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Does Co-location Scam Really Exist? A Review of National Stock Exchange Co-location Scam

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Abstract

The present paper provides the comprehensive review of co-location facility and related technical glitch or scam at National Stock Exchange (NSE). The previous technological advancements such as algorithmic trading (AT) and high-frequency trading (HFT) contributes the market positively by controlling volatility and as liquidity provider. Particularly, Algorithmic trading has been praised for providing liquidity and controlling volatility, particularly for retail traders. However, some argue that it harms both small and institutional traders and the market's order. This article analyses the influence of co-location on the major characteristics affecting market quality: Price discovery, liquidity, transaction costs, volatility, and punishing slower traders. The findings of the paper suggest that co-location is not a scam it is a glitch of servers which has given loopholes to the institutional traders and ultra-speed of information flow.

Keywords: co-location, high-frequency trading, algorithmic trading.

JEL Classification: G10, G18, G23.

Introduction

The expansion of financial markets and the improvement of market quality have traditionally been driven mostly by technical advancements. The adoption of computer technology to automate the trading process has resulted in substantial changes to the structure of financial markets. In addition to the automation of financial markets, computer algorithms are increasingly widely used to support and make different trading choices. However, the server rooms of exchanges and other trading venues - where computers predominate- have become the new arena for investor competitiveness, replacing the trading floors of such venues. These days, traders' competitive edge depends on how fast and efficiently these computer-based algorithms operate. From a technological and financial perspective, recent developments like algorithmic trading (AT), high-frequency trading (HFT), and co-location services (COLO) have a big influence on investors and markets (Zhang & Riordan, 2011).

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Since the advent of fully automated trading platforms and completely computerised securities markets, scholars, regulators, and market participants have debated the direct and indirect consequences of this technological advancement on modern securities markets. From the year 2008 to 2010 India stock exchanges have witnessed a drastic technological advancement, which brings the paradigm shift into the Indian stock market. Similarly, shifting from outcry market to computerized trading brings new structural changes into the Indian market microstructure and attracted investors, traders and other market participants.

Moreover, in August 2009, NSE launched the co-location service, allowing brokers to host their servers in NSE's data centre. Of course, there was a fee for this service, and only large brokers could afford it. Co-location provides faster access to the stock exchange's pricing feed (buy/sell quotations). That is because the broker's server is directly adjacent to the stock exchange's server, thus data only needs to travel a short distance from the exchange server to the broker's server. This provided a significant edge to trading participants who used high frequency trading tactics[2].Co-location facility is a add Ons for the algorithmic trading (introduced in 2008) and high-frequency trading (introduced in 2009)[3] as it provides milliseconds speed to data feeds, and it can mean the difference between a lucrative deal and not being able to capture it at all. Because the co-located server receives the quote first, the deal is performed before the broker on a non-co-located server sees it.

In Indian stock exchange one of the most contentious topics is the influence of information flow speed on market quality at the National Stock Exchange (NSE). In particular, the NSE's co-location service and its unfair benefits for broking businesses who paid for it. In January 2015, it was claimed that select trading members got faster access to the price feed sent by the National Stock Exchange to members. A whistle-blower had written to market regulator securities exchange board of India (SEBI), describing flaws in the NSE's co-location system and how certain brokers had exploited them in cooperation with NSE staff. It was a complete failure of proper vigilance of Indian stock market regulator (Nanda, 2023), which further came up with an order penalising NSE, India's biggest exchange, several of its former officials, and various individuals and companies for exploitation of the NSE's co-location services. As a consequence, the exchange has been ordered to return back the part of the revenues earned via tick-by-tick data distribution between 2010-11 and 2013-14. This equates to Rs 625 crore plus a 12% interest rate starting in April 2014. In this study our main objective to perform empirical examination of the impact of this controversial topic so called "co-location scam[4]" on market quality measures, particularly liquidity and price discovery, for the period from 12th December 2012 to 11th December 2013 (1st year of co-location scam period) and from 12th December 2013 to 11th December 2014 (Second year of co-location scam period)[5]. The present study cover the co-location scam period which was started from 2012 to 2014, which gives the uniqueness of the data which has not been studied in the previous papers and ignored by the literature.

