Losing is Optional: Retail Option Trading and Expected Announcement Volatility*

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August 29, 2025

Abstract

We document the growth of retail options trading and provide evidence that retail investors are drawn to options by anticipated spikes in volatility. Retail investors purchase options in a concentrated fashion before earnings announcements, particularly those with greater expected abnormal volatility. Comparing across asset markets, we also find retail investors disproportionately trade options over stocks as anticipated announcement volatility increases. In doing so, retail investors display a trio of wealth-depleting behaviors: they overpay for options relative to realized volatility, incur enormous bid-ask spreads, and do not close their positions until weeks after announcements. These translate to retail losses of 5-to-9% on average, and 10-to-14% for high expected volatility announcements.

*First draft: January 11, 2022. Corresponding emails: tdesilva@stanford.edu; kevinsm@stanford.edu; eso@mit.edu. We thank Svetlana Bryzgalova, John Dinh, Chuck Downing, Allen Hu, David Kim, Jeff Kimsey, Cardin Masselink, Eben Lazarus, Yura Olshanskiy, Max Ruston, Harm Schutt, Taisiya Sikorskaya (discussant), David Thesmar, Rodrigo Verdi, and seminar participants at various seminars and conferences for helpful comments and suggestions. We thank the Nasdaq Stock Market for generously sharing data used in this paper.

1 Introduction

Retail investor trading in option markets has risen dramatically in recent years, exceeding \$250 billion of total single-name option volume in 2020 alone. This prompted the SEC, in conjunction with local jurisdictions, to consider regulations focused on retail investor participation in options markets. Using recent data on options trades broken down by clientele groups, this paper addresses three central questions. First, what drives retail investor participation in options markets cross-sectionally and over time? Second, how does retail demand influence the cross-section of option prices, and how do these factors differ across equity and option markets? Finally, and perhaps most importantly, how do retail investors perform when trading options and who benefits from their mistakes?

This paper's main finding is that retail investors are drawn to purchase options prior to earnings announcements, particularly those expected to trigger high volatility, where this behavior disproportionately concentrates in options relative to stocks. This behavior is extraordinary because these events create precipitous price jumps, presenting option writers with large, unhedgable risk. As a result, retail investors pay hefty premiums for these options relative to realized volatility and incur abnormally high transaction costs. Retail investors compound these losses through an especially puzzling and problematic behavior: they sluggishly close their option positions post-announcement even as their prices predictably decay. Taken together, these patterns lead retail investors to suffer double-digit percentage losses when trading options around earnings announcements.

This evidence yields an important insight for researchers and regulatory debates focused on retail investors through the lens of equity markets. Specifically, our results suggest that inferences regarding retail investors' sophistication, contribution to price discovery, and wealth dynamics are likely incomplete when confined to equity markets. Prior research shows that retail investors earn excess stock returns around earnings announcements on average, consistent with retail investors providing liquidity and benefiting from private information regarding firms' earnings (e.g., Kaniel, Liu, Saar, and Titman 2012; Kelley and Tetlock 2013;

Barrot, Kaniel, and Sraer 2016; Boehmer, Jones, Zhang, and Zhang 2021). In contrast, our results indicate that retail traders demand liquidity and seemingly lack private information when trading in options around earnings announcements, suffering large losses as a result. Given past evidence that investors are more prone to behavioral mistakes in complex settings (Hirshleifer 2001; Gao, Hu, Kelly, Peng, and Zhu 2024) and learn to avoid these mistakes only with experience (Seru, Shumway, and Stoffman 2010; Linnainmaa 2011), the difference in retail behavior across markets likely reflects the complexity to trading in options relative to stocks and the expanding set of retail investors that trade options.

Our main analyses use a recent dataset that details buying and selling volumes at the contract-day level for options traded on Nasdaq and OMX PHLX exchanges. A key feature of the data is that it allows us to observe whether a trade originated from retail, professional customers, market makers, firms, or broker/dealers in a large panel dataset across several years, though we also find and present similar evidence using a more recent dataset discussed in Bryzgalova, Pavlova, and Sikorskaya (2023). To conduct cross-market comparisons, we merge this data with estimated retail net trading behavior in equity markets.

To motivate our focus on retail behavior around earnings announcements, we begin by documenting several empirical facts present in our sample. First, the extent of retail trading in options has grown substantially over time, increasing more than ten-fold over the past decade in terms of dollar volume traded. Second, for all clientele groups, option trading activity concentrates around firms' quarterly earnings announcements relative to non-announcement periods. Finally, retail investors and market makers are the most active clientele groups around earnings announcements, with market makers largely offsetting positions by retail investors. These patterns indicate that retail trade is likely an increasingly important determinant of both retail traders' wealth and option prices, particularly around earnings announcements.

Our main tests explore the link between retail option demand and the extent of expected announcement volatility (EAV). These tests are motivated by prior evidence that retail tends to gravitate towards firms with more media coverage (e.g., Barber and Odean 2008) and that the media is more likely to cover earnings announcements with larger anticipated spikes in volatility (e.g., Noh, So, and Verdi 2021). We therefore expect retail investor option demand to increase with EAV, which we measure using the term-structure of implied volatility (Patell and Wolfson 1979; Dubinsky, Johannes, Kaeck, and Seeger 2019). To mitigate concerns that our results are mechanically driven by the use of equilibrium prices to predict quantities, we also proxy for EAV using a firm's largest absolute return over recent quarterly earnings announcements. This approach is based on the idea that investors and the media use historical announcement volatility to forecast future announcement volatility and that extreme past events have an especially strong impact on investors' beliefs (Bali, Cakici, and Whitelaw 2011).

Using both measures of EAV, we find that retail investors take sizable net long option positions in the days immediately preceding high-EAV announcements. We then study several dimensions of this demand to shed light on its drivers. First, consistent with our hypothesis, we demonstrate that high EAV spurs media coverage, and the link between EAV and retail demand is concentrated among firms that receive such coverage. Second, retail investors mainly purchase call options while also buying the underlying stocks, but shift their overall buying toward options. Finally, their trades focus on at-the-money contracts and are close to evenly spread across long- and short-dated maturities.

Collectively, this evidence points to a specific mechanism driving the link between EAV and retail option demand: the anticipation of high volatility at earnings announcements grabs retail investors' attention through increased media coverage. This media coverage generates systematic optimism, leading retail investors to take long positions in both stock and options. However, the leverage provided by options, which amplifies both directional exposure and volatility, makes them particularly attractive relative to stocks. Importantly, our findings are inconsistent with several alternative motives: retail investors do not appear to be seeking lottery-like payoffs (they buy at-the-money rather than out-of-the-money options), they are not hedging (they buy calls rather than puts despite being typically long stocks), and they lack private information (they systematically lose money on these trades).

Retail's focus on high EAV announcements is especially notable because the unhedgable risk that option writers face peaks around these events, which are expected to create large price jumps. Since most retail option demand ahead of high EAV announcements is absorbed by a single clientele group, market makers, demand-based option pricing theory predicts market makers are likely to charge exceptionally high premiums to accommodate this retail demand (Garleanu, Pedersen, and Poteshman 2009). Consistent with this theory, we find that retail investors' option demands generate large price impact prior to high EAV earnings announcements. For announcements in the top quintile of retail option purchases, option-implied variances escalate by 40% more in the days immediately prior to the announcement compared to announcements with no such purchases.

Next, we conduct two sets of tests that illustrate how retail's proclivity towards purchasing options prior to high EAV announcements depletes their wealth. In the first, we showcase three factors that shape the dynamics of retail investor performance around earnings announcements. In the second, we take a novel, aggregate approach that tracks retail positions in event-time to directly quantify how these factors combine to impact retail wealth.

The first of three factors contributing to retail investment performance is that options earn significantly negative returns during earnings announcements, particularly those with high EAV. For these tests, we focus on at-the-money straddle returns because they allow us to study retail investors' pricing of volatility separately from their ability to predict directional price moves in the stock market. We find these straddles underperform on high EAV announcement dates relative to low EAV announcement dates by a whopping 11%, on average (t-statistic = 19.55). This suggests retail investors deplete their wealth by buying options ahead of anticipated spikes in volatility, but, in doing so, overpay for these options relative to realized volatility.

The second factor contributing to retail investors' performance is that they trade options with enormous bid-ask spreads, which predictably concentrate ahead of high EAV announcements. We conservatively estimate the transaction costs that retail traders incur by assuming they hold all options they purchase until maturity, and thus only pay half of the bid-ask spread. Among high EAV announcements, we find retail investors lose an average additional 9% of their investment due to this half-spread.

The third factor we document is that retail investors compound their losses by continuing to hold onto their option positions post-announcement as their prices continue to decay. This finding is consistent with Chang, Solomon, and Westerfield (2016), who show that retail investors exhibit the disposition effect in options and are slow to close underperforming positions. This combination of results is particularly striking because it shows retail investors are holding option positions and losing money during a period of subdued risk, making rational explanations (e.g., based on jump risk or stochastic volatility) increasingly unlikely. An implication of retail investors sluggishly closing long option positions is that market makers continue to bear inventory risk. Consistent with retail holdings influencing prices, we show that straddles continue to underperform over the two weeks following high relative to low EAV announcements by an additional 9% (t-statistic = 8.26).

Our final tests leverage the granularity of our data to more directly track wealth dynamics in event-time relative to earnings announcements. We conduct these tests by cumulating positions for each clientele type and estimating their sensitivities to realized changes in price. As a complement to our straddle return tests, these tests provide a more precise picture of the wealth dynamics of retail investors.

We find that retail investors deplete their wealth on average by trading ahead of earnings announcements, but particularly so for the subsample of high EAV announcements. After accounting for bid-ask spreads and making conservative assumptions about the price improvement they receive, we estimate that retail investors lose 5-to-9% of option investments around earnings announcements on average, and 10-to-14% for high EAV announcements. In aggregate, our estimates indicate that retail investors lost approximately $3 billion on option investments during our sample window. Market makers are the primary beneficiaries of these patterns, particularly around the COVID pandemic, resulting in large capital flows from retail to market makers. As a comparison, Bauer, Cosemans, and Eichholtz (2009) finds that retail investors in the Netherlands lose an average of 1.81% per month on their option positions. Coupled with our findings, these results suggest retail's option trading is exceptionally costly around high EAV announcements.

Collectively, our findings are particularly relevant in light of increased regulatory scrutiny of retail trading in options markets. Whether and how to respond to the growth of retail options trading hinges upon understanding both their drivers and consequences. Thus, a key contribution of our paper is to show that retail investors' option demands are driven by expected announcement volatility and that their demands have a first-order impact on market prices and wealth dynamics. We highlight that retail investors generate losses in options markets for three distinct reasons: they overpay for options relative to realized volatility, trade in options with large bid-ask spreads, and continue to hold options post-announcement as their prices predictably decay.

A second key insight of our paper is that retail's pre-EA speculation in options is not a routine spillover from stock trading but a distinct mechanism with distinct consequences. Whereas prior studies show that retail stock trading tends to increase *after* spikes in return volatility (Barber and Odean 2008), we document that retail option trading increases *before* such spikes, precisely because the anticipation of volatility attracts media attention. This forward-looking behavior is unique to options markets and generates extreme outcomes: retail investors actively substitute options for stocks as expected volatility rises—rather than just trading more, they lose an order of magnitude more in options than in stocks, and fail to close losing positions post-announcement even after prices continue to decline.

Finally, our study contributes by underscoring that inferences regarding the sophistication of retail investors, their contribution to price discovery, and wealth dynamics are likely incomplete when confined to equity markets. Our evidence that retail investors are contrarian is consistent with evidence from equity markets (e.g., Kaniel et al. 2012; Barrot et al. 2016). However, unlike that literature, which emphasizes how retail investors profit from providing market liquidity and increase market stability, we find the contrarian nature of retail investors in options markets generates wealth losses and equilibrium price distortions (as in Foucault, Sraer, and Thesmar 2011).

2 Data Description and Descriptive Results

2.1 Data and Sample Construction

We begin our sample construction with the Nasdaq Options Trade Outline (NOTO) and the PHLX Options Trade Outline (PHOTO) End-of-Day files provided to us by the Nasdaq Stock Exchange.[1] To our knowledge, we are the first to use these data to academically study options markets, but Lakonishok, Lee, Pearson, and Poteshman (2007) use a similar, proprietary dataset from the 1990s. For each option traded on the Nasdaq Options Market (NOM) or Nasdaq PHLX (PHLX), these data provide the daily number of opening buys, opening sells, closing buys, and closing sells by five different categories of traders: customers, professional customers, market makers, broker/dealers, and firms. Opening buys (sells) refer to trades in which the trader initiates a new long (short) position in the particular option, while closing sells (buys) refer to trades in which the trader settles a previously established long (short) option position. These data cover all electronic trades that occur on the NOM and PHLX and also contain the daily low, high, open, and last trade prices for each option.

An important feature of these data is the breakdown of daily option trades into the five clientele groups, which we now describe in more detail. The "professional customer" category captures persons and entities that are not broker/dealers and place more than 390 orders in listed options on average per day during a calendar month for their own beneficial accounts, where 390 corresponds to one trade per minute during trading hours. This category would

[1] For more detail on these data outside of what is provided in this section, see https://data.nasdaq.com/databases/NOTO/documentation and https://data.nasdaq.com/databases/PHOTO/documentation.

include institutional investors that actively trade options, such as quantitative hedge funds. Our primary category of interest is "non-professional customer," which captures customers of the exchange trading on behalf of their own accounts that are not active enough to be classified as professional customers.[2]

We measure the trading activity of retail investors using the non-professional customers category, which includes all options trades by retail investors. This measure is an imperfect proxy because it may also capture trades by small sophisticated non-retail investors. However, our conversations with the data provider indicate that the presence of non-retail trades in the non-professional customer group is likely quite small. Nevertheless, in the presence of such measurement error, our descriptive results on the extent of retail trading activity (e.g., dollar volume) are likely overstated, while the extent of behavioral tendencies that we ascribe to retail investors are likely understated. Because we are primarily interested in the latter, we view the use of this measure as a proxy for retail investors' option trading as conservative.

The remaining three clientele groups are market makers, broker/dealers, and firms. The "market maker" category captures registered/designated market makers on NOM and/or PHLX, which are required to maintain two-sided quotes during market hours for the options each entity is registered to trade. The "broker/dealer" category captures institutions that may serve as market makers without formal registration, in addition to brokers trading on behalf of institutional clients. Finally, the "firm" category captures entities that do not fall into the prior four categories, such as proprietary trading desks at an investment bank.[3]

We next collect the largest possible set of earnings announcements for US publicly traded

[2]Choy and Wei (2012) studies the extent of retail trading activity using a related dataset from the CBOE over a 6-month window in 2006, and examines its link to stock returns but not option returns.

[3]The designation of a given option trade across clienteles is done on a trade-by-trade basis. This means that a given entity could show up under two clientele designations if, for example, it traded some options on behalf of clients but also traded on behalf of its own book. The entity is required to flag its order capacity according to who the order is for, which Nasdaq and PHLX use to prioritize and route orders. Unlike in equity markets, where retail order flow is internalized off-exchange, retail order flow in options is sent for execution on the exchanges, where it may fulfilled by a pre-arranged counterparty similar to payment for order flow in equity markets.

firms between January 1st, 2010 and February 28th, 2021, which is the time period of our Nasdaq data.[4] We construct this set of earnings announcements by merging the Compustat Quarterly Fundamentals file with the Thomson Reuters IBES detailed EPS file and the CRSP Daily Stock File. We determine announcement dates following DellaVigna and Pollet (2009) and Johnson and So (2018), taking into account the time at which an announcement occurs. We denote $t = 0$ as the date in which earnings announcement occurs, which corresponds to the day of the announcement for pre-open and market-hours announcements and the day after the announcement for after-close announcements. Throughout, we use the notation $t = \tau$ to refer to the day that occurs τ trading days after the earnings announcement.

Following Dubinsky et al. (2019), we filter our sample to those announcements that have traded options in OptionMetrics, had a trailing dividend yield below 2%, and whose stock traded above $5 in the prior quarter. We also require announcements to have sufficient price data to calculate straddle returns as defined below. Finally, we merge this set of announcements to our Nasdaq data through the ticker of the underlying, which results in a final sample of 32,758 quarterly earnings announcements spanning 2010-2021. We compute a series of other variables from CRSP, Compustat, OptionMetrics, Nasdaq, and Factiva.com for this final sample of announcements that we use in our analyses, which we discuss below.

In Figure 1, we provide evidence on the coverage of our Nasdaq data for the underlyings in our sample. Panel A plots the average ratio of trading volume and open interest per underlying observed in our Nasdaq data relative to the total volume and open interest observed for that underlying in OptionMetrics.[5] The results show these data capture somewhere between 20-30% of total options trading volume and 25-30% of open interest, suggesting they provide a reasonable characterization of aggregate option market activity.

Recent studies employ alternative, complementary methods for identifying retail options

[4]In an earlier draft of this paper, we conducted our analysis using a sample that ended in December 31st, 2019. Our results are qualitatively and quantitatively similar when using that sample, suggesting the spike in retail options during 2020 and 2021 does not entirely drive our results.

[5]We define trading volume in our Nasdaq data as the sum of opening buys, opening sells, closing buys, and closing sells. Open interest for each option contract is provided directly.

trading. Notably, Bryzgalova et al. (2023) develop a measure based on single-leg price improvement auctions that captures market and marketable limit orders for options from retail brokerage accounts. This measure has been available since November 2019, when OPRA introduced a flag for such auctions and covers a broad set of option exchanges. We evaluate the robustness of our findings using this measure in Section 3.5. Bogousslavsky and Muravyev (2024) utilize data from a trading journal platform where retail traders link their brokerage accounts to track performance. This allows direct observation of individual transactions for these traders between 2020 and 2022.

