December 18, 2018

Executive Summary

The Canadian Securities Administrators (**CSA** or **we**) are publishing for comment a proposed Trading Fee Rebate Pilot Study that would apply temporary pricing restrictions on marketplace transaction fees applicable to trading in certain securities (**Proposed Pilot**). We are publishing the Proposed Pilot for a 45-day comment period to solicit views. We are seeking comment on all issues raised in this notice, including the design of the Proposed Pilot that is contained in the Design Report at Appendix A, as well as the specific questions raised within it.

The comment period will end on February 1, 2019.

I.   Introduction

The CSA has been considering a pilot study on the payment of trading fee rebates for many years in relation to our continued work to foster fair and efficient capital markets and confidence in capital markets. On May 15, 2014, we published a Notice and Request for Comment (the **2014 Notice**) that proposed amendments to National Instrument 23-101 *Trading Rules* (**NI 23-101**) in relation to the order protection rule (**OPR**).[1] On April 7, 2016, as a result of our review of OPR, we published a Notice of Approval of Amendments to NI 23-101 and Companion Policy 23-101CP (the **2016 Notice**).[2] In the 2016 Notice, we acknowledged that we had been considering a pilot study for a number of years but, due to certain risks arising from the interconnected nature of North American markets and securities that are interlisted in the United States, we decided not to move forward with a pilot study unless a similar study was undertaken in the United States.[3]

On March 14, 2018, the United States Securities and Exchange Commission (**SEC**) proposed new Rule 610T of Regulation National Market System (**NMS**) that would conduct a transaction fee pilot for NMS securities (the **Proposed SEC Transaction Fee Pilot**),[4] and, as a result, an opportunity has emerged to move forward with a Canadian pilot study.

On March 16, 2018, we published CSA Staff Notice 23-322 *Trading Fee Rebate Pilot Study*[5] to provide an update on our plans to study the impacts of transaction fees and rebates on order routing behaviour, execution quality, and market quality, and noted that we have been engaged in dialogue with SEC staff on this issue.

We are publishing for comment the design and specifications of the Proposed Pilot to solicit feedback. We will continue discussions with SEC staff about coordinating the pilot studies,

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[1] Published at: (2014) 37 OSCB 4873.
[2] Published at: (2016) 39 OSCB 3237.
[3] Please refer to section 7 *Pilot Study on Prohibition on Payment of Rebates by Marketplaces* in (2016) 39 OSCB 3237.
[4] Published at: https://www.sec.gov/rules/proposed/2018/34-82873.pdf.
[5] Published at: http://www.osc.gov.on.ca/en/SecuritiesLaw_sn_20180316_23-322_trading-fee-rebate-pilot-study.htm.

where possible and appropriate.

II.   Background

Trading Fee Models

The "maker-taker" trading fee model originated in the United States as a method by which new marketplaces could attract orders and compete with established exchanges. The maker-taker model attracts orders through the payment of trading rebates. When a trade occurs, the participant that enters the liquidity providing order displayed in the order book (i.e. "makes" liquidity) is paid a rebate and the participant who removes that order from the order book (i.e. "takes" liquidity) is charged a fee. The fee is higher than the rebate and the difference between the two is the trading revenue earned by the marketplace.

In Canada, the maker-taker model was first introduced by the TSX in 2005 in order to compete with marketplaces in the U.S. trading interlisted securities. Since that time, and as marketplace competition emerged in Canada, the use of rebate payments to attract orders has become the standard fee model employed by Canadian marketplaces. The maker-taker model has also evolved to include an "inverted maker-taker" or "taker-maker" fee model, where the provider of liquidity pays a fee and the liquidity remover receives a rebate when a trade occurs.

Potential Issues Identified

In the 2014 Notice, we expressed our view that the payment of rebates by a marketplace is changing behaviours of marketplace participants. As elaborated below, the payment of rebates may be:

- creating conflicts of interest for dealer routing decisions that may be difficult to manage;
- contributing to increased segmentation of order flow; and
- contributing to increased intermediation on actively traded securities.

