

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/310261822>

ALGORITHMIC TRADING: IS THE MACHINE TAKING OVER OUR EQUITY MARKETS?

Article · April 2016

CITATIONS

0

READS

6

1 author:



Ritesh Dubey

ICFAI Business School

4 PUBLICATIONS 1 CITATION

SEE PROFILE

Algorithmic Trading: Is the Machine Taking Over Our Equity Markets?

Ritesh Kumar Dubey

The quest for minimizing risk and maximizing returns has brought us to the advent of Algorithmic Trading (AT). AT is a rule-based (automated execution logic-based) system responsible for executing orders to buy or sell a given asset at a specific time, price and location (market venue). AT has witnessed a phenomenal growth in India in the last five years. This article examines the impact of AT on market quality and human trading behavior.

What Is Algorithmic Trading?

An algorithm is a set of instructions for accomplishing a certain task. So, a trading algorithm can be seen as a set of instructions for executing a trade. It appears to be quite simplistic, but with the use of complex execution logics, an algorithm can run through pages and also become cumbersome for humans to trade on them. With the use of computers and electronic trading platforms across various exchanges, today, we can incorporate some of the most complex trading algorithms and get them executed in fractions of a second. Algorithmic Trading (AT) can be defined as “a rule-based system responsible for executing orders to buy or sell a given asset” (Johnson, 2010). The rules of AT are predefined by the traders, in their algorithms, based on their trading strategy. The rules are based on time, price, quantity and other exchange-related regulations. As per the SEBI circular dated March 30, 2012, all the trading members are required to obtain prior permission of the exchange before providing the facility of AT to their clients. Hence, the algorithms are approved by the exchanges before they are allowed to trade on exchanges. Though the trading strategies might differ, the algorithms have to adhere to the order level checks (e.g., Price, Quantity/Value, Maximum cumulative pending order quantity/value, etc.), client level checks (e.g., Net position versus available margin) and RBI violation checks (e.g., FII restrictions, trading limit checks, etc.).

¹ Calculation based on average of exchange rate for the month of September 2012 (1USD = 51.415 INR). Source: <http://www.x-rates.com/average/?from=USD&to=INR&amount=1&year=2012>



Ritesh Kumar Dubey is currently pursuing his PhD from ICFAI Business School, (IFHE University) Hyderabad. His areas of interest broadly include Market Microstructure and Algorithmic Trading. He was a Visiting Scholar at Fogelman College of Business and Economics (FCBE), University of Memphis, Memphis, TN, USA, from August 2012 to May 2013. He is UGC Net (2012) qualified and currently teaches corporate finance and quantitative finance courses at IBS Hyderabad. He has published in journals listed in Scopus and Cabell's directories and has participated in national and international conferences. He has also industry experience in some of the leading MNCs like IBM, e4e Inc., etc.

In today's context, we can say that AT is a trading system which utilizes very advanced and complex mathematical models for making decisions on behalf of an investor in the financial markets. There are strict rules that determine the optimal time for an order to be placed, to be modified and to be canceled in such a way that it will cause the least amount of impact on the stock's price and also will ensure availability of liquidity for the investors. Yang and Jiu (2006) identify the same and state, "The relentless pursuit of lower transaction cost and market efficiency has led to increasing demands for sophisticated trading tools and algorithms. And, algorithmic trading is one of such tools."

Examples of AT Strategies

Some of the common trading strategies used by algorithmic traders are Time Weighted Average Price (TWAP), Volume Weighted Average Price (VWAP), arbitrage opportunities, pairs trading, moving average-based trading, trends-based strategies, index-based strategies, mathematical model-based trading strategies, strategies based on predictive analytics, market information-based trading, sniffing algorithms for identifying other traders' trading strategy thereby taking advantage of the same, etc. The strategies can be based on complex mathematical modeling or simple intuitive logic. It all depends on the traders' strategy.

A simple example of a trader's strategy can be directing the algorithm to buy any share which has gone below 52-week low and sell a stock if it touches 52-week high. Another strategy may be buying a stock if its 90-day moving average goes above the 240-day moving average and selling a stock when its 90-day moving average goes below the 240-day moving average. Recently, trading based on twitter trends has also been observed.