While these methods likely yield fewer false positives in identifying retail trading activity, they cover considerably shorter time periods than our primary dataset, which extends back to 2010. Furthermore, our measure likely captures all retail trading activity on the exchanges covered, whereas Bryzgalova et al. (2023) focuses on retail market orders and Bogousslavsky and Muravyev (2024) focuses only traders who choose to post their trades to the trading journal platform. Bogousslavsky and Muravyev (2024) find that the retail traders they study perform comparatively well relative to our aggregate sample of retail traders, indicating there may be considerable heterogeneity in retail traders' option-trading skill.

2.2 Measures of Trader Positions

Our primary tests examine the dynamics of holdings by clientele and their implications for returns. We track holdings for each earnings announcement by the daily change in the net option position of each clientele group, defined as follows:

$$\begin{aligned}\Delta \text{Trader Position}_t = 100 * \Big[&\text{Trader Opening Buys}_t + \text{Trader Closing Buys}_t \\ &- \text{Trader Opening Sells}_t - \text{Trader Closing Sells}_t\Big],\end{aligned} \tag{1}$$

where trader buys and sells are summed across all options available on Nasdaq for a given announcement.[6] We scale buys and sells by 100 to account for the fact that an option contract

[6]Throughout our analysis, we aggregate opening buys, closing buys, opening sells, and closing sells of the same option contract across NOM and PHLX.

consists of 100 options, each corresponding to one share of the underlying. We do not weight options by maturity or moneyness for simplicity.[7] Throughout, we denote changes in this variable between t_1 and t_2 as ΔTrader Position$_{t_1,t_2}$, which captures net trader buying from market close at t_1 to market close at t_2. To measure each clientele's exposure to changes in option prices, we cumulate these changes in net option positions to arrive at the net option position for each clientele group:

$$\text{Trader Position}_t = \sum_{s=\underline{t}}^{t} \Delta\text{Trader Position}_s, \tag{2}$$

where $\underline{t}$ represents the first day that a given option appears in our sample.

Although both these variables vary at the firm-quarter-day level, we drop firm-quarter subscripts for simplicity and focus on t, which refers to the day on which we measure positions relative to the earnings announcement at $t = 0$. To capture the option demand of retail investors that is specific to earnings announcements, in the remainder of the paper we calculate our measures of trader positions in (1) and (2) across all options that expire at least 10 days after the earnings announcement.[8]

As a benchmark, we also consider retail trade in the stock market in some of our analyses. To do so, we construct measures of the amount of retail buying and selling in the underlying stock. Using TAQ data, we identify retail marketable trades following Boehmer et al. (2021). We then calculate the total number of shares bought and sold by retail investors in the underlying stock on day t, which we denote by Retail Equity Buys$_{it}$ and Retail Equity Sells$_{it}$, respectively.

2.3 Descriptive Results on Pre-Announcement on Trading Activity

In this section, we provide three descriptive results on option market trading activity by clientele groups that motivate our subsequent analyses of retail options trading around

[7] In untabulated results, we find that our inferences are unchanged when delta-weighting positions as in Lakonishok et al. (2007).

[8] We do this to avoid potential measurement issues around option expiration, as our data does not contain information on option positions closed due to expiration.

earnings announcements. Panel B of Figure 1 shows our first result: the extent of retail trading activity in option markets has increased markedly over time. Retail dollar option trading increased over ten-fold from approximately $20 billion in 2010 to approximately $240 billion in 2020. Given our sample coverage has remained relatively constant over time, this finding is consistent with discussion in the mainstream press that infers a recent increase in retail options trading from the increasing number of small-lot traders.[9] The rise in retail option volume tracks the rise in overall market volume while also underscoring the growth in capital invested by retail customers, particularly in recent years coinciding with the COVID pandemic.

Figure 2 illustrates our second descriptive result: option trading activity is heavily concentrated around earnings announcements. In Panel A, we plot the average option dollar trading volume across all announcements in our sample at different trading days relative to the earnings announcement day, $t = 0$. The results show a steep rise in overall option market trading concentrated around firms' earnings announcement dates. Trading volume spikes to two- or three-times normal levels in the days immediately surrounding the announcement. Panel B also shows the amount of pre-announcement option trading, defined over $t = -5$ to $t = -2$, has increased markedly in recent years for all clientele groups.

Our final motivating descriptive result is that retail investors and market makers are the most active clientele groups around earnings announcements. We illustrate this in Figure 3 by plotting the average change in each clientele group's position in (1) relative to the earnings announcement day, $t = 0$. Panel A shows retail traders tend to open option positions in the days prior to EAs, which are primarily absorbed by market makers. In contrast, Panel B shows the activity of professional customers, broker/dealers, and firms is relatively minor. Consequently, market makers are the primary bearers of the inventory risk posed by the announcement-specific option demand of retail investors. This role of market makers as liquidity providers and option writers is central to the mechanism through which we later

[9] See `https://www.ft.com/content/b330e091-2a59-4527-b958-9213731a526c` for an example.

argue retail demand impacts option prices.

In Table 1, we provide summary statistics on our measures of trader positions in (1) and (2). Panel A shows the retail clientele group buys an average of 5,045 options between $t = -5$ and $t = -2$ prior to earnings announcements, which are offset primarily by market makers, consistent with Figure 3. Panel B shows this difference in trading behavior generates heterogeneity in announcement exposure across clientele groups: retail investors tend to be net long, while market makers, firms, and broker/dealers tend to be net short. Both panels illustrate substantial variation in pre-announcement trading behavior across the announcements in our sample, which is the variation in option market activity we seek to understand in our main tests.

Taken together, these results suggest that the bulk of options trading activity is concentrated around earnings announcements and mostly occurs between retail investors and market makers. Given these findings, we center the timing of our subsequent analyses around earnings announcements and focus on the determinants and equilibrium consequences of retail investors' options demand.

As an additional way to gauge the importance of retail option trade prior to EAs, we also compare the magnitude of their positions in options relative to those in the stock market. We compute the following two measures, where buys and sells are measured from days -5 to -2 relative to each EA:

$$\text{Unsigned OS Ratio}_{it} = 100 \times \frac{\sum_{o} |\Delta_{ito}| * \Delta\text{Retail Position}_{ito}}{\text{Retail Equity Buys}_{it} + \text{Retail Equity Sells}_{it}}; \tag{3}$$

$$\text{OS Call Buy Ratio}_{it} = 100 \times \frac{\sum_{o \in \text{Calls}} \Delta_{ito} * (\text{Retail Opening Buys}_{ito} + \text{Retail Closing Buys}_{ito})}{\text{Retail Equity Buys}_{it}}. \tag{4}$$

Intuitively, Unsigned OS Ratio$_{it}$ captures the amount of unsigned retail volume in options relative to stocks. We examine this metric as a simple way to compare the overall amount of retail trade in the two markets. On the other hand, OS Call Buy Ratio$_{it}$ focuses on retail call purchases relative to stock purchases, placing them in comparable units by weighting call purchases by their respective option delta Δ_{ito}. This metric allows us to focus specifically on retail investors' *purchasing* behavior in options relative to stocks. We focus on call purchases because they can be directly compared to retail's purchases in the equity market, and in light of the evidence we will provide that retail focuses their purchases in calls (see Panel A of Table 4). However, we obtain similar results when applying alternative means to comparing retail activity in stocks vs. options, such as netting purchases against sales or considering retail's positions across both calls and puts.

Figure 4 plots these two metrics around EAs. It shows that both metrics spike just prior to and then drop soon after EAs. This indicates that, not only are retail traders trading more in options prior to EAs, but their trading behavior shifts across markets from stock to options. This shift suggests that the forces that drive retail option purchases prior to EAs are either considerably stronger than and/or distinct from those that drive retail stock purchases. Moreover, it indicates that existing theories on what drives retail trade in the stock market may not be able to fully explain retail trader behavior in options prior to EAs.

3 Pre-Announcement Retail Demand

3.1 Expected Announcement Volatility and Retail Demand

Our first main result is that retail option purchases concentrate ahead of announcements with high expected volatility, which we abbreviate with EAV (expected announcement volatility). Our primary proxy for EAV relies on the market prices of options to back out these expectations. This metric uses the difference between the level of volatility implied by short- and long-horizon options and is defined as:

$$AbnormalIV_t = \frac{IV_{t,30} - IV_{t,60}}{\frac{1}{30} - \frac{1}{60}}, \tag{5}$$

where $IV_{t,\tau}$ is the Black-Scholes implied volatility from the OptionMetrics Standardized Option Price Files of an option with τ days to maturity at t and t is measured in event-time with respect to earnings announcements. Intuitively, when investors expect earnings to create greater return variation, the short-term implied variance rises relative to the long-term implied variance because the event reflects a greater proportion of a short-term option's remaining lifetime (Smith and So 2021). Formally, if stock prices follow a log-normal diffusion process with log-normal jumps at $t = 0$, $AbnormalIV_t$ measures precisely the expected squared jump on the EA date under the risk-neutral measure (Dubinsky et al. 2019).

Because $AbnormalIV_t$ is derived from the market prices of options, retail demand may be mechanically associated with $AbnormalIV_t$ through market clearing. As Ni, Pan, and Poteshman (2008) show, demand for options has price impact prior to EAs, suggesting retail demand likely raises short-term implied volatility due to short-term options having a higher gamma and thus posing more unhedgeable risk for market makers. This greater price impact may influence $AbnormalIV_t$, which introduces concerns about reverse causality. To mitigate these concerns, we exploit the fact that, as shown in Figure 3, retail trades are most prominent starting 3 days prior to the EA and examine $AbnormalIV$ measured 5 days prior to the announcement, denoted as $AbnormalIV_{-5}$. By design, $AbnormalIV_{-5}$ is measured prior to the window over which we measure retail investors' pre-announcement trading.

Figure 5 plots average pre-announcement changes in each clientele group's positions across quintiles of $AbnormalIV_{-5}$ in Panel A and the corresponding levels of their positions in Panel B. The results in Panel A show that pre-announcement retail trading from $t = -5$ to $t = -2$ monotonically increases with $AbnormalIV_{-5}$ and reflects buying behavior in all but the lowest quintile. We also see in Panel A that market makers are net sellers of options in all quintiles, consistent with their role in writing options. Firms are the only other clientele that tends to buy options ahead of high EAV announcements, but this buying behavior is low relative to their buying in the low EAV quintiles (unlike that of retail investors).

Panel B of Figure 5 focuses on the level of each clientele's pre-announcement positions, rather than changes. The results show that the level of retail positions also increases monotonically across quintiles of $AbnormalIV_{-5}$. Retail investors are actually net short options in the bottom quintile. This result may be initially surprising, but it is consistent with the evidence in Lakonishok et al. (2007) that the average non-market-maker position is negative. Anecdotally, these short positions appear consistent with the use of cash covered puts and covered calls to generate income on positions in cash or the underlying.[10] Panel B also shows that retail is the only clientele group with statistically significant net long positions immediately prior to high EAV announcements.

Columns (1) and (3) of Panel A of Table 2 show that retail demand is significantly increasing in EAV as measured by $AbnormalIV_{-5}$, after controlling for potential confounders. Economically, the coefficient on $AbnormalIV_{-5}$ in column (3) indicates that a one standard deviation increase in $AbnormalIV_{-5}$ translates into roughly 2,300 more options bought by retail investors immediately prior to the announcement.[11] Moreover, as shown in Panel B, this increase in retail investors' positions is mostly driven by these investors opening new long options positions prior to the announcement rather than closing existing short positions.[12] In our Internet Appendix, we show the relation between EAV and retail demand is specific to earnings announcements and is not present in non-announcement periods, suggesting EAV does not reflect a static firm characteristic that consistently draws retail attention.

Panel C of Figure 5 plots coefficients similar to column (5) of Panel A in Table 2 for each year in our sample window, where each regression coefficient is scaled by the average absolute pre-announcement retail position change in each year.[13] The annual coefficients show that retail investor demands have become increasingly sensitive to variation in EAV. Retail investor sensitivity to EAV peaks in recent years coinciding with the COVID-19 pandemic and the secular rise in retail participation in options.

[10]See, for example, descriptions on Charles Schwab, Fidelity, or Robinhood.

[11]In our Internet Appendix, we show the probability of retail buying also increases monotonically with EAV. The use of a binary variable to capture increases also helps mitigate concerns that high EAV announcements have mechanically higher trading activity due to greater availability of options.

[12]Our Internet Appendix shows the relation between EAV and retail investors' option buying occurs on the intensive margin, where retail shifts their options positions away from lower to high EAV announcements. This suggests retail investors do not appear offset their positions in high EAV announcements by holding diversifying positions in other options.

[13]This scaling is done to address the fact that retail trading volume has increased over time. The upward trend in the plot is robust to various scaling choices.

To verify that these results are not mechanically driven by the impact of retail demand on prices, columns (2) and (4) of Table 2 incorporate an additional proxy for EAV: the largest absolute return at an EA in past 5 years, which we refer to as MAX_{EA}. This proxy is founded upon the notion that traders and the media may base their expectations of the significance of the announcement on the price movements surrounding past EAs – and hence price behavior around past announcements drives attention at future announcement dates. We compute the maximum EA return to capture anticipated volatility (as opposed to, e.g., historical volatility around EAs) following Bali et al. (2011), who examine an analogous metric in the equity market (the maximum stock return in the past month) and provide empirical support for the notion that investor beliefs about future returns are strongly influenced by the extremes, as opposed to the average, of past outcomes.

3.2 Potential Explanations for the Link between EAV and Retail Demand: Skewness Preferences and Hedging

We start by considering whether two standard motives for retail trade and option trade more generally can explain why retail buys prior to high EAV events: (i) preference-based explanations, and in particular, a preference for skewness, and (ii) a rational use of options to hedge against (or to speculate on) information regarding the volatility of future returns (i.e., stochastic volatility or jump risk).

We begin by considering retail preferences for skewness. Two popular theories of investor preferences in behavioral finance are prospect theory (Barberis, Huang, and Santos 2005) and theories of motivated reasoning (Brunnermeier and Parker 2005), both of which generate a preference for positively-skewed (i.e, lottery-like) payoffs. These theories are supported by empirical evidence showing that retail investors exhibit this preference in equity markets (e.g. Han and Kumar 2013). Given option return skewness might conceivably rise prior to high EAV announcements, this mechanism could in principle also explain our results.

Several facts suggest that our results are not fully explained by a preference for skewness.

First, Boyer and Vorkink (2014) demonstrate that option return skewness strongly *declines* in implied volatility for OTM options and is close to constant in implied volatility for ATM and ITM options (see their Figure 2). Secondly, Panel A of Table 4 shows pre-announcement option purchases by retail investors concentrate in ATM and OTM call options. These results indicate that the skewness of returns for options purchased by retail investors is comparable to or even lower around high EAV announcements than low EAV announcements. Finally, Panel B shows that retail demand is roughly evenly distributed across options with less than one month and more than two months to maturity. Because at-the-money and relatively long-dated options have the largest volatility exposure but significantly less exposure to skewness, these results suggest our findings are not likely to be driven by a preference for lottery-like payoffs.

Moving to the second category of alternative explanations, in rational models of trade that feature derivatives, these derivatives can be used either (i) to hedge the risk exposure, such as variance risk or directional stock exposure that results from positions in the underlying stock, and (ii) to speculate on private information regarding the future return variance (e.g. Leland 1980; Buraschi and Jiltsov 2006; Smith 2019). Several patterns in our data cast serious doubt on rational hedging of stochastic volatility or jump risk as explanations for retail option demand.

The reason that purchasing options is useful for hedging in these models is that they protect investors' equity positions against extreme moves in the stock price. Put options hedge the tail risk associated with long positions, while call options hedge the tail risk associated with short positions in the underlying stock. Thus, given retail investors are more likely to be long rather than short the stock due to short-sale constraints, if they used options for hedging, we would expect them to purchase put options. However, Panel A in Table 4 shows that the link between EAV and retail demand concentrates in call options rather than put options.

A second piece of evidence that casts doubt on retail investors using options to hedge is Panel C of Table 4, which shows that EAV is negatively associated with the holdings of other groups of traders as these traders absorb the spike in retail demand. The fact that the positive relation between EAV and clienteles' net positions is absent for professional customers, firms, and broker-dealers suggests retail investors are contrarian and have different motivations to trade than other clientele groups. In contrast, if retail investors were using options to hedge, we would expect similar trading behavior among alternative clientele groups (e.g. professional customers), who likely have correlated risk exposures.

Third, the dramatic temporal evolution of retail participation presents a significant challenge to hedging-based explanations. Retail option volume has increased more than tenfold over our sample period, yet there is no commensurate increase in the underlying jump risk or volatility of volatility that would necessitate such expanded hedging demand.

Fourth, we show in Section 4 that retail investors maintain their option positions and continue to experience negative returns for up to two weeks following earnings announcements – a period when jump risk is essentially eliminated. We further find in this section that retail post-announcement losses concentrate specifically among positions that experienced negative returns on the announcement day, consistent with the disposition effect documented in options markets by Chang et al. (2016). A rational hedging framework would need to explain not only why investors maintain exposure during periods of minimal jump risk, but also why this behavior manifests primarily for losing positions.

Finally, as we will show in Section 5, retail investors lose 10-14% on high EAV options positions over roughly two weeks – an economically substantial cost that would require extraordinarily large underlying exposures or extreme risk aversion to justify on hedging grounds. Thus, although we cannot fully rule out a rational hedging explanation, the combination of these patterns casts serious doubt and instead points to behavioral mistakes by retail investors.