(a) Conflicts of Interest

Dealers that manage client orders make decisions regarding the marketplaces to which these orders will be routed. The payment of a rebate by a marketplace raises a potential conflict of interest when a dealer must choose between routing an order to a marketplace that pays them a rebate or to a marketplace that charges them a fee, neither of which are typically passed on to the end client. A decision to route orders based on costs may conflict with routing orders in a manner that results in the best outcome for clients. For example, the payment of a rebate may create a conflict of interest for dealers who must pursue the best execution for their clients' orders while facing potentially conflicting economic incentives to avoid fees or earn rebates. A dealer that routes to a marketplace that offers a rebate but does not offer high execution quality (i.e. orders are either less likely or take longer to execute) may ultimately provide suboptimal outcomes for clients.

This potential conflict has been the subject of academic literature including Angel, Harris, and

Spatt 2010[6] and Battalio, Corwin, and Jennings 2016,[7] and was also highlighted by the International Organization of Securities Commissions (**IOSCO**) in a December 2013 publication, *"Trading Fee Models and their Impact on Trading Behaviour: Final Report"* (the **IOSCO Report**).[8] The IOSCO Report notes that

> …various jurisdictions raised concerns about the potential conflicts of interest [trading fees or trading fee models] may create – for example, by providing incentives to enter into transactions for improper purposes (such as increasing trading volumes solely for the purposes of achieving volume-based incentives) or by impacting routing decisions based on earning a rebate or discount for the participant at the expense of the quality of best execution for its client.[9]

In prohibiting the payment of marketplace rebates for a test group of securities, we believe the Proposed Pilot will provide an opportunity to understand any inherent conflicts for dealers and study both changes in order routing practices and impacts on market quality measures.

(b) Segmentation of Orders

In the context of the execution of orders, segmentation refers to the separation of orders from one class or type of market participant to other classes or types of market participants, and in the Canadian context, is often associated with the orders of retail investors. For instance, it is our understanding that a key driver for the introduction of the inverted maker-taker model was to attract orders from dealers that are more cost-sensitive to "take" fees, such as retail dealers. Retail investors may tend to demand immediacy of trade execution (i.e. use marketable orders) more frequently than other types of clients. As a result, retail dealers often "take" liquidity from order books and may choose to route orders to marketplaces with an inverted maker-taker model, where they receive a rebate rather than pay a fee.

The use of different fee models that pay rebates to different sides of a trade may be contributing to the segmentation of orders by type of client. The Proposed Pilot will study any changes in dealer routing practices based on type of client in an environment where for certain securities rebates do not play a role in influencing decisions.

(c) Increased Intermediation on Actively Traded Securities

It was argued that marketplace rebate payments have contributed to increased market participation by intermediaries that provide liquidity to Canadian marketplaces. In the 2014 Notice, we highlighted the concern that while the payment of rebates has successfully increased the level of liquidity primarily in the most liquid securities, it may have led to a situation where there is intermediation of investor orders where sufficient liquidity already exists and is least needed. The Proposed Pilot will study the level of intermediation on Canadian marketplaces

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[6] *"Equity Trading in the 21st Century,"* May 2010, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1584026.
[7] *"Can Brokers Have It All? On the Relation between Make-Take Fees and Limit Order Execution Quality,"* available at https://onlinelibrary.wiley.com/doi/abs/10.1111/jofi.12422.
[8] *"Trading Fee Models and their Impact on Trading Behaviour: Final Report,"* available at http://www.iosco.org/library/pubdocs/pdf/IOSCOPD430.pdf.
[9] *Id.*

where the payment of rebates to providers of liquidity is prohibited for certain securities.

III.   Summary of the Proposed Pilot

The objective of the Proposed Pilot is to study the effects of the prohibition of rebate payments by Canadian marketplaces. In July 2018, we selected and retained three Canadian academics (the **Academics**)[10] to design the Proposed Pilot and measure the results. While greater detail can be found in the Design Report at Appendix A, a summary of the Proposed Pilot is set out below.