[2] https://www.moneycontrol.com/news/business/companies/explainer-nse-co-location-case-what-happened-faq-3985511.html

[3] https://www.nseindia.com/national-stock-exchange/history-milestones

[4] Brokers that use the co-location facility are provided information about the servers and ports through which they may connect to obtain the price feeds. Investigations discovered that numerous brokers utilised different IP addresses to access the systems. An IP address is a unique identifier for a device on the Internet or a local network. OPG Securities was accused of mapping numerous IP addresses to a single server so that it would receive the first two or three connections to that server, crowding out others. There were purportedly no policies and processes for allocating/mapping members' IP addresses to exchange servers, nor was there a Standard Operating Procedure to handle requests for changes in IP mapping to a specific server. OPG Securities was said to routinely connect to the backup server, also referred to as the secondary server, which had the least amount of demand. Such requests were left up to the judgement of the NSE's Project Support and Management Team. Despite being aware of this, the NSE did nothing to stop it.

[5] https://www.thehindubusinessline.com/blexplainer/all-you-need-to-know-about-the-nse-co-location-scam/article65058505.ece

1. Benefits and Consequences of the Technological Advancements

With the advent of the technological advancement in Indian stock market attracted numerous researchers examining the impact of these technological changes to the Indian stock market microstructure, particularly, algorithm trading (AT) and high-frequency trading (HFT) and its impact on the various market quality measures. there are two schools of thoughts regarding the technological changes. First, which suggests, positive associations with market quality and second, which suggest negative relationships. There are ample of studies focused on examining the relationship between technological advancements and its impact on market variables, particularly AT and HFT and their relationship between various market variables. (Mestel et al., 2018; Conrad et al., 2015; Chaboud et al., 2014; Frino et al., 2020; Seo and Chai, 2013;Hendershott & Riordan, 2013)

In the Indian context, Syamala & Wadhawa (2020) examine the algorithmic trading activities and its impact on the market qualities measures. The findings of their study suggest that algorithmic trading enhances the price efficiency in Indian stock market. Similarly, Iyer et al., (2019) by employing experts' interviews on algorithmic trading suggest that a AT enhance the market quality by reducing the market volatility. In line with the similar results in Indian context, Aggarwal and Thomas (2014) using tick-by-tick data examine the causal impact of algorithmic trading on market quality. The result of their study suggest that increased intensity of AT reduces the liquidity risk and also diminishes the flash crash scenarios. Kokane (2024) also highlighted the lawsuit focusses on governance difficulties that the National Stock Exchange (NSE), an esteemed stock exchange in India, is facing.

The issuing of co-location permits in 2010 marked the beginning of governance failure. The fraud was discovered in 2015 following a letter written by a prominent Indian journalist and a whistle-blower to the Securities Exchange Board of India (SEBI), the regulatory body. The broker's preferential licenses granted by the NSE were validated by Ernst Young's forensic audit. Other governance issues at the stock market were also found as a result of the probe, and in February 2022, SEBI fined the defendants. Mr. Ashish Chauhan became the next managing director and managing director (CEO and MD) of NSE in July 2022 after being chosen by SEBI.

Similarly, Kandukuri (2024) explained that In India, stockbroker scams are common and result in large financial losses for investor and expose the several questionable tactics used by stockbrokers to deceive investors in the recent past and the corrective measures that the market regulator has put in place to stop and identify fraud. Moreover, Li et al. (2024) investigates the effects of frauds in marketplace lending on investor confidence and attention. They discover that when the anomalous platform ratio rises, lenders become more likely to lose trust and withdraw investments. They grow increasingly worried about the hazards involved with marketplace lending and the broader sector. These symptoms are typically the result of severe scam circumstances.