Why Would One Use AT?

There are various benefits of AT. And certainly AT has many advantages over human traders. The speed and accuracy of calculations and decisions based on complicated trading logics are certainly better in AT systems than human traders. Executing an order as soon as a security is

available, splitting orders, selecting different pools of liquidity and assimilating real-time information, etc. are a few more common advantages that we can think of over the traditional human traders. Efficiency and precision of trades are also certainly higher in algorithmic trades. Johnson (2010) provides an interesting comparison of various methods of trading (see Table 1).

Current Status of AT in India

AT has seen a phase in the developed markets. In the US markets, it has seen a phenomenal growth since its inception in the mid-1990s. Recently, AT has been allowed in India and it is observed that NSE is catching up with its Asian peers at a fast rate.² The use of AT across the world is widely

Table 1: Comparing Algorithmic and Manual (Non-Algorithmic) Trading

	Factors	AT	Manual
Efficiency	Capacity	***	*
	Speed	***	*
Usability	Control	*	*
	Transparency	*	*
	Anonymity	**	**
	Market Conditions	**	*
	Market Knowledge	***	***
Performance/Cost	Asset Knowledge	***	***
	Performance	**	**
	Commission	**	*
Other	Risk/Cost Control	**	**
	Regulations	**	**

Note: Graded from weakest (*) to strongest (***)

Source: Johnson (2010), *Algorithmic Trading & DMA: An Introduction to Direct Access Trading Strategies*, Myeloma Press. (Observation not based on any study)

Table 2: Advantages and Disadvantages of Algorithmic Trading

Advantages	Disadvantages
Reduced emotional errors	Mechanical failures
Ability to back test and simulate	Time to get algorithm approved by exchange
Enhanced discipline	Costly
Achieve consistency	
Increased order entry speed	
Diversified trading	
Multiple/Simultaneous trading strategies	

² "India's Catching up with Asian Peers in Algorithm Trade", *The Economic Times*, October 26, 2010.

accepted and observed. AT is thought to be responsible for almost three-fourths of the trading volume of US in 2009 (Hendershott *et.al.*, 2011).³ 60% of overall trades in Hong Kong and Singapore markets are done by using algorithmic strategies.⁴ Two-and-a-half years ago, “only 5% trades on the BSE used to take place using algo products, but this has now gone up to 25%”.⁵ AT is a recent phenomenon in India but still it accounts for 90% of volumes here.⁶

AT in India was launched by Credit Suisse’s Advanced Execution Services (AES) on June 22, 2009. The launch of AT was focused around the Indian equities. The momentum for AT in India was gained by the allowance of co-location facilities by NSE in June 2010. Co-location allows broker member servers’ to be placed side by side to the exchange server in order to reduce latency. It was aimed at reducing the time taken in the transmission of data (orders) from broker terminals to exchange servers. Since speed is the key for AT, most of the brokerage firms were adopted for the co-location of their server terminals. And there was 6 months’ waiting period for availing co-location facilities. By August 2013

on NSE in Nifty 50 stocks, more than 95% (20423.70 lakhs) of the orders had been placed using algos and more than 75% (484.00 lakhs) of the trades were algo trades (by frequency, Total Orders: 21379.27 lakhs; Total Trades: 641.12 lakhs)⁷. Trades on an exchange can happen in three ways: Algo trading with Algo (Pure Algo), Non-Algo trading with Non-Algo (Pure Non-Algo), and mixed trades, i.e., Algo trading with Non-Algo and vice versa (Partial Algo).

Pure algo has increased by a whopping 99.93% in just over a year’s period, whereas the growth in non-algo trades has been mere 34.44%. This also leads one to infer the growing role of AT in Indian market. AT is clearly dominating the trades, but is it leading to a decline of non-algorithmic trades (see Table 3, Sept-12 to Aug-13)?