Although retail investors do not appear to be using options to hedge prior to high EAV announcements, they could be rationally using them to speculate based on private information. Indeed, past evidence lends some credibility to the notion that retail purchases may reflect rational trade on private information regarding volatility in options. For example, Ni et al. (2008) show that total option demand by non-market-makers (which includes retail investors) predicts future stock return volatility, which they attribute to informed volatility trading. Additionally, Kaniel et al. (2012) shows that retail trade in the stock market appears to be informed prior to earnings announcements. However, for this to explain why retail traders systematically purchase options prior to high EAV announcements, these options would have to be, on average, under-priced by market makers, and retail traders would have to recognize this. At face value, this appears unlikely given the relative sophistication of these two investor groups. Moreover, in later tests, we provide evidence that this is unlikely the case, as options earn significantly negative returns following high EAV announcements.

3.3 The Role of Retail Investor Attention

We next turn to study mechanisms that can explain the strong relation between EAV and retail option demand and are a better match to the data. First, in this section, we provide evidence supporting the role of attention-based theories in explaining this pattern in retail option demand. Prior research emphasizes the role of media coverage in capturing retail investors' attention and subsequently affecting their trading decisions (e.g., Barber and Odean 2008; Da, Engelberg, and Gao 2011; Barber, Huang, Odean, and Schwarz 2021). Motivated by this evidence, Panel A of Table 3 examines the relation between EAV and media coverage. We capture news coverage using the number of news articles published in the WSJ, Washington Post, USA Today, and New York Times, as in Niessner and So (2018).

Panel A shows that both of our proxies for EAV are associated with higher news coverage pre-announcement, in addition to coverage during and after the earnings announcement. Specifically, a one standard deviation increase in EAV coincides with an increase in the number of news articles published by 22% during $t \in [-5, -2]$, 20% during $t \in [1, 1]$, and 16% during $t \in [2, 5]$. This finding is consistent with prior evidence that announcements with novel information attract more media coverage (e.g., Noh et al. 2021).

The heightened news coverage prior to high EAV announcements documented in Panel A likely increases their salience in the minds of retail investors. Theories of rational (Sims 2003; Gabaix 2014) and behavioral attention allocation (Bordalo, Gennaioli, and Shleifer 2012) predict that this should, in turn, increase retail investors' propensity to trade around these announcements.

In Panel B of Table 3, we show this increased media coverage indeed plays a crucial role in shaping the relation between EAV and the trading behavior of retail investors. The results in columns (1) and (2) show the relation between EAV and retail investor demand increases by a factor of around four for a one-standard deviation increase in news coverage. Columns (3) and (4) further emphasize this: the amount of buying in top quintile high EAV announcements is an order of magnitude larger in the subsample of announcements with positive pre-announcement media coverage. Collectively, these findings suggest that retail investor attention, spurred through media coverage, contributes strongly to their pre-announcement option demand. These findings complement a substantial literature that highlights retail investors respond to the *realization* of attention-grabbing news, by highlighting that retail buying is also driven by the *anticipation* of attention-grabbing news.

Lakonishok et al. (2007) and Mahani and Poteshman (2008) use proprietary datasets similar to ours from the 1990s to explore the option strategies that investor groups follow. Lakonishok et al. (2007) show that individual investors tend to be net-short options but use call options to speculate on growth stocks (i.e., firms with high market-to-book ratios). Mahani and Poteshman (2008) find these investors similarly purchase options in growth stocks before earnings announcements, but that this behavior does not appear to be driven by attention effects. Our findings thus complement evidence in Barber et al. (2021) that recent generations of retail investors behave differently than those from the 1990s.

3.4 Preference for Volatility, Directional Bias, and Retail Trade in Options Relative to Stocks

While attention helps explain why retail investors are drawn to high EAV announcements, it cannot account for a key feature of retail demand: as EAV rises, retail investors' pre-announcement option purchasing grows not only in absolute terms, but also relative to their stock market activity. To demonstrate this, we apply the measures of relative trade in stock versus options, Unsigned OS Ratio_{it} and OS Call Buy Ratio_{it}, that we defined in (3) and (4). In Table 5, we regress these measures onto our metrics of EAV.

Across both of our measures of EAV, we find that retail's overall activity and purchasing activity increase in the option relative to the stock market. This shift in retail trade towards options distinguishes our results from the existing literature showing attention-grabbing events induce retail traders to purchase stocks (e.g., Barber and Odean 2008). While this literature links historical volatility to retail stock purchases, the evidence in Table 5 suggests that the anticipation of *future* volatility drives these traders to take option positions.

One explanation for why retail investors shift their demand towards options prior to high EAV announcements is that these investors exhibit a preference for return volatility. Both options and stocks allow investors to gain exposure to an asset's price movements. However, due to their implicit leverage, investing a given dollar amount in an option typically results in significantly greater return volatility than investing the same amount directly in the stock. This is particularly true when the underlying's volatility (in our setting, EAV) is high.

A preference for volatility arises in, for instance, models of realization utility. In such models, the ability to immediately realize gains while delaying the recognition of losses creates an option-like payoff for any asset, making more volatile assets more attractive (Barberis and Xiong 2012; Ingersoll and Jin 2013). In fact, a testable implication of realization utility is that investors should prefer longer-dated options, which provide more time to delay the realization of losses. As shown in Panel B of Table 4, retail buying ahead of high EAV announcements is indeed strong in longer-dated options.

While a preference for volatility can explain retail's shift towards options, it does not explain our previous finding in Table 4 that retail investors focus their purchasing primarily in call, as opposed to put, options. Since both types of options exhibit similar levels of return volatility, this focus suggests that retail is systematically optimistic prior to high EAV events. Their shift towards options may be driven by the directional leverage they provide relative to stocks.

Consistent with the presence of systematic optimism, in columns (5) and (6) of Table 5, we regress a measure of pre-announcement retail imbalance in the equity market, defined as the dollar difference between buys and sells normalized by their sum (Barber and Odean 2008), onto our metrics of EAV. While the results in columns (1)-(4) show that retail tilts their trading to the options market, these results show that retail buys more in the equity market ahead of higher EAV announcements. This directional bias towards long positions suggests that retail investments disproportionately seek upside exposure, consistent with the concentration of buying in call relative to put options.

In sum, among the explanations we consider, our evidence is most consistent with the anticipation of high EAV announcements grabbing the attention of retail traders and causing them to be systematically bullish. Moreover, they shift their purchasing away from stocks and towards call options due to the leverage these options provide and/or a preference for volatility.

3.5 EAV and an Alternative Measure of Retail Demand

To further validate the link between EAV and retail demand and ensure that it is not driven by the specific characteristics of our Nasdaq dataset, we next assess its robustness to an alternative measure of retail trading activity. In particular, we consider the measure derived from the CBOE's Options Price Reporting Authority (OPRA) data developed in Bryzgalova et al. (2023). This measure utilizes a flag in the OPRA data for price improvement mechanisms that isolates market and marketable limit orders stemming from retail brokerages. This classification is more conservative than Nasdaq's customer category in identifying retail trade because it focuses exclusively on trades that went through single-leg price improvement auctions. Moreover, given that the flag was introduced in 2019, the measure is available over a shorter time frame, and we calculate it for all stocks in 2020. However, its key advantage relative to the Nasdaq data is that, as previously discussed, the customer category in the Nasdaq data likely commingles retail trade and trade from small non-retail investors who infrequently trade options.

Using the CBOE measure, we follow the same procedure as in our previous analysis to construct a metric of retail traders' cumulative option positions taken over days -5 to -2, for options that expire at least 10 days post-announcement. We then assess its relationship with the Nasdaq measure and use it to replicate our main results in Table 2 on the predictive power of EAV for retail positions.

Table 6 presents the results of this analysis. Columns 1 and 2 illustrate a strong positive correlation between our primary measure and the CBOE-based measure, consistent with their joint ability to capture retail trading. Columns 3 and 4 show that the predictive power of EAV for the Nasdaq measure, as previously studied in Table 2, continues to hold when restricting attention to the 2020 subsample in which we calculate the CBOE measure.

Critically, Columns 6 and 7 show that EAV also predicts the CBOE measure of retail trade, which replicates our main results in Table 2. The reduction in the magnitude of the coefficient on $log(AbnormalIV_{-5})$ in Column 7 relative to Column 2 is consistent with the CBOE measure being more conservative in identifying a trade as retail (focusing only on orders that are sent to single-leg price improvement auctions). Columns 5 and 8 demonstrate that EAV's predictive power is quantitatively similar on the extensive margin across the two measures. Collectively, these results demonstrate that our main findings are not specific to the Nasdaq data, but instead they reflect a broader pattern of retail investors being drawn to options with high EAV.

3.6 Pre-Announcement Retail Price Pressure

Existing evidence on retail trading in equity markets has found retail investors can be contrarian, trading in opposite directions as other traders (e.g., Kaniel et al. 2012). Our evidence in the prior section suggests a similar pattern holds in option markets. However, this literature in equity markets also emphasizes that retail traders earn a premium from supplying liquidity, which in turn enhances market stability (e.g., Barrot et al. 2016). In this section, we provide evidence suggesting this latter result does not extend to options market (as in Foucault et al. 2011).

To provide evidence that retail investors demand, rather than supply, liquidity prior to high EAV announcements, we next study their impact on option prices. We base our predictions on the demand-based option pricing theory from Garleanu et al. (2009). In the presence of market incompleteness that prevents perfect replication of options using the underlying stock, this theory predicts demand from end-users (i.e. retail investors in our setting) that must be fulfilled by market makers will directly impact option prices.

According to this theory, the size of end-users' price impact increases with the difficulty market makers face in hedging the option. As a result, this theory predicts that retail traders' purchases should have potent price impact leading up to earnings announcements. Retail investors form their option positions primarily by trading with market makers, which causes market makers to also hold concentrated positions and thus bear inventory risks through high EAV earnings announcements. Moreover, these announcements lead to discrete changes in the underlying stock prices (Lee and Mykland 2008). These jumps make it impossible for market makers to fully hedge their option exposure using the underlying stock, forcing market makers to take on heightened risk when holding options through these announcements.

To assess retail's impact on option prices pre-announcement, we examine the relation between retail buying during $t \in [-5, -2]$ and $AbnormalIV_{-1}$, controlling for $AbnormalIV_{-5}$. The logic of this approach is as follows. Recall $AbnormalIV_{-5}$ captures the expected abnormal return variance on the announcement date calculated using option prices 5 days before the announcement, i.e., prior to when retail traders tend to enter the market. Absent demand effects, $AbnormalIV_t$ would, on average, remain constant from day −5 to day −2, as the amount of volatility expected on the announcement date should not systematically change over time. Thus, an on-average change in $AbnormalIV_t$ over these days should capture the price impact of investor demand.[14] Formally, this approach relies on the following identifying assumption: shocks to retail demand during $t \in [-5, -2]$ that are independent of option prices are orthogonal to price-independent demand shocks of other investors. We view this as a reasonable assumption given that retail investors demands are primarily absorbed by market makers, who are mostly passive providers of liquidity (as in the model of Garleanu et al. 2009).

Our results in Table 7 suggest retail demand indeed has a large impact on option prices, as it is positively associated with $AbnormalIV_{-1}$ controlling for $AbnormalIV_{-5}$. Economically, our estimates imply that option prices are around 40% higher in terms of implied variances at $t = -1$ for an announcement with top-quintile retail buying relative to another announcement with no retail buying but identical EAV (measured using $AbnormalIV_{-5}$). As a result, it appears that equilibrium prices adjust in response to the demand pressure from retail investors in order to compensate market makers for holding these positions through high EAV announcements.

4 Three Factors that Influence Retail Investment Performance

Over the next two sections of our paper, we conduct two sets of tests that jointly illustrate how retail's proclivity towards purchasing options prior to high EAV announcements depletes their wealth. In Section 4, we provide evidence on three factors contributing to the dynamics

[14]Note this approach has two advantages relative to examining, e.g., option returns. First, it places options across announcements, which vary in moneyness and maturities, in common units – implied variances – rendering their price changes comparable. Second, since $AbnormalIV_t$ is calculated as the (weighted) difference in the implied variances of short- and long-term options, it essentially controls for changes in the prices of long-term options. This helps to isolate retail price impact from any news regarding post-announcement diffusive volatility that arrives during days $[-5, -2]$, since such news will affect the implied variances of both short- and long-term options.

of retail investor performance around earnings announcements. In Section 5, we take an aggregate approach that tracks retail positions in event-time to directly quantify how these factors combine to impact retail wealth.

4.1 EAV and Post-Announcement Option Returns

Our results in Table 7 suggest retail traders may be reducing price efficiency when trading prior to announcements by inflating prices. However, past evidence shows that retail traders earn positive trading profits in equity markets around earnings announcements (e.g., Kaniel et al. 2012; Kelley and Tetlock 2013). Thus, it is conceivable that retail traders are drawn to buy options prior to high EAV announcements not only because they draw their attention, but also because they recognize such options are systematically *underpriced*. In this case, their price impact would bring the implied variance closer to the actual level of this variance, raising price efficiency. If this were the case, we would expect to see that options earn non-negative returns following high EAV announcements.

Alternatively, retail traders may purchase options prior to high EAV announcements for behavioral reasons, such as the attention-based explanation for which we provide support in Section 3.3. In this case, we would expect to see that options earn negative returns following high EAV announcements, for two non-exclusive reasons. First, if retail traders do not have private information on future volatility, the price pressure they create prior to these announcements will gradually reverse after they establish their positions, generating negative returns. The reason is that after the announcements, both the quantity of options held by market makers declines as retail investors close their positions *and* the quantity of risk per option declines due to the resolution of uncertainty. Jointly, these patterns imply the total unhedgeable risk faced by market makers decreases post-announcement, which (in the model of Garleanu et al. 2009) implies a correction in option prices.

The second reason options could earn negative returns in the event that retail investors do not have private information is that the market may have incorrect expectations with respect to the magnitude of the price moves certain announcements will create. In this case, when sorting announcements on EAV, short-term options in the upper quintiles are more likely to be those where the market has overshot the true announcement volatility. Hence, these options will have negative expected returns. The evidence in Goyal and Saretto (2009) that the implied volatility premium negatively forecasts option returns provides support for this possibility.

To provide insight into the impact that retail option trade has on price efficiency and to motivate our subsequent analysis of how this trade impacts retail's wealth, we next examine the relation between EAV and post-announcement option returns. To be precise, we examine the predictive power of two measures: (i) $AbnormalIV_{-5}$, which captures EAV alone, and (ii) $AbnormalIV_{-1}$, which captures the combination of EAV and the price pressure that retail traders create:

$$AbnormalIV_{-1} = \underbrace{AbnormalIV_{-5}}_{\text{EAV}} + \underbrace{AbnormalIV_{-1} - AbnormalIV_{-5}}_{\text{retail price pressure}}.$$

For each announcement, we select one straddle by choosing a call and put pair of the same strike and maturity. We choose the closest-to-the-money pair, defined based on the ratio of the forward to strike price, among all pairs that expire most closely after 13 days past the earnings announcement. We select 13 days in order to study returns over the two weeks following the announcement date and add an additional 3 days to mitigate concerns about microstructure effects near expiration (Carr and Wu 2009). We then compute the returns to *selling* a straddle at time t as

$$SRET_t = -1 * \left[\frac{\text{Call Price}_t + \text{Put Price}_t - \text{Call Price}_{t-1} - \text{Put Price}_{t-1}}{\text{Call Price}_{t-1} + \text{Put Price}_{t-1}}\right], \tag{6}$$

where Call Price_t and Put Price_t correspond to midpoints of the best bid and ask exchange quotes at market close on day t from OptionMetrics.[15] By looking at straddles, we isolate

[15]On days where quotes are missing in OptionMetrics, we assume the option price is unchanged. Duarte,

the pricing of volatility from any directional pricing effects in the underlying (e.g., Coval and Shumway 2001).[16] Additionally, we complement this approach by examining returns on the specific options in which retail transacts in Section 5.

Panels A and B of Table 8 show results from quarterly portfolio sorts on $AbnormalIV_{-1}$, using lagged quarterly breakpoints. We find straddles for high EAV announcements underperform straddles for low EAV announcements by a whopping average return of 11% per announcement (t-stat = 19.44) on the announcement day and an additional 9% (t-stat = 8.31) over the 10 days after the announcement, with little skewness or kurtosis. This substantial negative return on the announcement and the continuation post-announcement (i.e., the absence of a reversal) indicates that retail traders do not appear to have private information when purchasing options ahead of high EAV announcements. Instead, it suggests retail investors purchase options that are overpriced relative to realized volatility.[17]

In Panel C, we perform quarterly Fama-MacBeth regressions. To assess whether the post-announcement returns in Panels A and B simply represent overpricing in high EAV announcements or are driven in part by retail demand pressure, we compare the return predictive power of $AbnormalIV_{-5}$ and $AbnormalIV_{-1}$. Columns (3) and (7) show $AbnormalIV_{-5}$ is a strong predictor of announcement-day and post-announcement straddle returns, after controlling for other important option return predictors. However, columns (4) and (8) show $AbnormalIV_{-1}$ is a significantly more potent predictor of returns, as it absorbs the predictive power of $AbnormalIV_{-5}$. Since the primary difference between these measures is that $AbnormalIV_{-1}$ more accurately accounts for retail demand pressure, these results retail demand pressure has a non-trivial influence on option prices.

