Informed Trading around Earnings Announcement- Spot, Futures or Options?[1]

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Abstract

A trader with private information can choose to trade either in the equity spot market or in the equity derivatives market. Derivatives provide higher embedded leverage, facilitate short-selling, and have lower transactions costs. The venue of informed trading between spot and Single Stock Options (SSO) has been well studied in the US. However, Indian markets allow to analyse the Single Stock Futures market - the second largest in the world - along with SSO and spot markets. Futures do not incur delta-hedging costs of options, while options provide non-linear payoffs and downside risk protection. We compare volumes around Earnings Announcements in each of the three markets and observe a measurable increase in informed trading in Indian spot market. A surge in informed trading may be detectable in spot but not in derivatives market because derivatives markets have a high proportion of noise trading. We further find that popular proxies for derivatives Volume (O/S, F/S) may be unsuitable for markets characterized by a flourishing spot market like India.

Keywords: Information Trading, O/S, F/S

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Abstract

A trader with private information can choose to trade either in the equity spot market or in the equity derivatives market. Derivatives provide higher embedded leverage, facilitate short-selling, and have lower transactions costs. The venue of informed trading between spot and Single Stock Options (SSO) has been well studied in the US. However, Indian markets allow to analyse the Single Stock Futures market - the second largest in the world - along with SSO and spot markets. Futures do not incur delta-hedging costs of options, while options provide non-linear payoffs and downside risk protection. We compare volumes around Earnings Announcements in each of the three markets and observe a measurable increase in informed trading in Indian spot market. A surge in informed trading may be detectable in spot but not in derivatives market because derivatives markets have a high proportion of noise trading. We further find that popular proxies for derivatives Volume (O/S, F/S) may be unsuitable for markets characterized by a flourishing spot market like India.

1 Introduction

A trader with private information can choose to trade either in the equity spot market or in the equity derivatives market. Derivatives literature has argued that futures and options provide higher embedded leverage (Back, 1993), facilitate short-selling, and have lower transactions costs (Black, 1975), making them valuable to traders. Recent studies have examined the informational role of options, particularly in the US, and have noted the heightened volume of Single Stock Options (SSOs) before Earnings Announcements (EA) (Roll et al., 2010; Truong and Corrado, 2014). Researchers argue that the aforementioned benefits in the options market attract informed traders to the SSO market.

However, unlike many developed markets, Indian equity derivatives have liquid SSOs as well as liquid Single Stock Futures (SSFs)[6]. SSFs provide an alternative to SSOs for traders wishing to exploit embedded leverage and short-sell provisions in the derivatives markets. Further, futures markets' absence of any delta-rebalancing constraints makes them more attractive to informed traders (Danielsen et al., 2009). On the other hand, traders would prefer options for their ability to trade nonlinear payoffs and downside risk protection (Cao et al., 2005). India provides a unique setting to study relative advantages of SSOs over SSFs due to liquidity in both markets. If

[6] India is the second largest SSF market and the fourth largest SSO market in the world (World Federation of Exchanges, 2017)

embedded leverage and short-sell provisions are the reasons why informed trading occurs in the options market, there should be negligible informed trading before EAs in the Indian SSOs. On the other hand, if investors also value options' other advantages, like non-linear payoffs and downside risk protection, then one would observe high informed trading in both Indian SSOs and Indian SSFs. This paper compares the volumes in SSFs, SSOs, and the spot markets around Quarterly EA for the sample period 2008-2015. To the best of our knowledge, this is the first study to disentangle informed trading in SSO and SSF markets.

Our key results show that spot volumes are predictive of absolute post-EA Cumulative Abnormal Returns (CAR) while derivative volumes are not even though most informed trading happens in derivatives. This is consistent with the unique structure of the Indian markets: First, the proportion of noise traders in Indian equity derivatives market is very high at about 85%[7]. Infact, most derivatives volume is attributed to noise-traders, which would make picking up increased informed trading in this segment difficult. Sophisticated institutional investors contribute less (about 14% in 2016) to derivatives turnover, in part due to certain regulatory restrictions[8]. Second, derivatives attract a lot of participants with low investment horizon ranging from milli-seconds to end-of-day as evident by the low change in Open Interest as a percentage of Volume[9]. This would make capturing overnight views in derivatives market tougher. Equity markets, on the other hand, have a considerable portion of volume from institutional investors[10], and investors with longer investment horizon[11]. Hence, our results tend to capture informed trading in spot and not in derivatives. Our results also indicate that popular proxies for derivatives Volumes, namely O/S (daily options volume by daily spot volume) (Roll et al., 2010) may be unsuitable for markets characterized by a flourishing spot market like India.

The results of the study are expected to have several important contributions. First, they are expected to help the surveillance arm of the Exchanges and the Regulator to detect footprints of informed trading through volumes. Second, the results may be useful for liquidity providers who may choose to monitor volumes to estimate the extent of informed trading. Third, the study may pique the interest of informed traders who are interested in assessing the extent to which any information is already incorporated into the

[7]Discussion Paper on Growth and Development of Equity Derivatives Market in India, SEBI, 2017 (Table 5)

[8]Domestic instituions are not allowed to write option contracts, exposure to option premium paid must not exceed 20% of the net assets of the scheme etc

[9]It's 10% for SSFs and 30% for SSOs in 2011-15.

[10]The institutional percentage in equity reached record 40.7% in June 2017.

[11]We find the average daily delivery percentage of over 50% in equity.

stock prices. Fourth, the study has implications for corporates/firms which could monitor volume to check leakage of information around events. Fifth, value investors may also benefit from the study by monitoring volumes before taking large contrarian position.

The structure of the paper is as follows. Section 2 outlines the literature and section 3 mentions data sources, sample formulation and methodology. Section 4 gives summary statistics and section 5 reports the regression results and discussion. Robustness tests are included in Section 6. Section 7 concludes.

