The Possibilities and Limitations of Algorithmic Trading

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When nothing is sure, everything is possible.
Margaret Drabble

Introduction

Algorithms have long been used by the capital markets industry. In the beginning, and still today, algorithms are created on spreadsheets by some and other more complex methods are used by others. What has evolved is not necessarily the tool used to do the programming, but the complexity of the algorithm itself, both in terms of technological requirements to execute the algorithm and the intelligence weaved into the program.

Multiple markets and the ever evolving market microstructure globally, require algorithms to be intelligent - built with the programmer’s knowledge and an extensive decision tree to provide for when the computer meets or doesn’t meet various parameters. There must also be disparate algorithmic strategies so as not to be seen in the books of the proliferating venues that are queried for liquidity.

Algorithmic trading falls into two very general categories:
- Firms with a sole strategy to algorithmically execute all of their trades; and
- Firms that enhance their trading desk with algorithms as an alternate trading tool.

Algorithm-only firms are typically called high-frequency traders (HFTs). Though to trade often may not be their strategy, their tendency to ping multiple markets and do so at a very high speed has these buy-side (typically) firms labeled as such. The sell-side, not to be left behind is or already has set up ‘HFT’ desks in jurisdictions where it is permitted.

High Frequency Trading Defined

What exactly is High Frequency Trading (HFT)? Is HFT good for the market or is it synonymous with toxic order flow? Does it fly in the face of anti-competition laws? How many different HFT strategies are there and what differentiates them? These are just some of the burning questions this type of trading is faced with every day. The main reasons high frequency trading has garnered so much attention in recent months is the misappropriation of terminology, a significant amount of confusion regarding key definitions and the fact that the use of HFT has ballooned over the course of the last couple of years. A better understanding of high frequency trading, its history and the technologies that underpin its implementation would go a long way toward ensuring it retains a productive position in today’s highly evolved capital markets.

A key point of clarification - HFT firms typically do not manage other people’s money, they take on the risk with their own money. More often than not, they are proprietary traders, and for most, their modus operandi is to generate profit by seeking out inefficiencies in the market.
Using complex, quantitative trading models, these traders often execute hundreds, if not thousands, of trades per day.

Another tranche of high frequency traders, known as Electronic Liquidity Providers (ELPs), take a slightly different approach and will sit passively in the order book so they can collect a rebate for providing liquidity. Regardless of the technique, with the potential to turn huge profits, it’s no surprise that we have witnessed a virtual explosion in the number of high frequency trading firms around the world. And exchanges and ECNs are happily wooing their business.

Fantasy versus Reality

**Fantasy**  
High frequency traders are a new market phenomenon.

High frequency traders have been around for at least a decade in other asset classes depending upon your definition. It is only recently that they entered the equity markets and consequently, the spotlight. In the United States, estimates are that high frequency trading currently accounts for approximately 60-70% of all stock trading. Three or four years ago that number was more in the range of 20-30%. In Canada, high frequency trading currently accounts for an estimated 40-45% of all stock trading. Algorithmic trading solely among the buyside (Canada, US, UK) using DMA (direct market access) accounts for 43% of their volume on average in Canada’s market as indicated in Forefactor’s Investment Technology 2011 research study.

**Reality**  
High frequency traders have faster technology than traditional asset managers.

We know from classic economic theory that markets are not perfect. High frequency trading firms have found innovative ways to identify where the market imperfections are and by inputting complex quantitative trading models into a hydrogen cooled nanochip, are able to quickly capitalize on those opportunities at unprecedented speeds. There is nothing illegal going on here, simply a competitive edge.

**Fantasy**  
In the event that regulators disallow sponsored access, high frequency trading firms will no longer exist.

The short answer is “untrue.”

There is worry that a lack of oversight and risk control with respect to sponsored access – especially the “naked” variety - could allow for suspicious trading activity, and for that reason, regulators are keeping a close eye. If regulators were to ever disallow sponsored access, Forefactor believes that HFTs will acquire their own broker number and utilize proximity hosting (i.e. trading technology is located close to the trading venue), but not directly on the premises. This would still allow for fast execution, with the added benefit of being able to follow liquidity as it changes from venue to venue.

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1 Rosenblatt Securities.
2 Forefactor Inc., 2011
Sponsored access or no sponsored access, the reality is, high frequency trading firms are here to stay and evolve.

**Going Forward**

Like any trading strategy, high frequency trading has good days and bad days, and not all high frequency traders are making money hand over fist. It is a real trading strategy based on innovative technology. It comes with its fair share of problems and risk, and it has pros and cons. Does it require more education and regulatory oversight? The answer is probably yes. At the very least, as trading strategies continue to evolve, high frequency trading firms should be routinely invited to the regulatory discussion table so that they can participate in the ongoing debate.

Algorithm trading, more generally speaking, is used pervasively across the entire capital markets community. It is used by most asset management firms and broker dealers for an abundance of reasons.