Notably, the regressions in Panel C include several controls based on prior work on

Jones, and Wang (2019) highlight big microstructure biases in option prices, resulting in errors in returns to option strategies of 50bps per day. However, the biases they find are almost non-existent for ATM straddles (the focus of our return predictability tests), while they are much larger for OTM unhedged option strategies.

[16]Although retail demand prior to high EAV announcements is concentrated in calls, the model from Garleanu et al. (2009) implies demand for calls impacts both the prices of both calls and puts (and thus straddles) because put-call parity holds.

[17]In our Internet Appendix, we show this return predictability is not present around pseudo-announcements and generalizes to all earnings announcements in OptionMetrics outside of those in our Nasdaq sample.

that explores the predictability of option returns. First, this work suggests that option returns may capture a premium for systematic variance risk (Leland 1980; Barth and So 2014; Smith 2019). We thus continue to control for the proxies for this risk on the earnings date that we applied in the previous section. Second, we again control for the measure of the lotteryness of an option's payoff from Boyer and Vorkink (2014), calculated for the straddles under consideration. Looking across the columns in Panel A, we see that adding controls strengthens the relation between EAV and straddle returns, further highlighting how a preference for skewness or hedging demand cannot entirely explain our results and thus should be seen as complementary drivers of option prices.[18]

4.2 Pre-Announcement Transaction Costs

A second factor that impacts retail investor performance is the large bid-ask spreads they incur when opening their positions. This result is driven by the fact that single-name equity options in general have high bid-ask spreads (Muravyev and Pearson 2020), but also because these spreads are abnormally large prior to high EAV announcements.

To illustrate this result, we approximate the bid-ask spread retail investors incur when buying options between $t = -5$ and $t = -2$, as in Table 2. Throughout, we make conservative assumptions about these transaction costs to ensure we have a lower bound on their importance. In particular, we assume such an investor holds the option to maturity, implying the investor only incurs half of the bid-ask spread (the "half-spread"). Let $\text{Half-Spread}_{iqot}$ denote the half-spread (in % of midpoint) from OptionMetrics for an option o written on firm i on event-day t relative to the earnings announcement in quarter q. We compute our estimate of the half-spread incurred by retail investors by buying options before firm i's announcement in quarter q as the following weighted average:

$$\text{Half-Spread Incurred by Retail}_{iq} = \sum_{o} \omega^{1}_{iqo} \sum_{t=-5}^{-2} \omega^{2}_{iqot} \text{Half-Spread}_{iqot}, \tag{7}$$

[18]In our Internet Appendix, we show our return predictability is independent of option liquidity and is complementary to that documented by Boyer and Vorkink (2014).

where the outer summation occurs over all available options o in our sample and the weights (which both sum to one) in the summation are:

$$\omega^1_{iqo} = \frac{|\text{Retail Position}_{iqo-1}|}{\sum_o |\text{Retail Position}_{iqo-1}|}, \quad \omega^2_{iqot} = \frac{|\Delta\text{Retail Position}_{iqot}|}{\sum_{t=5}^{-2} |\Delta\text{Retail Position}_{iqot}|}.$$

Our calculation of the half-spread incurred by retail investors in (7) captures the fact that the bid-ask spreads incurred by retail investors depend both on the particular options they buy and the day on which they buy them. By weighting the half-spread on a particular option based on the amount retail trades on a given day, ω^1_{iqot}, our calculation gives greater weight to days on which retail investors trade more. The weights when summing across options, ω^2_{iqo}, give larger weight to options in which retail has more exposure.

Figure 6 illustrates the spreads that retail face and how these spreads vary with EAV, measured using $AbnormalIV_{-1}$. Panel A shows retail investors pay a large amount of transaction costs in dollars prior to all announcements, but that these costs are close to 50% greater prior to high than low EAV announcements. In Panel B, we examine the transaction costs incurred by retail investors in percentage of the midpoint. This panel demonstrates that the typical percentage half spreads that retail traders incur are on the order of 8%. Collectively, both panels demonstrate that spreads prior to announcements increase with top-quintile EAV to roughly 9%, which compounds the losses retail investors face.

4.3 Holding onto Positions Post-Announcement

The third factor we document that influences the loss of wealth by retail investors around high EAV announcements is their tendency to hold on to the option positions they open prior to high EAV announcements. In Table 9, we examine the extent to which post-announcement retail positions one week after the announcement are predictable using our measures of EAV. Columns (1) and (4) in Panel A show that retail traders continue to hold on to the positions one week after the announcement, on $t = 5$, that they opened prior to high EAV announcements. Figure 7 portrays this phenomenon in more detail, showing the average position held by retail traders in event-time. This analysis reveals retail investors do not revert to their pre-announcement option position until approximately two weeks after the earnings announcement at $t = 10$. Given the evidence in Table 8 that options continue to earn large negative expected returns over the two weeks following high EAV announcements, this behavior is likely to further deplete retail investors' wealth.

A natural explanation for this finding is that retail investors hold on to options to hedge against large stock prices moves that might follow high $AbnormalIV_{-1}$ announcements. This explanation is unlikely valid for two reasons. First, in Figure 8, we plot the average event-time idiosyncratic volatility in top and bottom quintiles of EAV in Panel A and the difference between the two in Panel B. Figure 8 shows there is no meaningful difference in idiosyncratic volatility between high and low EAV announcements aside from on the announcement day. Second, Panel B of Table 9 shows other traders behave differently from retail investors post-announcement. A notable finding is the reduction in positions from firms, who also buy options pre-announcement (Figure 5).

An alternative explanation for this finding is that it reflects portfolio inertia, similar to that documented in retail investors' equity portfolio choices (e.g., Calvet, Campbell, and Sodini 2009; Choukhmane and de Silva 2024). However, this explanation is unlikely in our setting given retail investors appear to intentionally open these options prior to earnings with the goal of being exposed to the earnings price move. Additionally, the large negative average return to being long volatility as documented in Table 8 is difficult to reconcile with reasonably-sized portfolio adjustment costs.

We hypothesize two remaining forces that could drive retail investors' persistent option holdings. First, retail traders may hold option positions to maturity in order to avoid the transaction costs (i.e., bid-ask spread) associated with closing out these positions. Second, given the negative returns to straddles around high EAV announcements documented in the previous section, retail traders lose on average around these announcements. In the presence of such losses, retail investors may fail to sell due to a disposition effect, which could occur due to convexity of investors' value functions in the loss domain (Kahneman and Tversky 1979; Barber and Odean 2008) or the negative realization utility from selling (Barberis and Xiong 2012; Ingersoll and Jin 2013).

In the remaining columns of Table 9 Panel A, we empirically explore these two potential explanations. Beginning with the disposition effect, we examine how retail traders' P&L on the announcement date influences their proclivity to hold on to their option positions. We adopt an analogous approach to Genesove and Mayer (2001) and examine retail traders' losses at $t = 0$, defined as $\max(0, -\text{Retail P\&L}_0)$ where Retail $\text{P\&L}_0$ is calculated by aggregating the product of Retail's position in each option at $t = -1$ multiplied by the change in each option price from $t = -1$ to $t = 0$. To test for the disposition effect, we focus on the interaction between $\max(0, -\text{Retail P\&L}_0)$ and our metrics of EAV. This interaction captures whether retail investors are more likely to continue holding option positions following high EAV announcements when these announcements subject them to large losses.

Consistent with the disposition effect driving retail traders' proclivity to maintain their option positions, we find that they hold on to a greater proportion of their options around high EAV announcements when they experience losses on the announcement date. Quantitatively, columns (2) and (5) of Panel A show that a one standard deviation increase in the losses experienced by retail investors doubles the relation between EAV and retail investors' post-announcement positions. Columns (3) and (6) show retail investors appear to respond to transaction costs, but notably this response is about one-fifth as large as their response to prior losses. In sum, these results suggest the post-announcement trading behavior of retail investors appears to be primarily influenced by a disposition effect, even after controlling for the effect of transaction costs, consistent with behavioral motives driving their trading decisions.

5 Tracking Wealth Dynamics around Earnings Announcements

Our final tests take an aggregated approach that leverages the granularity of our data to more directly track wealth dynamics in event-time relative to earnings announcements. As a complement to our straddle return tests, these tests provide a more precise picture of the wealth dynamics of retail investors after accounting for their concentrated positions in options ahead of high EAV announcements as well as conservative assumptions about the transaction costs they incur.

5.1 Approximating Trader Profit and Loss

In Appendix B, we show that the P&L of each trader on day, t, summed across options, i, can be approximated as follows:

$$\text{Trader P\&L}_t \approx \sum_i \text{Trader Position}_{it-1} * (\text{Option Price}_{it} - \text{Option Price}_{it-1}). \qquad (8)$$

Calculating the P&L of each clientele group using (8) requires three key assumptions. First, it requires that we observe all of the options positions of each trader. Since this assumption clearly fails as traders trade options on other exchanges than Nasdaq, we choose to scale the P&L of each trader by the average dollar trading volume on Nasdaq one month before the announcement. By estimating P&L as a multiple of observed trading volume, we hope to take into account variation in Nasdaq sample coverage that would pollute an unnormalized measure in dollars. Second, when implementing (8) empirically, we use the last traded price of each option from Nasdaq. Thus, we make the assumption that all traders rebalance at market close, as we do not observe intra-day trading in our data.[19]

The final simplifying assumption needed for (8) is that there are no bid-ask spreads. By ignoring bid-ask spreads in this initial calculation, (8) under-estimates the P&L to market makers and over-estimates of the P&L to other traders. In Section 5.3, we relax this

[19] In our Internet Appendix, we show our main result in Figure 9 Panel A is robust to using opening prices or the average of daily low and high prices, instead of closing prices.

assumption and consider varying levels of transaction costs.

5.2 Trader Profitability across Announcements

In Panel A of Figure 9, we plot the average P&L of each clientele group between market close on $t = -1$ and market close at $t = 10$, the same time period over which we examine straddle returns, across five quintiles of our measure of EAV, $AbnormalIV_{-1}$. The results show retail investors' P&L decreases monotonically across the quintiles of EAV, with retail investors losing a statistically significant amount in the highest EAV announcements. Quantitatively, retail loses on average around 5% of non-EA dollar trading volume on the typical earnings announcement, yet around 50% for a top-quintile EAV announcement. Given the average non-EA dollar volume in our sample is \$134K, this implies an on average loss of approximately \$6K per announcement and approximately \$60K per top quintile EAV announcement. Aggregating across approximately 6,000 high EAV announcements in our sample, the latter estimate implies a total \$360M wealth transfer. Under the assumption that a similar wealth transfer occurs across all traded options, our sample's ~25% coverage of total option activity implies a \$1.5 billion wealth transfer away from retail investors in options markets over our sample period before accounting for spreads.[20]

Panel A also shows the majority of capital flows away from retail investors goes to market makers, as transfers to the remaining clientele appear indistinguishable from zero. Given this calculation ignores bid-ask spreads, we expect the actual wealth transfer to be considerably larger, as market makers receive the spread as additional compensation. In our Internet Appendix, we replicate the same analysis around pseudo-earnings announcements and find these wealth transfers we document appear specific to earnings announcements.

We next estimate the investment returns of retail investors by calculating three variables. First, we calculate daily returns of retail's long positions by calculating their P&L according

[20]These results complement the findings in Poteshman and Serbin (2003) that unsophisticated investors exercise options early by showing that not only do these investors misunderstand the mechanics of options, but also they trade these options at times when and in stocks where they have exceptionally high prices.

to (8) summing only across long positions. We then divide this by the net long dollar exposure of retail to measure long option returns, Retail Avg. $\text{Return}_t^{\text{Long}}$. Second, we calculate the daily returns of retail's short positions analogously, denoted by Retail Avg. $\text{Return}_t^{\text{Short}}$. Finally, we calculate a weighted average of the two based on the dollar exposure of retail on long and short positions for each announcement at $t = -1$, denoted by Retail Avg. $\text{Return}_t^{\text{Weighted}}$.

Table 10 estimates how much lower these returns are for top-quintile EAV announcements. The first two columns show that retail investors lose an average of 250 basis points (bps) per day on their long positions over the announcement day and 10 days following the announcement, while they lose around 55-70bps more on high EAV announcements. In contrast, retail investors make on average 180bps on their short positions over the same time period, but gain around 40bps more on their short positions around high EAV announcements.

Columns (5) and (6) of Table 10 examine how retail investors' weighted return varies across announcements. We find retail investors earn a small average return of around 6bps (not accounting for transaction costs) around lower EAV announcements. However, around high EAV announcements, we estimate that retail investors lose roughly 60bps per day over the 11 days beginning with the announcement date. Cumulating these returns over these 11 days results in our final estimate that retail investors lose around 7% on average of their options investments around high EAV earnings announcements. These losses are an order of magnitude larger than the losses that Bauer et al. (2009) show retail investors in the Netherlands incur trading options on the typical day, which amount to 181 basis points *per month*. This is consistent with retail investors buying options that are exceptionally overpriced around high EAV announcements.

5.3 Incorporating Transaction Costs

We next quantify how the large spreads incurred by retail, as documented in Section 4.2, influence their returns and the amount of wealth they yield to market makers. Figure 9

Panel B shows how the variation in Retail P&L across quintiles of EAV varies after we take into account transaction costs. We convert our estimate of the half-spread in (7) into dollars by multiplying by $|\text{Retail Position}_{-1}|$ and then subtract it from our estimate of Retail's P&L in (8) to produce these estimates. In the figure, we show how our estimates vary based on the assumptions we make about the price-improvement that retail investors receive relative to the best quoted half-spread (a price improvement of 100% would give identical results to Panel A of Figure 9).

As evident from Panel B, for all values of possible price improvement we consider, retail investors lose significantly more wealth due to transaction costs. Assuming that retail traders receive price improvement of 20% is conservative, particularly in light of evidence in Ernst and Spatt (2022) that retail price improvement hovers around 10%. Under this assumption, we estimate the average loss for announcements in the top quintile of EAV doubles relative to Panel A. Applying the simple aggregation calculation from the previous section, this translates into a wealth loss by retail investors of around $3 billion over our sample.

In Panel C, we show how incorporating transaction costs affects our estimates of retail's cumulative returns from $t = 0$ to $t = 10$ under the assumption of 20% price improvement. Comparing the results with Table 10 highlights two effects of transaction costs. First, transaction costs contribute to retail investors now losing wealth in all quintiles: a cumulative 6% *loss* over 11 days in the bottom four quintiles, in contrast to the 1% *gain* implied by the 9bps average daily return column (6) of Table 10. Thus, any gains retail traders make from the premium they receive by selling options are eroded by transaction costs.

A second key insight of Figure 9 is transaction costs compound retail investors' losses around high EAV announcements: in Panel C the cumulative negative loss is around 12% compared to the approximate 7% loss estimated in column (6) of Table 10. Moreover, as shown in Figure 10, more than half of this -12% return occurs on the announcement day alone. Finally, following the announcement, after again assuming 20% price improvement, Figure 10 also shows that transaction costs result in retail losing an additional ~5% over the

10-day post-announcement window.

6 Conclusion

The COVID pandemic coincided with a significant increase in retail investors participating in options markets, and this behavior has led to concern among regulators. This study aims to offer important insights into how their behavior impacts prices, gains, and losses. We first show that retail investors are attracted to trading options around announcements with high expected volatility (EAV), likely due to their greater salience through news coverage. Second, these retail demands generate risk for market makers that are priced and hence generate return predictability on and following high EAV announcements. Finally, retail investors are slow to close their positions following losses on the announcement day as option prices predictably decay. This combination of behaviors translates to retail losses of 5-to-9% around earnings announcements on average, and 10-to-14% for high expected volatility announcements. Additionally, these behaviors led to significant capital transfers from retail investors to market makers, especially during the COVID pandemic.

