary exchange listing and find that the average announcement reversal return is 130 basis points among NYSE-listed firms and 171 basis points among Nasdaq-listed firms. Reversal magnitudes decline over time for both exchanges. These findings suggest that inventory risks are larger among Nasdaq firms but does not identify whether the disparity is attributable to differences in the composition of firms across exchanges and/or differences in exchange structures that were more pronounced early on in the sample window. Finally, we find that reversal magnitudes are significantly larger when there are a large number of firms in the same two-digit SIC industry that announce earnings on the same day. To the extent that market makers tend to provide liquidity in peer firms, these results compliment findings in Corwin and Coughenour (2008) that specialists have limited capacity for attention and focus their resources on stocks with information events by shifting liquidity away from remaining assigned stocks.

5. Conclusion

This study documents a dramatic increase in short-term return reversals during earnings announcements relative to non-announcement periods. Our findings suggest that liquidity providers' short-term demand curves are increasingly downward sloping prior to anticipated information events due to increases in inventory risks associated with the announcement.

We show that a long (short) position in firms whose returns strongly underperform (outperform) the market in the three-days prior to earnings announcements produces an average return of 145 basis points during the announcement window. By comparison, the average return to a comparable portfolio during non-announcement periods is 22 basis points, indicating that return reversals increase more than six-fold during earnings announcements. This effect is driven by increasingly positive returns of recent 'losers' and increasingly negative returns of recent 'winners' that are consistent with a sizable shift in liquidity as defined by Pastor and Stambaugh (2003) in the sense that order flow induces increasingly large price fluctuations prior to earnings news. Contrary to prior studies that measure intra-day inventory risks, our findings suggest that earnings announcements elicit predictable increases in overnight inventory risks associated with holding net positions through the announcement and that these increases have an economically large impact on both liquidity and returns.

Using implied volatility from pre-announcement prices, we also show that return reversals are increasing in the level of volatility directly associated with the announcement, suggesting that market makers anticipate the level of volatility associated with information events and adjust expected returns to compensate themselves for varying levels of inventory risk. By focusing on return reversals, our analysis highlights increased inventory risks as an alternative and complementary reason for decreases in liquidity prior to anticipated information events that are not attributable to adverse selection. Collectively, our findings show that anticipated information events elicit increases in inventory risks that have a striking influence on the autocorrelation of returns and the information content of market prices.

Appendix A: Estimation of Implied Announcement Volatility

This appendix provides an overview of the calculation of the total volatility associated with the earnings announcement date as implied by option prices. The calculation follows Patell and Wolfson (1981), which posits that instantaneous volatility remains at the level γ, except at the earnings announcement. During an announcement with length τ, the instantaneous volatility increases to $\gamma + \tau\delta$. Letting t_e denote the announcement date, the implied volatility of an option on day t_a<t_e satisfies

$$\sigma(t_a) = \gamma + \frac{\tau\delta}{(t_e - t_a)}, \tag{A.1}$$

Using the implied volatility of an at-the-money option with the expiration date t_e on days t_a and t_b, where t_a<t_b<t_e, we solve for $\tau\delta$ as follows:

$$\tau\delta = \frac{(\sigma(t_b) - \sigma(t_a))(t_e - t_a)(t_e - t_b)}{(t_b - t_a)} \tag{A.2}$$

We calculate the implied increase in volatility at announcements, $\tau\delta$, for three-different pairs of dates separated by five-trading days: [t_a, t_b]=[(t-7, t-2), (t-8,t-3), (t-9,t-4)]. To reduce measurement error associated with a particular date, we calculate $\tau\delta$ for each pair and use the average. Plugging $\tau\delta$ back into equation (A.1) allows us to solve for γ. Next, we solve for the total implied announcement volatility (IAV) as follows:

$$IAV = \gamma + \tau\delta, \tag{A.3}$$

where IAV reflects the total implied volatility specific to the earnings announcement and is expressed as an instantaneous variance.

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Figure 1: Timeline of Analysis

The figure contains a timeline of actual and pseudo-announcement dates used in the main analyses. The timeline uses firms with a December 2nd earnings announcement date as an example, and ignores weekends and trading holidays, to illustrate the separation between actual and pseudo-announcement dates. Actual announcement dates reflect the quarterly earnings announcement as reported in Compustat. Pre-announcement returns are calculated from t-4 to t-2 as the cumulative market-adjusted return, where day t is the earnings announcement. Pseudo-announcement dates are calculated by subtracting a randomly selected number of trading days from the actual announcement date. The randomly selected numbers are drawn from a uniform distribution spanning 10 to 40.