2 Literature Review

2.0.1 Informed Trading in Equity Options

As mentioned earlier, SSOs are the more liquid equity derivatives in the developed markets including the US. Hence, the literature has concentrated more on options volume and their relationship with informed trading. Easley et al. (1998) model informed trading in options market and spot market. Their model can result either in a pooling equilibrium (when both informed traders and noise traders trade in options markets) or a separating equilibrium (when only the noise traders trade in the options markets). A pooling equilibrium will occur when the profit from buying a call or selling a put (buying a put or selling a call) earned by an informed trader in options markets is more than buying (selling) a stock in the stock market when there is a positive (negative) signal. Such profits are a function of relative leverage, depth in the two markets and the fraction of informed traders in the world. Empirically, using top 50 SSOs for 44 trading days, they show that signed options volumes predict future stock returns. Pan and Poteshman (2006) use a proprietary dataset to conclude that Put-Call Ratio, defined as Put Volume/(Put Volume+Call volume) of open-buy option positions, predicts future stock returns. If there is a positive (negative) signal and the informed trader buys a call (put), the P/C is expected to decline (increase). Ge et al. (2016) also use signed options data and conclude that the predictability of abnormal future stock returns using SSO volume is due to the embedded leverage present in the options markets. Recently, the literature has shifted from using proprietary signed options volume towards using unsigned option volumes data.

Roll et al. (2010) introduced to the literature the ratio O/S, which is defined as the ratio of the volume of all options over the volume of stocks traded in a calendar period. It can be defined both in terms of number of shares and currency value. Their empirical results show that larger firms, lower option bid-ask spread, and more volatile stocks have higher O/S. Their results also point to the informed trading in options markets - Lower institutional holding in stock and a higher number of analysts following a stock are associated with a higher O/S.

Johnson and So (2012) note that informed traders make use of options market's leverage. They find that lowest decile O/S stocks outperform the highest decile O/S stocks by over 19% per year. They argue that short-sell constraints in the equity markets make options market a more preferred venue for informed traders during the negative news. They extend Easley et al. (1998)'s model to allow short-selling and find that O/S is a stronger informed trading signal when short-sale costs are high, or option leverage is low. Choy and Wei (2012) argue that the higher trading in options is caused by divergence of opinions proxied by stock return volatility, dispersion of earnings forecasts, sidedness, the number of analysts following the firm.

2.1 Option Volume around Earnings Announcements

Skinner (1997) discusses that the informed traders have largest advantages, if any, before significant information events. Kim and Verrecchia (1991) also suggest that traders have the incentive to acquire private information before anticipated information events. Hence, the recent literature reports higher Options volume before Earnings Announcements (EA) and pricing of some information before the event itself[12].

Roll et al. (2010) point to an increased option trading during the five days before a firm's EA in their sample from 1996 to 2009. They also find that the absolute cumulative abnormal returns (CAR) post-EA [0,+2] are significantly related to pre-O/S [-3,-1]. The relationship weakens after controlling for absolute pre-EA [-3,-1] CAR but remains significant for both positive and negative CAR. They interpret it as evidence of increased option trading before large earnings surprises. Johnson and So (2012) find that pre-EA (week) O/S is negatively related to the earnings surprise, implying that options markets make all information public before the event. Choy and Wei (2012) use a dataset that breaks down the daily options volume along three dimensions: initiator (firm vs. customers), trade type (buy vs. sell vs. open vs. close), and trade size (small vs. medium vs. large). They find that option volume is high before EA, but the increase is largely attributable to smaller, retail investors engaging in speculative trades. They also find that pre-EA option turnovers do not predict post-EA returns after controlling for pre-EA returns. Truong and Corrado (2014) finds that the stocks with higher average option-volume before EA [-50, -11] have a higher pre-EA [-10,-2] stock price reaction and a smaller during-EA [-1,+1] stock price reaction than the ones with lower options volume. This is an indication of

[12] Other information-heavy events like Mergers and Acquisitions (M&A), Insider Trading, Bankruptcy and their relationship with options volume are also considered in literature. We focus our study to Quarterly Earnings Announcement in this paper.

private information being incorporated into the stock prices through options trading.

2.2 Options Volume in Indian Markets

The work on information content in the volume of Indian SSOs is limited and does not use most recent data. Srivastava (2003) compares SSO volume and Open Interest (OI) related measures to predict the underlying stock prices. The measures of OI (volume) predictors are adopted from Bhuyan and Yan (2001). The paper finds that both measures are significant in predicting stock price, with OI measures slightly more informative. The paper uses four expiry dates options November 2002, December 2002, January 2003 and February 2003 (comprising a total of 77 trading days). Srivastava et al. (2008) expand to all dates from November 2001 to November 2004 and find similar results. Pathak and Rastogi (2010) study volume and OI based predictability of 17 highly traded Nifty 50 constituents. Predictors are adopted from Bhuyan. The period of study covers stock options contract of July-September 2009, and the prediction of returns is carried out at 4 days: T-3, T-6, T-10, and T where T is the expiry day. OI predictors and Volume predictors both are significantly positive.

To the best of our knowledge, our study is the first attempt that uses spot, option and futures volume measures together and attempts to disentangle the informational content in their volumes around Earnings Announcement events.

3 Data and Method

Daily volume of the spot, SSO, and SSFs are taken from January 2008 to December 2015 from NSE Bhavcopy. We take volumes for near month contracts only, owing to higher liquidity. Quarterly Earnings Announcements (EA) are taken from CMIE prowees[13]. The Earning Announcements have been moved to the next trading day if the date of EA falls on a non-trading day (weekend or public holiday). Firm-specific data is collected from CMIE Prowess - daily market capitalization, quarterly Institutional percentage, and NIC codes. Annual values for the number of Analysts following a firm are taken from Thomson Reuters I/B/E/S database.

We use a 3-factor CAR model[14] for our analysis. The three factors (Market, SMB, and HML) are taken from IIM-A Fama-French data library[15]. Dividend-adjusted daily returns of each firm are taken from the

[13]Randomized checks with MoneyControl give complete overlap.

