

Is Australia Safe From the Dark Side of High Frequency Trading?

The increasing use of algorithmic trading¹, where orders are executed in milliseconds, creates greater opportunities for High Frequency Trading and 'Dark Pools'². With the emergence of these phenomena, there is a greater risk of 'flash crashes'³ and no market can be complacent. New risk models have to be developed, harnessing multidisciplinary expertise and high performance computing, even for seemingly unaffected markets such as Australia. We explore this point of view in the context of a recent survey in Australia.

Introduction

Since the Flash Crash of the US S&P index⁴ in May 2010, High Frequency Trading (HFT) and cross-engine systems (commonly referred to as Dark Pools) have come under the scrutiny of academic researchers, regulators as well as the financial analysis community. In March 2013, the Australian Securities and Investments Commission (ASIC) released an exhaustive report⁵ on the state of high frequency and dark liquidity trading based on the work of two internal taskforces since mid-2012.

HFT accounts for about 32% of the total equity trades in the Australian market. Trading through Dark Pools or Dark Venues, accounts for nearly 7% of the total equity market shares in Australia. (Comparative figures for the US are: HFT almost 50%; trading through crossing systems 13.4% of the total equity market shares.)

ASIC, the frontline supervisor of Australian licensed markets proactively studied the structural and behavioral changes in its markets. It has assured the Australian financial community that the reasons behind the largely negative perception of HFT and Dark Pools in the US are, with notable exceptions, inapplicable to Australian markets.

The report said that the majority of high-frequency traders in Australia currently have holding times of above 30 minutes, compared with holding times of milli- or even sub-milliseconds in the US. It also said that it found no "systemic manipulation" or predatory behavior from high frequency traders in Australia.

Context to the Report Findings on the Integrity of the Australian Market

ASIC has convinced its investors of the integrity of the Australian market. During its study, it noted, that follow ups were necessary only for some "discrete incidents". We analyze the likely factors that led to this confidence.

The nature of the study: The ASIC's analysis was based on data from a time period marked by relatively low volatility. It may not have included sufficient data related to the microstructure of rare events. (US regulators noted in a special fact-finding report that the Flash Crash of May 06, 2010 occurred "in the backdrop of unusually high volatility and thinning liquidity")

The evolutionary stage of the market: The Australian market is relatively young and is dominated by fundamental investors. Australian high frequency traders operate more or less in lockstep with fundamental investors. For example, most high frequency traders as well as fundamental traders have a comparable order-to-trade ratio of 4:1.

Regulatory Compliance: Major banking institutions such as CBA and ANZ run the largest crossing systems. This brings a greater degree of due diligence in the way these crossing systems function and is quite different, historically, from how Dark Pools started in the US.

¹ Algorithmic trading, broadly speaking, is the use of automated algorithms to buy and sell securities and other financial instruments using preset benchmarks related to timing, price as well as volume. A closely related notion is that of high-frequency trading where automated algorithms buy, sell or place orders for the same at the time-scales much smaller than human response times. In the recent years, algorithmic trading have also been taken to mean the deployment of artificially intelligent trading algorithms in financial markets

² A type of trading platform that allows large blocks of shares to be traded without the prices being revealed publicly until after trades are completed. – Mary Watkins, Financial Times

³ Flash Crash was a United States stock market crash on Thursday May 6, 2010 in which the Dow Jones Industrial Average plunged about 1000 points (about 9%).

⁴ S&P Index is The Standard & Poor's stock market index based on the market capitalizations of leading companies publicly traded in the U.S.

⁵ Report 331 – Dark Liquidity and High Frequency Trading ([http://www.asic.gov.au/asic/pdf/lib.nsf/LookupByFileName/rep331-published-18-March-2013.pdf/\\$file/rep331-published-18-March-2013.pdf](http://www.asic.gov.au/asic/pdf/lib.nsf/LookupByFileName/rep331-published-18-March-2013.pdf/$file/rep331-published-18-March-2013.pdf))

Considering the context of the report, the findings are good for the present. But we go on to evaluate some of the foreseeable challenges that the Australian investors will face as the market evolves, and discuss possible approaches to avoid resultant 'flash crash' like scenarios.