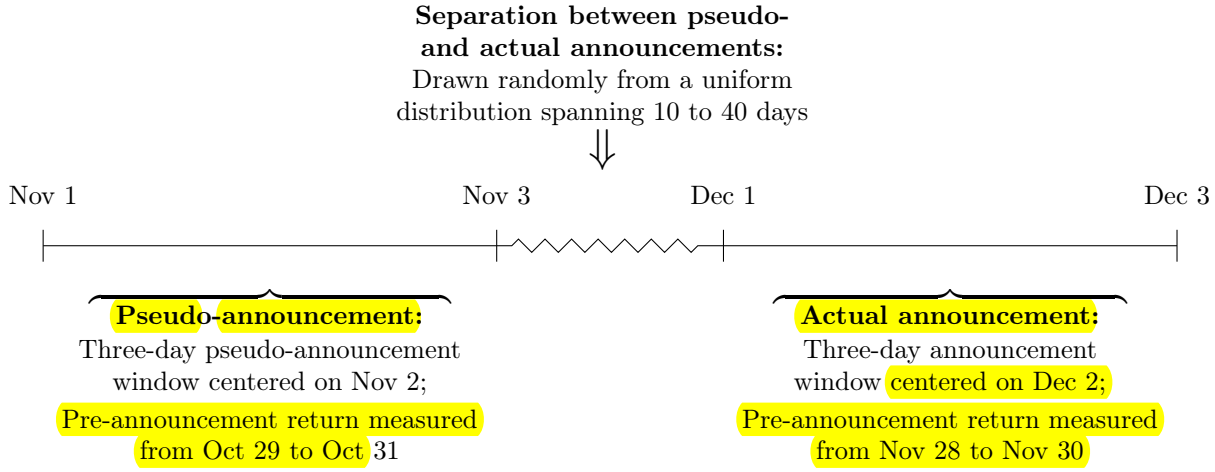

Figure 2: Event Time Return Reversals Relative to Announcement

Figure 2 plots the average three-day return reversal and 95% confidence interval from a strategy that takes a short position in firms within the highest quintile of returns over the prior three-day window and a long position in firms within the lowest quintile. Quintiles are formed each calendar quarter using breakpoints from the prior calendar quarter. The figure is shown in event time, where day t corresponds to the earnings announcement date. The reported strategy return is centered on the date shown on the X-axis such that the reported quantity corresponding to day t reflects the three-day cumulative strategy return from t-1 to t+1 from a long position in the lowest quintile of returns from t-4 to t-2 and a short position in the highest quintile of returns from t-4 to t-2. The 95% confidence interval is constructed using the time-series of quarterly average returns. The sample consists of 107,039 earnings announcements spanning 1996 through 2011.

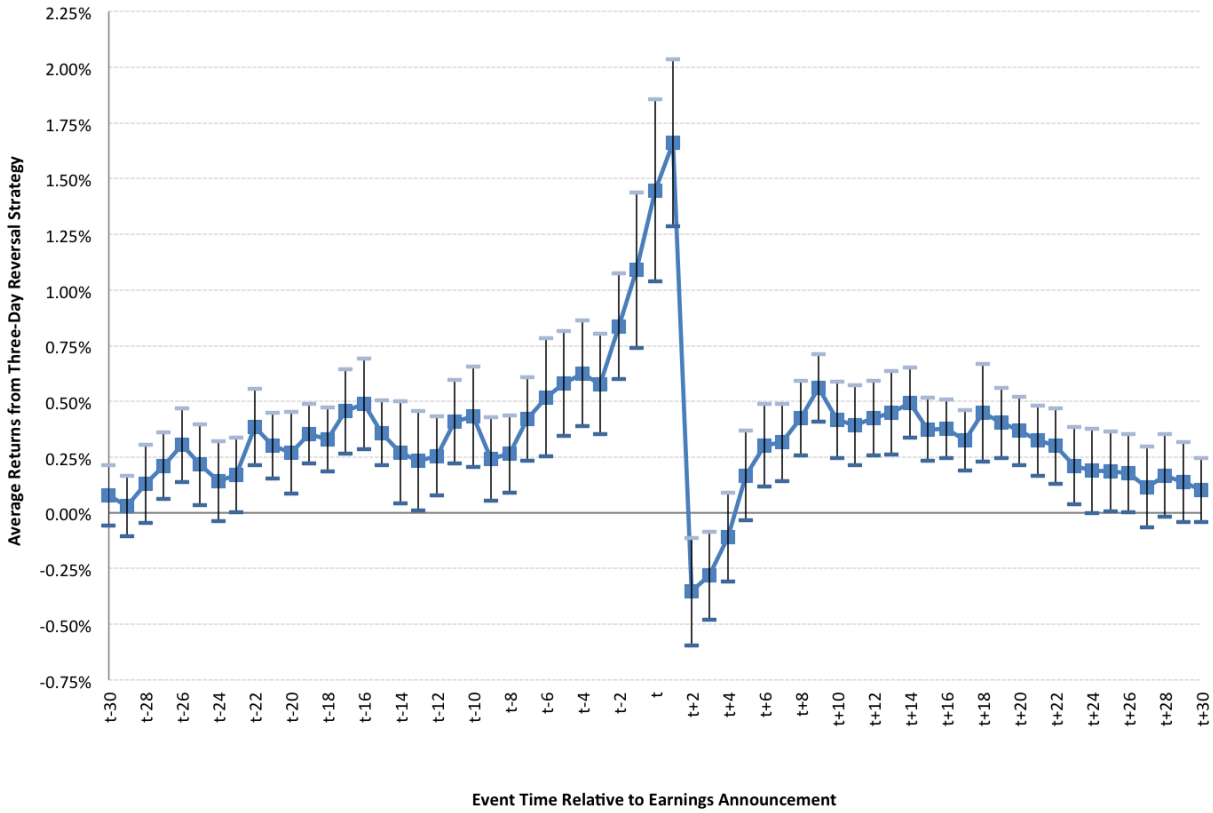

Figure 3: Event-Time Returns to Buying Past Winners and Losers

Figure 3 plots the average three-day returns to firms within the highest quintile of returns over the prior three-day window and those within the lowest quintile. Quintiles are formed each calendar quarter using breakpoints from the prior calendar quarter. The figure is shown in event time, where day t corresponds to the earnings announcement date. The reported strategy return is centered on the date shown on the X-axis such that the reported quantity corresponding to day t reflects the three-day cumulative return from t-1 to t+1 for firms in the highest and lowest quintile of returns from t-4 to t-2. The sample consists of 107,039 earnings announcements spanning 1996 through 2011.