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A Variable Definitions

Variable	Definition	Time Period	Data Sources
t	days relative to an earnings announcement, which occurs at $t = 0$		Compustat and IBES
ΔTrader Position$_t$	see (1)	t	Nasdaq
Trader Position$_t$	see (2)	t	Nasdaq
Trader Position Share$_t$	Trader Position$_t$ divided by the sum of Trader Position$_t$ across all underlying on date t	t	Nasdaq
Trader P&L$_t$	see (8)	t	Nasdaq
Retail Avg. Return$_t^{\text{Long}}$	average daily return on all retail long options positions in a given underlying, described in Section 5	t	Nasdaq
Retail Avg. Return$_t^{\text{Short}}$	average daily return on all retail short options positions in a given underlying, described in Section 5	t	Nasdaq
Retail Avg. Return$_t^{\text{Weighted}}$	weighted average of Retail Avg. Return$_t^{\text{Long}}$ and Retail Avg. Return$_t^{\text{Short}}$, with weights determined by relative dollar exposure of retail long and short positions at $t = -1$, described in Section 5	t	Nasdaq
Half-Spread Incurred by Retail$_{iq}$	estimate of half of bid-ask spread incurred by retail investors trading before the earnings announcement of firm i in quarter q calculated in (7)	$t \in \{-5, -2\}$	Nasdaq
Retail Equity Buys$_t$	number of shares bought by retail investors in the underlying stock i on day t, identified following Boehmer et al. (2021)	t	TAQ
Retail Equity Sells$_t$	number of shares sold by retail investors in the underlying stock i on day t, identified following Boehmer et al. (2021)	t	TAQ
$AbnormalIV_t$	see (5)	t	OptionMetrics
MAX_{EA}	largest absolute return at an EA in past 5 years	$t \in \{-1260, -1\}$	CRSP
$SRET_t$	see (6)	t	OptionMetrics
AT	total assets	$t \in \{-126, -1\}$	Compustat
$log(BTM)$	log of book-to-market	$t \in \{-126, -11\}$	CRSP and Compustat
β_V	variance beta $= \frac{corr(r_{it}^2, r_{mt}^2) * sd(r_{it}^2)}{sd(r_{mt}^2)}$ (Carr and Wu 2009)	$t \in \{-252, -11\}$	CRSP
$IdioVol$	in-sample RMSE from the market model in Figure 8	$t \in \{-252, -11\}$	CRSP
Volatility$_0$	absolute value of announcement day return multiplied by $\sqrt{252}$	$t = 0$	CRSP
Volatility$_{-60,-5}$	standard deviation of daily returns multiplied by $\sqrt{252}$	$t \in \{-60, -5\}$	CRSP
Volume$_{-22,-5}$	trading volume across all options	$t \in \{-22, -5\}$	OptionMetrics
$EAOrder$	$\frac{\text{\# days between first announcement in same quarter}}{\text{\# days between first and last announcements in same quarter}}$	by announcement	Compustat and IBES
$skew_{BV}$	option-implied skewness calculated following Boyer and Vorkink (2014), averaged across all options traded on a given announcement, meaasured prior to the announcement	$t = -10$	CRSP and OptionMetrics
$skew_{BV}^S$	option-implied skewness calculated for straddles traded calculated following Boyer and Vorkink (2014), averaged over 132 days	$t \in \{-129, -3\}$	CRSP and OptionMetrics
$ROTP$	average ratio of Customer trading volume to total OptionMetrics trading volume (Choy 2015)	$t \in [-22, -1]$	Nasdaq and OptionMetrics
News Articles$_{\tau,s}$	the number of news articles published in the WSJ, Washington Post, USA Today, and New York Times on a given underlying during $t \in [\tau, s]$, where announcements that do not match with Factiva.com are assumed to have zero news articles published.		Factiva.com

B Additional Details on P&L Calculation

Our approach to calculating the profit and loss (P&L) of different traders is as follows. Denote the portfolio value in dollars of a given trader's position on day t as Trader PV_t and let i denote an option that the trader holds. By definition,

$$\text{Trader PV}_t = \sum_i \text{Trader Position}_{it} * \text{Option Price}_{it} + \text{Outside Wealth}_t, \tag{9}$$

where Trader Position_{it} corresponds to the position of the trader in option i at t, Option Price_{it} denotes the price of option i at t, and the sum over i is across all options on all underlyings that the trader holds. Outside Wealth_t denotes other assets held in the traders' portfolio (e.g., the underlying stock), which we do not observe. Taking first differences of (9) and rearranging gives an expression for the trader P&L:

$$\begin{aligned}\text{Trader P\&L}_t \equiv \Delta\text{Trader PV}_t = &\sum_i \text{Trader Position}_{it-1} * (\text{Option Price}_{it} - \text{Option Price}_{it-1}) \\ &+ \sum_i \text{Option Price}_{it} * (\text{Trader Position}_{it} - \text{Trader Position}_{it-1}) \\ &+ \Delta\text{Outside Wealth}_t.\end{aligned}$$

Since a trader's outside wealth is not observable, we assume that changes in outside wealth stem from using assets (e.g., cash) to buy options and receiving assets from selling options:

$$\sum_i \text{Option Price}_{it} * (\text{Trader Position}_{it} - \text{Trader Position}_{it-1}) = -\Delta\text{Outside Wealth}_t. \tag{10}$$

Under this assumption, we can calculate the P&L of each trader using (8).

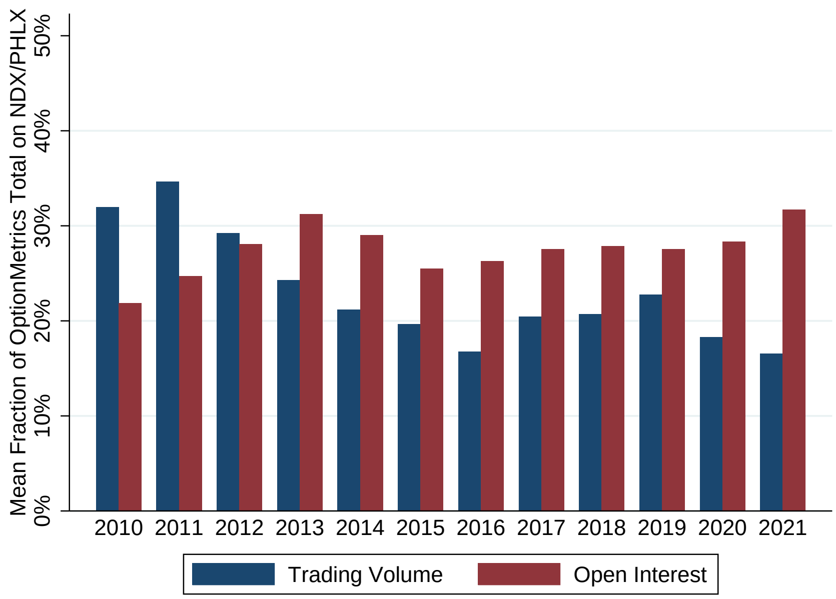
Calculating the P&L of each clientele group using (8) requires three additional assumptions. First, it requires that we observe all of the options positions of each trader. Since the latter assumption clearly fails as traders trade options on other exchanges than Nasdaq, we choose to scale the P&L of each trader by the average dollar trading volume on Nasdaq one month before the announcement. By estimating P&L as a multiple of observed trading volume, we hope to take into account variation in Nasdaq sample coverage that would pollute an unnormalized measure in dollars. Second, when implementing (8) empirically, we use the last traded price of each option from Nasdaq. Thus, we make the assumption that all traders rebalance at market close, as we do not observe intra-day trading in our data. Finally, we ignore bid-ask spreads in this calculation, which will result in an understatement of the P&L to market makers and an overstatement of the P&L to other traders (we relax this assumption in subsection 4.2). Although these assumptions required for us to correctly estimate the level of trader P&L may appear restrictive, we emphasize our interest is primarily in how P&L *varies across* announcements and we see no reason for the validity of these assumptions to meaningfully vary with EAV.

In Table 10, we using this methodology to approximate the returns of retail investors. When doing so, we require the additional assumption that there are no collateral requirements associated with shorting options. In practice, this is of course not the case. However, we view this as a conservative assumption because it results in an over-estimate of the return of retail investors on short positions, which in practice require the option writer to post additional collateral that drives down the return.

Figure 1. Option Trading Over Time

This figure plots trading volume and open interest in our sample over time. Panel A of this figure plots the fraction of total volume and open interest in OptionMetrics that is covered in the Nasdaq data. For each option-day, we merge Nasdaq with OptionMetrics and calculate the ratio of Nasdaq to OptionMetrics trading volume and open interest. Panel A then plots the average of these ratios across every day in each year using all options available on Nasdaq. Panel B of this figure plots the total dollar trading volume of Retail for each year in our sample across all options available on Nasdaq. The asterisk on 2021 in Panel B denotes the fact that our sample ends in February 2021.

Panel A: Sample Coverage



Panel B: Retail Trading Over Time

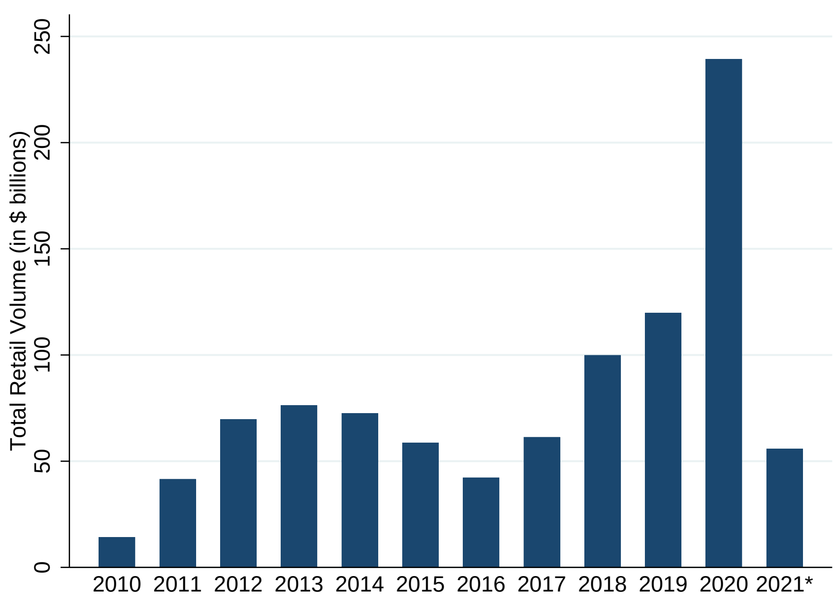
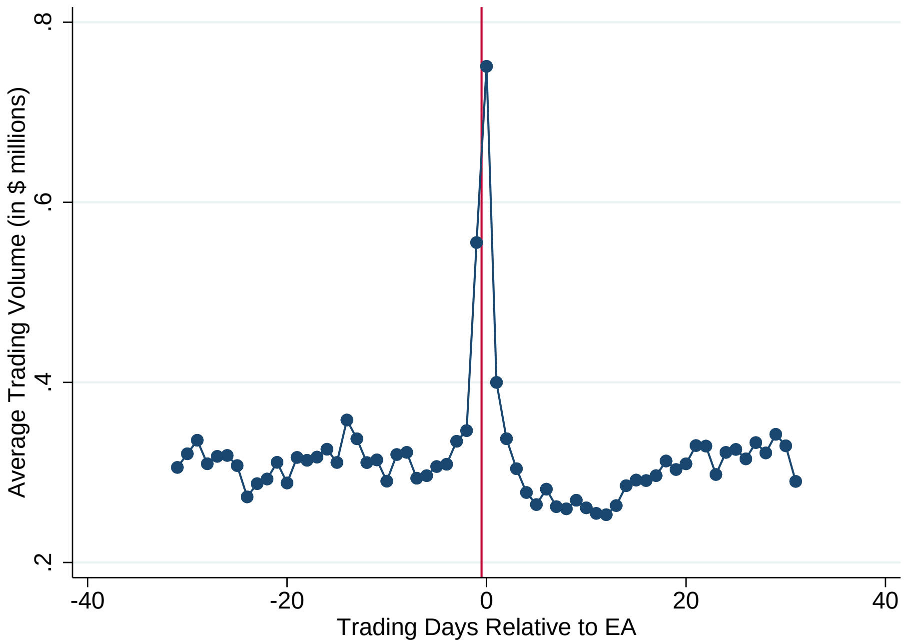


Figure 2. **Options Trading around Earnings Announcements**

This figure plots option trading volume around earnings announcements. Panel A plots average dollar trading volume across all announcements in our sample at different trading days relative to earnings announcements, which occurs at day $t = 0$. Panel B plots the average dollar trading volume across all announcements in each year that occurs between $t = -5$ and $t = -2$ for our five different classifications of traders. Both panels aggregate across all options for each announcement from Nasdaq.

Panel A: Dollar Volume in Event-Time



Panel B: Pre-Announcement Dollar Volume

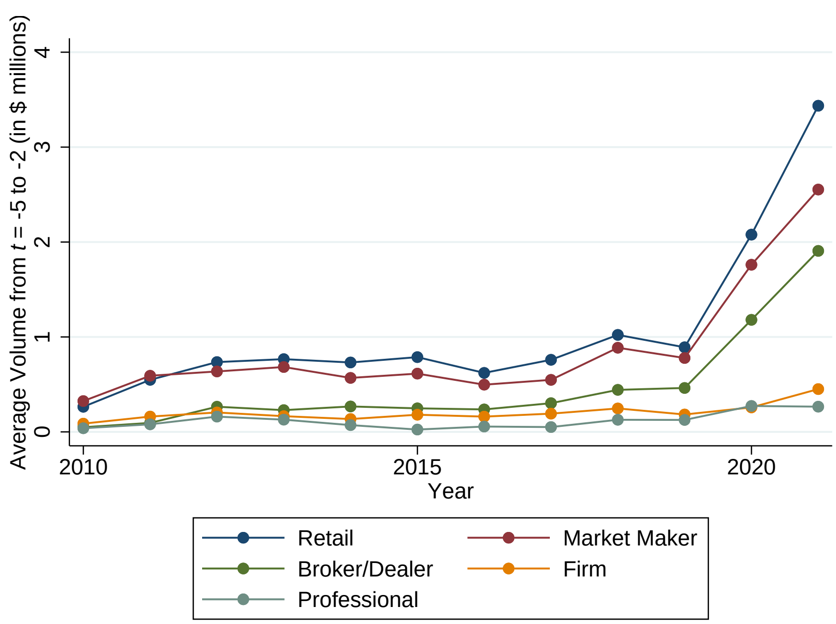
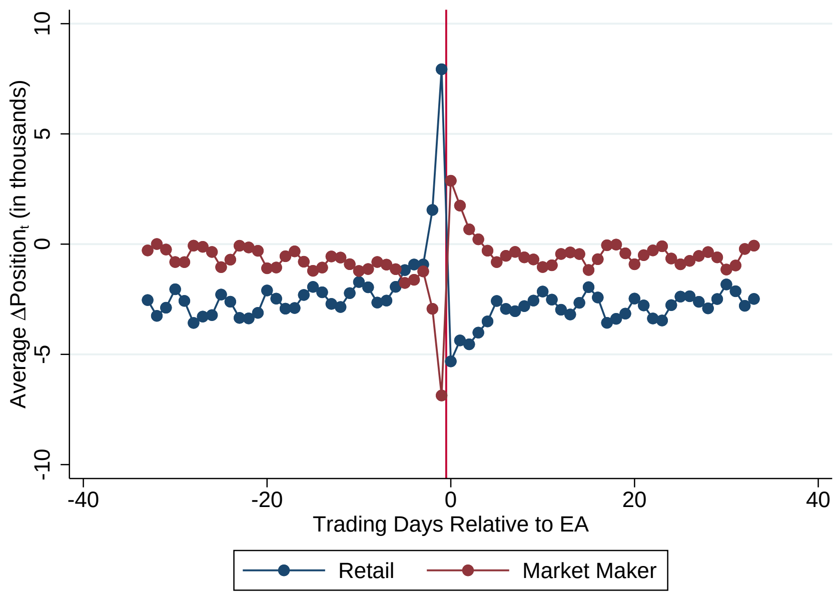


Figure 3. Option Trading in Earnings Announcement Event-Time

This figure plots the average change in option positions in earnings announcement event-time for different traders, corresponding to ΔTrader Position$_t$ in (1). For each earnings announcement (firm-quarter), Panel A plots the average number of options purchased by Retail and Market Makers, while Panel B plots the analogous results for Broker/Dealers, Firms, and Professionals. The number of options purchased is equal to 100 multipled by the number of contracts purchased. Trader positions are aggregated across all options on each underlying and are winsorized at 2%-98%. Detailed variable definitions are provided in Appendix A.

Panel A: Retail and Market Makers



Panel B: Other Traders

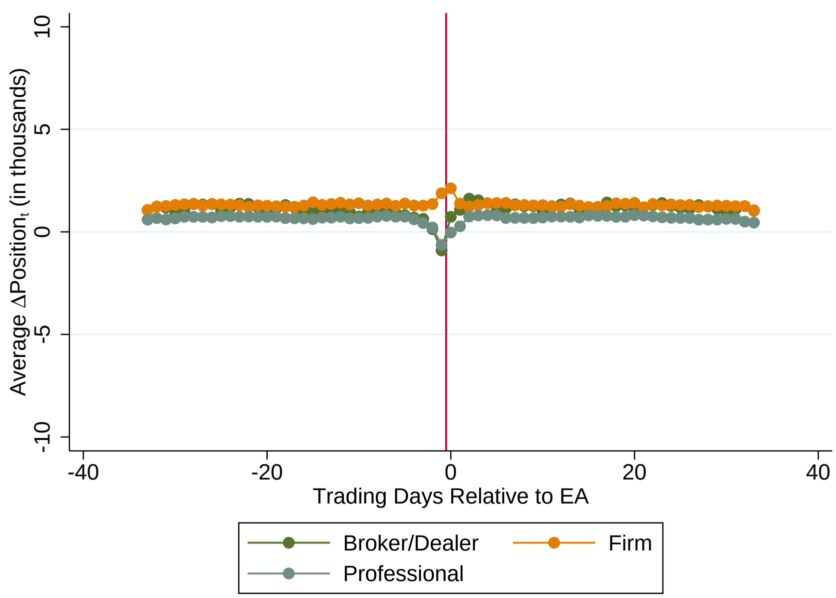


Figure 4. Retail Equity vs. Option Trading in Earnings Announcement Event-Time

This figure plots the average value of the ratio of unsigned delta-weighted retail option trades to total retail buys and sells in the equity market defined in (3), Unsigned OS Ratio$_{it}$, and the ratio of delta-weighted retail call purchases to retail buys in the equity market defined in (4), OS Call Buy Ratio$_{it}$. Retail option positions are aggregated across all options that expire at least 10 days after the earnings announcement and both variables are winsorized at 2%-98%. Detailed variable definitions are given in Appendix A.

