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IIROC Study of High Frequency Trading – Phase III – Publication of Three Academic Papers

Executive Summary

IIROC is publishing academic papers prepared by three of the four academic teams selected by IIROC to assess the impact of high frequency trading (HFT) and related activity on Canadian equity markets. We expect the remaining two papers from the fourth team to be published by the summer of 2015.

On December 12, 2012, IIROC published its HOT Study¹, which summarizes the results of Phases I and II. On May 2, 2013, IIROC published a Request for Assistance² (“RFA”) for Phase III of its Study of High Frequency Trading Activity on Canadian Equity Marketplaces (the “HFT Study”). The RFA generated significant international interest. IIROC selected the four teams after reviewing nineteen comprehensive projects submitted by seven respondent groups and negotiating terms to ensure the protection and confidentiality of all data.

¹ See IIROC Notice 12-0373 – [The HOT Study: Phases I and II of IIROC’s Study of High Frequency Trading Activity on Canadian Equity Marketplaces](#)

² See IIROC Notice 13-0125 – IIROC Study of High Frequency Trading – Phase III – Request for Assistance



In response to industry and public anticipation surrounding the results of the HFT Study, IIROC is publishing the papers without internal review or commentary. The papers are published as they were provided to IIROC by the authors. French translations of the papers will be published by January 31, 2015.

IIROC made available to the teams, through appropriately secure access, a unique dataset containing all messages received by IIROC from all Canadian equity trading venues in the period January 1, 2012 through June 30, 2013, with masked market-, broker- and user attribution to protect confidentiality.

This Study will complement other initiatives already adopted by IIROC to govern high frequency and algorithmic trading. In particular, in 2013 IIROC issued [guidance on manipulative and deceptive trading](#). Surveillance alerts have been implemented and IIROC is actively monitoring to detect these rule violations.

IIROC will review and discuss all of the papers internally, and with other regulators and key stakeholders, before determining what, if any, regulatory response may be required in light of the findings. We are also exploring opportunities for the authors to present their findings, and for interested stakeholders to debate their implications, in a public forum. In the interim, IIROC welcomes comments from interested stakeholders.

IIROC continues to work on its own internal research, focussed on the identification of HFT and other Participants and their activities, and will continue to build upon the foundational work outlined in our paper entitled “Identifying Trading Groups – Methodology and Results³” published in September 2013.

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³ See IIROC Notice 14-0210 – [Identifying Trading Groups – Methodology and Results](#)



1. Background

IIROC has been recognized as a self-regulatory organization by each of the Canadian provincial securities regulatory authorities, and as such, is authorized to be a regulation services provider for the purposes of National Instruments 21-101 and 23-101. As a regulation services provider, IIROC administers and enforces trading rules for the marketplaces that retain our services⁴.

IIROC has undertaken a study of certain trading behaviours associated with high frequency trading (“the HFT Study”). The HFT Study consists of three phases:

- Phase I – the identification of a study group for Phase II;
- Phase II – a detailed descriptive statistical analysis of the trading activity of the study group on Canadian equity marketplaces; and
- Phase III – a study of the impact of HFT on Canadian marketplaces with respect to market quality and market integrity.

On December 12, 2013, IIROC published “The HOT⁵ Study”⁶ which summarizes the results of Phases I and II of the HFT Study. The HOT Study did not attempt to define HFT. Rather, Phase I statistically identified an outlier group of trader user IDs with a high order-to-trade ratio (one of the key characteristic commonly associated with HFT activity) to establish the “HOT Group”. The HOT Group encompassed a wide range of participant types who directly trade electronically on the market through a Direct Market Access (“DMA”) arrangement with a Canadian dealer, dealers engaging in proprietary trading, dealers trading on behalf of their clients, and dealers engaging in specialist trading / market making for Exchange-Traded Funds and Notes (“ETFs/ETNs”) and other listed securities (“HOT Users”). Appendix A includes the key findings of the HOT Study.