A Further enhancement in the technology in Indian market like HFT also shows positive relationship with market quality measures (Agnihotri and Nagpal, 2019; Aggarwal and Thomas, 2014). Unlikely there are several researchers also suggest the negative associations among Algorithmic trading and high-frequency trading and market quality (Boehmer et al., 2021; Frino et al., 2017; Kwan et al., 2015; Bershova & Rakhlin, 2013; Kelejian & Mukerji, 2016; Zhang, 2010)

2. Co-location Scam and Market Variables

To comprehend the co-location fraud, we must first define co-location facilities. There are designated areas in the exchange building, directly adjacent to the exchange servers, for high-frequency and algo traders to put their systems or programs. Because the co-location facilities are so close to stock exchange servers, traders here have an edge over other traders owing to the reduced latency (time required for order execution). However, co-location is mostly employed by institutional investors and brokers for their proprietary trading. Retail investors have a small presence here.

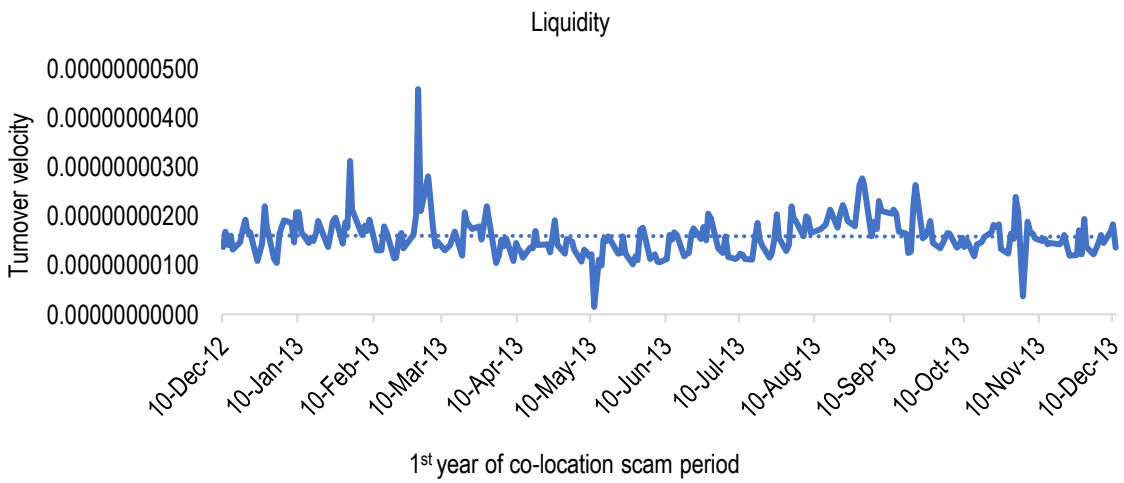
Co-location service provide the speed edge to the traders as it gives special facility of having trader's server near and close proximity to the exchange server. Being close to marketplaces is important. The first people to notice changes in the market are those closest to it. In the past, obtaining a seat on the exchange allowed one to acquire such proximity. These days, being close to an exchange means setting up trading servers there and signing up for direct data connections. Nearly ten years have passed since the fraud in NSE's co-location facility occurred. Between 2012 and 2014, OPG Securities, one of the trading members, was accused of receiving unfair access that allowed him to reach the secondary server first and obtain the data before other users in the co-location facility. Due to this member's special access, their algorithmic transactions were executed before those of other members.

For a price, several exchangers provide varying degrees of physical proximity and speed of access. Although co-location services save customers' latency and provide exchanges with income, it is uncertain if the market as a whole benefits from them. The connection between market quality and speed is of interest to scholars, investors, and policy officials. Speedier trading could minimise costs and frictions in the market, but it might also result in faster traders charging slower merchants more rent. To slow the market down, regulators have recommended adjustments to its structure. For example, minimum quote lives have been contested in certain markets but imposed in others (Jones, 2013). Scheduled periodic auctions have been proposed as an alternative to continuous trade (Budish et al., 2013). This article investigates how speed impacts market liquidity.