(a) Timing and Duration

The Proposed Pilot will run concurrently with the Proposed SEC Transaction Fee Pilot, and thus timing is dependent both on SEC approval of their proposed rules and the date of implementation. Should timing of the Proposed SEC Transaction Fee Pilot permit, the intention is to implement the Proposed Pilot on a staggered basis consisting of two stages:

1. non-interlisted stocks three to six months prior to the implementation of the Proposed SEC Transaction Fee Pilot; and
2. interlisted stocks in tandem with the implementation of the Proposed SEC Transaction Fee Pilot.

(b) Applicable Marketplaces

The Proposed Pilot will be applicable to trading rebates paid by Canadian marketplaces, both exchanges and alternative trading systems (**ATSs**), for the execution of an order with respect to certain equity securities outlined in more detail below.

(c) Proposed Pilot Securities

The Proposed Pilot will include a sample of securities selected from a list of highly liquid securities that is prepared and published by the Investment Industry Regulatory Organization of Canada (**IIROC**) [11] and a sample of actively traded, medium liquidity securities that will be constructed by the Academics. These sample securities will include both interlisted and non-interlisted common stocks.

A matched pairs design will be used to find securities that closely match on a set of characteristics such as firm size, share price, and/or trading volume, and then a treated security and a control security will be randomly selected from each pair.

We do not believe that the Proposed Pilot will harm issuers even though it may result in the elimination of trading fee rebate incentives that would otherwise be used to attract posted liquidity in certain securities. While the Proposed Pilot will eliminate trading rebates in certain

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[10] http://www.osc.gov.on.ca/en/NewsEvents_nr_20180801_csa-trading-fees-rebates-pilot-study.htm. The CSA has selected the following group of researchers with expertise in Canadian equity market structure to design and conduct the pilot study: Katya Malinova, Andriy Shkilko and Andreas Park.
[11] Please see: http://www.iiroc.ca/industry/rulebook/Pages/Highly-Liquid-Stocks.aspx.

securities, it will not impact the application of OPR. Marketplaces that display protected orders will continue to receive trade-through protection under OPR,[12] which may continue to serve as an incentive to attract liquidity.

Furthermore, the temporary elimination of trading rebates for certain securities may make it less expensive, and consequently more attractive, to transact in those securities, which also may offset the reduced rebate incentive and attract liquidity. The cost of capital for issuers is determined by a number of factors, most of which are not impacted by secondary market trading activity.

While the Proposed Pilot is limited in scope (for instance, it does not include illiquid securities or exchange traded products), this is because a study is, by nature, limited. The exclusion of certain securities from the Proposed Pilot is in no way intended to signal that these securities will not be subject to whatever policy actions are taken as a result of the findings of the Proposed Pilot.

(d) Proposed Pilot Design

The Proposed Pilot will prohibit the payment of trading fee rebates by marketplaces with respect to trading in treated securities.[13] The Academics will conduct an empirical analysis based on market quality metrics and compare the treated securities with the control securities. This statistical analysis will investigate the effects of the prohibition of rebates both pre- and post-implementation of the Proposed Pilot.

As the purpose of the Proposed Pilot is to study the effects of prohibiting rebates, the design relies on only this prohibition. In relation to studying conflicts of interest in order routing, we recognize that prohibiting rebates alone will not eliminate all conflicts and, in consultation with the Academics, we considered alternative approaches such as mandating symmetrical marketplace fee models.[14] Although symmetrical fee models may better control for conflicts of interest, we ultimately decided that this approach would be overly prescriptive and limit the ability of marketplaces to compete to attract orders. For this reason, we have proposed only a rebate prohibition for the treated securities.

In order to ensure that the Proposed Pilot meets the objective of providing a better understanding of the effects of the prohibition of rebate payments on Canadian marketplaces, marketplaces seeking to implement either a fee or major market structure change throughout the implementation period of the Proposed Pilot will be required to demonstrate to the CSA that such a change does not interfere with this objective. The regulators may seek public comment on these changes to aid in making such determinations.

