



A STUDY ON THE IMPACT OF ALGORITHMIC TRADING ON PRICE DISCOVERY IN INDIAN EQUITY MARKET

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ABSTRACT

Algorithmic trading “is computerized rule based system answerable for executing orders to buy or sell a given asset”. It reduces and sometimes eliminates the manual interventions of a trader and comes up with efficient decisions regarding time, price, and quantity of orders. The decision-making is predicated on the knowledge gathered by dynamically monitoring the market conditions across the securities and trading venues. the concept behind this can be to scale back the market impact by optimally breaking the big orders and closely tracking benchmarks over the execution intervals. As an investor or trader, everyone aims at maximizing the profits and minimizing the risks by carefully choosing different investment avenues. this can be what the Algorithmic Trading (Execution) intends to try to to. Algorithmic trading utilizes very advanced and complicated mathematical models for creating decisions on behalf of an investor within the financial markets. There are strict rules that determine the optimal time for an order to be placed, to be modified and to be cancelled in such how that it'll cause the smallest amount amount of impact on the stock's price and also will ensure availability of liquidity for the investors.

Key words: Algo trading, stock exchange, equity market, price discovery

Introduction

In the world of technological interventions and innovations, trading in financial markets has been revolutionized and has witnessed a noteworthy transition everywhere the world. Ever since the first 1990s, stock exchanges have increasingly embraced electronic trading systems and order books to expedite trading, substituting it for traditional floor trading systems. Rapid computation power, paired with quicker internet access has presented traders with immediate access to developments in order books. Market makers, in specific, gain from such movements, facilitating them to more closely monitor price

fluctuations and mitigate their adverse selection costs. Numerous headways to exchange trading platforms have recently given rise to a fresh breed of traders referred to as Algo Traders (AT) or High-Frequency Traders (HFT). Algorithmic Trading (AT) or High-Frequency Trading (HFT) has lately clothed to be a buzzword within the current trading ecosystem. It's also become one in all the widely discussed issues within the capital markets debate. In developed economies, the majority of such technology-driven transactions has significantly increased over the years. The Indian market has also been gradually embracing the AT or HFT since 2009 as more and more transactions are being routed through this platform

Motivation for the Study

The above observations do implicate the dominance and importance of AT in the Indian market. In our preliminary descriptive analysis, we find that AT orders result in more trades than the non-AT orders. It also shows that the share of non-algo trades have declined. Based on the order modification rates of algo orders one can infer that AT is quick in incorporating any new information in the stock prices and hence leading to better price discovery in the market. Most of the times AT is supplying liquidity by placing limit orders in the market and hence AT might be improving the overall market liquidity. The increasing use of disclosed volume by AT also indicates lowering of impact costs and also reducing the volatility in the market. The aforementioned observations form the basis of our first motivation to examine the impact of AT on Liquidity, Volatility and Price Discovery in the Indian market.

Algorithmic Trading and Liquidity One of the major difference between most developed and developing (emerging) markets is that the developed markets have quote driven systems whereas developing markets like India have order driven systems. In quote driven markets, market makers contribute to the liquidity of the market by continuously updating the quotes / orders. Whereas, in order driven markets, the liquidity is completely determined by demand and supply. In order driven markets, limit orders are the main source of liquidity supply. It is also known that AT has the ability to quickly assimilate any new information and incorporate the same in the prices and also utilizing the reduced order size in order to minimize impact cost. This should impact liquidity positively and help in providing liquidity instantly to a trader.