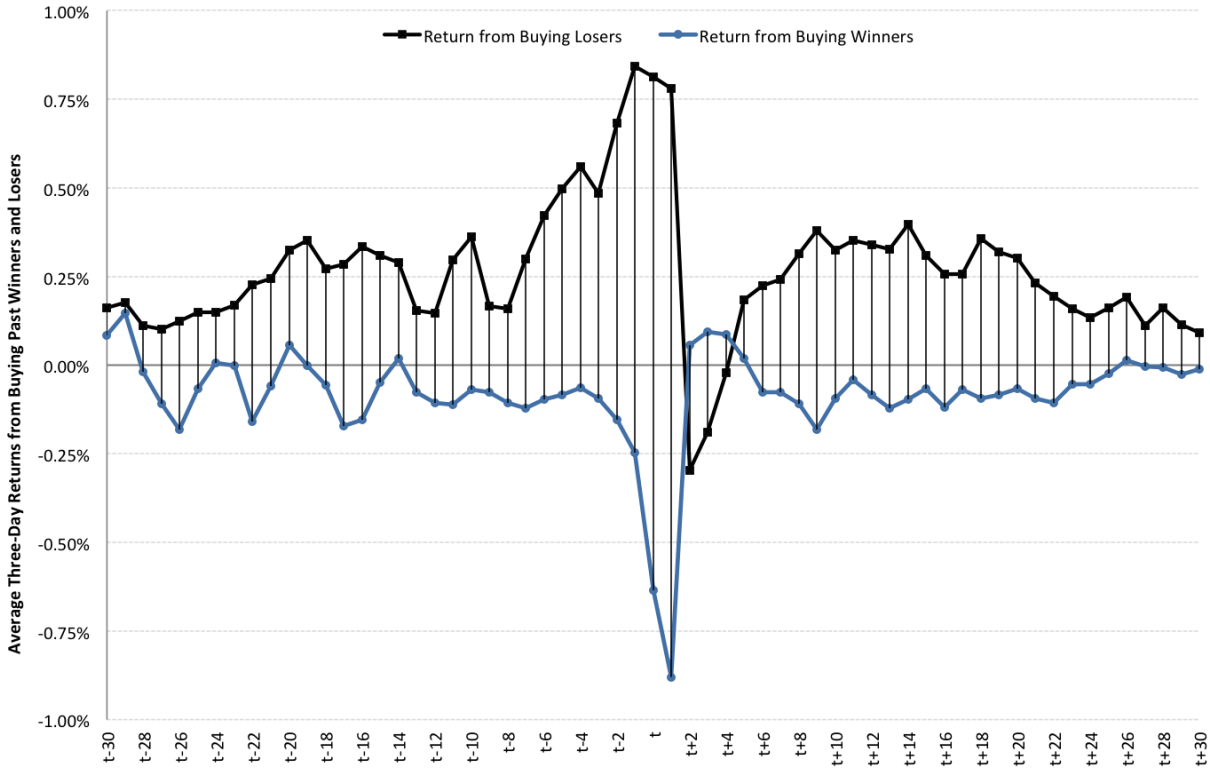

Figure 4: Average Reversal Returns by Calendar Quarter

Figure 4 plots the average reversal strategy return for each calendar quarter in the sample. The strategy involves buying (selling) firms in the lowest (highest) pre-announcement returns (PAR) during the firm's three-day earnings announcement window, denoted by t-1 to t+1, where day t is the earnings announcement. PAR is calculated from t-4 to t-2 as the cumulative market-adjusted return. Quintiles are formed each calendar quarter using breakpoints from the prior calendar quarter. The sample consists of 107,039 earnings announcements spanning 1996 through 2011.