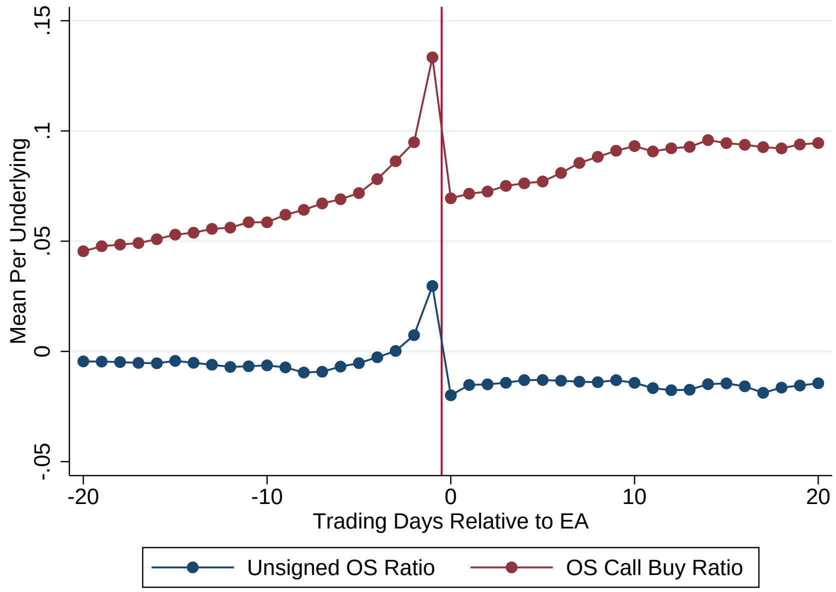
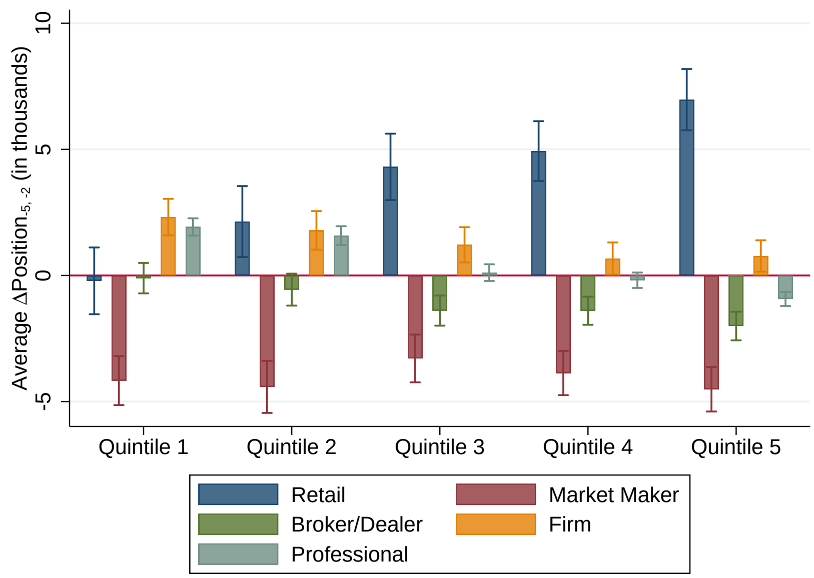


Figure 5. Trader Positions Pre-Announcement

This figure plots the average pre-announcement trading behavior and positions for different traders and different quintiles of $AbnormalIV_{-5}$, defined as $\Delta\text{Position}_t$ and Position_t in (1) and (2). For each quintile of $AbnormalIV_{-5}$ and trader group, Panel A shows the average number of options bought between $t = -5$ and $t = -2$, $\Delta\text{Position}_{-5,-2}$. Panel B shows the average position at $t = -2$, Position_{-2}. Trader positions are aggregated across all options that expire at least 10 days after the earnings announcement and are winsorized at 2%-98%. Error bars in both panels represent 95% confidence intervals. Panel C shows the coefficients and 90% confidence intervals from running the regression in column (5) of Table 2 separately each year. The resulting coefficients are normalized by the average value of $|\Delta\text{Retail Position}_{-5,-2}|$ across all announcements in each year. Detailed variable definitions are given in Appendix A.

Panel A: Pre-Announcement Buying Across Quintiles of $AbnormalIV_{-5}$



Panel B: Pre-Announcement Positions Across Quintiles of $AbnormalIV_{-5}$

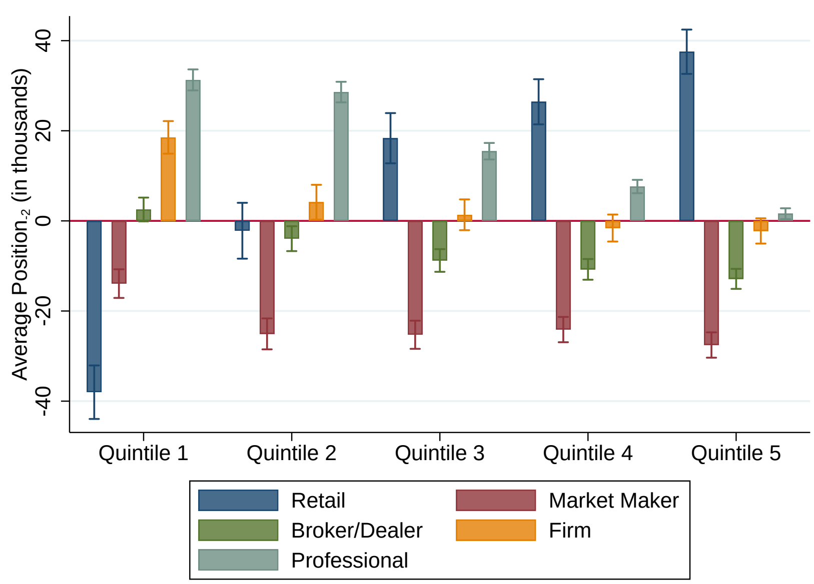


Figure 5. Trader Positions Pre-Announcement (continued)

Panel C: Annual Fama-MacBeth Regressions of $\Delta Retail\ Position^{Calls}_{-5,-2}$ onto $AbnormalIV_{-5}$

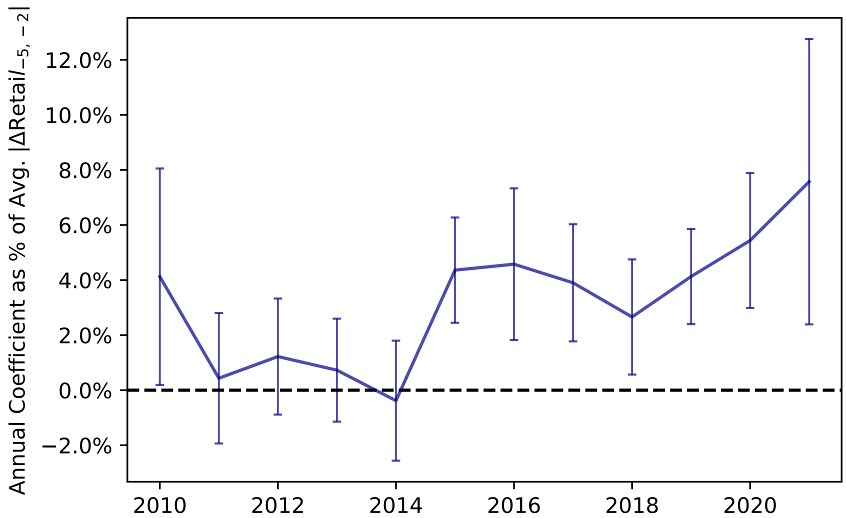
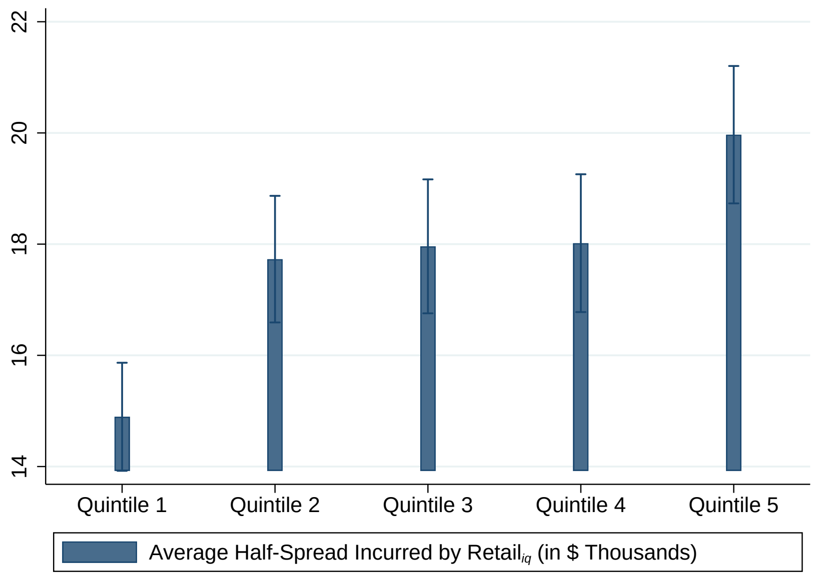


Figure 6. **Transaction Costs Incurred by Retail Investors**

This figure plots the transaction costs incurred by retail investors across quintiles of $AbnormalIV_{-1}$. For each quintile of $AbnormalIV_{-1}$, Panel A plots the average value of Half-Spread Incurred by Retail$_{iq}$ defined in (7) converted into dollars by multiplying by |Retail Position$_{-1}$|, as in Panel C of Figure 9. Panel B plots the average value of Half-Spread Incurred by Retail$_{iq}$ defined in (7). In both panels, we winsorize at 2%-98%. Error bars in all panels represent 95% confidence intervals. For detailed variable definitions see Appendix A.

Panel A: Dollar Half-Spreads Incurred by Retail Investors



Panel B: Half-Spreads Incurred by Retail Investors

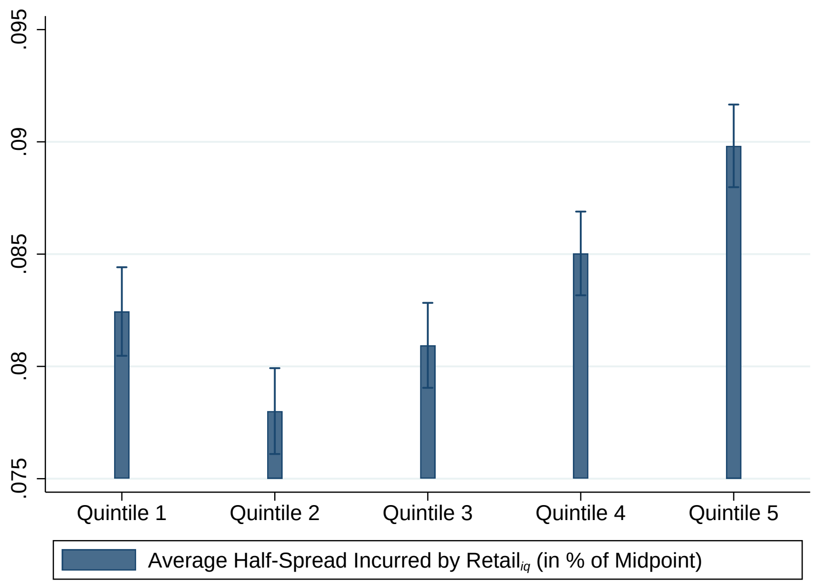


Figure 7. Retail Positions in Event-Time

This figure plots the regression coefficients and 95% confidence intervals from regressing retail positions at day t onto event-time indicators with year-quarter fixed effects. The regression is run separately for the lowest and highest quintile $AbnormalIV_{-5}$ announcements. Trader positions are aggregated across all options that expire at least 10 days after the earnings announcement, winsorized at 2%-98%, and normalized by the Nasdaq trading volume across all options on a particular underlying at $t = -22$. Coefficients at $t = -22$ are normalized to zero. Confidence intervals are based on two-way clustered standard errors by firm and year-quarter.

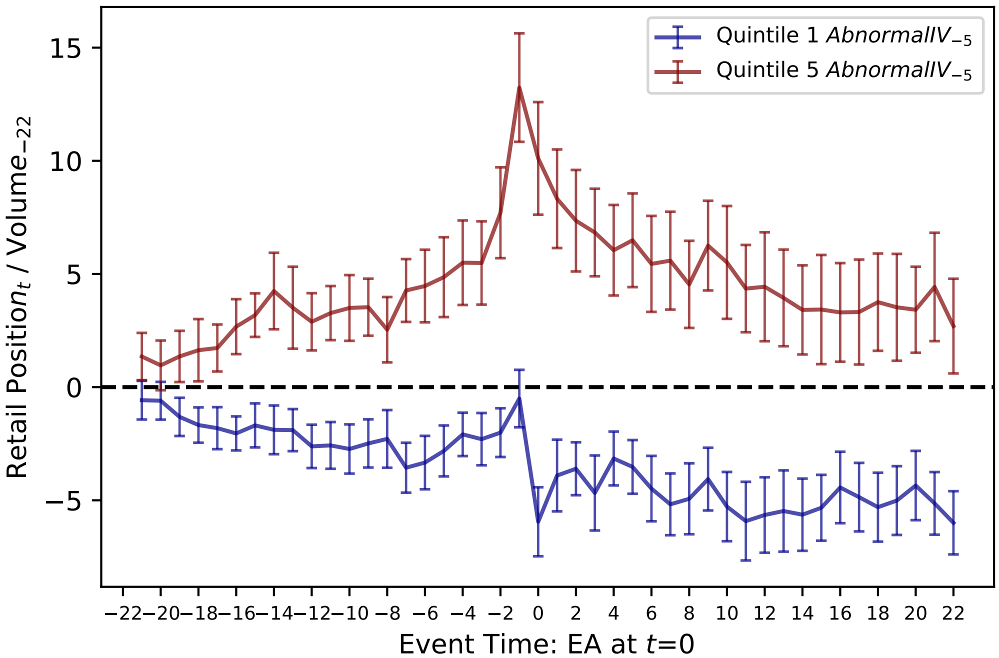
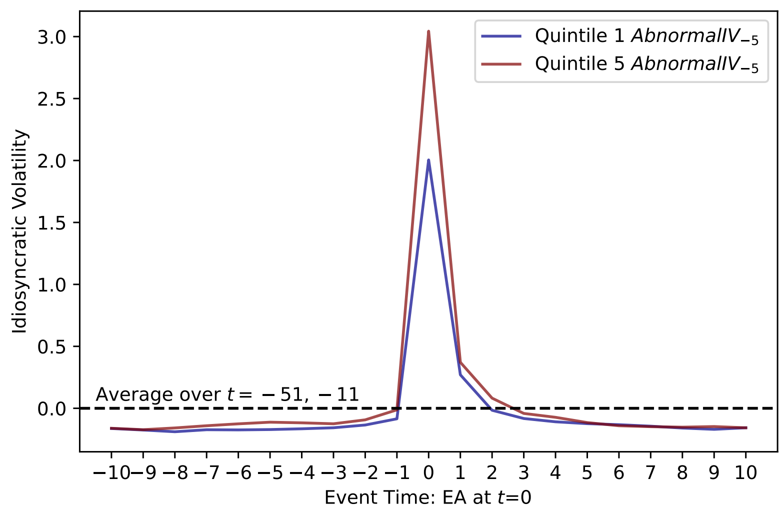


Figure 8. Idiosyncratic Volatility and Expected Announcement Volatility

This figure plots the relationship between idiosyncratic volatility and our measure of expected announcement volatility. Panel A plots the average idiosyncratic volatility in event-time relative to earnings announcements, which occurs at $t = 0$, for two groups of earnings announcements: (i) those in the bottom quintile of $AbnormalIV_{-5}$; (ii) those in the top quintile of $AbnormalIV_{-5}$. Panel B plots the regression coefficients and 95% confidence intervals from regressing idiosyncratic volatility at day t onto an indicator variable that captures whether the announcement is in the top quintile of $AbnormalIV_{-5}$ with year-quarter fixed effects using only announcements in the top and bottom quintile of $AbnormalIV_{-5}$. Idiosyncratic volatility on day t is defined as the ratio of the absolute value of the residual on day t from a firm-specific market model regression (with three lags) estimated over $t = -51$ to $t = -11$ to the average absolute residual in the estimated model, subtracting one. Confidence intervals are based on two-way clustered standard errors by firm- and year-quarter.