[14]Referred from MacKinlay (1997)

[15]http://faculty.iima.ac.in/ iffm/Indian-Fama-French-Momentum/

CMIE database. The estimation window is [-250,-50] with respect to earnings event day 0. Following Roll et al. (2010), two event windows are taken - Pre-Announcement window of [-3,-1] and Post-Announcement window of [0,2], relative to the announcement day 0. Since only unsigned option values are available, we use the absolute value of CAR in these periods. It should be noted that in India the day 0 event is contestable. Anecdotal evidence suggests that most Earnings announcement are made after the market hours, rendering day 0 closing values as pre-event values. However, we have carried out analysis considering 0 as the post-event day.

The main variables of interest are O/S and F/S. O/S is defined in line with Roll et al. (2010), as Daily Option Volume (in shares) divided by the daily Spot Volume (in shares), for each stock . We also define F/S analogously, as Daily Futures Volume divided by the daily Spot Volume. These rations are calculated daily and then averaged over the pre-event period [-3,-1].

Our main regression equation is as follows:

$$\begin{aligned} post - CAR[0,2] = Ln(D/S[-3,1]) + \\ Ln(D/S[-3,1]) * pre - CAR[-3,1] + \\ Ln(D/S[-3,1]) * pre - CAR[-3,1] + \\ Ln(D/S[-3,1]) * pre - CAR[-3,1] * Size + \\ Ln(D/S[-3,1]) * pre - CAR[-3,1] * Insti + \\ Ln(D/S[-3,1]) * pre - CAR[-3,1] * Analy \end{aligned} \tag{1}$$

where, D/S is either O/S or F/S, 'Size' is the log of market capitalization on event day, 'Insti' is the Institutional Percentage on the beginning of the event quarter and 'Analy' is the Number of Analysts for the event quarter. Since we dont have access to signed volume data, we take the absolute values of pre- and post-CAR (following Roll et al. (2010)).

Roll et al. (2010) argues that if informed trading takes place in the equity derivatives (options in the US), then the pre-event derivatives volume should predict the post-CAR. Further, a higher pre-CAR would imply a larger profit by the informed traders before the event. Hence, controlling for the size of the pre-CAR, the relationship between the pre-event volume and post-CAR should be attenuated. Roll et al. (2010)'s results corroborate this hypothesis. The paper reports that O/S is positive and significant, indicating that more pre-event options volume (compared to stock volume) is associated with a bigger absolute post-CAR. The interaction term of O/S and pre-CAR is negative and significant, implying that the relationship between pre-event options volume and post-CAR is attenuated when the pre-CAR is high. The authors conclude that the results are consistent with the idea that informed trading takes place in the options markets, where informed traders realize the event gains before the event itself.

Following Truong and Corrado (2014), we also control for industry and Quarter-fixed effects. Reported standard error are robust and controlled for heteroskedasticity.

4 Summary Statistics

4.1 Descriptive Statistics

The mean O/S [-3,-1] ratio is 0.413 [16]. The F/S ratio [-3,-1] is greater than 1, with the mean of about 2.067. Hence, on an average, a stock has higher SSFs trading than shares trading during [-3,-1]. The mean O/S (F/S) ratio for the [0,2] is 0.562 (1.84). We see that the F/S falls considerably in [0,2].

[Insert Table 1 here]

4.2 Correlations

The correlation between F/S and O/S are low at 0.170. Thus, using F/S and O/S in regression together will not pose problems of multicollinearity.

4.3 Graphs

Figure 1 shows that although there is an increase in both SSF volume and SSO volume in the pre-event period, the increase in the spot value (volume follows a similar pattern) is high. Further, the graphs suggest that the higher trading around events happen on day 0.

[Insert Figure 1 here]

As noted earlier, in India the day 0 event is contestable. Anecdotal evidence suggests that most EAs are made after the market hours, rendering day 0 closing values as pre-event values. The discussion of the paper is robust to both specifications. If 0 is taken as part of the pre-event window, then we can say that the information leakage takes places not many days but only a few hours before the actual event. The information leak in the spot is higher due to lower noise traders in this segment (detailed in the next section). On the other hand, if 0 is the post-event window (as considered by Roll et al. (2010)), then a spike on 'day 0' means, investors are rebalancing their portfolios in light of the news.

[16] Roll et al. (2010) reports Ln(O/S) of -1.3

5 Regression Results and Discussion

We first run a regression analogous to Roll et al. (2010). The main regression results are shown in Table 2. The first column controls for size, institutional percentage and number of analysts (as interaction terms) along with industry and quarter fixed effects. The second column controls only for industry and quarter fixed effects, while the third column omits all controls.

[Insert Table 2 here]

We observe that our signs in regression results are just the opposite of what Roll et al. (2010) reports. For Indian equity futures markets, F/S is negative whereas F/S interacted with pre-CAR is positive. Both are significant at 1%. For Indian equity options markets, O/S terms are negative, with O/S interacted with pre-CAR and significant at 5%. The results seem puzzling at first until we combine them with the high spot (value) peak observed in Figure 1. The reversed signs observed indicate that the volume ratios (F/S and O/S) are not capturing the effect of Futures and Options volumes, but rather of the Spot Volumes in the denominator. The results seem consistent with the structure of the Indian market:

1. The proportion of noise traders in Indian equity derivatives market is very high: Non-Proprietary Non-Institutional Investors (comprising majorly of individual retail investors) and Proprietary Investors contributed around 85% of equity derivatives turnover in 2016-17[17]. Such high noise-trading percentage may make picking up increased informed trading in this segment difficult.

2. Most volume in derivatives is due to the noise-traders, and sophisticated investors contribute less to derivatives volume: Institutional Investors contributed only about 14% of equity derivatives turnover in 2016 (10% is SSOs and around 18% in SSFs) in India. Further, this contribution seems to be decreasing over the years. The lower presence of institutional investors in Indian equity derivatives markets is in part due to certain regulatory restrictions on institutions. For example, domestic institutions are not allowed to write option contracts, exposure to option premium paid must not exceed 20% of the net assets of the scheme etc[18].