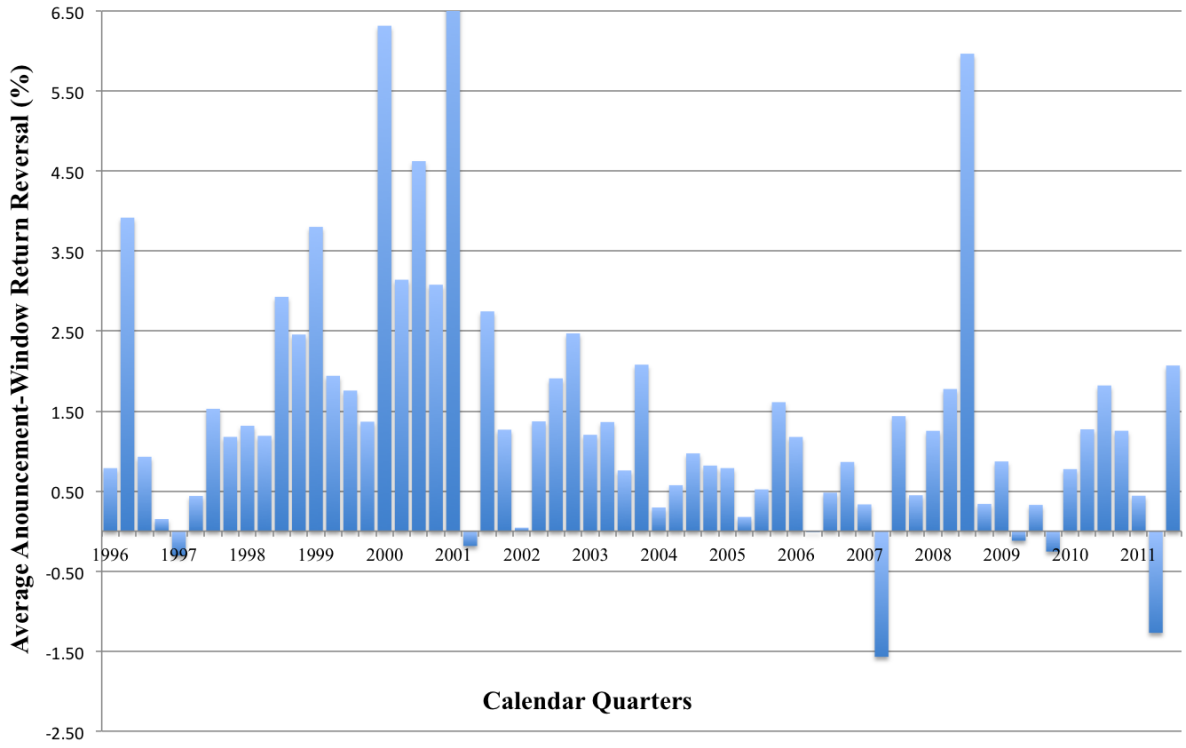

Figure 5: Partitioned Event Time Return Reversals Relative to Announcement

Figure 5 plots the average three-day reversal strategy return for each day relative to the earnings announcement, where day t corresponds to the earnings announcement date. The left (right) panel contains the plot for the average return among firm-quarters in the high (low) implied announcement volatility (IAV) quintile from a strategy that takes a short position in firms within the highest quintile of returns over the prior three-day window and a long position in firms within the lowest quintile. Quintiles are formed each calendar quarter using breakpoints from the prior calendar quarter. The reported strategy return is centered on the date shown on the X-axis such that the reported quantity corresponding to day t reflects the three-day cumulative strategy return from t-1 to t+1 from a long position in the lowest quintile of returns from t-4 to t-2 and a short position in the highest quintile of returns from t-4 to t-2. IAV is the total announcement-specific volatility implied by option prices in the t-4 to t-2 window and is calculated using the procedure developed by Patell and Wolfson (1981). See Appendix A for more details on the calculation of IAV. The 95% confidence interval is constructed using the time-series of quarterly average returns. The sample consists of 107,039 earnings announcements spanning 1996 through 2011.

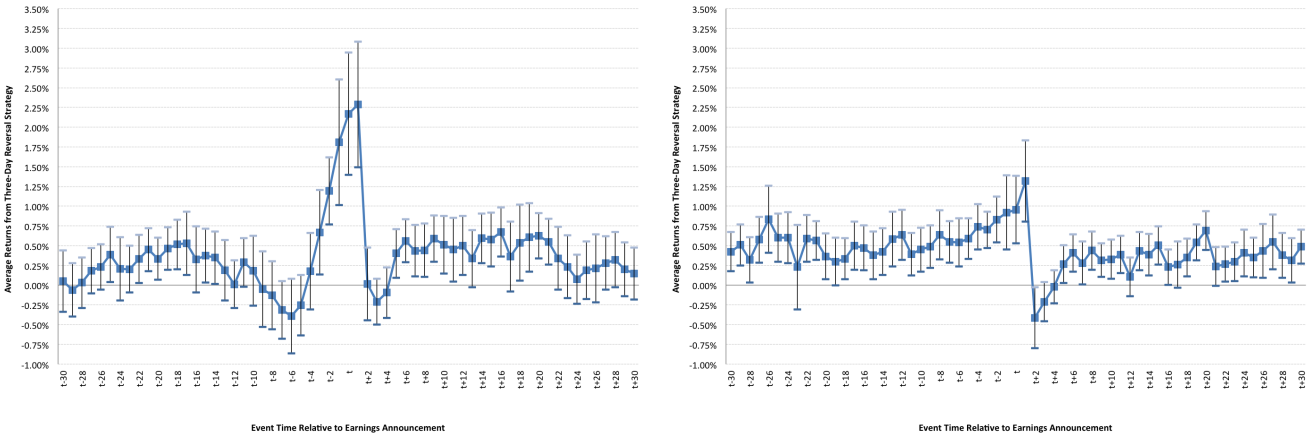

Table 1: Descriptive Statistics

Panel A presents descriptive statistics of the main variables used throughout the paper. PAR is the pre-earnings-announcement return calculated as the cumulative market-adjusted return from t-4 to t-2, where day t denotes the earnings announcement date. SUE is the standardized unexpected earnings, calculated as realized EPS minus EPS from four-quarters ago, divided by its standard deviation over the prior eight quarters. RET(-1,+1) is the market-adjusted earnings announcement return from t-1 to t+1. SIZE and LBM are the log of market capitalization and log of one plus the book-to-market ratio, respectively. VLTY is the standard deviation of daily returns over the six months ending on t-10. SP equals the relative spread calculated from t-4 to t-2. PRICE is the beginning of quarter equity share price. Panel B contains descriptive statistics across PAR quintiles. Observations are assigned to quintiles each calendar quarter where the highest (lowest) values are assigned to quintile Q5 (Q1) using distributional breakpoints from the prior calendar quarter. The sample consists of 107,039 earnings announcements spanning 1996 through 2011.

