# Algorithmic Traders and Volatility Information Trading
## (White Paper)[*]

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# 1    Introduction

Do algorithmic traders have information on future volatility? Informational role of algorithmic traders has been discussed extensively in the academic literature. Most of the studies suggest that algorithmic traders do not have directional information, but react much faster to publicly available information. Unlike directional information, which is primarily utilized in the spot (cash) or futures market, the options market is uniquely suited for traders with volatility related information. In this paper, we examine whether algorithmic trades in the Indian stock options market have predictive ability for future realized volatility in the spot market.

The benefit of leverage and lower margin requirements suggest that derivative markets are better suited for informed traders. The nature of information that traders use could be either directional or volatility related. In the case of directional information, the trader is supposed to know if the price of a particular security was to go up or down. In case of volatility information, the direction of future price movement is not known to the trader. However, the trader is better informed to predict if the price level is supposed to move from its current level (in either direction).

The last decade has witnessed a significant growth in algorithmic trading activities, not just in developed markets, but also in developing markets. A significant proportion of the order messages received by the exchanges is generated automatically through computers without any real time manual intervention. A subset of these algorithmic traders are known as high-frequency traders (HFT) who use the advantage of speed to bring the round-trip trade execution time down to microseconds. This significant change in dynamics calls for a better understanding of the role of algorithmic traders, especially in derivative markets, where they are more active.

# 2   Our Study

We try to estimate if any particular trader group has volatility related information while trading in the options market. We use a unique dataset obtained from the National Stock Exchange of India, which provides identifiers for algorithmic trades. NSE is a completely order-driven market with no designated market maker. Due to their non-linear payoff structures, stock options are usually perceived riskier by the less sophisticated (retail) traders. Considering that NSE also has a liquid stock futures market, the stock options market is usually more attractive for algorithmic and other sophisticated traders.

We estimate the volatility demand of algorithmic and non-algorithmic traders and check if this demand has predictive ability for future realized volatility in the spot market. We use six months (Jan-Jun 2015) of intraday data for all 159 stocks which are permitted to be traded in the derivatives market during this period. We use data for both spot and options market to estimate the volatility demand and realized volatility measures. We also further split algorithmic traders into proprietary and agency algorithmic traders and check if they behave differently with respect to trading on volatility related information.

Our primary findings suggest that non-algorithmic traders are informed regarding future volatility while algorithmic traders are not. The options market volatility demand for non-algorithmic traders has predictive ability for future realized volatility in the spot market even after controlling for options implied volatility and other relevant controls. However, the predictive ability of options market volatility demand rarely lasts more than two days into the future. We also find that neither proprietary (who trade in their own account) nor agency (who execute trades on behalf of others) algorithmic traders have volatility related information. We consider both scheduled and unscheduled corporate announcements for periods with higher information asymmetry. Our findings are robust for both these announcement types. We also document the variation in results with respect to different estimates of realized spot market volatility. We also test for the impact of this informativeness on options price changes. We find similar results stating positive relationship between volatility informativeness of non-algorithmic traders and price changes.

# 3   Volatility Information Trading

Investors with access to private information regarding future volatility are likely to take positions in options contract that are positively related to future realized volatility. Existing research shows that non-market maker's demand for volatility is positively related to future realized volatility. Order-driven markets do not have any designated market maker. Limit orders from various market participants are matched to each other by the exchange matching engine. However, in recent times algorithmic traders, and more specifically HFTs have assumed the role of modern market makers. Unlike the traditional market makers, they are not obliged to provide quotes at all times. As such, it might be expected that the behavior of algorithmic traders should resemble that of traditional market makers, while non-algorithmic traders behave like non-market makers.

Corporate announcements create increase information asymmetry in the market, with market participants with access to private information able to leverage that information earlier compared to others. The situations result in volatility spikes. In periods leading to the corporate announcements, informed investors are likely to use volatility information in the options market. We argue that similar to pre-scheduled earnings announcements, un-

scheduled corporate announcements create similar situations of information asymmetry. As such trading volume of informed investors prior to any corporate announcement should convey additional information.