3. Indian Stock Market Behaviour During Co-location Scam Period

Figure 1a illustrates the daily observations of the total turnover velocity during the period from 12th December 2012 to 11th December 2013, which coincides with the scam period. The data in this figure suggests that there were no significant or drastic fluctuations in the liquidity levels at the National Stock Exchange (NSE) during this time frame. The total turnover velocity, which serves as an indicator of liquidity, remained relatively stable throughout the period, implying that the market did not experience major disruptions in terms of trading activity despite the alleged scam. This suggests that, contrary to expectations of heightened volatility or reduced liquidity during such events, the NSE's market operations continued with a consistent level of turnover, pointing to an overall resilience in the liquidity of the market during this challenging period.

Figure 1a: Liquidity during 1st year of co-location scam period[6] (Nifty-500 Index)



[6] According to SEBI's estimation, NSE's co-location business generated a profit of Rs 624.89 crore between 2010–11 and 2013–14. SEBI has ordered Narain to disgorge 25% of the salary drawn for 2011 to 13 to the IPEF after finding him guilty in the matter. In Ramkrishna's case, she has been requested to disgorge 25% of her financial year 2014 pay. For five years, she has also been barred from interacting with any listed businesses or market infrastructure organisations. https://moneylife.in/article/nse-colocation-scam-sebi-orders-disgorgement-of-profits-from-nse-and-salaries-of-former-mds-ravi-narain-and-chitra-ramkrishna/57040.html

Figure 1b: Liquidity during 2nd year of co-location scam period (Nifty-500 Index)

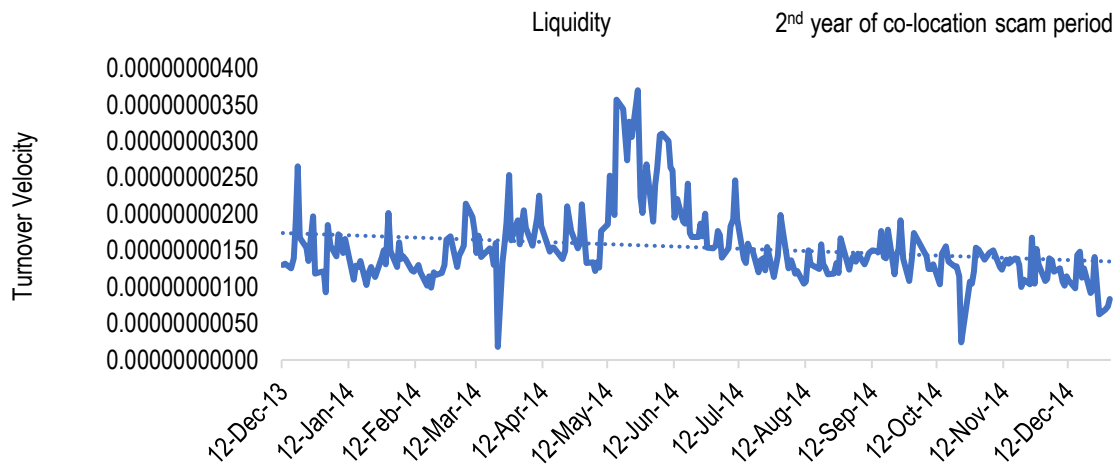


Figure 1b shows daily observations of the total turnover velocity during (12th Dec 2013 to 31st Dec 2014) scam period. Which suggest there is slight downward change in the liquidity at NSE.