Panel A: Sample Characteristics (Obs=107,039)

	Mean	STD	P25	Median	P75
PAR	0.153	4.893	-2.040	-0.018	2.099
SUE	0.003	1.869	-0.539	0.081	0.690
RET(-1,+1)	0.176	8.774	-3.771	0.092	4.205
SIZE	14.265	1.527	13.156	14.094	15.178
LBM	0.387	0.256	0.219	0.345	0.501
VLTY	0.026	0.015	0.016	0.023	0.033
SP	0.610	0.835	0.109	0.224	0.830

Panel B: Characteristics by PAR Quintiles

	SIZE	LBM	VLTY	SP	PRICE
Q1 (Low PAR)	13.913	0.383	0.031	0.696	26.319
Q2	14.380	0.388	0.025	0.664	41.734
Q3	14.529	0.386	0.023	0.656	41.829
Q4	14.428	0.387	0.025	0.660	49.017
Q5 (High PAR)	13.962	0.377	0.031	0.680	38.111
High-Low	0.049	-0.006	0.000	-0.016	11.792
p-value	(0.05)	(0.14)	(0.70)	(0.11)	(0.14)

Table 2: Announcement Window Returns Across PAR Portfolios

Panel A presents the time-series average returns by quintiles of PAR. PAR is the pre-earnings-announcement return calculated as the cumulative market-adjusted return from t-4 to t-2, where t denotes the earnings announcement date. Observations are assigned to quintiles each calendar quarter where the highest (lowest) values are assigned to quintile Q5 (Q1) using distributional breakpoints from the prior calendar quarter. RET(X,Y) equals the cumulative market-adjusted return from X days relative to the announcement until Y days relative to the announcement date. The average return to each PAR quintile is calculated each calendar quarter and subsequently averaged across all quarters in the 1996-2011 sample window. Panel B presents analogous average returns using pseudo-earnings-announcements. Pseudo-announcement dates are calculated by subtracting a randomly selected number of trading days from the actual announcement date. The randomly selected numbers are drawn from a uniform distribution spanning 10 to 40. Panel C compares the returns from reversal strategies at actual and pseudo-announcement dates. The p-values corresponding to the high-low difference are based on the time-series of quarterly returns. Bolded values indicate that the return is significant at the 5% confidence level. The sample consists of 107,039 earnings announcements spanning 1996 through 2011.

Panel A: Averages Across PAR Quintiles

	PAR	RET(-1,+1)	RET(+2,+5)	RET(+6,+8)
Q1 (Low PAR)	**-5.780**	**0.813**	0.072	0.038
Q2	**-1.763**	**0.529**	0.099	0.074
Q3	-0.018	**0.250**	0.032	**0.086**
Q4	**1.823**	0.059	0.042	0.045
Q5 (High PAR)	**6.621**	**-0.635**	**-0.191**	0.011
Low-High	-12.401	1.448	0.263	0.028
p-value	(0.00)	(0.00)	(0.01)	(0.75)

Panel B: Averages Across Pseudo PAR Quintiles

	PAR	RET(-1,+1)	RET(+2,+5)	RET(+6,+8)
Q1 (Low PAR)	**-5.734**	**0.214**	**0.196**	0.106
Q2	**-1.771**	0.032	**0.142**	-0.012
Q3	**-0.101**	0.029	-0.007	-0.012
Q4	**1.616**	-0.029	-0.039	0.025
Q5 (High PAR)	**6.323**	-0.004	-0.085	0.044
Low-High	-12.058	0.218	0.281	0.062
p-value	(0.00)	(0.00)	(0.00)	(0.47)

Panel C: Average Differences between Actual and Pseudo Dates

	PAR	RET(-1,+1)	RET(+2,+5)	RET(+6,+8)
Mean	-0.343	1.230	-0.018	-0.035
p-value	(0.04)	(0.00)	(0.88)	(0.80)

Table 3: Alternative Strategy Returns

Panel A presents the time-series average returns across quintiles of pre-announcement returns, using four implementations of the reversal strategy. Open-to-Close indicates returns in a given window from the opening price on the first day of the window to the closing price on the last day of the window. OPAR measures open-to-close returns from t-4 to t-2 and ORET measures open-to-close returns from t-1 to t+1, where t is the announcement date. Midpoint-to-Midpoint indicates returns in a given window from the midpoint quote at the close of the day prior to the first day of the window to the midpoint quote on the last day of the window. MPAR measures midpoint-to-midpoint returns from t-4 to t-2 and MRET measures midpoint-to-midpoint returns from t-1 to t+1. Close-to-Close, 1-Day Skip indicates the use of standard returns reported in CRSP while measuring pre-announcement returns from t-5 to t-3 and announcement window returns from t-1 to t+1. The Turnover-Weighted column contains results analogous to the main tests in Table 2 when weighting observations by the amount of share turnover during the pre-announcement window, where share turnover is defined as total volume scaled by total shares outstanding. RET(X,Y) equals the cumulative market-adjusted return from X days relative to the announcement until Y days relative to the announcement date. Observations are assigned to quintiles each calendar quarter where the highest (lowest) values are assigned to quintile Q5 (Q1) using distributional breakpoints from the prior calendar quarter. Panel B presents analogous average returns using pseudo-earnings-announcements. Pseudo-announcement dates are calculated by subtracting a randomly selected number of trading days from the actual announcement date. The randomly selected numbers are drawn from a uniform distribution spanning 10 to 40. Panel C compares the returns from reversal strategies at actual and pseudo-announcement dates. The p-values corresponding to the high-low difference are based on the time-series of quarterly returns. Bolded values indicate that the return is significant at the 5% confidence level. The sample consists of 107,039 earnings announcements spanning 1996 through 2011.