Since the publication of the HOT Study, IIROC has created a data repository, the Equity Data Warehouse, which enables us to perform detailed monitoring of trends and patterns in the Canadian marketplaces. We have continued to refine the identification of specific groups of participants, looking at individual user attributes (such as order life, inventory management,

⁴ Presently, IIROC has been retained to be the regulation services provider for: Alpha Exchange Inc., Canadian National Stock Exchange (“CNSX”), Toronto Stock Exchange (“TSX”) and TSX Venture Exchange (“TSXV”), each as an “exchange” for the purposes of the Marketplace Operation Instrument (“Exchange”); and for Bloomberg Tradebook Canada Company, Chi-X Canada ATS Limited, Instinet Canada Cross Ltd., Liquidnet Canada Inc., Omega ATS Limited, TMX Select and TriAct Canada Marketplace LP (the operator of “MATCH Now”), each as an alternative trading system (“ATS”). CNSX presently operates an “alternative market” known as “Pure Trading” that is entitled to trade securities that are listed on other Exchanges and that presently trades securities listed on the TSX and TSXV.

⁵ HOT refers to “high order-to-trade” ratio.

⁶ See IIROC Notice 12-0373 - Administrative Notice – General – UMIR - *The HOT Study: Phases I and II of IIROC’s Study of High Frequency Trading Activity on Canadian Equity Marketplaces* (December 12, 2012).



order types and marker usage, and others) and continue to explore a variety of approaches to defining and measuring market quality and integrity.

In November 2013, IIROC published “Market Quality in a Changing Environment”, a presentation given at the 2013 OSC/IIROC Market Structure Conference which provided both an update on IIROC’s approach to identifying HFT, and some preliminary insights into three market structure issues: (1) intermediation by HFT; (2) the impact of the repeal of the short sale tick test; and, (3) the impact of the new Dark Liquidity Rules introduced on October 15, 2013.

In September 2014, IIROC published a further study entitled “Identifying Trading Groups – Methodology and Results” which outlines IIROC’s recently-developed approach, using a “supervised machine learning” method, to identifying distinct groups trading on the Canadian equity markets.

2. Phase III of the Study

On May 2, 2013 IIROC requested assistance from interested outside parties with demonstrated expertise in the area of equity market structure to assist in Phase III of the HFT Study, assessing the impact of HFT on the integrity and quality of the Canadian equity markets.

2.1 The Teams

The RFA generated significant international interest. IIROC selected the four teams after reviewing nineteen comprehensive projects submitted by seven respondent groups and negotiating terms to ensure protection and confidentiality of all data. The teams are:

1. Jonathan Brogaard (“Brogaard”), Foster School of Business, University of Washington; Terrence Hendershott (“Hendershott”), Haas School of Business, University of California – Berkeley; and Ryan Riordan (“Riordan”), Queen’s School of Business, Queen’s University, Canada⁷.
2. Andriy Shkilko (“Shkilko”), Wilfrid Laurier University, Canada; and Ryan Riordan (“Riordan”), Queen’s School of Business, Queen’s University, Canada⁸.
3. Robert Korajczyk (“Korajczyk”), Kellogg School of Management, Northwestern University, Evanston, Illinois; and Dermot Murphy (“Murphy”), University of Illinois, Chicago⁹.
4. Andreas Park, University of Toronto, Canada; Katya Malinova, University of Toronto, Canada; and Carol Comerton-Forde, University of Melbourne, Australia¹⁰.

⁷ See IIROC News Release dated April 23, 2014 – “IIROC announces Academics for HFT Impact Study”.

⁸ Op cit.

⁹ See IIROC News Release dated May 27, 2014 – “IIROC announces third project team to study impact of HFT”.



2.2 Data

IIROC made available a unique dataset, which can be used to investigate specific trading behaviours, to the teams to further the purposes of the study. The dataset contained all order messages, quote updates and trades from all Canadian equity trading venues, including private data that is not available via public feeds. For reasons of confidentiality, all market-, broker- and user attribution was masked. The dataset was available for use only through appropriately secure access.

The dataset encompassed all data provided to IIROC through Canadian marketplace regulatory feeds in the period January 1, 2012 through June 30, 2013. This period covers a number of significant events; among them:

- IIROC’s new Fee Model implementation¹¹;
- the introduction of new Dark Liquidity rules¹²;
- the repeal of the short sale tick test and implementation of the Short-Marking Exempt (SME) marker¹³; and
- the introduction of new order types by several marketplaces.

2.3 Research Papers

IIROC is publishing the papers as they were provided to IIROC by the authors.