Please refer to the attached Design Report for more details. Please also refer to GitHub for ongoing code and data analysis from the Academics as the Proposed Pilot moves forward.

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[12] See https://www.osc.gov.on.ca/documents/en/Securities-Category2/sn_20160620_23-316_order-protection-rule.pdf.
[13] This will include the prohibition of rebate payments for intentional crosses.
[14] Symmetrical marketplace fee models charge the same fee to both sides of a trade.

(e) Local Matters - Implementation

In Ontario, the Proposed Pilot will be implemented by orders of the Ontario Securities Commission (the **Commission**) under s. 21(5) and s. 21.0.1 of the *Securities Act* (Ontario), as applicable for each exchange and ATS carrying on business in Ontario. Where a marketplace pays a trading fee rebate with respect to trading in a security that is included in a treatment group in the Proposed Pilot, the Commission will order that marketplace to file a fee amendment that would eliminate the rebate payment for the duration of the Proposed Pilot. The Commission will also order that for the duration of the Proposed Pilot, where a marketplace seeks any amendment to its Form 21-101 F1/F2, including the exhibits thereto, that marketplace will file submissions that satisfy the Commission that any such proposed amendments do not negatively impact the objective of the Proposed Pilot. A draft model order for both an exchange and an ATS is attached at Appendix B. Note that should we have any concerns about the Proposed Pilot following its implementation, we will immediately apply to the Commission for orders under s. 144 of the *Securities Act* (Ontario) revoking or varying the orders issued under ss. 21(5) and 21.0.1, as applicable.

In other jurisdictions, the Proposed Pilot will be implemented by orders of such jurisdictions, as applicable.

IV.   Next Steps

The CSA will seek public comment on the Proposed Pilot for 45 days following the publication of this proposal, and if implemented, will monitor the Proposed Pilot on an ongoing basis and evaluate the results. Prior to implementation, the CSA will also be requesting that marketplace participants advise the CSA what actions they are taking or will take to comply with the Proposed Pilot.

We invite participants to provide input on the issues outlined in this public Consultation Paper. You may provide written comments in hard copy or electronic form. The consultation period expires **February 1, 2019.**

Please submit your comments in writing on or before **February 1, 2019**. If you are not sending your comments by email, please send a CD containing the submissions (in Microsoft Word format).

Address your submission to all of the CSA as follows:

British Columbia Securities Commission
Alberta Securities Commission
Financial and Consumer Affairs Authority of Saskatchewan
Manitoba Securities Commission
Ontario Securities Commission
Autorité des marchés financiers
Financial and Consumer Services Commission, New Brunswick
Superintendent of Securities, Government of Prince Edward Island
Nova Scotia Securities Commission

Office of the Superintendent of Securities, Service NL (Newfoundland and Labrador)
Superintendent of Securities, Northwest Territories
Superintendent of Securities, Yukon
Superintendent of Securities, Department of Justice, Government of Nunavut

Deliver your comments **only** to the addresses below. Your comments will be distributed to the other participating CSA regulators.

The Secretary
Ontario Securities Commission
20 Queen Street West
22nd Floor
Toronto, Ontario M5H 3S8
Fax: 416-593-2318
comments@osc.gov.on.ca

Me Anne-Marie Beaudoin
Corporate Secretary
Autorité des marchés financiers
800, rue du Square Victoria, 22e étage
C.P. 246, tour de la Bourse
Montréal (Québec) H4Z 1G3
Fax : 514-864-6381
Consultation-en-cours@lautorite.qc.ca

V.   Questions

Questions and comments may be referred to:

Kent Bailey Trading Specialist, Market Regulation Ontario Securities Commission kbailey@osc.gov.on.ca	Alex Petro Trading Specialist, Market Regulation Ontario Securities Commission apetro@osc.gov.on.ca
Heather Cohen Legal Counsel, Market Regulation Ontario Securities Commission hcohen@osc.gov.on.ca	Serge Boisvert Analyste en réglementation Direction des bourses et des OAR Autorité des marchés financiers serge.boisvert@lautorite.qc.ca
Roland Geiling Derivatives Product Analyst Direction des bourses et des OAR Autorité des marchés financiers roland.geiling@lautorite.qc.ca	Maxime Lévesque Analyste aux OAR, Direction des bourses et des OAR Autorité des marchés financiers Maxime.levesque@lautorite.qc.ca
Sasha Cekerevac	Bruce Sinclair