3. Apart from noise traders, derivatives attract a lot of participants with

[17] Discussion Paper on Growth and Development of Equity Derivatives Market in India, SEBI, 2017 (Table 5)

[18] Discussion Paper on Growth and Development of Equity Derivatives Market in India, SEBI, 2017

low investment horizon. For example, quantative funds, algorithmic traders, arbitrageurs and other very sophisticated speculators tend to have short horizons ranging from milli-seconds to end-of-day. This is evidenced by the fact that the change in Open Interest as a percentage of Volume for equity derivatives is very low[19]. Hence, fewer overnight views are traded in the equities derivatives segment.

4. Equity markets, on the other hand, have a considerable portion of volume from institutional investors: The institutional percentage in equity reached 40.7% in June 2017. It has been around 35% over the last few years[20].

5. More participants in the equity segment tend to be long-horizon investors. We ran a preliminary check and found the average daily delivery percentage of over 50%.

Hence, in India, regression results show that spot volumes are predictive of future CAR and derivative volumes are not even though most informed trading happens in derivatives. In that regard, our results present a methodological critique of Roll et al. (2010) - F/S and O/S - are not good variables to capture the informed trading in India. We run a regression with simple volumes in Section 5.3.

Also note that our R-square are higher (0.081) than that reported by Roll et al. (2010) (0.0243), presumably due to controlling for firm and quarter fixed effects. The O/S becomes significant (at 10%) when FYFQ are not controlled for. This pattern is visible throughout the regressions.

5.1 Multi-collinearity effects

To ascertain that our results are not driven by any other factors, we perform few other tests. First, we run the regression separately for F/S and O/S to remove any overlapping derivatives trading (although the F/S and O/S have low correlation). The results are reported in Table 3. The results remain unchanged. The results are also unaffected by the effect of control Variables. The R-square of 0.07 is lesser than with both considered together, indicating some explained variance being attributable to both SSFs and SSOs.

[Insert Table 3 here]

[19] Mean Absolute Open Interest divided by Volume in 2011-2015 is 10% for SSFs and 30% for SSOs

[20] https://www.bloombergquint.com/markets/2017/08/08/institutional-ownership-in-indian-stocks-at-record-high-says-morgan-stanley

5.2 Seasonality Adjustment

Second, we check for seasonality. The graph 2 shows seasonality evident in F/S and O/S. Here, all months are normalized to have 18 trading days. This is done by taking the expiry day for each month (Trading Day = 0), the 8 trading days before expiry day (Trading Day from 17 to 10) and 8 trading days after expiry day (Trading Day from 1 to 8). The remaining trading days (if any) are assumed to be day 9.

[Insert Figure 2 here]

Roll et al. (2010) does not remove the seasonal component, whereas Truong and Corrado (2014) and others drop the observations traded on 5 days before expiry day. Our approach of explicitly controlling for seasonality effect has 2 advantages - first, we do not drop observations, and second, we also control for the after expiry-day high volumes. To remove the seasonality, we regress the log of O/S on trading days 0, 17, and 16 and 1 and the log of F/S on trading days 0, 17, 16, 15, 14 and 1. The residuals from each of the regressions are then used.Our final regression results as shown in Table 4.

[Insert Table 4 here]

The results indicate that F/S has a negative coefficient and the interaction with pre-CAR has a positive coefficient as earlier. However, the O/S interacted with pre-CAR now becomes insignificant.

5.3 Simple Volumes

Having checked that our signs are not due to external factors, we test our hypothesis by running a regression with natural log of pre-event [-3,-1] volumes of Spot, SSF, and SSO. The results are shown in Table 5. We find that although futures and options volumes by themselves are significant at 5% now, interaction with pre-CAR terms are not significant. Spot volume, on the other hand, is highly significant at 1% and is positive as expected. Note that R-sq remains the same as the main regression. Hence, in India informed trading is only detectable in the spot market, with a marginal measurable increase in volumes in the derivatives before EA.

[Insert Table 5 here]

6 Robustness Tests

6.1 BHAR

BHAR or Buy-And-Hold-Abnormal Returns are computed as (following Truong and Corrado (2014)),

$$BHAR[m,n]_i = \prod_{i=m}^{n}(1 + r_{i,t}) - \prod_{i=m}^{n}(1 + dec_t) \quad (2)$$

where, r is the return on stock i on day t, and *dec* is the equally-weighted return from the size decile that stock i belonged to on day t[21]. BHAR is calculated for post-period [0,2] and the pre-period [-3,-1].

The results with absolute values of BHAR in Equation 1 are shown in Table 6. The results remain consistent to CAR, implying that the Fama-French Factors in the CAR do not affect the results.

[Insert Table 6 here]

6.2 Positive and Negative post-CAR

Following Roll et al. (2010), we also check if the derivatives are trading in the correct direction. Since we do not have signed options or futures volume, we run regressions based on signed post-CAR. First, we take all the observations where the post-CAR is positive, and then take the absolute value of it. Roll et al. (2010) reports that O/S is positive when post-CAR is positive, implying that higher options volume before a positive event implies an even bigger post-CAR. Our results are reported in Table 7. We observe that the signs of all variables remain unchanged but F/S interacted with pre-CAR term becomes insignificant.

Second, we take all the observations where the post-CAR is negative, and then take the absolute value of it. Roll et al. (2010) shows that O/S is negative when post-CAR is negative, implying that higher options volume before a negative event implies a lower post-CAR. Our results are in Table 8. The signs do not change, however, none of the O/S variables are significant now. The results of F/S are both significant, implying that SSF markets are used to circumvent the short-sell constraints of the Indian equity markets, as expected.

[Insert Tables 7 and 8 here]

[21] BHAR is in 0.01%, so multiply by 100 to compare BHAR with CAR. Same results.

6.3 Other Windows

We consider 3 other windows. The results are shown in Table 9:

1. pre = [-20,-11] and post =[0,2]: Truong and Corrado (2014) uses this window to check if the level of derivatives volume can be a proxy for informed trading.

2. pre = [-4,-2] and post =[-1,1]: Following Truong and Corrado (2014), we use event window from -1 to 1, however this has two issues. First, the event window is not the same as post-event window. Second, Most EAs are released after market hours, and we have shifted non-trading day announcements to the next trading day.