The answer lies in the order-to-trade ratio. Order-to-trade ratio for algo orders is 42.20, in comparison to only 6.08 for non-algo orders. Order-to-trade ratio increased by 17% for algo orders during the period September 2012 to August 2013, which is a good sign for the market

Figure I: Current Status of AT in India*

	Month	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14
Month-wise Average Daily Turnover	Total Volume (in ₹ cr)	172843	207641	188343	227233	187400
	% AT Volume	18.23	19.89	17.73	19.22	25.18

* “High Tech Algo Trades Pick Up”, *Business Standard*, June 10, 2014.

Source: BSE and NSE Compiled by BS Research Bureau

³ “SEC Runs Eye Over High-Speed Trading,” *The Financial Times*, July 29, 2009.

⁴ “Brokers Upgrading to Algorithmic Trading for FI Clients”, *The Economic Times*, May 17, 2011.

⁵ “Worried, But No Plans to Ban Algorithmic Trading Products: SEBI”, *The Economic Times*, November 29, 2011.

⁶ “Indian Versus US Markets: Why a Domestic Market Expert Wasn’t Impressed by ‘The Wolf of Wall Street’”, *The Economic Times*, January 19, 2014.

⁷ Data analysis of NSE Order Level Historical Data provided by DOTEX, for Nifty 50 stocks in August 2013. Note: The author would like to thank IFHE University, Hyderabad, for funding of the Order Level Historical Data, obtained from DOTEX International Ltd. (100% subsidiary of NSE).

Figure 2: Change in Algorithmic Trading (Sept-12 to Aug-13)

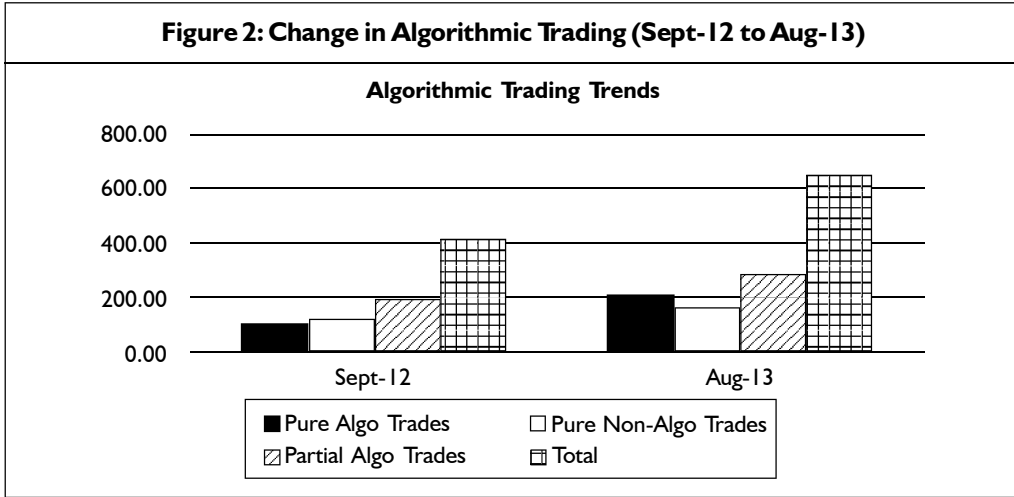


Figure 3: Change in Algorithmic Trading (Sept-12 to Aug-13)