Foreseeable Challenges from HFT

- 1 **Tension between genuine investors and high frequency traders:** Algorithmic trading is all set to grow. This leads to decreasing latency of trading systems. Decreasing holding times in periods of extreme volatility will have a negative impact. Retail investors will most likely be 'pushed out' of the market. Australian investors tend to adopt value-based positions to a large extent. How can banks and other trading entities reconcile this demand for value with the intrinsically different drivers of algorithmic trading?
- 2 **Dark Pools evolve from accepted practice to a risky one:** It is important to note that, historically, Dark Pools were simply yet another venue for trading within the 'rules of the game', mirroring the exchange-based system. So, even if currently dark pools are a small part of the trade and not a worry factor, they may not remain so.
- 3 **Shocks can come from within:** Conventional financial theory holds that the strongest component of a sudden jump in the price of any asset is a large exogenous shock in the form of new information. However, sustained research by Didier Sornette of ETH Zurich and his associates has disproved this theory. In the decomposition of a price signal, the endogenous component (due to noise trading in the form of herding and other imitative behavior) can cause significant changes in volatility.
- 4 **More advanced technology, faster algorithms:** The only way for one market player to 'contain' the deployment by another of an automated, artificially intelligent trading algorithm is to deploy an incrementally more powerful algorithm for the same purpose. With sufficiently large number of iterations, this will push the market into a fully algorithms-driven state. In the absence of a strong regulatory disincentive for the introduction of sophisticated and automated trading algorithms by players, both in the dark and lit markets, Moore's Law⁶ of computing combined with recent progress in the development of artificially intelligent systems, a complete transformation of the landscape of financial markets is on the cards.

Towards a Solution

So how should the Australian market prepare for risks? We suggest usage of a conceptual and technical framework to understand the issues of HFT and the structure and function of dark trading venues in financial markets. The framework must take into consideration the recent developments in complex systems theory, econophysics and high-performance computing solutions for financial markets. It should aim at:

- **Prediction of Flash Crashes:** Much can be learnt from Sornette's work⁷ which shows that financial crashes, far from being outliers, have special signatures. In particular, they generally take years to build up and the pre-crash market dynamics can be modeled in a very specific way. Vladimir Filimonov and Sornette have developed a mathematical model using a specific decomposition of the price signal. The model shows that endogenous market behavior can cause such events.
- **Research on risk measures specific to HFT:** As markets move towards very high-frequency trading, newer risk management models in tune with the markets should be developed. The 'Volume Synchronized Probability of Informed Trading' (VPIN) model developed by David Easley, Marcos Lopez de Prado and Maureen O'Hara is one such example. It has proved fairly effective in gauging illiquidity in markets through order-flow toxicity.
- **Use of High-Performance Computing (HPC)-based 'Early Warning Systems':** As holding times decrease to the millisecond and sub-millisecond scale, regulators as well as financial entities would need to analyze a deluge of data as part of their risk management programs. Following the Flash Crash, the US Department of Energy's Lawrence Berkeley National Laboratory initiated a program to leverage its considerable supercomputing prowess to analyze very high throughput data towards the development of an 'Early Warning System' for market crashes. The agenda of the Center for Innovative Financial Technology was to use HPC to:
 - Monitor financial stability with prospective large-scale models of financial markets,
 - Leverage supercomputing to validate newer systemic risk measures such as VPIN,
 - Predict anomalous events such as the Flash Crash and
 - Validate financial regulatory analysis.

⁶ An axiom of microprocessor development usually holding that processing power doubles about every 18 months especially relative to cost or size" Merriam Webster

⁷ An accessible introduction to Sornette's ideas is his book "Why Stock Markets Crash", Princeton University Press, 2003.

Banks and other financial entities have much to gain from the adoption of such HPC-based systems to monitor risks specific to HFT and trading through crossing systems.

Conclusion

Much of the challenge in HTF comes with technology disruptions – cheaper hardware, better connectivity, powerful AI based applications. The solutions to the challenges too must take advantage of technology, especially of High Performance Computing. Also, markets analysis today is interdisciplinary work. Financial institutions ought to pay attention to the convergence between computer scientists, information technologists and trading and risk management practitioners. Market complexities will increase, but we must devise new frameworks for assessing them. No market can be complacent where there is lure for millions to change hands in milliseconds.

About the author

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