The limitations:

- **Human behaviour.**
  Many traders remain uncomfortable with computers executing their orders and will continue to provide a plethora of excuses for not using them (i.e. they are too much work to watch, a block is easier; there is less market impact when trading with brokers; they get more colour from brokers; I can bypass the HFTs and toxic flow if I trade upstairs; I want to be number one on my broker’s call list). This behaviour will continue to limit the growth of HFT as they strive to retain upstairs, block markets.
  Traders that require capital are also very aware that they need their brokers. Given that algorithmic trading can be as low as a sub-penny in pricing, it does not pay the brokers to the degree that many buy-side participants believe will continue to procure the capital they need and access to the IPOs, etc. that they want a part of.

- **Capital and resource intensive.**
  A significant technological investment is required to trade algorithmically and even more so to high-frequency trade.
  There is, so far, a relatively small pool of computer science talent that is equipped to program algorithms. The issue, as we understand it, is that computer programmers are not hard to come by but finding those that also understand capital markets is more of a challenge.

- If the regulators evaluate and discover that algorithmic trading has a negative impact on the marketplace, their ensuing regulations may make it more difficult to utilize that trading strategy.

The limitations and possibilities are inextricably linked. It was challenging to categorize the variables as one or the other.
The possibilities:

- The entire market may reach a place where all technological communications travel at the same or nearly the same speed which would eliminate one of the HFTs key strategies (i.e. get there before the other guy) but is likely to promote further technological evolution in the capital markets community.

- Increased globalization. Computers and therefore, algorithms, eliminate boundaries and provide the buy-side with the ability to access a market they may have little information on. In the past, there was a great degree of dissatisfaction among the buy-side when accessing opaque or oligopolistic marketplaces; algorithms and direct market access have the ability to appease concerns about being gamed.

- Almost everyone is accessing multiple algorithm strategies for trading into Canada. On average 5.8 different strategies are being employed. There are no differences by country on this measure. This chart demonstrates the increasing prevalence of algorithm strategies in the trader’s toolbox. As traders become more comfortable in their comprehension of how various algorithms work, so too will their use of them increase.

Figure 52: Number of DMA Algorithm Strategies Used

<table>
<thead>
<tr>
<th>Number of Strategies</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>One - Two</td>
<td>9%</td>
</tr>
<tr>
<td>Three - Four</td>
<td>27%</td>
</tr>
<tr>
<td>Five - Six</td>
<td>28%</td>
</tr>
<tr>
<td>Seven+</td>
<td>36%</td>
</tr>
</tbody>
</table>

Average number of DMA algorithm strategies – 5.8

Base: Respondents using DMA algorithms (n=67)
Source: Forefactor, Investment Trading Technology 2011

- The evolution of artificial intelligence. If the world of technology arrives at the point where computers are able to think for themselves (i.e. without man-made programs), the investment industry would be altered to such a great extent, it may offer investors an increased ability to impact their portfolios through superior trading. It may also eliminate volatility which aids the trading community in generating revenue.

Summary and Conclusions

The limitations or possibilities of algorithmic trading are largely dependent upon human behaviour. As it pertains to the regulation of the market, the creation of new algorithmic strategies, the desire to adopt – in essence, the ability to accept and embrace change – all of these factors tie back to human decision and action. Risk plays a large part in the human comfort with change. In the trading world, when the buy-side trader gives the trade to a broker, he is absolved of the risk associated with the trade. When he/she decides to trade an order himself/herself, the risk of the trade and its success or failure measured against specific benchmarks, resides squarely on that individual. The advantage is control over the trade – the disadvantage is control over the trade. Traders have to get past the inherent compulsion to control an order (or not) and avoid risk at any cost. By choosing one algorithm over another, he/she maintains control and the parameters are set, altered, or not, by him/her.

Oddly enough, human behaviour is what many programmers are trying to correct when developing algorithms – sudden reactions to qualitative market events that may be detrimental to the entire marketplace. Flash crashes are a testament to this type of behaviour. The Flash Crash in the US on May 6, 2010 is still shrouded in mystery; what is not a mystery is the fact that traders reacted to a rapidly dropping market and increased the chaos. In Canada, where news of the crash took one full minute to arrive, there was no market movement whatsoever because, by the time the participants became aware of what had happened, it had recovered. Now, all markets know that there are mini flash crashes every day and simply ignore them – it is a market behaviour born of algorithms and now understood by the trading community.

So, for those that make the argument that a computer makes better decisions because they are not impacted by fear of risk or specific news, they may have a point. However, we must not forget, it is man that creates the algorithms and one significant flaw is that many of them are based on the past, the other is that no matter how hard you try to eliminate human bias, you cannot. In a marketplace that will never be the same and evolves faster than anyone is able to track it, a marketplace where we tentatively walk into unfamiliar territory, there is only one solution - trial and error.