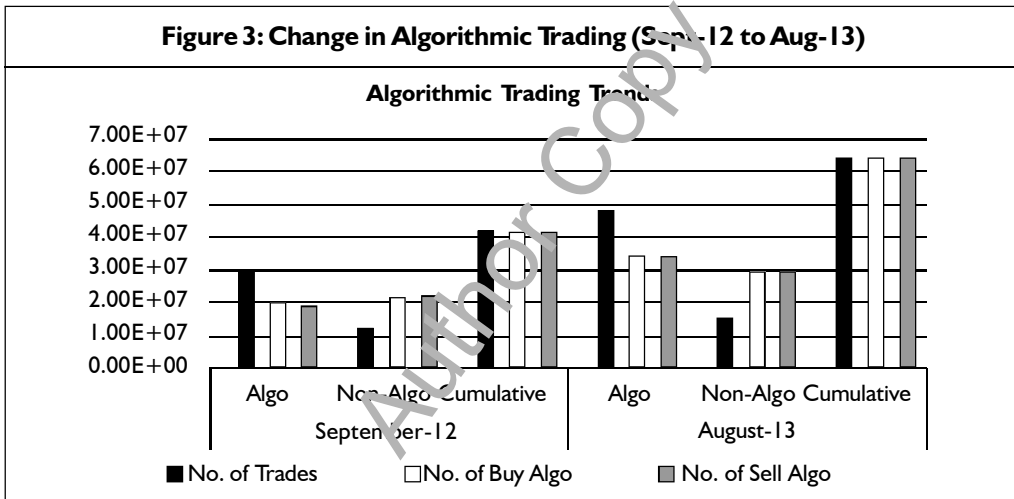
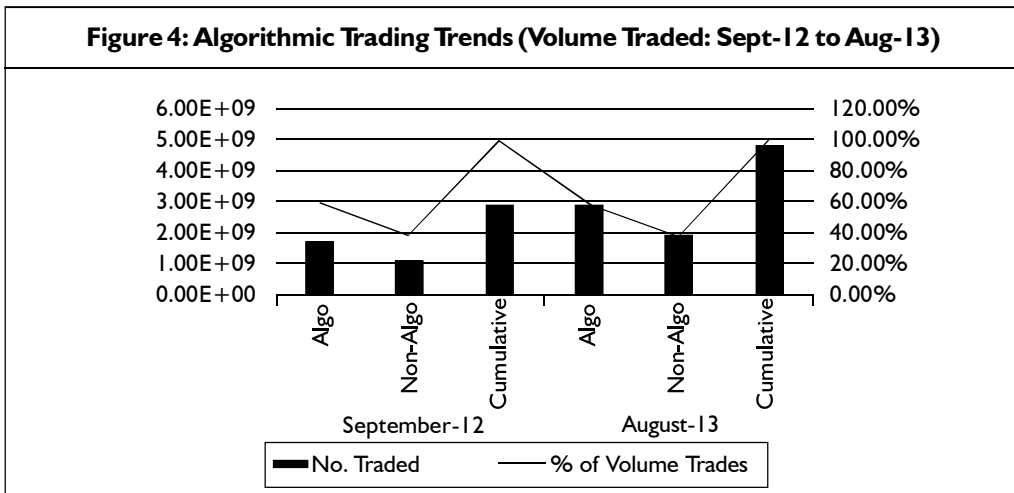


Figure 4: Algorithmic Trading Trends (Volume Traded: Sept-12 to Aug-13)



Values in lakhs (x 100000)	Change%
Pure Algo Trades	99.93
Pure Non-Algo Trades	34.44
Partial Algo Trades	46.26
Total	55.90

regulators.

The observations shown in Table 4 also reflect the decline in the volume of stock orders being placed by the non-algorithmic traders. The decline may be perceived as reduction in algo traders.

Given the expectation of high profits and the capability to reap benefits of high speed, it is bound to attract the investors towards AT and in the long run it might lead to decline of non-AT traders by a huge margin. This shift might be organic in nature due to technological

advancements and movement of retail non-AT traders from traditional form of trading to AT. But in the current scenario, investors with hefty technology budgets at their disposal are reaping the benefits of AT. The investment required for AT is huge. The cost of co-location goes to the tune of ₹20 lakh/rack. On top of it, there is speed/connectivity charge which may vary from ₹1 lakh to ₹10 lakh for an order connectivity speed of 40 msg/sec to 400 msg/sec. Apart from these, there are other costs for initial setup, broadband connectivity, IT support services, and also algorithm generation by specialists. Overall, it makes sense to invest in AT only for bigger players as they have the capacity to pay for these costs and also capability to hire good algorithm creators.