3. pre = [-4,-2] and post =[0,2]: To capture the post-event window with another pre-window.

For each of these windows, the signs remain unchanged. However, the results are weaker, indicating that the informed trading is concentrated in days nearer to EAs.

[Insert Table 9 here]

7 Conclusion

Futures and Options both provide higher embedded leverage, facilitate short-selling, and have lower transactions costs as compared to spot, making them valuable to traders with private information. The US and many other developed markets have an illiquid Single-Stock Futures (SSF) markets, and hence the Single-Stock Options (SSO) market is the preferred venue to trade in the derivatives markets. Recent studies in the US have examined the informational role of options and have noted evidence of heightened volume of SSOs before Earnings Announcements. However, Indian equity derivatives have liquid SSOs as well as liquid SSFs. SSFs provide an alternative to SSOs for traders wishing to exploit embedded leverage and short-sell provisions in the derivatives markets. Further, futures markets' absence of any delta-rebalancing constraints makes them more attractive to informed traders. On the other hand, traders would prefer options for their ability to trade nonlinear payoffs and downside risk protection. This paper attempts to disentangle informed trading in SSO and SSF markets.

Our key results show that spot volumes are predictive of future CAR and derivative volumes are not even though most informed trading happens in derivatives. This is consistent with the unique structure of the Indian markets. Derivatives markets have the highest proportion of noise traders and most derivatives volume is noise-trading. Hence, an increase in informed trading around EA is difficult to capture amongst the noise. Derivatives also attract a lot of participants with low investment horizon ranging from milliseconds to end-of-day, again limiting capturing any overnight views in this segment. On the other hand, equity markets have a considerable portion of volume from institutional investors and investors with longer investment horizons. Such characteristics allow any informed trading in the spot to be captured more easily. Popular proxies for derivatives Volumes, namely O/S (Roll et al., 2010) capture the informed trading in spot market rather than derivatives market. In that respect, these proxies may be unsuitable for markets characterized by a flourishing spot market like India.

The results of the study are expected to have several important contributions for the surveillance arm of the Exchanges, the Regulator, liquidity providers, corporates/firms, value investors who may benefit from the study by monitoring volumes to understand the presence of informed traders.

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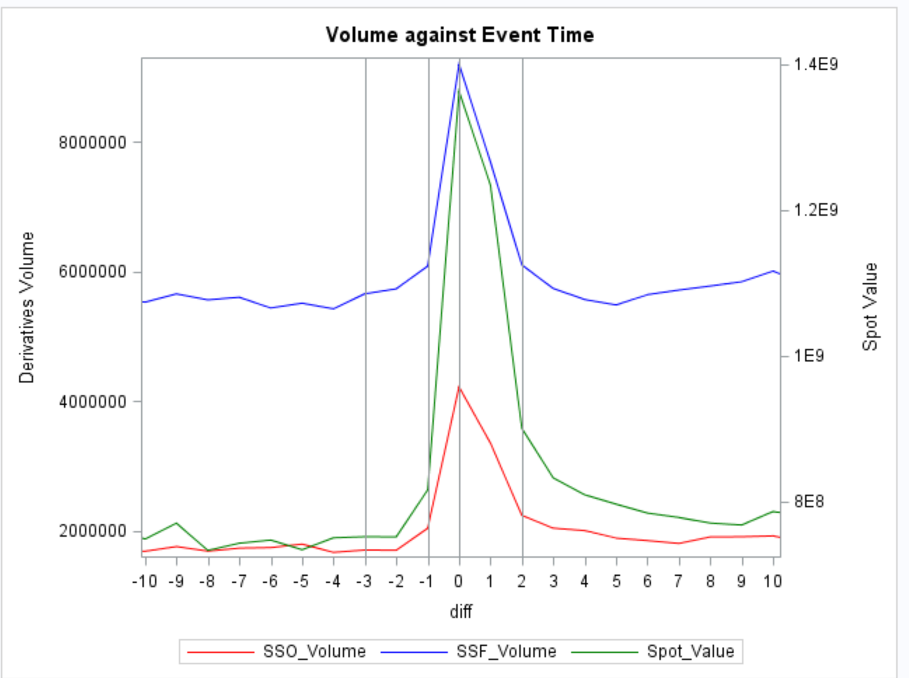
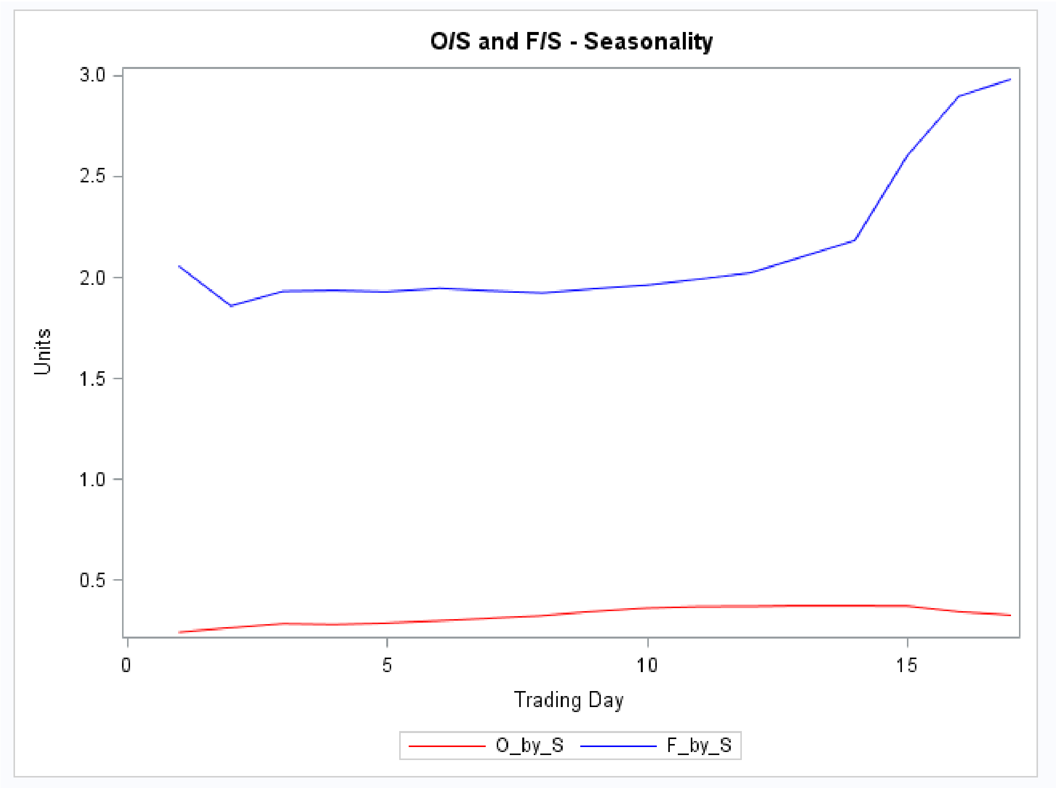
Figure 1: Volumes of SSF, SSO and Value of Spot