Panel A: Average Idiosyncratic Volatility by $AbnormalIV_{-5}$ Quintile



Panel B: Difference in Idiosyncratic Volatility Quintile 5 and Quintile 1 $AbnormalIV_{-5}$

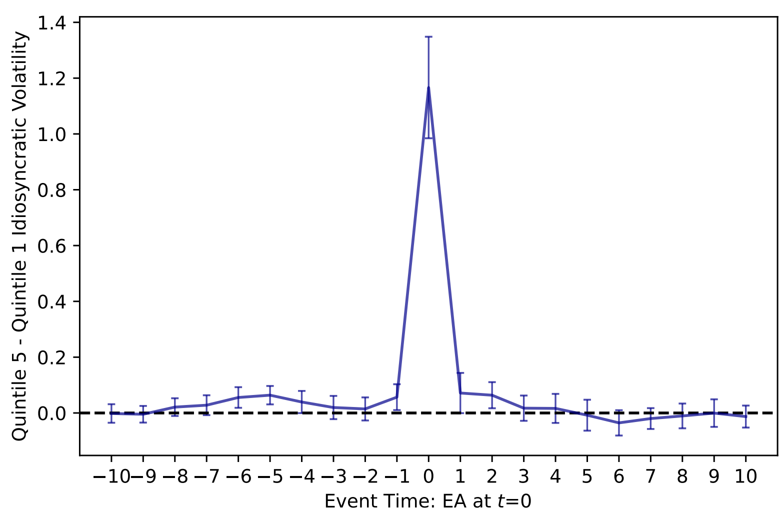
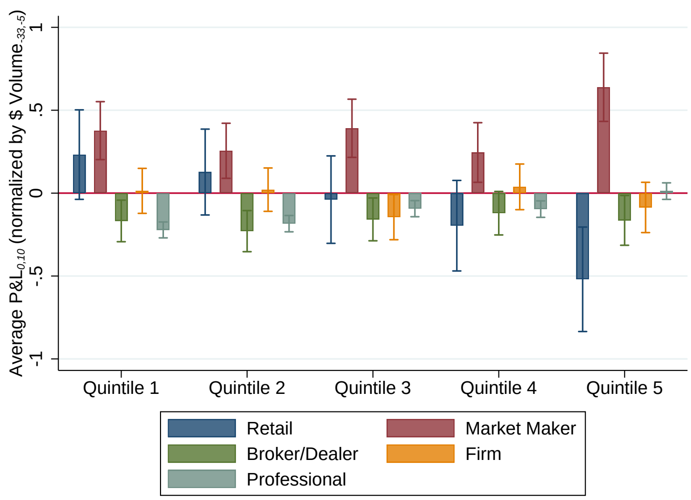


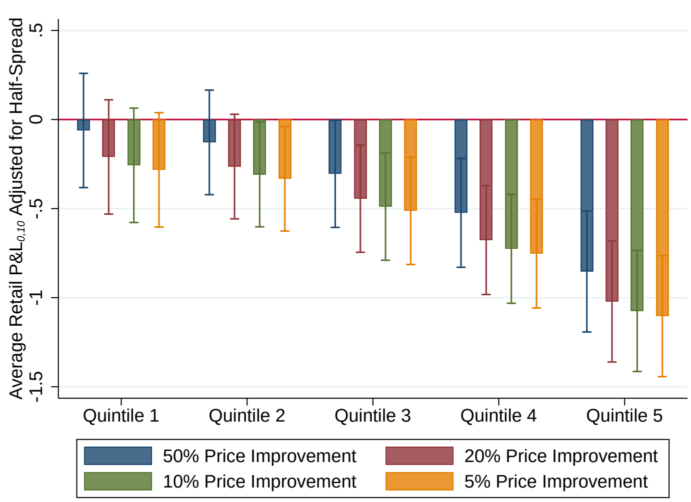
Figure 9. **Wealth Dynamics**

This figure plots the trading performance of each trader across quintiles of $AbnormalIV_{-1}$. For each quintile of $AbnormalIV_{-1}$, Panel A plots the average P&L for each trader. P&L represents our estimate of the dollar change in a trader's position on market close at day t across all options that expire at least 10 days after the earnings announcement. Trader P&L is then normalized by the average daily option dollar volume on Nasdaq for $t \in [-33, -5]$ across all options on each underlying and is winsorized at 2%-98%. In Panel B, we plot the P&L of Retail from Panel A after adjusting for our estimates of the half-spread incurred by retail investors from (7). We convert this half-spread into dollars by multiplying by $|\text{Retail Position}_{-1}|$ and dividing by the measure of average trading volume used to normalize Retail P&L in Panel A, reducing this estimate based on various assumptions about the level of price improvement receives. Panel C makes an analogous plot to Panel B with our approximation to the return of retail investors described in Table 10, including the average return across quintiles in the right graph. Error bars in all panels represent 90% confidence intervals. For detailed variable definitions see Appendix A.

Panel A: P&L Across Quintiles of $AbnormalIV_{-1}$



Panel B: Transaction Cost Adjusted Retail P&L Across Quintiles of $AbnormalIV_{-1}$



Panel C on Next Page

Figure 9. Wealth Dynamics (continued)

Panel C: Transaction Cost Adjusted Retail Return Across Quintiles of $AbnormalIV_{-1}$

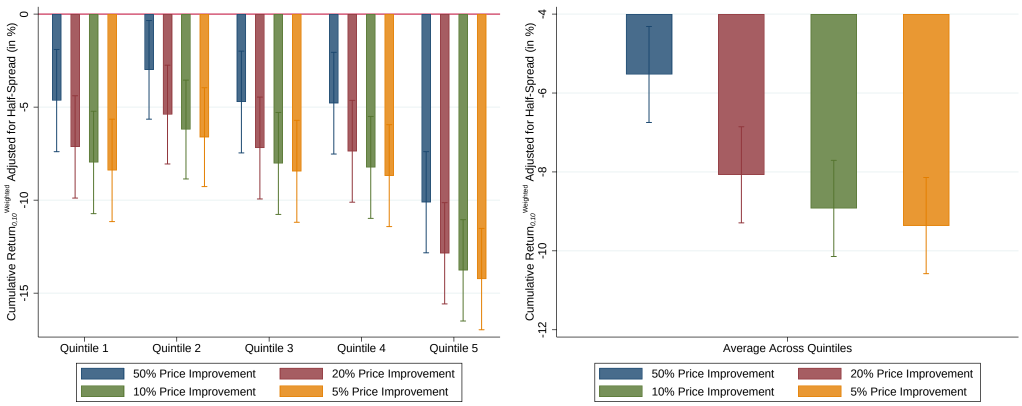


Figure 10. Announcement-Day Retail Investor Returns

This figure plots the average return of retail investors adjusted for transaction costs on the announcement day across quintiles of $AbnormalIV_{-1}$. To approximate the return of retail investors, we use the measure described and used in Table 10 adjusted for transaction costs estimated according to (7). We assume a price improvement for retail investors of 20%. Error bars in all panels represent 90% confidence intervals. For detailed variable definitions see Appendix A.

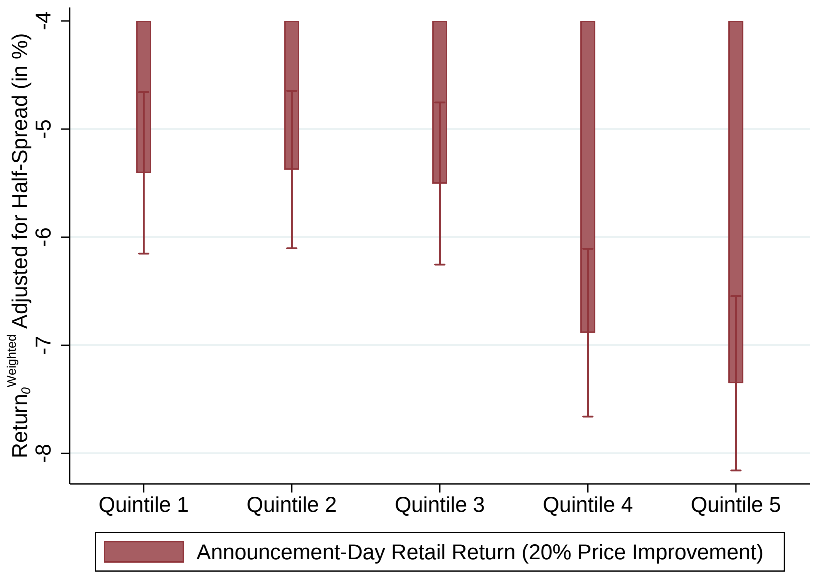


Table 1. Summary Statistics

This table shows summary statistics on the trading of each type of trader across the earnings announcements in our sample in number of options. Panel A shows summary statistics on the average number of options bought between $t = -5$ and $t = -2$, $\Delta\text{Position}_{-5,-2}$. Panel B shows summary statistics on the average position at $t = -2$, Position_{-2}. Trader positions are aggregated across all options that expire at least 10 days after the earnings announcement. Detailed variable definitions are given in Appendix A.

Panel A: Pre-Announcement Trading

	Obs.	Mean	10%	25%	50%	75%	90%
ΔRetail $\text{Position}_{-5,-2}$	32,758	5,045	-31,000	-6,200	0	7,500	38,200
ΔMarket Maker $\text{Position}_{-5,-2}$	32,758	-5,098	-37,100	-8,800	-100	4,200	23,600
ΔBroker/Dealer $\text{Position}_{-5,-2}$	32,758	-1,591	-15,000	-2,600	0	2,700	13,400
ΔFirm $\text{Position}_{-5,-2}$	32,758	1,002	-9,900	-500	0	2,000	17,900
ΔProfessional $\text{Position}_{-5,-2}$	32,758	642	-5,900	-300	0	300	8,000

Panel B: Pre-Announcement Positions

	Obs.	Mean	10%	25%	50%	75%	90%
Retail Position_{-2}	32,758	57,574	-116,200	-18,300	-300	11,900	101,900
Market Maker Position_{-2}	32,758	-44,316	-106,400	-22,400	-500	6,000	45,600
Broker/Dealer Position_{-2}	32,758	-20,436	-45,100	-5,000	0	7,100	42,900
Firm Position_{-2}	32,758	-18,134	-29,000	-1,200	0	10,600	71,300
Professional Position_{-2}	32,758	25,313	-10,700	-400	0	4,200	51,800

Table 2. Retail Option Trading and EAV

This table displays regressions of the change in positions of retail investors over $t = -5$ to $t = -2$ onto our two measures of expected announcement volatility, $AbnormalIV_{-5}$ and MAX_{EA}. Columns (1)-(4) aggregate across all retail traders. Columns (5)-(6) use net retail opening trades, which are defined as opening buys minus opening sells. Columns (7)-(8) use an analogous definition for closing trades. Trader positions are aggregated across all options that expire at least 10 days after the earnings announcement and are winsorized at 2%-98%. Detailed variable definitions are given in Appendix A.

	ΔRetail Position$_{-5,-2}$				ΔRetail Position$^{Open}_{-5,-2}$		ΔRetail Position$^{Close}_{-5,-2}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$log(AbnormalIV_{-5})$	1686.3		1586.4		3608.3		-2610.3	
	(4.67)		(4.46)		(7.20)		(-8.52)	
$log(MAX_{EA})$		7145.8		7022.8		12557.3		-7088.2
		(7.53)		(8.85)		(8.53)		(-7.05)
Volatility$_{-60,-5}$			-14887.4	-15921.0	2735.1	2203.8	-18170.7	-18012.1
			(-2.42)	(-2.67)	(0.29)	(0.27)	(-3.23)	(-3.56)
$log(AT)$			-101.4	175.9	6752.2	7173.7	-6231.1	-6183.6
			(-0.19)	(0.35)	(6.37)	(6.62)	(-9.45)	(-8.91)
β_V			-241.4	-345.8	-202.3	-356.7	165.8	224.5
			(-1.14)	(-1.90)	(-0.60)	(-1.20)	(0.71)	(1.04)
$EAOrder$			5065.4	5405.3	871.4	1135.5	2898.6	2555.8
			(0.68)	(0.81)	(0.07)	(0.10)	(0.41)	(0.39)
$IdioVol$			218784.2	207309.1	466019.5	430389.9	-225744.6	-208382.5
			(2.40)	(2.42)	(3.40)	(3.23)	(-2.42)	(-2.32)
$skew_{BV}$			172.3	151.6	566.7	519.0	-342.2	-327.7
			(2.51)	(2.47)	(6.17)	(6.16)	(-6.46)	(-6.66)
$log(BTM)$			-535.3	-673.3	-5277.2	-5599.2	4682.5	4743.2
			(-1.13)	(-1.49)	(-5.27)	(-5.88)	(7.77)	(8.16)
Year-Quarter Fixed Effects			✓	✓	✓	✓	✓	✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓	✓	✓
Total Observations	29130	32462	24473	27463	24473	27463	24473	27463
Adjusted R-Squared	0.00234	0.00712	0.00675	0.0105	0.0518	0.0536	0.0853	0.0813

Table 3. The Role of News Coverage

Panel A of this table displays Poisson regressions estimated via maximum likelihood of the number of news articles on a given announcement onto our two measures of expected announcement volatility, $AbnormalIV_{-5}$ and MAX_{EA}. News $\text{Articles}_{\tau,s}$ is defined as the number of news articles published in the WSJ, Washington Post, USA Today, and New York Times on a given underlying during $t \in [\tau, s]$. The first two columns of Panel B displays regressions of Retail pre-announcement trading onto $AbnormalIV_{-5}$ and an interaction with an indicator for whether the announcement receives news coverage between $t = -10$ and $t = -2$. The second two columns of Panel B display regressions of Retail pre-announcement trading onto indicators for each quintile of $AbnormalIV_{-5}$ for two subsamples: announcements without news coverage in column (3) and announcements with news coverage in column (4). Trader positions are aggregated across all options that expire at least 10 days after the earnings announcement and are winsorized at 2%-98%. Detailed variable definitions are given in Appendix A.

Panel A: News Coverage and Expected Announcement Volatility

	News $\text{Articles}_{-5,-2}$		News $\text{Articles}_{-1,1}$		News $\text{Articles}_{2,5}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$log(AbnormalIV_{-5})$	0.163		0.139		0.111	
	(3.19)		(3.99)		(2.31)	
$log(MAX_{EA})$		0.223		0.371		0.189
		(1.98)		(4.47)		(1.88)
Poisson MLE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Year-Quarter Fixed Effects	✓	✓	✓	✓	✓	✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓
Total Observations	25048	28121	25048	28121	25048	28121

Panel B: News Coverage and Retail Trading

	ΔRetail $\text{Position}_{-5,-2}$			
	(1)	(2)	(3)	(4)
$log(AbnormalIV_{-5})$	1058.9	1033.3		
	(4.06)	(3.44)		
$1(\text{News Articles}_{-10,-2} > 0)$	35108.8	26504.5		
	(4.94)	(4.30)		
$log(AbnormalIV_{-5}) \times 1(\text{News Articles}_{-10,-2} > 0)$	4729.4	3673.9		
	(4.24)	(3.75)		
Quintile 1 $AbnormalIV_{-5}$			799.1	-2186.3
			(1.42)	(-0.83)
Quintile 2 $AbnormalIV_{-5}$			606.3	1563.8
			(0.99)	(0.60)
Quintile 3 $AbnormalIV_{-5}$			2694.4	7709.6
			(4.48)	(2.86)
Quintile 4 $AbnormalIV_{-5}$			3262.5	11110.5
			(5.49)	(3.95)
Quintile 5 $AbnormalIV_{-5}$			4431.8	15674.4
			(6.53)	(4.44)
News $\text{Articles}_{-10,-2} > 0$			✗	✓
Controls		✓	✓	✓
Year-Quarter Fixed Effects	✓	✓		
Firm and Year-Quarter Clustering	✓	✓		
Total Observations	29130	24473	20557	3916
Adjusted R-Squared	0.00706	0.00927	0.00738	0.0132

Table 4. Option Trading and EAV: Breakdown by Option and Trader Type

This table displays regressions of the change in positions of different traders over $t = -5$ to $t = -2$ onto our two measures of expected announcement volatility, $AbnormalIV_{-5}$ and MAX_{EA}. Panels A and B show analogous results to columns (3) and (4) of Table 2 for the positions of retail traders aggregating across different option moneyness and option maturity, respectively. Option maturity is defined in terms of business days relative to the earnings announcement. At-the-money options are defined as options where the spot price is within 10% of the strike price. Panel C shows the analogous results to columns (3) and (4) of Table 2 for other traders. Trader positions are aggregated across all options that expire at least 10 days after the earnings announcement and are winsorized at 2%-98%. Detailed variable definitions are given in Appendix A.

Panel A: Retail Trading by Option Type

	ΔRetail Position$_{-5,-2}$											
	OTM Calls		ATM Calls		ITM Calls		OTM Puts		ATM Puts		ITM Puts	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(AbnormalIV_{-5})$	431.3		1111.1		-13.36		-139.5		58.77		-29.21	
	(4.76)		(5.25)		(-0.74)		(-2.44)		(0.74)		(-5.52)	
$log(MAX_{EA})$		1778.0		4768.9		-42.95		-46.01		102.4		-73.80
		(6.29)		(8.89)		(-0.89)		(-0.26)		(0.38)		(-5.03)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year-Quarter Fixed Effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total Observations	24473	27463	24473	27463	24473	27463	24473	27463	24473	27463	24473	27463
Adjusted R-Squared	0.0232	0.0254	0.00807	0.0114	0.00310	0.00276	0.0101	0.0101	0.0157	0.0177	0.0183	0.0176

Panel B: Retail Trading by Option Maturity

	ΔRetail Position$_{-5,-2}$					
	2 to 4 Weeks		5 to 8 Weeks		> 8 Weeks	
	(1)	(2)	(3)	(4)	(5)	(6)
$log(AbnormalIV_{-5})$	700.1		350.8		535.0	
	(4.48)		(3.23)		(3.58)	
$log(MAX_{EA})$		2217.6		2195.9		2345.1
		(5.05)		(8.08)		(6.96)
Controls	✓	✓	✓	✓	✓	✓
Year-Quarter Fixed Effects	✓	✓	✓	✓	✓	✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓
Total Observations	24473	27463	24473	27463	24473	27463
Adjusted R-Squared	0.00561	0.00596	0.00489	0.00858	0.00823	0.0118

Panel C: Trading of Other Traders

	ΔMarket Maker$_{-5,-2}$		ΔBroker/Dealer$_{-5,-2}$		ΔFirm$_{-5,-2}$		ΔProfessional$_{-5,-2}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$log(AbnormalIV_{-5})$	-563.0		-453.7		29.47		-449.2	
	(-2.99)		(-3.32)		(0.20)		(-5.02)	
$log(MAX_{EA})$		-3432.9		-2069.8		-304.1		-1047.5
		(-5.60)		(-5.71)		(-0.74)		(-4.44)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Year-Quarter Fixed Effects	✓	✓	✓	✓	✓	✓	✓	✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓	✓	✓
Total Observations	24473	27463	24473	27463	24473	27463	24473	27463
Adjusted R-Squared	0.00608	0.00860	0.00899	0.0101	0.00361	0.00575	0.0214	0.0254

Table 5. Retail Option vs. Stock Trading and EAV

This table displays regressions of the change in positions of retail investors over $t = -5$ to $t = -2$ in options markets relative to stock markets onto our two measures of expected announcement volatility, $AbnormalIV_{-5}$ and MAX_{EA}. Columns (1)-(2) use the ratio of unsigned delta-weighted trades to total retail buys and sells in the equity market, defined in (3). Columns (3)-(4) use the ratio of delta-weighted call purchases to retail buys in the equity market, defined in (4). Columns (5)-(6) use a measure of retail's equity market imbalance in dollars, which we define as the difference between the dollar value of retail buys in sells in the equity market normalized by their sum as in Barber and Odean (2008). These dependent variables are summed from market close at $t = -5$ to market close at $t = -2$, corresponding to the same time horizon as the dependent variable in Table 2. Retail option positions are aggregated across all options that expire at least 10 days after the earnings announcement and are winsorized at 2%-98%. Detailed variable definitions are given in Appendix A.