Figure 2a: Market returns during 1st year of co-location scam period (Nifty-500 Index)

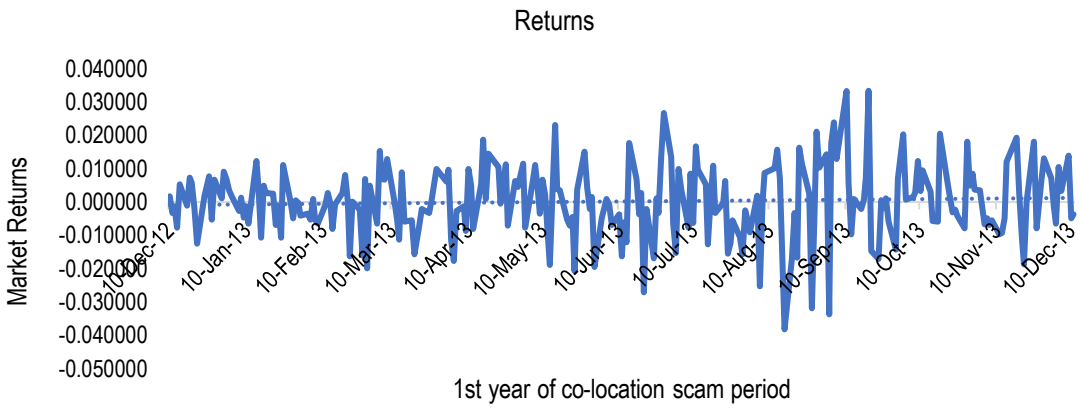


Figure 2a shows daily observations of the total market returns during (12th Dec 2012 to 11th Dec 2013) scam period. Which suggest there is no such drastic changes in the returns at NSE.

Figure 2b: Market returns during 2nd year of co-location scam period (Nifty-500 Index)

Figure 2b shows daily observations of the total market returns during (12th Dec 2013 to 31st Dec 2014) scam period, and we find quite similar changes in the returns at NSE.

Figure 3a. Price Volatility during 1st year of co-location scam period (Nifty-500 Index)

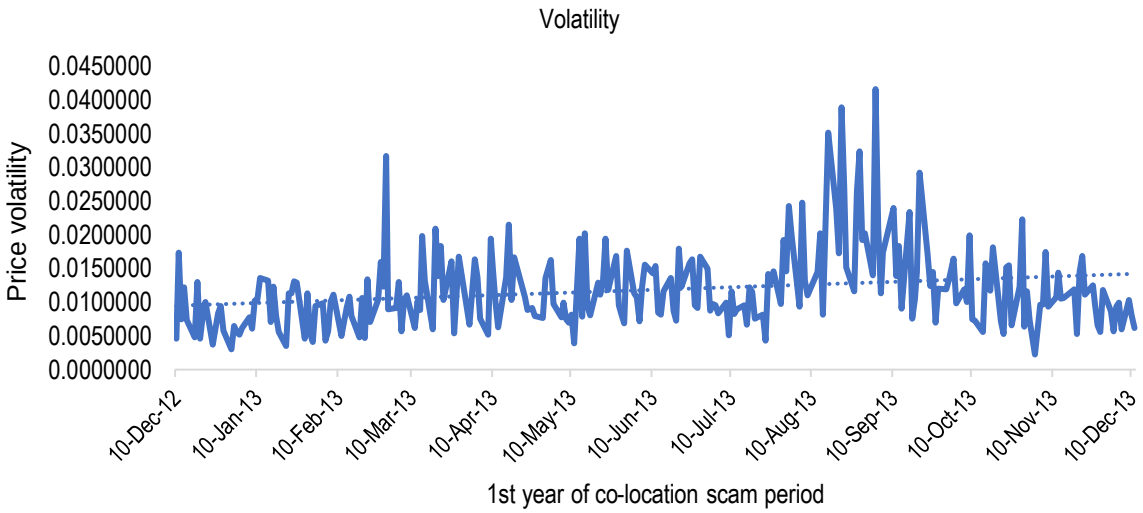


Figure 3a depicts daily observations of the price changes during (12th Dec 2012 to 11th Dec 2013) scam period, and we find upward changes in the volatility in the first year of the scam period at NSE.