Note: Derivatives Volumes (SSO and SSF) and Spot Value (Price X Volume) are plotted for Earnings date [Event Time=0] and 10 days before and after the Announcement.

Figure 2: Volumes of SSF, SSO and Value of Spot



Note: O/S and F/S are plotted against Trading days. 0 is the expiry day, 17 is the expiry day - 1, 17 is the expiry day -2, and so on. 1 is expiry day +1, 2 is expiry day +2 and so on. 8 days on each side of the expiry are taken and the rest are included as trading day 9.

Table 1: Summary Statistics

Statistic	Mean	St. Dev.	Min	Median	Max
B/M	0.620	0.575	−2.610	0.459	4.411
Analysts	20.512	13.722	1	20	57
Institutional (pc)	30.224	15.396	1.034	28.517	88.389
Size	11.900	1.371	7.746	11.905	15.422
CAR [-3,-1]	0.125	3.717	−16.165	0.035	50.703
CAR [0,2]	−0.355	5.685	−33.948	−0.387	35.283
O/S [-3,-1]	0.413	0.642	0.0001	0.186	12.012
F/S [-3,-1]	2.067	1.435	0.037	1.784	39.398
O/S [0,2]	0.562	0.766	0.00003	0.279	8.410
F/S [0,2]	1.840	0.896	0.053	1.691	15.240

Note: B/M is Book to Market Ratio, Size is Log of Market Capitalization, CAR is Cumulative Abnormal Return in Percentage, O/S is Option Volume by Spot Volume, F/S is Futures Volume by Spot Volume

Table 2: ABS. CAR POST [0,2] ON FS,OS PRE [-3,-1]

	Dependent Variable		
	Absolute CAR [0,2]		
	(1)	(2)	(3)
ln(O/S)	−0.057	−0.071	−0.054
	(0.060)	(0.059)	(0.057)
ln(O/S)*pre-CAR	−0.149**	−0.020**	−0.044***
	(0.065)	(0.009)	(0.008)
ln(F/S)	−0.777***	−0.767***	−0.903***
	(0.180)	(0.175)	(0.180)
ln(F/S)*pre-CAR	0.962***	0.125***	0.141***
	(0.338)	(0.042)	(0.042)
ln(O/S)*pre-CAR*size	0.011*		
	(0.005)		
ln(O/S)*pre-CAR*Insti	−0.0002		
	(0.0003)		
ln(O/S)*pre-CAR*Analy	0.001		
	(0.001)		
ln(F/S)*pre-CAR*size	−0.077**		
	(0.030)		
ln(F/S)*pre-CAR*Insti	−0.002		
	(0.002)		
ln(F/S)*pre-CAR*Analy	0.005		
	(0.003)		
Constant	9.718***	8.872***	4.124***
	(2.131)	(1.892)	(0.226)
Quarter Controls	Yes	Yes	No
Industry Controls	Yes	Yes	No
Observations	3,788	3,788	3,788
Adjusted R^2	0.084	0.079	0.039

Note: *p<0.1; **p<0.05; ***p<0.01

O/S is Option Volume [-3,-1] by Spot Volume [-3,-1], F/S is Futures Volume [-3,-1] by Spot Volume [-3,-1]. O/S and F/S are in Ln. pre-CAR is CAR [-3,-1]. Robust Standard Errors are in parenthesis.

Table 3: ABS. CAR POST [0,2] ON INDIVIDUALLY FS,OS PRE [-3,-1]

	Dependent Variable			
	Absolute CAR [0,2]			
	(1)	(2)	(3)	(4)
ln(F/S)	−1.240***	−0.917***		
	(0.172)	(0.173)		
ln(F/S)*pre-CAR	0.135***	1.082***		
	(0.046)	(0.309)		
ln(F/S)*pre-CAR*size		−0.084***		
		(0.027)		
ln(F/S)*pre-CAR*Insti		−0.002		
		(0.002)		
ln(F/S)*pre-CAR*Analy		0.005		
		(0.003)		
ln(O/S)			−0.105*	−0.089
			(0.054)	(0.059)
ln(O/S)*pre-CAR			−0.047***	−0.153**
			(0.009)	(0.072)
ln(O/S)*pre-CAR*size				0.011*
				(0.006)
ln(O/S)*pre-CAR*Insti				−0.0003
				(0.0003)
ln(O/S)*pre-CAR*Analy				0.001
				(0.001)
Constant	4.707***	10.694***	3.670***	8.489***
	(0.159)	(2.089)	(0.141)	(2.098)
Quarter Controls	No	Yes	No	Yes
Industry Controls	No	Yes	No	Yes
Observations	3,788	3,788	3,788	3,788
Adjusted R^2	0.021	0.077	0.030	0.077

Note: *p<0.1; **p<0.05; ***p<0.01

O/S is Option Volume [-3,-1] by Spot Volume [-3,-1], F/S is Futures Volume [-3,-1] by Spot Volume [-3,-1]. O/S and F/S are in Ln. pre-CAR is CAR [-3,-1]. Robust Standard Errors are in parenthesis.