Though the study is seminal with respect to algorithmic trading and has examined the impact of AT on Liquidity for the first time, it has a few shortcomings; (i) since NYSE doesn't identify AT directly so reliability and validity of proxy is a cause of concern and also quantification of impact on liquidity is not feasible. (ii) the current empirical work assumes that the liquidity has been affected only because of AT which may not be true in reality. Though the authors acknowledge this shortcoming, but don't provide any suggestion to address this problem. (iii) One of the authors supports the fact that "such a proxy makes it difficult to directly examine when and how ATs behave and their role in liquidity supply and demand

Algorithmic trading activity improves liquidity

The advent of AT was definitely for the pursuit of speed and accuracy of execution of trades. But, as the sophistication of algorithms increased the capability of the AT also increased drastically. The newer algorithms had the ability of the algorithms to quickly gather the available information and incorporate the same in the prices. Jhonson (2010) suggest the various benefits of algorithmic trading and argues that algorithmic trading has many advantages over human traders. He argues that the speed and accuracy of calculations and decisions based on complicated trading logics is certainly better in algorithmic trading systems than human traders. He also suggests that the decision-making pertaining to execution of an order as soon as a security is available, splitting orders, selecting different pools of liquidity and assimilating real time information, etc. are few of the common advantages that algorithmic trading has over the traditional human traders. Certainly, the advantages of algorithmic trading should be passed on to the market and the same should be observed in the market as well. Therefore, algorithmic trading should improve the liquidity in the market due to its capability to quickly identify the security availability from different pools of liquidity and trade at the earliest. The ability to split orders into smaller chunks also makes the orders more tradable and therefore improve the liquidity chances for those orders. Also, the capability to gather the information from different sources and incorporating the same in prices by modifying or cancelling the orders or placing fresh orders will also provide chances of better liquidity to existing or new orders.

Higher the algorithmic trading activity better is the price discovery

One of the most prominent arguments favouring the use of algorithmic trading has been the role of AT in price discovery. The capability of the AT to incorporate any new information with least latency into the prices of AT orders is often regarded as the positive role of AT in the price discovery. AT is capable of capturing the information dissemination at a lightning speed and incorporating the relevant information into the stock prices and thereby making the market more efficient. This ability of AT is also argued as a source for reducing the adverse selection risks arising out of private information held by individual traders. Chabound et.al. (2013), Hendershot et.al. (2011), and Hendershott and Riordan (2013) have coherently indicated that ATs have the ability to monitor the market more actively than human traders and therefore this capability of AT may help in better price discovery. The price discovery process is the essence of an efficient market. The speed at which new information is incorporated into prices and the speed at which arbitrage opportunities disappear exemplify the quality of an efficient market and its price discovery process. Taking the speed of algorithmic trading into consideration, one can assume that it (AT) leads to better price discovery and the price impacts due to AT are there for a long run

Formulation of Research Hypotheses

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LITERATURE REVIEW

The existing literature on algorithmic trading is mostly with respect to the quote driven markets. There is a lack of evidence on algorithmic trading in emerging order driven economies. Considering the various differences in the market structure of developed and emerging markets, our study aims at examining the impact of algorithmic trading on liquidity, volatility and price discovery in an emerging market (India). We present our literature review in three sections. The first section discusses the impact of algorithmic trading on liquidity. The second section presents the literature on impact of algorithmic trading on volatility. And the third section entails the literature on impact of algorithmic trading on price discovery.

Hendershott, T., Jones, C. M. and Menkveld (2011) were the first to examine the impact of algorithmic trading in an equity market context. They examine the causal effect of Algorithmic Trading on liquidity. They suggest that algorithmic trading has grown rapidly since the mid-1990s and liquidity in the world equity market have also dramatically improved. In this paper, they examine these two trends of liquidity improvement and algorithmic trading participation and investigate if algorithmic trading is responsible for the liquidity improvements. This is one of the few papers in the area of Algorithmic Trading and this is the first paper which attempts to identify the impact of AT on liquidity. They use electronic message traffic (messages: number of electronic messages per minute) as a proxy for the amount of algorithmic trading taking place. Various market participants also commonly use this proxy. The messages include order entry, order cancelations and trade reports.