Regulatory Analyst, Market Regulation Alberta Securities Commission sasha.cekerevac@asc.ca	Securities Market Specialist British Columbia Securities Commission bsinclair@bcsc.bc.ca

Design Report
for the CSA Pilot Study on Rebate Prohibition*

Katya Malinova   Andreas Park   Andriy Shkilko

First version: July 24, 2018
This version: November 21, 2018

Disclaimer: This document is subject to a request for comments and may change as the comments are addressed. The final design of the Pilot will be determined by the Canadian Securities Administrators (CSA).

I. Executive Summary

The CSA has proposed a pilot study to better understand the effects of the prohibition of rebate payments by Canadian marketplaces (the Pilot). The United States Securities and Exchange Commission (SEC) has announced its intention to conduct a pilot study examining a similar set of issues (the SEC Pilot).

Rebates are often paid to market participants to attract their orders to a particular platform. The CSA has commissioned the authors of this report to develop the methodology for the Pilot, analyze the results, and complete a final research report detailing the findings of the Pilot. In this document, we propose a design and discuss the framework for the analysis of the Pilot. In particular, we cover the following issues: timing, sample construction, empirical measures, statistical tools, and anticipated challenges. We also include a list of questions for industry feedback and discuss some of the issues that have arisen in our previous discussions with the regulators and market participants.

An important feature of the Pilot is design simplicity. A complex design that tries to answer too many questions may confound the analysis and as such will be detrimental to drawing policy-relevant conclusions. Consequently, key conditions for the Pilot to be successful are as follows:

- for a group of securities selected using objective and transparent criteria (hereafter, treated securities), marketplaces are prohibited from paying fee rebates[15] to dealers, including offering discounts on liquidity removal fees if such discounts are linked to the dealers' liquidity-providing activities. For all remaining securities, the rules remain unchanged;
- the prohibition applies to all marketplaces trading equity securities;
- with respect to interlisted securities, the timing of the Pilot and the set of the Pilot securities are coordinated with the SEC;
- the Pilot matches the duration of the SEC Pilot;
- the Pilot is introduced in two stages to mitigate the effects of unexpected market-wide events that may coincide with the Pilot start date;
- in the analysis stage, a set of market quality and order routing metrics is computed using data from the Investment Industry Regulatory Organization of Canada (IIROC) Surveillance Technology Enhancement Platform (STEP) data;[16]
- a set of standard techniques is applied to examine these data; and
- the codes used in the analysis are publicly available and comments are encouraged.

The sample will be selected from corporate equity securities split into highly liquid and medium-liquid. Each treated security will be matched with a control security that has similar characteristics, i.e., firm size, share price, and trading volume. The control securities will not be treated. The sample selection will be governed exclusively by statistical considerations. We expect the sample to consist of:

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[15] This will include the prohibition of rebate payments for intentional crosses.
[16] STEP offers a consolidated view of equity trading on all marketplaces.

- 50-60 highly liquid and 20-30 medium liquid interlisted securities, with an equal number of interlisted matches, and
- 60-80 highly liquid and 80-100 medium liquid non-interlisted securities, with an equal number of non-interlisted matches.

Precise quantities will be determined on the date the sample is finalized, approximately three months prior to the start of the Pilot.

In the analysis stage, we will use standard market quality metrics (e.g., quoted spreads and depths, effective and realized spreads, implementation shortfall, volatility, trade and order autocorrelation, time to execution for competitively priced limit orders, etc.). We will examine these metrics before and after rebate prohibition for the market overall and for several types of market participants separately (e.g., dealers, retail investors, institutional participants, participants using high frequency strategies, etc.). The final report will present the results with due care to preserve anonymity of the participants.