The first paper, co-authored by Korajczyk and Murphy, is entitled “[High Frequency Market Making to Large Institutional Trades](#)”. The authors examine the behaviour of HFT firms during times of market stress, where the execution of large institutional trades, particularly those that comprise a high percentage of trading volume, is used as a proxy. They compare the behaviours of HFT firms and traditional Designated Market Makers and examine how these relate to the execution costs of large trades.

The second paper, co-authored by Brogaard, Hendershott and Riordan, is entitled “[Market Integration and High Frequency Intermediation](#)”. The paper examines the role of HFT firms in integrating fragmented markets, including their role in transmitting information, liquidity provision, contagion, and risk (inventory) management across multiple trading venues.

The third paper, co-authored by Shkilko and Riordan, is entitled “[The market quality effects of the 2012 UMIR amendments to the short selling rules in Canada](#)”. The paper examines the

¹⁰ See IIROC News Release dated October 17, 2014 – “IIROC announces final project team to study impact of HFT”.

¹¹ See IIROC Notice 12-0043 – Administrative Notice – Notice of Approval – *Approval of Integrated Fee Model* (February 3, 2012).

¹² See IIROC Notice 12-0130 – Rules Notice – Notice of Approval – *UMIR - Provisions Respecting Dark Liquidity* (April 13, 2012).

¹³ See IIROC Notice 12-0078 – Rules Notice – Notice of Approval – *UMIR - Provisions Respecting Regulation of Short Sales and Failed Trades* (March 2, 2102)



effects of the relaxation of short sale restrictions on the functionality of Canadian securities markets.

2.4 Next Steps

These papers represent the work of three of the four teams selected by IIROC for the HFT Study. We expect the remaining two papers from the fourth team to be completed by the summer of 2015.

IIROC continues to pursue its own internal research focusing on the identification of HFT and other Participants. As noted in our study “Identifying Trading Groups – Methodology and Results”, we are building upon our work in a number of ways, which may include:

- operationalizing use of the methodology for internal market monitoring purposes;
- applying the new methodology, where appropriate, to future studies on the impact of particular groups on market quality and integrity;
- extending the approach to identify sub-groups within each segment, recognizing that some groups, such as HFT, are not homogeneous; and
- identifying trading patterns and strategies that differentiate one group from another.

In conjunction with our internal research, IIROC will review and discuss the academic papers internally, and with other regulators and key stakeholders, before determining what, if any, regulatory response may be required in light of the findings.

We are also exploring opportunities for the authors to present their findings, and for interested stakeholders to debate their implications, in a public forum. In the interim, IIROC welcomes comments from interested stakeholders.

Comments may be sent to:

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Appendix A – Key HOT Study Findings

For the period August through September 2011:

- HOT Users:
 - represented 11% of User IDs;
 - accounted for 22% of trading volume, 32% of dollar value, 42% of trades and 94% of all order messages sent;
 - traded 36% of all Canadian share volume traded in US inter-listed securities; and
 - traded 60% of all Canadian trading in ETFs and ETNs.
- HOT Users traded:
 - a larger percentage of total dark activity than displayed market activity;
 - anonymously more often than other market participants;
 - passively approximately 66% of the time;
 - over 90% of their activity through seven IIROC Dealer Members;
 - 23% of their volume within the same broker¹⁴ – generally more than retail users and less than other users (excluding retail);
 - predominantly liquid TSX-listed securities priced over \$1.00;
 - more in TSX 60 Index securities than in other TSX-listed securities; and
 - primarily outside of the Opening or Market-on-Close trading sessions.
- HOT Users earned \$250,000 more per day in rebates than they paid in fees¹⁵. All other participants earned more rebates than HOT Users; however these other participants paid \$462,000 more per day in fees than they earned in rebates.
- 40% of HOT Users were identified as trading through DMA (as opposed to non-DMA).
- HOT DMA Users:
 - were responsible for the majority of trading by all HOT Users;
 - that were categorized as “Fast” (44% of HOT DMA Users) were responsible for 91% of HOT DMA Users’ share volume; and
 - had lower order-to-trade ratios when compared with non-DMA HOT Users.

¹⁴ Same-broker trading encompasses both intentional and unintentional crosses.

¹⁵ Over the study period for the securities included in the trading fee sample.



- Average order-to-trade ratio was higher in ETF trading for all HOT Users, but particularly for the non-DMA groups.
- By all measures, HOT Users identified as clients (DMA and non-DMA) were more active in common shares and HOT non-DMA (inventory and other) were more active in ETFs/ETNs.