Panel A: Alternative Returns on Actual Announcements

	Open-to-Close		Midpoint-to-Midpoint		Close-to-Close, 1-Day Skip		Turnover-Weighted	
	OPAR	ORET(-1,+1)	MPAR	MRET(-1,+1)	PAR(-5,-3)	RET(-1,+1)	PAR	RET(-1,+1)
Q1 (Low PAR)	**-5.787**	**0.503**	**-5.483**	**0.678**	**-5.835**	**0.634**	**-7.831**	**0.960**
Q2	**-1.801**	**0.429**	**-1.634**	**0.330**	**-1.801**	**0.383**	**-1.793**	**0.430**
Q3	-0.049	**0.199**	-0.020	0.207	-0.049	**0.285**	-0.015	**0.182**
Q4	**1.792**	0.007	**1.668**	-0.143	**1.777**	0.057	**1.868**	0.072
Q5 (High PAR)	**6.479**	**-0.694**	**6.092**	**-0.492**	**6.643**	**-0.374**	**9.149**	**-1.025**
Low-High	-12.266	1.197	-11.575	1.169	-12.479	1.007	-16.979	1.985
p-value	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Panel B: Alternative Returns on Pseudo Announcements

	Open-to-Close		Midpoint-to-Midpoint		Close-to-Close, 1-Day Skip		Turnover-Weighted	
	OPAR	ORET(-1,+1)	MPAR	MRET(-1,+1)	PAR(-5,-3)	RET(-1,+1)	PAR	RET(-1,+1)
Q1 (Low PAR)	**-5.735**	0.116	**-5.478**	**0.223**	**-5.799**	0.140	**-7.815**	0.279
Q2	**-1.811**	0.006	**-1.607**	0.043	**-1.773**	0.061	**-1.800**	-0.108
Q3	**-0.117**	-0.041	**-0.060**	-0.013	**-0.087**	0.026	**-0.100**	0.107
Q4	**1.610**	0.007	**1.520**	-0.053	**1.631**	0.061	**1.666**	0.131
Q5 (High PAR)	**6.206**	-0.057	**5.850**	0.001	**6.395**	-0.036	**9.025**	0.126
Low-High	-11.940	0.174	-11.328	0.222	-12.194	0.176	-16.840	0.153
p-value	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.34)

Panel C: Differences between Actual and Pseudo Dates

	Open-to-Close		Midpoint-to-Midpoint		Close-to-Close, 1-Day Skip		Turnover-Weighted	
	OPAR	ORET(-1,+1)	MPAR	MRET(-1,+1)	PAR(-5,-3)	RET(-1,+1)	PAR	RET(-1,+1)
Mean	-0.326	1.023	-0.247	0.947	-0.285	0.831	-0.139	1.833
p-value	(0.07)	(0.00)	(0.20)	(0.00)	(0.06)	(0.00)	(0.78)	(0.00)

Table 4: Announcement-Window Return Regressions

This table presents the results from regressions where the dependent variable equals the three-day market-adjusted announcement-window return from t-1 to t+1, where t is the earnings announcement date. PAR is the pre-earnings-announcement return calculated as the cumulative market-adjusted return from t-4 to t-2. LBM and SIZE are the log of one plus the book-to-market ratio and log of market capitalization, respectively. MOMEN equals the firm's market-adjusted return over the six months ending on t-10. CAPM is the firm's market-beta, estimated over the year ending 10 days prior to the announcement. SUE is the standardized unexpected earnings, calculated as realized EPS minus EPS from four-quarters ago, divided by its standard deviation over the prior eight quarters. Pre-Decimal is an indicatory variable that equals one for earnings announcements that took place prior to quote decimalization, which took place on April, 9th 2001. All continuous control variables are assigned to quintiles each calendar quarter using distributional breakpoints from the prior calendar quarter. Observations in the highest (lowest) quintile are assigned a value 1 (0). The sample consists of 107,039 earnings announcements spanning 1996 through 2011. t-statistics, shown in parentheses, are based on two-way cluster robust standard errors, clustered by firm and quarter. ***, **, and * indicate significance at the 1, 5, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Q(PAR)	-1.161***	-1.166***	-1.167***	-1.166***	-1.248***	-1.004***
	(-6.35)	(-6.40)	(-6.40)	(-6.41)	(-6.91)	(-4.74)
Q(SIZE)	–	0.429***	0.429***	0.421***	0.319**	0.315**
	–	(2.93)	(3.03)	(3.04)	(2.33)	(2.30)
Q(LBM)	–	0.244*	0.245*	0.243*	0.516***	0.515***
	–	(1.65)	(1.70)	(1.69)	(3.72)	(3.71)
Q(MOMEN)	–	–	0.002	0.001	-0.387**	-0.388**
	–	–	(0.01)	(0.01)	(-2.43)	(-2.45)
Q(CAPM)	–	–	–	-0.092	-0.122	-0.121
	–	–	–	(-0.73)	(-0.97)	(-0.96)
Q(SUE)	–	–	–	–	2.824***	2.821***
	–	–	–	–	(15.88)	(15.85)
Pre-Decimal	–	–	–	–	–	0.496*
	–	–	–	–	–	(1.76)
Q(PAR)*Pre-Decimal	–	–	–	–	–	-0.848**
	–	–	–	–	–	(-2.33)
Intercept	0.756***	0.422**	0.420*	0.472**	-0.786***	-0.924***
	(5.85)	(2.22)	(1.82)	(2.16)	(-3.75)	(-4.07)
Adj-R^2	0.002	0.003	0.003	0.003	0.015	0.015