Table 4: ABS. CAR POST [0,2] ON RFS,ROS PRE [-3,-1]

	Dependent Variable		
	Absolute CAR [0,2]		
	(1)	(2)	(3)
ln(r(O/S))	-0.142^{**}	-0.142^{**}	-0.157^{**}
	(0.066)	(0.069)	(0.069)
ln(r(O/S))*pre-CAR	0.065	0.010	-0.005
	(0.120)	(0.014)	(0.016)
ln(r(F/S))	-0.395^{*}	-0.428^{**}	-0.428^{*}
	(0.218)	(0.206)	(0.226)
ln(r(F/S))*pre-CAR	-0.309	-0.032	-0.091
	(0.429)	(0.056)	(0.057)
ln(r(O/S))*pre-CAR*size	-0.006		
	(0.010)		
ln(r(O/S))*pre-CAR*Insti	-0.0002		
	(0.001)		
ln(r(O/S))*pre-CAR*Analy	0.001		
	(0.001)		
ln(r(F/S))*pre-CAR*size	0.024		
	(0.035)		
ln(r(F/S))*pre-CAR*Insti	-0.001		
	(0.005)		
ln(r(F/S))*pre-CAR*Analy	0.002		
	(0.005)		
Constant	9.519^{***}	9.777^{***}	4.196^{***}
	(2.087)	(2.082)	(0.095)
Quarter Controls	Yes	Yes	No
Industry Controls	Yes	Yes	No
Observations	3,788	3,788	3,788
Adjusted R^2	0.074	0.074	0.025

Note: *p<0.1; **p<0.05; ***p<0.01

r(O/S) is Residual of O/S (Option Volume [-3,-1] by Spot Volume [-3,-1]), r(F/S) is residual F/S (Futures Volume [-3,-1] by Spot Volume [-3,-1]). r(O/S) and r(F/S) are in Ln. pre-CAR is CAR [-3,-1]. Robust Standard Errors are in parenthesis.

Table 5: ABS. CAR POST [0,2] ON Ln Volumes PRE [-3,-1]

	Dependent Variable		
	Absolute CAR [0,2]		
	(1)	(2)	(3)
SSO Vol	−0.173**	−0.188**	−0.189**
	(0.078)	(0.079)	(0.077)
SSO Vol*pre-CAR	0.018	−0.004	−0.021
	(0.109)	(0.012)	(0.013)
SSF Vol	−0.529**	−0.532**	−0.582***
	(0.212)	(0.207)	(0.219)
SSF Vol*pre-CAR	0.484	0.081	0.081
	(0.457)	(0.058)	(0.061)
Spot Vol	0.862***	0.899***	1.006***
	(0.198)	(0.180)	(0.186)
Spot Vol*pre-CAR	−0.451	−0.073	−0.054
	(0.434)	(0.054)	(0.056)
SSO Vol*pre-CAR*size	−0.002		
	(0.009)		
SSO Vol*pre-CAR*Insti	−0.0001		
	(0.001)		
SSO Vol*pre-CAR*Analy	0.001		
	(0.001)		
SSF Vol*pre-CAR*size	−0.042		
	(0.039)		
SSF Vol*pre-CAR*Insti	−0.002		
	(0.005)		
SSF Vol*pre-CAR*Analy	0.007		
	(0.005)		
Spot Vol*pre-CAR*size	0.040		
	(0.037)		
Spot Vol*pre-CAR*Insti	0.003		
	(0.004)		
Spot Vol*pre-CAR*Analy	−0.008*		
	(0.004)		
Constant	6.872***	6.053**	0.298
	(2.538)	(2.393)	(1.177)
Quarter Controls	Yes	Yes	No
Industry Controls	Yes	Yes	No
Observations	3,788	3,788	3,788
Adjusted R^2	0.087	0.081	0.043

Note: *p<0.1; **p<0.05; ***p<0.01

Table 6: ABS. BHAR POST [0,2] ON FS,OS PRE [-3,-1]

	Dependent Variable		
	Absolute BHAR [0,2]		
	(1)	(2)	(3)
ln(O/S)	−0.0001	−0.0003	−0.0002
	(0.001)	(0.001)	(0.001)
ln(O/S)*pre-BHAR	−0.116*	−0.016*	−0.036***
	(0.065)	(0.009)	(0.010)
ln(F/S)	−0.008***	−0.008***	−0.009***
	(0.002)	(0.002)	(0.002)
ln(F/S)*pre-BHAR	0.799**	0.108***	0.129***
	(0.331)	(0.039)	(0.041)
ln(O/S)*pre-BHAR*size	0.008		
	(0.005)		
ln(O/S)*pre-BHAR*Insti	−0.0002		
	(0.0003)		
ln(O/S)*pre-BHAR*Analy	0.001		
	(0.001)		
ln(F/S)*pre-BHAR*size	−0.065**		
	(0.030)		
ln(F/S)*pre-BHAR*Insti	−0.002		
	(0.002)		
ln(F/S)*pre-BHAR*Analy	0.005*		
	(0.003)		
Constant	0.090***	0.086***	0.043***
	(0.019)	(0.017)	(0.002)
Quarter Controls	Yes	Yes	No
Industry Controls	Yes	Yes	No
Observations	3,788	3,788	3,788
Adjusted R^2	0.073	0.069	0.029

Note: *p<0.1; **p<0.05; ***p<0.01

O/S is Option Volume [-3,-1] by Spot Volume [-3,-1], F/S is Futures Volume [-3,-1] by Spot Volume [-3,-1]. O/S and F/S are in Ln. pre-BHAR is BHAR [-3,-1]. Robust Standard Errors are in parenthesis.