Risks of AT

The recent surge in the trading volumes using AT is also accompanied by the risk of episodic illiquidity and market crashes. The Flash Crash⁸, Knight Glitch⁹ and Muhurat Trade failures are


Comparing AT and Manual Trading									
Values in Multiples of 1,00,000 (x1 lakhs)	September-12			August-13			Change %		
	Algo	Non-Algo	Cumulative	Algo	Non-Algo	Cumulative	Algo	Non-Algo	Cumulative
Orders Placed	10761.15	754.07	11515.22	20423.70	955.56	21379.27			
Number of Trades	297.18	121.90	419.08	484.00	157.12	641.12			
Order-to-Trade Ratio	36.21	6.19	27.48	42.20	6.08	33.35	17%	-2%	21%

Comparing AT and Manual Trading							
Values in Multiples of 1,00,000 (x1 cr)	September-12			August-13			
	Algo	Non-Algo	Share of Algo	Algo	Non-Algo	Share of Algo	
Volume of Orders (Qty)	47175.04	2627.00	95%	114917.89	2356.27	98%	
Disclosed Volume (DV-Qty)	1623.73	174.61	90%	15199.23	123/98	99%	

⁹ Kirilenko *et al.* (2011) suggest that AT did not cause Flash Crash but they did worsen the volatility; Kirilenko A, A S Kyle, M Samadi and T Tuzun (2011), "The Flash Crash: The Impact of High Frequency Trading on an Electronic Market", Manuscript.

some of the recent examples of these types of risks. AT will have some impact on market quality and also on human trading behavior. The regulatory authorities will also face certain considerations about AT as to whether to encourage it or discourage it¹⁰.

The cases of Flash Crash, Knight Glitch, Muhurat Trade, etc. also indicate that if AT is not properly regulated and if proper risk mechanisms are not in place, then it may impact the market and investors in an unfavorable way. SEBI organized its first conference on AT on

January 27, 2014 to discuss the risks¹¹ of AT. This shows that AT has left investors and regulators worried. 

Disclaimer: The tables and figures, where source has not been indicated, have been computed and generated by the author based on the Order Level Historical Data made available by DOTEX International Ltd. (a subsidiary of NSE India Ltd.)

Reference # 05M-2016-04-07-01

RBI Worried About Trends in Algorithmic Trading in India: Report

The RBI is worried about the trends in algorithmic trading in India. With nearly 90% of the orders placed getting canceled, the RBI suspects foul play by some. Also, the more than doubling of total algo trades is also worrisome, says the central bank in the Financial Stability report issued on Thursday.

“The increased complexities of algorithm coding and reduction in latency due to faster communication platforms needs focused monitoring as they may pose risks in the form of increased possibilities of error trades and market manipulations,” the report says.

“The share of canceled Algo orders in the total orders in the total number of canceled orders is around 90% creates concerns relating to systemic risks.” Algo trading allows traders to use electronic platforms for entering trading orders with a computer program called algorithm with high frequency but without human intervention mostly. This was introduced in India in April 2008. Capital market regulator Securities and Exchange Board of India regulates it.

Volumes in Algo trading and High Frequency Trading (HFT) increased substantially in the cash segment of the Indian equity market to 40% of total trades in two stock exchanges till March this year from 17% (NSE) and 11% of trades (BSE) respectively, in 2001.

“There have been certain instances of abnormal market movements in India stocks, which have been attributed, by market experts, to algo trading/HFT,” it says. HTF is a special class of Algo trading, in which computers make elaborate decisions to initiate order based on electronically accessed information at a supersonic speed, much higher than humanely processed information.

Source: http://articles.economictimes.indiatimes.com/2015-06-26/news/63862310_1_algo-trading-high-frequency-trading-total-orders

⁹ “Loss Swamps Trading Firm”, *The Wall Street Journal*, August 2, 2012.

¹⁰ “Worried, But No Plans to Ban Algorithmic Trading Products: SEBI”, *The Economic Times*, November 29, 2011.

¹¹ The risks may be: (a) Alienation of small/retail investors, (b) risks of erroneous trades (Eg. Muhurat Trade Failure, Flash Crash, etc.), (c) regulatory checks and balances are not in the tune of highly tech-savvy algorithms, (d) manipulation of markets and stock prices.