Table 5: Return Reversals Conditioned on Asymmetric Information Proxies

This table presents time-series average three-day market-adjusted announcement-window returns from independently sorting firm-quarters into quintiles of PAR and two proxies for asymmetric information. PAR is the pre-earnings-announcement return calculated as the cumulative market-adjusted return from t-4 to t-2, where day t denotes the earnings announcement date. SIZE is the log of market capitalization and PIN is the probability of informed trade in the quarter prior to the earnings announcement. Observations are assigned to quintiles each calendar quarter where the highest (lowest) values are assigned to quintile Q5 (Q1) using distributional breakpoints from the prior calendar quarter. Reported t-statistics are estimated using the quarterly time-series over the 1996-2011 sample window. The sample consists of 107,039 earnings announcements spanning 1996 through 2011.

Panel A: Announcement Returns Conditioned on SIZE

	SIZE Quintiles					
	Q1 (Low SIZE)	Q2	Q3	Q4	Q5 (High SIZE)	High-Low SIZE
Q1 (Low PAR)	0.414	0.767	1.018	1.272	0.988	0.574
Q2	0.314	0.596	0.659	0.413	0.623	0.310
Q3	-0.188	0.431	0.466	0.257	0.179	0.367
Q4	-0.096	0.189	0.037	0.227	-0.117	-0.021
Q5 (High PAR)	-1.249	-0.531	-0.264	-0.398	-0.600	0.649
Low-High PAR	1.663	1.298	1.282	1.670	1.588	-0.075
t-statistic	(5.57)	(4.34)	(4.60)	(6.00)	(6.54)	-(0.25)

Panel B: Announcement Returns Conditioned on PIN

	PIN Quintiles					
	Q1 (Low PIN)	Q2	Q3	Q4	Q5 (High PIN)	High-Low PIN
Q1 (Low PAR)	0.855	0.780	0.841	0.602	0.689	-0.166
Q2	0.388	0.518	0.242	0.838	0.238	-0.151
Q3	-0.238	-0.099	0.427	0.029	-0.092	0.146
Q4	0.100	-0.188	-0.303	0.007	0.053	-0.047
Q5 (High PAR)	-0.671	-0.898	-0.574	-0.910	-0.408	0.263
Low-High PAR	1.526	1.678	1.416	1.512	1.097	-0.430
t-statistic	(3.19)	(4.09)	(3.52)	(4.00)	(3.48)	-(1.00)

Table 6: Expected Earnings Announcement Dates

This presents the time-series average expected earnings announcement window returns by quintiles of PAR. We calculate the expected earnings announcement date for each firm/fiscal quarter by calculating the median number of trading days between the end of a calendar quarter and the firm's actual announcement date, where the median is calculated for the same fiscal quarter over the prior ten years. For each firm/fiscal quarter, we then add the historically estimated median to the most recent calendar quarter end to arrive at the expected announcement date. We report announcement return averages across early, on-time, and late announcements, where on-time announcements are those whose actual announcement occurs within one day of the expected date. PAR is the pre-earnings-announcement return calculated as the cumulative market-adjusted return from t-4 to t-2, where t denotes the earnings announcement date. Observations are assigned to quintiles each calendar quarter where the highest (lowest) values are assigned to quintile Q5 (Q1) using distributional breakpoints from the prior calendar quarter. RET(X,Y) equals the cumulative market-adjusted return from X days relative to the announcement until Y days relative to the announcement date. The average return to each PAR quintile is calculated each calendar quarter and subsequently averaged across all quarters in the 1996-2011 sample window. The p-values corresponding to the high-low difference are based on the time-series of quarterly returns. Bolded values indicate that the return is significant at the 5% confidence level. The sample consists of 102,895 expected earnings announcement dates spanning 1996 through 2011.

	Expected (All)	Early	On-Time	Late
Q1 (Low PAR)	**0.408**	-0.046	**0.971**	**0.458**
Q2	**0.306**	-0.038	**0.652**	**0.233**
Q3	0.094	-0.014	**0.273**	-0.001
Q4	0.005	0.023	-0.096	0.036
Q5 (High PAR)	**-0.245**	0.101	**-0.695**	**-0.231**
Low-High	0.652	-0.147	1.666	0.689
p-value	(0.00)	(0.28)	(0.00)	(0.00)
N	102,895	29,778	34,837	38,280

Table 7: Pre-announcement Return and Earnings Surprises

This table presents regression results where SUE and SURPRISE are the dependent variables. SUE is the standardized unexpected earnings, calculated as realized EPS minus EPS from four-quarters ago, divided by its standard deviation over the prior eight quarters. SURPRISE equals the actual EPS number reported in IBES minus the last consensus forecast available immediately prior to the announcement, and scaled by beginning-of-quarter price. PAR is the pre-earnings-announcement return calculated as the cumulative market-adjusted return from t-4 to t-2, where day t denotes the earnings announcement date. LBM and SIZE are the log of one plus the book-to-market ratio and log of market capitalization, respectively. MOMEN equals the firm's market-adjusted return over the six months ending on t-10. ACC is lagged accruals from the prior quarter scaled by beginning-of-quarter total assets. PastSURPRISE equals the SURPRISE from the prior calendar quarter. All control variables are assigned to quintiles each calendar quarter using distributional breakpoints from the prior calendar quarter. Observations in the highest (lowest) quintile are assigned a value 1 (0). t-statistics, shown in parentheses, are based on two-way cluster robust standard errors, clustered by firm and quarter. The sample consists of 107,039 earnings announcements spanning 1996 through 2011. ***, **, and * indicate significance at the 1, 5, and 10% level, respectively.