Table 7: ABS. CAR POST [0,2] (CAR GE 0) ON FS,OS PRE [-3,-1]

	Dependent Variable		
	Absolute CAR [0,2]		
	(1)	(2)	(3)
ln(O/S)	-0.118	-0.136^{*}	-0.129^{*}
	(0.077)	(0.077)	(0.071)
ln(O/S)*pre-CAR	-0.286^{***}	0.001	-0.034^{**}
	(0.108)	(0.015)	(0.013)
ln(F/S)	-0.762^{***}	-0.730^{***}	-0.842^{***}
	(0.226)	(0.223)	(0.206)
ln(F/S)*pre-CAR	0.463	0.118^{**}	0.131^{***}
	(0.468)	(0.049)	(0.050)
ln(O/S)*pre-CAR*size	0.025^{***}		
	(0.009)		
ln(O/S)*pre-CAR*Insti	-0.0003		
	(0.0004)		
ln(O/S)*pre-CAR*Analy	0.0003		
	(0.001)		
ln(F/S)*pre-CAR*size	-0.028		
	(0.042)		
ln(F/S)*pre-CAR*Insti	-0.003		
	(0.003)		
ln(F/S)*pre-CAR*Analy	0.004		
	(0.004)		
Constant	11.234^{***}	10.138^{***}	3.960^{***}
	(2.844)	(2.124)	(0.257)
Quarter Controls	Yes	Yes	No
Industry Controls	Yes	Yes	No
Observations	1,748	1,748	1,748
Adjusted R^2	0.084	0.074	0.037

Note: *p<0.1; **p<0.05; ***p<0.01

O/S is Option Volume [-3,-1] by Spot Volume [-3,-1], F/S is Futures Volume [-3,-1] by Spot Volume [-3,-1]. O/S and F/S are in Ln. pre-CAR is CAR [-3,-1]. Robust Standard Errors are in parenthesis.

Table 8: ABS. CAR POST [0,2] (CAR L 0) ON FS,OS PRE [-3,-1]

	Dependent Variable		
	Absolute CAR [0,2]		
	(1)	(2)	(3)
ln(O/S)	−0.011	−0.029	0.004
	(0.076)	(0.077)	(0.072)
ln(O/S)*pre-CAR	−0.057	−0.031***	−0.051***
	(0.096)	(0.010)	(0.010)
ln(F/S)	−0.856***	−0.848***	−0.987***
	(0.237)	(0.230)	(0.238)
ln(F/S)*pre-CAR	1.300**	0.154**	0.160***
	(0.515)	(0.062)	(0.061)
ln(O/S)*pre-CAR*size	0.003		
	(0.008)		
ln(O/S)*pre-CAR*Insti	−0.001		
	(0.001)		
ln(O/S)*pre-CAR*Analy	0.001		
	(0.001)		
ln(F/S)*pre-CAR*size	−0.102**		
	(0.046)		
ln(F/S)*pre-CAR*Insti	−0.003		
	(0.004)		
ln(F/S)*pre-CAR*Analy	0.006		
	(0.006)		
Constant	6.321***	5.775***	4.262***
	(1.319)	(1.258)	(0.260)
Quarter Controls	Yes	Yes	No
Industry Controls	Yes	Yes	No
Observations	2,040	2,040	2,040
Adjusted R^2	0.087	0.083	0.040

Note: *p<0.1; **p<0.05; ***p<0.01

O/S is Option Volume [-3,-1] by Spot Volume [-3,-1], F/S is Futures Volume [-3,-1] by Spot Volume [-3,-1]. O/S and F/S are in Ln. pre-CAR is CAR [-3,-1]. Robust Standard Errors are in parenthesis.

Table 9: ABS. CAR POST [0,2]/POST [0,2]/DURING-1,1 ON FS,OS PRE3011/PRE42/PRE42

	Dependent Variable		
	ABS. CAR [0,2]	ABS. CAR [-1,1]	ABS. CAR [0,2]
	(1)	(2)	(3)
ln(F/S)[-20,-11]	-0.044		
	(0.063)		
ln(F/S)[-20,-11]*pre-CAR	-0.007		
	(0.036)		
ln(F/S)[-20,-11]*pre-CAR*size	-0.215		
	(0.214)		
ln(F/S)[-20,-11]*pre-CAR*Insti	0.698^{***}		
	(0.178)		
ln(F/S)[-20,-11]*pre-CAR*Analy	-0.0003		
	(0.003)		
ln(O/S)[-20,-11]	-0.0001		
	(0.0003)		
ln(O/S)*pre-CAR	0.0002		
	(0.0004)		
ln(O/S)[-20,-11]*pre-CAR*size	-0.068^{***}		
	(0.017)		
ln(O/S)[-20,-11]*pre-CAR*Insti	-0.0003		
	(0.001)		
ln(O/S)[-20,-11]*pre-CAR*Analy	0.004^{**}		
	(0.002)		
ln(F/S)[-4,-2]		0.002	-0.054
		(0.071)	(0.068)
ln(F/S)[-4,-2]*pre-CAR		-0.128^{*}	-0.032
		(0.071)	(0.057)
ln(F/S)[-4,-2]*pre-CAR*size		-0.511^{***}	-0.500^{***}
		(0.183)	(0.194)
ln(F/S)[-4,-2]*pre-CAR*Insti		1.033^{***}	0.987^{***}
		(0.374)	(0.364)
ln(F/S)[-4,-2]*pre-CAR*Analy		0.007	0.002
		(0.006)	(0.005)
ln(O/S)[-4,-2]		0.0005	-0.001
		(0.0005)	(0.001)
ln(O/S)*pre-CAR		0.001	0.001
		(0.001)	(0.001)
ln(O/S)[-4,-2]*pre-CAR*size		-0.098^{***}	-0.083^{**}
		(0.035)	(0.034)
ln(O/S)[-4,-2]*pre-CAR*Insti		0.001	-0.002
		(0.002)	(0.002)
ln(O/S)[-4,-2]*pre-CAR*Analy		0.006^{**}	0.005
		(0.003)	(0.004)
Constant	10.121^{***}	3.433	9.733^{***}
	(2.048)	(2.538)	(2.062)
Year, Industry Control	Yes	Yes	Yes
Observations	3,932	3,753	3,762