Brogaard, Hendershott and Riordan (2014) studied the High-Frequency Trading (HFT) and its impact on market quality for the US equity market. The study illustrates the High Frequency Trading aspect of a trade, which is also a common phenomenon for Algorithmic Trading. The paper addresses eight specific questions: 1) how active are HFTrs; 2) what determinants influence HFTrs' market activity; 3) what determinants influence HFTrs' buying and selling decision; 4) how profitable is the US Equity industry; 5) do HFTrs systematically engage in anticipatory trading; 6) are HFTrs' strategies more correlated than non-HFTrs'; 7) do HFTrs herd; and 8) do HFTrs have a positive feedback look

Chaboud, Benjamin, Hjalmarsson and Vega (2014) study the impact that algorithmic trading, price discovery and volatility in the foreign exchange market. They study the order

persistence i.e., the direction of trade. They identify human and computer generated trades and study whose trade has more permanent impact on prices and how do they affect volatility and liquidity. The study directly relates to the Algorithmic Trading and it focuses on similar issues as that of equity market but in another market (Forex)

Research Objectives

Based on the gaps in the existing literature, we identify the following objectives for our study:

1. To examine the impact of AT on Liquidity
2. To examine the impact of AT on Volatility
3. To examine the impact of AT on Price Discovery

Average order to trade ratio

Financial year	Average order to trade ratio
2018-19	10.86
2019-20	25.42
2020-21	13.58

Note: Algorithmic order is identified based on identification code as provided by the trading member.

Unit Root test with augmented Dickey Fuller

Security name	Level	1 st difference	2 nd difference
Nifty	0.0023*	-	-
Bank nifty	0.0000*	-	-
Nifty future	0.0000*	-	-
SBI	0.0040*	-	-
ONGC	0.0000*	-	-
Reliance	0.0000*	-	-
TCS	0.0672	0.0000*	-
Infosys	0.0000*	-	-

**significant at 5% level*

Summary Findings

Liquidity, volatility and price discovery are important aspects of any market and regulatory authorities and exchanges have always attempted to enhance upon them so as to move towards an efficient market. Rapid technological advancements are adopted by the markets and therefore the market participants so as to boost upon the liquidity, volatility and price discovery aspect of the markets. Algorithmic trading was one such tool which got wide acceptance across the markets and participants in recent years.

Existing literature on AT is proscribed because of non-availability of the dataset with clear identification of AT. Most of the stock exchanges don't identify AT and it's led to the employment of several proxies (message traffic, order cancelation time, etc.). The results derived from the use of such proxies have often been acknowledged by the authors¹ as weak or unreliable and have suggested the employment of direct measures of AT

The findings of the study have both theoretical and practical implications. The study is one amongst the few studies with direct identification of AT and thus it adds value to the present body of literature. together with that there's lack of studies pertaining to studying the impact of AT in emerging order driven markets, as most of the studies are in developed quote driven market. The evidences per impact of AT on liquidity, volatility and price discovery should remove any doubts regarding the ill effects of AT within the minds of regulators, exchanges, academicians and practitioners or traders. Often stumble upon exchanges probing, if they have to curb or promote algorithmic trading. This study will help them to decide on the identical. The findings are important for the individual traders moreover, they have not been worried about being picked off and also AT adversely impacting the liquidity, volatility and price impact. The findings regarding algorithmic trading efficiency will help policy makers settle on reaching out for optimal level of orders to trade ratio.

Conclusion

The high frequency trading activity still in Indian is during a nascent stage. the longer term technological adoption by the institutional firms in HFT will play vital role within the equity market. This study has made a trial to grasp the high frequency trading role in market value quality, efficiency and volatility. The study has focused on qualitative and quantitative oriented with the help of 3 objectives. The study has considered the first and secondary data and applied the statistical tools to derive the conclusion as per the research questions. The high frequency trading industry today finds itself at a crossroad. Despite the large potential for growth, HFT is threatened by new regulations and greater competition as more market participants adopt this manner of trading. However, these are still period for the HFT industry, and it's imperative for firms to still concentrate on growth by taking advantage of improving technology so as to realize the advantages HFT holds. HFT firms should leverage the offerings of specialist firms to assist them manage their various forms of risk and compliance. Algorithm and code testing became extremely critical for HFT firms. HFT firms should ensure that there's comprehensive testing of their trading applications and techniques.

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