	SUE			**SURPRISE**		
	(1)	(2)	(3)	(4)	(5)	(6)
Q(PAR)	0.131***	0.120***	0.109***	0.079***	0.076***	0.074***
	(4.92)	(4.84)	(4.21)	(6.43)	(6.24)	(5.77)
Q(SIZE)	–	0.129***	0.135***	–	0.072***	0.079***
	–	(4.03)	(4.07)	–	(5.25)	(6.04)
Q(LBM)	–	-0.510***	-0.557***	–	-0.136***	-0.137***
	–	(-5.60)	(-5.58)	–	(-3.06)	(-3.07)
Q(MOMEN)	–	0.584***	0.478***	–	0.140***	0.090***
	–	(12.90)	(11.22)	–	(8.76)	(5.55)
Q(ACC)	–	–	0.018	–	–	-0.015
	–	–	(0.34)	–	–	(-1.22)
Q(PastSURPRISE)	–	–	0.499***	–	–	0.291***
	–	–	(15.74)	–	–	(8.91)
Intercept	-0.063	-0.156***	-0.336***	-0.041**	-0.078***	-0.197***
	(-1.31)	(-4.33)	(-6.29)	(-2.15)	(-4.33)	(-9.24)
Adj-R^2	0.001	0.030	0.041	0.001	0.013	0.029
Obs.	107,039	107,039	85,299	88,717	88,717	85,299

Table 8: Return Reversals Conditioned on Inventory Risk Proxies

This table present time-series average three-day market-adjusted announcement-window returns during actual announcements from independently sorting firm-quarters into quintiles of PAR and proxies for inventory risks. PAR is the pre-earnings-announcement return calculated as the cumulative market-adjusted return from t-4 to t-2, where day t denotes the earnings announcement date. IAV is the total announcement-specific volatility implied by option prices in the t-4 to t-2 window and is calculated using the procedure developed by Patell and Wolfson (1981). See Appendix A for more details on the calculation of IAV. IV is the implied volatility from a thirty-day standardized, at-the-money option and HR is the firm's historical absolute market-adjusted return during its most recent quarterly earnings announcement. Observations are assigned to quintiles each calendar quarter where the highest (lowest) values are assigned to quintile Q5 (Q1) using distributional breakpoints from the prior calendar quarter. Reported t-statistics are estimated using the quarterly time-series over the 1996-2011 sample window.

Panel A: Announcement Returns Conditioned on Implied Announcement Volatility

	Implied Announcement Volatility (IAV) Quintiles					
	Q1 (Low IAV)	Q2	Q3	Q4	Q5 (High IAV)	High-Low IAV
Q1 (Low PAR)	0.763	0.642	0.292	0.870	1.305	0.542
Q2	0.471	0.449	0.631	0.618	0.530	0.059
Q3	0.242	0.233	0.248	0.229	0.557	0.315
Q4	-0.079	-0.149	-0.016	0.310	0.116	0.195
Q5 (High PAR)	-0.193	-0.672	-0.646	-0.465	-0.866	-0.674
Low-High PAR	0.955	1.314	0.938	1.335	2.171	1.216
t-statistic	(4.37)	(4.40)	(3.20)	(5.42)	(5.49)	(3.20)

Panel B: Announcement Returns Conditioned on the Level of Implied Volatility

	Implied Volatility (IV) Quintiles					
	Q1 (Low IV)	Q2	Q3	Q4	Q5 (High IV)	High-Low IV
Q1 (Low PAR)	0.374	1.039	0.997	1.072	0.534	0.160
Q2	0.387	0.604	0.687	1.015	-0.255	-0.641
Q3	0.071	0.432	0.644	0.319	-0.210	-0.282
Q4	-0.095	0.140	0.072	0.065	-0.075	0.020
Q5 (High PAR)	-0.394	-0.110	-0.307	-0.380	-1.382	-0.988
Low-High PAR	0.768	1.149	1.304	1.451	1.916	1.148
t-statistic	(3.39)	(6.37)	(5.48)	(5.59)	(5.41)	(3.37)

Panel C: Announcement Returns Conditioned on Historical Announcement Return

	Historical Announcement Return (HR) Quintiles					
	Q1 (Low HR)	Q2	Q3	Q4	Q5 (High HR)	High-Low HR
Q1 (Low PAR)	0.621	0.550	0.669	1.011	1.156	0.534
Q2	0.469	0.425	0.482	0.699	0.664	0.195
Q3	0.292	-0.009	0.326	0.224	0.540	0.249
Q4	0.062	-0.001	-0.014	0.193	0.255	0.193
Q5 (High PAR)	-0.418	-0.423	-0.355	-0.528	-0.971	-0.554
Low-High PAR	1.039	0.973	1.024	1.540	2.127	1.088
t-statistic	(4.08)	(3.34)	(3.92)	(6.26)	(6.46)	(3.37)