	Unsigned OS Ratio$_{-5,-2}$		OS Call Buy Ratio$_{-5,-2}$		Equity Imbalance$_{-5,-2}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$log(AbnormalIV_{-5})$	0.00389		0.0302		0.00563	
	(2.74)		(9.28)		(2.67)	
$log(MAX_{EA})$		0.0198		0.0690		0.0136
		(5.89)		(9.21)		(2.21)
Volatility$_{-60,-5}$	-0.0692	-0.0712	-0.176	-0.134	0.113	0.110
	(-2.77)	(-3.15)	(-3.02)	(-2.66)	(2.48)	(2.36)
$log(AT)$	-0.00905	-0.00715	-0.00122	0.000507	-0.00184	-0.000984
	(-6.80)	(-5.73)	(-0.33)	(0.14)	(-0.82)	(-0.44)
β_V	-0.00102	-0.00127	-0.00168	-0.00278	0.000994	0.000605
	(-1.31)	(-1.63)	(-0.95)	(-1.65)	(0.64)	(0.44)
$EAOrder$	0.0522	0.0546	-0.0181	0.00337	0.0601	0.0444
	(1.75)	(2.06)	(-0.29)	(0.06)	(1.45)	(1.15)
$IdioVol$	0.0760	0.0241	2.248	2.015	-0.381	-0.392
	(0.25)	(0.09)	(2.79)	(2.81)	(-0.64)	(-0.64)
$skew_{BV}$	0.0000945	0.0000431	0.00199	0.00173	0.000363	0.000497
	(0.43)	(0.21)	(5.46)	(4.83)	(1.07)	(1.45)
$log(BTM)$	0.000725	-0.0000879	-0.0278	-0.0311	-0.00922	-0.00880
	(0.38)	(-0.05)	(-5.71)	(-6.21)	(-2.59)	(-2.72)
Year-Quarter Fixed Effects	✓	✓	✓	✓	✓	✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓
Total Observations	24688	27722	24688	27722	24688	27722
Adjusted R-Squared	0.00818	0.00988	0.0365	0.0347	0.00958	0.00844

Table 6. Replication with Alternative Measure of Retail Trading

Columns (1)-(2) of this table display regressions of our main measure of the change in positions of retail investors over $t = -5$ to $t = -2$ onto the analogous measure computed from CBOE data following Bryzgalova et al. (2023). Both measures are aggregated across buy and sell trades. Columns (3)-(4) replicate columns (1) and (3) of Table 2 on the sample of announcements in 2020 for which CBOE data are available, which is used across all columns. Columns (6) and (7) perform the analogous regression using the CBOE-based measure as the dependent variable. Columns (5) and (8) use an indicator for whether our main measure and the CBOE-based measure indicate positive net retail buying, respectively. Trader positions are aggregated across all options that expire at least 10 days after the earnings announcement. Detailed variable definitions are given in Appendix A.

	ΔRetail Position$_{-5,-2}$				ΔRetail Position$_{-5,-2} > 0$	ΔRetail Position$^{CBOE}_{-5,-2}$		ΔRetail Position$^{CBOE}_{-5,-2} > 0$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$log(AbnormalIV_{-5})$			1406.7	3416.4	0.0231	1925.6	1718.5	0.0277
			(1.70)	(3.54)	(2.18)	(2.82)	(2.02)	(2.55)
ΔRetail Position$^{CBOE}_{-5,-2}$	0.340	0.343						
	(8.73)	(8.93)						
Volatility$_{-60,-5}$		1747.9		-7678.6	-0.114		-10117.4	-0.274
		(0.17)		(-0.70)	(-0.90)		(-0.81)	(-2.13)
$log(AT)$		3422.5		3885.0	-0.0122		-780.8	-0.00292
		(3.65)		(3.51)	(-1.48)		(-0.81)	(-0.33)
β_V		704.5		721.7	0.0151		262.9	-0.00124
		(0.99)		(0.91)	(1.91)		(0.27)	(-0.15)
$EAOrder$		16007.7		27343.9	0.341		33203.5	0.198
		(1.27)		(1.91)	(2.33)		(2.60)	(1.25)
$IdioVol$		143658.5		181977.6	-0.0461		124826.4	3.589
		(0.93)		(1.18)	(-0.02)		(0.67)	(1.93)
$skew_{BV}$		561.3		459.4	0.00293		-240.4	-0.000780
		(2.06)		(1.64)	(1.43)		(-0.98)	(-0.37)
$log(BTM)$		-3486.6		-3465.7	-0.000447		58.10	-0.00188
		(-2.79)		(-2.59)	(-0.04)		(0.05)	(-0.16)
Quarter Fixed Effects		✓		✓	✓		✓	✓
Firm Clustering	✓	✓	✓	✓	✓	✓	✓	✓
Total Observations	1938	1938	1938	1938	1938	1938	1938	1938
Adjusted R-Squared	0.119	0.142	0.00126	0.0287	0.0137	0.00272	0.00897	0.00516

Table 7. Pre-Announcement Price Pressure

This table displays regressions of $log(AbnormalIV_{-1})$ onto measures of pre-announcement retail trading and $log(AbnormalIV_{-5})$. Columns (1)-(3) use the measure of retail trading from Table 2, after standardizing it to have zero mean and unit standard deviation; columns (4)-(6) use an indicator variable that equals one if the announcement is in terms of this measure. Trader positions are aggregated across all options that expire at least 10 days after the earnings announcement and winsorized at 2%-98%. Detailed variable definitions are given in Appendix A.

	$log(AbnormalIV_{-1})$					
	(1)	(2)	(3)	(4)	(5)	(6)
ΔRetail Position$_{-5,-2}$	0.123	0.0802	0.0850			
	(8.83)	(8.82)	(7.59)			
Q5 ΔRetail Position$_{-5,-2}$				0.416	0.336	0.394
				(10.29)	(11.88)	(14.50)
$log(AbnormalIV_{-5})$		0.555	0.475		0.549	0.464
		(38.00)	(28.96)		(38.13)	(29.55)
Positions Standardized	✓	✓	✓			
Controls			✓			✓
Year-Quarter Fixed Effects			✓			✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓
Total Observations	29114	27285	22878	30946	28939	23794
Adjusted R-Squared	0.00717	0.298	0.315	0.0124	0.296	0.319

Table 8. Straddle Return Predictability

This table displays the results from portfolio sorts quarterly Fama-MacBeth regressions using returns to selling straddles, defined as $SRET_0$ and $SRET_{1,10}$ in (6) for the announcement-day and 10 trading days post-announcement, respectively. The straddle for each announcement is chosen as the nearest-to-the-money straddle with the shortest maturity that expires at least 13 days after the announcement. In Panel A, firm-quarter observations are placed into quintiles each quarter, using quintile breakpoints from the prior quarter. We then calculate the returns for each portfolio in a given quarter by taking the equal-weighted average of $SRET_0$ for all firm-quarters in that portfolio. The values displayed in the left half of each table are the time-series mean and t-statistics (in parenthesis) of the resulting quarterly returns. The values displayed in the right half of each table are the time-series skewness and excess kurtosis (in parenthesis) of the quarterly portfolio returns. Panel B performs the analogous analysis with $SRET_{1,10}$. Panel C displays the results from quarterly Fama and MacBeth (1973) regressions with standard errors calculated from a frequency-domain heteroskedasticity and autocorrelation robust equal-weighted cosine estimator of the long-run variance matrix with the truncation rule suggested by Lazarus, Lewis, Stock, and Watson (2018).

Panel A: Announcement-Day Portfolio Sort: $AbnormalIV_{-1}$

Univariate: mean (t-stat)		Univariate: skew (excess kurtosis)	
1 (low $AbnormalIV_{-1}$)	0.07	1 (low $AbnormalIV_{-1}$)	0.16
2	0.08	2	-0.15
3	0.11	3	0.19
4	0.14	4	-0.03
5 (high $AbnormalIV_{-1}$)	0.18	5 (high $AbnormalIV_{-1}$)	-0.57
5 - 1 (long-short)	0.11	5 - 1 (long-short)	0.06
	(19.44)		(0.12)

Panel B: Post-Announcement Portfolio Sort: $AbnormalIV_{-1}$

Univariate: mean (t-stat)		Univariate: skew (excess kurtosis)	
1 (low $AbnormalIV_{-1}$)	0.07	1 (low $AbnormalIV_{-1}$)	-1.60
2	0.08	2	-0.69
3	0.11	3	-1.13
4	0.14	4	-0.99
5 (high $AbnormalIV_{-1}$)	0.17	5 (high $AbnormalIV_{-1}$)	-1.39
5 - 1 (long-short)	0.09	5 - 1 (long-short)	0.49
	(8.31)		(0.74)

Panel C on Next Page

Table 8. Straddle Return Predictability (continued)

Panel C: Fama-MacBeth Regressions

	$SRET_0$				$SRET_{1,10}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.170	0.245	0.265	0.346	0.190	0.260	0.352	0.437
	[6.929]	[7.961]	[5.459]	[8.301]	[15.079]	[14.776]	[6.384]	[7.205]
$log(AbnormalIV_{-5})$	0.009	-0.006	0.014	0.002	0.012	-0.001	0.014	0.003
	[3.406]	[-3.370]	[6.609]	[1.076]	[6.206]	[-0.182]	[3.457]	[0.885]
$log(AbnormalIV_{-1})$		0.027		0.028		0.024		0.025
		[10.022]		[18.564]		[6.657]		[9.684]
β_V			-0.014	-0.021			-0.005	-0.005
			[-2.056]	[-1.643]			[-0.427]	[-0.378]
$ROTP$			-0.061	-0.058			0.039	0.053
			[-2.607]	[-1.979]			[0.923]	[1.165]
$EAOrder$			-0.229	-0.206			-0.229	-0.206
			[-2.669]	[-2.150]			[-2.669]	[-2.150]
$log(\text{Volume}_{-22,-5})$			-0.002	-0.006			-0.002	-0.006
			[-0.540]	[-1.654]			[-0.540]	[-1.654]
$log(AT)$			-0.014	-0.009			-0.014	-0.009
			[-2.405]	[-1.604]			[-2.405]	[-1.604]
$log(BTM)$			0.002	0.003			0.016	0.015
			[1.612]	[1.176]			[1.729]	[1.673]
$IdioVol$			-0.025	-0.022			-0.026	-0.019
			[-7.535]	[-13.124]			[-3.046]	[-2.261]
$skew_{BV}^S$			0.012	0.010			0.007	0.005
			[3.412]	[3.044]			[4.177]	[2.585]
$\text{Volatility}_{-60,-5}$			0.006	-0.018			0.148	0.101
			[0.318]	[-0.514]			[2.606]	[1.712]
Avg. Adjusted R-Squared	0.979%	4.086%	5.128%	8.213%	0.343%	1.18%	3.511%	4.021%
Total Observations	24,504	22,838	18,756	17,398	30,124	28,153	21,893	20,379
Avg. Observations per Quarter	556.9	519.0	426.3	395.4	684.6	639.8	497.6	463.2
Number of Quarters	44	44	44	44	44	44	44	44

Table 9. Predicting Trader Positions Post-Announcement

This table displays regressions of trader positions five days after the announcement at $t = 5$ onto our two measures of expected announcement volatility, $AbnormalIV_{-1}$ and MAX_{EA}. Columns (1) and (4) of Panel A show the results for Retail positions; Panel B shows the analogous results for other traders, corresponding to specifications (1) and (2) of Panel A. The other columns of Panel A show results corresponding to columns (1) and (4) with a measure of the disposition effect in Retail, Retail Loss_0, defined as $max(0, -\text{Retail P\&L}_0)$ (in \$) following Genesove and Mayer (2001), and the average bid-ask spread across all options on a given underlying between $t = 1, ..., 5$, including their respective interactions. In Panel A, both of these variables are standardized and all regressions include the main effects of these variables. Trader positions and Retail Loss_0 are winsorized at 2%-98%. Detailed variable definitions are given in Appendix A.

Panel A: Retail Positions

	Retail Position_5					
	(1)	(2)	(3)	(4)	(5)	(6)
$log(AbnormalIV_{-1})$	12615.3	11502.6	11894.9			
	(7.94)	(6.95)	(6.78)			
$log(MAX_{EA})$				28255.8	24021.5	24550.6
				(5.20)	(4.71)	(4.68)
$log(AbnormalIV_{-1}) \times \text{Retail Loss}_0$		11356.3	10907.7			
		(2.69)	(2.59)			
$log(AbnormalIV_{-1}) \times \text{Average Bid-Ask Spread}_{1,5}$			-2982.4			
			(-5.86)			
$log(MAX_{EA}) \times \text{Retail Loss}_0$					23703.5	22433.4
					(2.55)	(2.43)
$log(MAX_{EA}) \times \text{Average Bid-Ask Spread}_{1,5}$						-9417.0
						(-5.93)
Main Effects Included	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Year-Quarter Fixed Effects	✓	✓	✓	✓	✓	✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓
Total Observations	25043	24295	24292	28281	27343	27340
Adjusted R-Squared	0.0275	0.0604	0.0614	0.0270	0.0583	0.0595

Panel B: Positions of Other Traders

	Market Maker_5		Broker/Dealer_5		Firm_5		Professional_5	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$log(AbnormalIV_{-1})$	-6858.2		-3905.6		-1917.8		-241.5	
	(-8.47)		(-6.28)		(-3.11)		(-0.50)	
$log(MAX_{EA})$		-15899.7		-9462.4		-5750.6		-19.02
		(-6.20)		(-5.13)		(-2.59)		(-0.01)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Year-Quarter Fixed Effects	✓	✓	✓	✓	✓	✓	✓	✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓	✓	✓
Total Observations	25043	28281	25043	28281	25043	28281	25043	28281
Adjusted R-Squared	0.0365	0.0329	0.0161	0.0142	0.0125	0.0154	0.143	0.143

Table 10. Returns of Retail Traders

This table displays regressions of our estimate of the average return by Retail traders over $t = 0, \ldots, 10$ onto an indicator for the top quintile $AbnormalIV_{-1}$ announcements. Retail Avg. $\text{Return}^{\text{Long}}_{0,10}$ corresponds to the average daily return in basis points of retail traders over $t = 0, \ldots, 10$. We calculate the return on day t by taking a weighted sum of option returns across all options in which retail traders are long with weights proportional to their positions. Retail Avg. $\text{Return}^{\text{Short}}_{0,10}$ is calculated analogously for short positions. Retail Avg. $\text{Return}^{\text{Weighted}}_{0,10}$ is the weighted average of Retail Avg. $\text{Return}^{\text{Long}}_{0,10}$ and Retail Avg. $\text{Return}^{\text{Short}}_{0,10}$ with weights corresponding to the relative dollar value of Retail's aggregate long and short positions in each announcement measured at $t = -1$. Returns are winsorized at 2%-98%. Detailed variable definitions are given in Appendix A.

	Retail $\text{Return}_{0,10}$					
	Avg. $\text{Return}^{\text{Long}}_{0,10}$		Avg. $\text{Return}^{\text{Short}}_{0,10}$		Avg. $\text{Return}^{\text{Weighted}}_{0,10}$	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-237.6	-253.6	181.0	184.9	6.525	3.922
	(-11.08)	(-57.88)	(7.66)	(34.03)	(0.64)	(1.08)
Quintile 5 $AbnormalIV_{-1}$	-70.99	-61.47	39.78	47.01	-61.18	-49.62
	(-3.12)	(-2.52)	(1.45)	(1.64)	(-3.32)	(-3.08)
$\text{Volatility}_{-60,-5}$		142.3		183.0		237.5
		(0.63)		(1.39)		(2.13)
$log(AT)$		39.07		-19.16		2.850
		(4.73)		(-2.11)		(0.67)
β_V		-7.209		-3.412		-1.536
		(-1.26)		(-0.55)		(-0.48)
$EAOrder$		-23.80		70.39		-44.14
		(-0.17)		(0.51)		(-0.53)
$IdioVol$		1370.5		-4720.0		-4295.1
		(0.38)		(-2.17)		(-2.23)
$skew_{BV}$		2.769		-0.556		-0.114
		(2.21)		(-0.43)		(-0.12)
$log(BTM)$		-0.0433		-15.04		3.815
		(-0.00)		(-1.50)		(0.50)
Controls Standardized		✓		✓		✓
Year-Quarter Fixed Effects		✓		✓		✓
Firm and Year-Quarter Clustering	✓	✓	✓	✓	✓	✓
Total Observations	31422	26186	31796	26560	28245	23439
Adjusted R-Squared	0.000327	0.00912	0.0000856	0.0114	0.000543	0.00317