

The Predictive Power of Options: Implied Volatility and Volume Dynamics Around Earnings

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Motivation

The options market has long intrigued both investors and academics due to the valuable insights it provides about future market expectations. A substantial body of literature demonstrates the informativeness of options data through measures such as option volume, implied volatility, and strike structures.

Earnings announcements provide an ideal setting for studying informational dynamics in the options market because scheduled disclosures create a timed window for information dissemination. When investors possess information about the timing of a public disclosure, informed traders strategically increase their positions before the announcement, while uninformed traders reduce participation. As a result, pre-earnings signals can be used to detect whether options capture asymmetric information and forecast earnings-related price reactions.

Research Questions

1. Do pre-earnings option-market characteristics predict the stock price reaction to earnings announcements?
2. What characteristics—whether based on volatility, sentiment, or volume—offer the most robust and dependable predictive insights?

Contributions

This paper offers three contributions.

First, it provides large-sample evidence that the call–put implied volatility spread is a significant predictor of earnings-day returns, confirming that pre-announcement volatility demand conveys directional information.

Second, it develops and validates an intensity-based abnormal volume measure (*Volume to Open Interest ratio*) that generates economically meaningful and robust out-of-sample predictions.

Third, it demonstrates that the *Max Pain* equilibrium shifts significantly at earnings, indicating that major disclosures disrupt dealer-based hedging equilibria.

Overall, this study shows that options markets do not merely react to earnings announcements but, in many cases, anticipate the direction and magnitude of the price response.

Data

The empirical analysis draws on daily option-chain data from OptionMetrics and earnings announcement information from Bloomberg for the 100 most liquid firms listed on the New York Stock Exchange.

- Sample period: 2001–2023
- Earnings events: 6,592
- Option observations: ~38.1 million contract-level records

Options are filtered to retain contracts with at least 30 days to expiration, sufficient strike depth, valid Greeks, and non-zero trading volume.

Methodology

Abnormal Option Activity

Abnormal trading activity is measured using total option volume (V) and the Volume/Open Interest (VOI) ratio, where large deviations in VOI indicate new position initiation relative to existing contract depth. Let T is the earning date, a trading signal is generated on day $t < T$, when both:

$$V_t > \theta_V \text{ and } VOI_t > \theta_{VOI}$$

Put/Call Ratio

Put/Call Ratios are constructed using option volume and open interest. Earnings-day returns (R) are regressed on lagged daily changes in the Put/Call Ratio (ΔPCR) over the pre-announcement window.

$$R = \beta_0 + \sum_{i=1}^5 \beta_i \Delta PCR_{T-i} + \varepsilon$$

Implied Volatility Spread

The Implied Volatility Spread is defined as the difference between call and put implied volatility. Open-interest–weighted implied volatilities ($IVSpread$) are aggregated across strikes on the day before earnings ($T - 1$), and predictive content is evaluated using cross-sectional regressions and quintile sorts.

$$R = \beta_0 + \beta_1 IVSpread_{T-1} + \varepsilon$$

Max Pain Shift

Max Pain is computed as the strike that minimizes total option payouts and is normalized by the stock price. A paired t-test compares Max Pain on the day before and the day of the earnings announcement to test for equilibrium disruption.

Empirical Findings

Abnormal Option Activity

Extreme abnormal option activity on the day before earnings provides the strongest predictive signal. The optimal training-sample thresholds are volume: $\theta_V=1,500$ and Volume/Open Interest: $\theta_{VOI} = 30$. Applied to the 2020–2023 test period (Test A), these thresholds yield: annualized return: 24.9%, standard deviation: 4.316, number of trades: 487. Out-of-sample scenarios (Test B, Test C) also yield positive returns.



Put/Call Ratio

Changes in aggregate Put/Call Ratios show *no statistical relationship* with earnings-day returns. Both volume-based and open-interest–based measures fail to capture informed trading ahead of earnings.

Table 3: Correlation of ΔPCR (Open Interest and Volume) with Earnings-Day Return

	ΔPCR (Open Interest)	ΔPCR (Volume)
No. Observations	6,085	6,085
Model Fit		
R-squared	0.001	0.012
Adj. R-squared	0.000	0.011
F-statistic	1.510	14.79
Prob (F-statistic)	0.183	1.88×10^{-14}
Coefficients		
β_0	0.0044 (0.000)	0.0042 (0.000)
ΔPCR_{T-1}	0.0019 (0.573)	-3.96×10^{-13} (0.014)
ΔPCR_{T-2}	0.0034 (0.108)	1.666×10^{-13} (0.153)
ΔPCR_{T-3}	0.0042 (0.057)	-8.025×10^{-13} (0.000)
ΔPCR_{T-4}	0.0034 (0.108)	1.687×10^{-13} (0.107)
ΔPCR_{T-5}	0.0018 (0.607)	1.379×10^{-13} (0.147)

Note. Values in parentheses denote p -values.

Max Pain Shift

The Max Pain equilibrium is *significantly different* from the day before earnings to the announcement day, indicating that earnings disclosures disrupt prevailing hedging equilibria.

Statistic	Value
t-statistic	2.274
P-value	0.023*
Degrees of Freedom (df)	4383

(*) significant level: $p < 0.05$

Empirical Findings

Implied Volatility Spread

The implied volatility spread is a *statistically meaningful* predictor of the announcement-day reaction. Higher pre-earnings spreads consistently predict stronger immediate price reactions, but do not predict post-announcement drift.

Metric	Pure Reaction (2010–2023)	Pure Reaction (2001–2023)	Pure Drift (2010–2023)
IV Spread Coefficient (β_1)	0.0145	0.0152	-0.0007
P-value	0.005	0.006	0.830
R-squared	0.002	0.002	0.000
F-statistic (Prob.)	7.776 (0.00532)	7.495 (0.00621)	0.04601 (0.830)
Interpretation	Significant	Significant	Not significant

Notes: IV Spread is the open-interest-weighted call–put implied volatility difference on day $T - 1$. Standard errors use HC3 corrections.

Quintile	Pure Reaction (2010–2023)	Pure Reaction (2001–2023)	Pure Drift (2010–2023)
Q1	0.003811	0.001637	-0.000657
Q2	0.001350	0.003365	0.000451
Q3	0.002161	0.002775	-0.000464
Q4	0.005393	0.004987	0.000376
Q5	0.007918	0.008162	0.000166
LS	0.004107	0.006525	0.000823
Interpretation	Monotonic $\uparrow$	Monotonic $\uparrow$	Non-monotonic

Notes: Pure Reaction returns measure returns from day $T - 1$ to T . Pure Drift returns measure returns from T to $T + 1$.

Conclusion

The results demonstrate that options contain economically meaningful information for predicting earnings-related stock price movements. Volatility- and volume-based metrics provide stronger signals than sentiment-based measures.

A strategy exploiting these signals achieves an annualized return of 24.9%, highlighting the substantial economic value of option-implied information. Overall, the findings suggest that option markets not only react to corporate news but also, in many cases, predict the direction and magnitude of the underlying asset’s price movement.

References

<https://phat-henry-diep.github.io/phd/r/#references>