Figure 3a Price Volatility during 2nd year of co-location scam period (Nifty-500 Index)

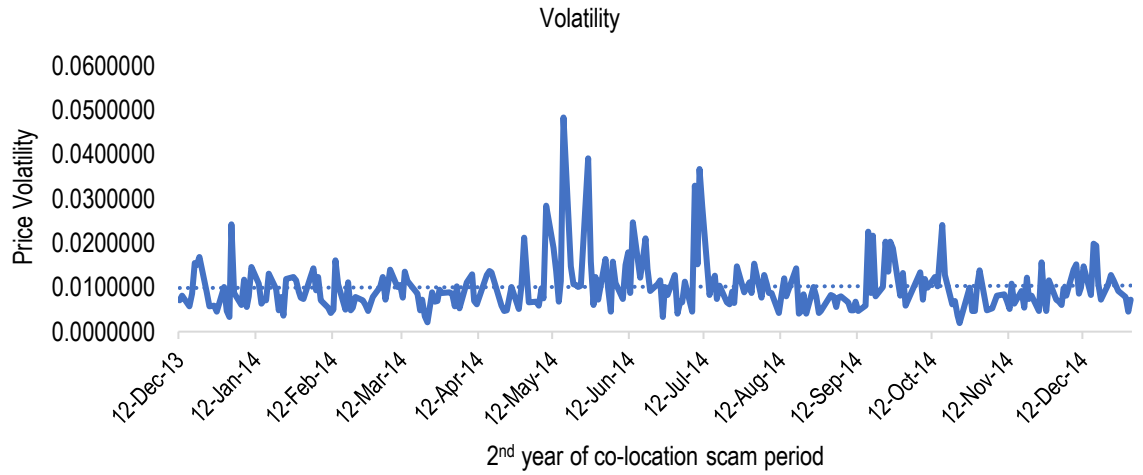


Figure 3b shows daily observations of the price changes during (12th Dec 2013 to 31st Dec 2014) scam period, and we find quite similar trend in price changes in the 2nd year of the scam period at NSE.

The above Figures 1a, 1b, 2a, 2b, 3a, and 3b show there is no such drastic fluctuation in these three stock market characteristics during the co-location scam period which suggest that the period from 12th December, 2012 to 31st December 2014 the scam period has not given any such benefits and edge of speed to the institutional traders and retail traders.

Conclusion

The financial market technological advancements (AT, HFT and co-location) and its impact on the market characteristics has been explored by the several authors, as these technological advancements are always for the betterment of the financial market growth, but there are some shortcomings of those advancements like co-location where NSE has been trapped as involvement of the scam co-location scam. This paper provides the

comprehensive overview of the co-location scam and its relationship with the financial market characteristics throughout the year of the co-location scam and suggest that there was no such scam, but it was a glitch of information load at servers at NSE. This paper provides insights to the institutional traders and market regulators as well as the retail traders that information flow and its speed matters, but it can go either way. The speed of transaction and information flow its intensity of speed matter but getting this service exchange charge certain amount which gives edge to those traders who has bought this service, so getting information in advance compared to the other traders with certain charges cannot be treated as scam.

Credit Authorship Contribution Statement

Harsh Raj Pathak wrote the first draft of the text, which was then vetted and modified for final content. He also prepared graphics and tables to highlight major points in the article and oversaw the research endeavour to ensure uniformity and academic rigour.

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Conflict of Interest Statement

The author certifies that the research was undertaken without any commercial or financial affiliations that could lead to a conflict of interest.

References

Aggarwal, N., & Thomas, S. (2014). The causal impact of algorithmic trading on market quality. http://hdl.handle.net/2275/323

Agnihotri, S., & Nagpal, A. (2019). The Impact of High-Frequency Trading on Market Quality: Testimony from Indian Equity Derivatives Market. *IUP Journal of Applied Finance*, 25(3).