Algorithmic traders are not expected to homogeneous in their behavior. The motivation for proprietary and agency algorithmic traders are very different. The proprietary algorithmic traders, who primarily engage in high-frequency trading, try to use their advantage of speed to exploit any arbitrage opportunity existing in the market. They are day-traders, who rarely carry over inventory. On the other hand, agency algorithmic traders execute trades on someone else's behalf. Their primary role is to split orders in such a way that the price impact is minimum. They also prevent investors trading on information from the risk of being front-run. As such, the information content of institutional trades may not be present when the trade is executed through algorithms.

Our primary results indicate that the volatility-demand for non-algorithmic traders has positive relation with future realized volatility, indicating non-algorithmic traders are informed regarding future realized-volatility whereas algorithmic traders are not. We also find that volatility information based trading have similar implications with regard to both scheduled and unscheduled announcements. We find that predictive ability of options trading volume is hardly significant beyond two trading days. We split the algorithmic trader group into proprietary algorithmic traders and agency algorithmic traders as these two groups differ fundamentally in the way they employ algorithms. Proprietary algorithmic traders are primarily high-frequency traders who use their advantage of speed to execute a large number of relatively small-sized trades in very small time. Agency algorithmic traders provide trade execution services for other investors. Results indicate that both these trader groups have no prior information regarding future volatility.

# 4 Price Impact and Information Asymmetry

We further study the informativeness of algorithmic and non-algorithmic traders by inspecting how their demand for volatility is related to option price changes. If a certain group of trader has information regarding future volatility, it is likely that their positive(negative) demand for volatility will be positively related to increase(decrease) in option prices. We estimate this change in option prices through changes in implied volatility. We construct near-the-money options straddles. This combination has high sensitivity to volatility but low sensitivity to directional movements.

Our results indicate that the demand for volatility for the non-algorithmic traders is positively related to change in option prices. However, we do not find information asymmetry as the primary reason behind this results. For both scheduled as well as unscheduled announcements, we do not find incremental increase in information asymmetry. For unscheduled announcements, there is a significant spike on the announcement day. This may be explained by the fact that for earnings announcements, the market already starts incorporating the information prior to the actual announcements. However, due to the unanticipated nature of unscheduled announcements, there is price correction on the announcement date itself. Also, consistent with our earlier analysis, we infer that due to modern electronic markets, the information asymmetry related to earnings announcement has reduced over time.

# 5    Conclusion

The exponential growth of algorithmic traders in the financial markets demands a better understanding of the role played by these machine traders. A lot of recent literature has been devoted towards their role in the spot market, especially in issues related to the provisioning of liquidity. However, the extent of literature devoted to the role of algorithmic traders in the derivative markets is considerably lesser. We do not find any literature exploring whether algorithmic traders have information regarding future volatility.

We use a large dataset obtained from the National Stock Exchange of India which provides identifiers for trades executed by algorithmic traders. We use six months of intraday data (Jan-Jun 2015) for both stock and options market for 159 stocks to create daily demand for volatility for various trader groups and relate that to future realized volatility in the spot market. We find that non-algorithmic traders are informed about future realized volatility while algorithmic traders are not. We use scheduled earnings announcements as well as unscheduled corporate announcements as exogenous shock. We find that different trader group behave similarly to both these type of events. We also find that the predictive ability of volatility demand for non-algorithmic traders for future realized volatility rarely lasts beyond one trading day.

We further inspect the relationship of this volatility with change in options prices. Instead of using options prices directly, we use the change in implied volatility as a proxy. We find that the volatility demand of non-algorithmic traders is positively related to change in options prices. However, it seems that the price impact is driven more by demand pressure rather than information asymmetry. However, we find slightly different results relative to scheduled and unscheduled corporate announcements, where the information asymmetry seems to be an important issue at least on the unscheduled announcement date. Presently there is more market-wide information dissipation using the electronic platforms which might reduce the overall information asymmetry between various trader groups in general. As such, it might be possible that the market already incorporates the estimated information regards to scheduled corporate announcements such as earnings announcements. However, the same may not be true in case of unscheduled announcements. These findings further strengthen our argument about the volatility informativeness of non-algorithmic traders.