Bershova, N., & Rakhlin, D. (2013). The non-linear market impact of large trades: Evidence from buy-side order flow. *Quantitative Finance*, 13(11), 1759-1778. https://doi.org/10.1080/14697688.2013.861076

Boehmer, E., Fong, K., & Wu, J. J. (2021). Algorithmic trading and market quality: International evidence. *Journal of Financial and Quantitative Analysis*, 56(8), 2659-2688. https://doi.org/10.1017/S0022109020000782

Budish, E., Cramton, P., & Shim, J. (2014). Implementation details for frequent batch auctions: Slowing down markets to the blink of an eye. *American Economic Review*, 104(5), 418-424. 10.1257/aer.104.5.418

Chaboud, A. P., Chiquoine, B., Hjalmarsson, E., & Vega, C. (2014). Rise of the machines: Algorithmic trading in the foreign exchange market. *The Journal of Finance*, 69(5), 2045-2084. https://doi.org/10.1111/jofi.12186

Conrad, J., Wahal, S., & Xiang, J. (2015). High-frequency quoting, trading, and the efficiency of prices. *Journal of Financial Economics*, 116(2), 271-291. https://doi.org/10.1016/j.jfineco.2015.02.008

Frino, A., Garcia, M., & Zhou, Z. (2020). Impact of algorithmic trading on speed of adjustment to new information: Evidence from interest rate derivatives. *Journal of Futures Markets*, 40(5), 749-760. https://doi.org/10.1002/fut.22104

Frino, A., Mollica, V., Monaco, E., & Palumbo, R. (2017). The effect of algorithmic trading on market liquidity: Evidence around earnings announcements on Borsa Italiana. *Pacific-Basin Finance Journal*, 45, 82-90. https://doi.org/10.1016/j.pacfin.2016.07.003

Hendershott, T., & Riordan, R. (2013). Algorithmic trading and the market for liquidity. *Journal of Financial and Quantitative Analysis*, 48(4), 1001-1024. https://doi.org/10.1017/S0022109013000471

Iyer, G., Jain, A., Gupta, A., Ahuja, B., & Shah, R. An Analysis of the Effects of Algorithmic Trading on National Stock Exchange. https://pramanaresearch.org/

Kelejian, H. H., & Mukerji, P. (2016). Does high frequency algorithmic trading matter for non-AT investors?. *Research in International Business and Finance*, 37, 78-92. https://doi.org/10.1016/j.ribaf.2015.10.014

Kokane, S. (2024). NSE: Corporate Governance Transgression. *Indian Journal of Corporate Governance*, 09746862241286277. https://doi.org/10.1177/097468622412862

Kwan, A., Masulis, R., & McInish, T. H. (2015). Trading rules, competition for order flow and market fragmentation. *Journal of Financial Economics*, 115(2), 330-348. https://doi.org/10.1016/j.jfineco.2014.09.010

Mestel, R., Murg, M., & Theissen, E. (2018). Algorithmic trading and liquidity: Long term evidence from Austria. *Finance Research Letters*, 26, 198-203. https://doi.org/10.1016/j.frl.2018.01.004

Seo, J. Y., & Chai, S. (2013). The role of algorithmic trading systems on stock market efficiency. *Information Systems Frontiers*, 15, 873-888. 10.1007/s10796-013-9442-9

Syamala, S. R., & Wadhwa, K. (2020). Trading performance and market efficiency: Evidence from algorithmic trading. *Research in International Business and Finance*, 54, 101283. https://doi.org/10.1016/j.ribaf.2020.101283

Zhang, F. (2010). High-frequency trading, stock volatility, and price discovery. Available at SSRN 1691679.

Jones, C. M. (2013). What do we know about high-frequency trading? Working paper. http://dx.doi.org/10.2139/ssrn.1691679

Zhang, S., & Riordan, R. (2011). Technology and market quality: the case of high frequency trading. https://aisel.aisnet.org/ecis2011/95

Kandukuri, R. (2024). An analysis of stockbroking frauds and regulatory action in India. *Journal of Financial Crime*, 31(4), 1037-1046. https://doi.org/10.1108/JFC-04-2023-0076

Li, J., Zhou, Y., & Hu, J. (2024). Unpacking the effects of scams in marketplace lending: investor confidence and attention. *Journal of Applied Economics*, 27(1), 2301797. https://doi.org/10.1080/15140326.2024.2301797