II. Details

A. Background

In its 2014 Request for Comments on Proposed Amendments to NI 23-101 Trading Rules,[17] the CSA cites several concerns regarding the maker-taker fee model. Specifically, the CSA suggests that the model may "distort transparency of the quoted spread, introduce inappropriate incentives and excessive intermediation, and create conflicts of interest" and proposes conducting a pilot study to formally examine these issues. The CSA specifically states that any pilot should "examine the impact of prohibiting the payment of rebates by marketplaces."

In proposing the Pilot design, we seek to better understand how the prohibition of rebates may affect dealers' routing practices, the level of intermediation, and standard measures of market quality. The analysis will be carried out for the market overall and for various groups of market participants separately.

In what follows, we provide a detailed description of the data, variables, and methods that will allow us to address the issues raised by the CSA. For the results to be meaningful and policy-relevant, two design features are important: sufficiently large and well-structured treatment and control samples and a staggered introduction of treatment. Furthermore, we will seek close coordination with the SEC, since trading in Canada may be affected by the final design of the SEC Pilot.

B. Merits of a Canadian Pilot

Although the U.S. and the Canadian equity markets are similar, there are several key differences that may affect dealer routing decisions. Examples include the practice of retail order internalization in the U.S. and broker-preferencing in Canada. Therefore, while we expect rebate

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[17] http://www.osc.gov.on.ca/en/SecuritiesLaw_csa_20140515_23-101_rfc-pro-amd.htm.

prohibition to have a similar impact on market-wide measures of market quality in both countries, changes in routing practices and the extent to which different groups of market participants are affected may differ. Consequently, a Canadian pilot, in combination with sufficiently granular data, will substantially improve understanding of the existing fee system and will be necessary for a well-informed Canadian regulatory policy.

C. Required Data

The Pilot aims to examine discretionary routing practices and the impact of fees on different groups of market participants. We will use masked data from IIROC's STEP system. In the STEP data, we will define a trader ID as the combination of the dealer ID, user ID, and account type (specialist, client, inventory, etc.). Once defined, we will use trader IDs following the classification of market participants proposed by Devani, Tayal, Anderson, Zhou, Gomez, and Taylor (2014).

III. Pilot Securities and Sample Construction

A. Background

There are about 3,800 securities listed on Canadian stock exchanges, some of which are interlisted on foreign exchanges. Trading characteristics differ significantly across securities, and in constructing the sample we must ensure that such differences do not confound the results.

First, a number of securities trade almost exclusively in rebate-free environments. Examples include CSE-listed securities, as well as TSX- and TSXV-listed securities priced under $1 that trade on the TSX, TSXV, and MatchNow. Such securities will not be included in the sample.

Second, while we expect that our analysis will provide the most statistically reliable results for the highly liquid securities, we recognize that there is significant interest in examining the impact of rebate prohibition for securities with medium activity levels. Therefore, we will analyze a sample of such securities, but caution that the resulting market quality measures may be statistically noisy. We will not examine very illiquid securities as such an analysis will not yield statistically meaningful insights. We will split the securities into two subsamples: U.S.-interlisted equities and non-interlisted equities.

B. Sample Selection and Matching Criteria

The two groups of corporate equities will be further split into highly liquid and medium liquid securities. IIROC defines a security to be "highly liquid" if it trades on average at least 100 times per day and with an average trading value of at least $1,000,000 per trading day over the past month.[18] Highly liquid securities account for more than 90 percent of the TSX market capitalization and as such are reasonably representative of the wealth invested in publicly-listed Canadian corporate equities. We will define a security as "medium-liquid" if it trades on average at least 50 times a day and with an average trading value of at least $50,000 over the past month.

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[18] http://www.iiroc.ca/industry/rulebook/Pages/Highly-Liquid-Stocks.aspx

To select the treatment and control groups, we will use a procedure that finds stocks similar to each other based on a set of pre-defined characteristics and then randomly selects a stock to treat from each pair. We will use the following matching characteristics as of three months prior to the Pilot start date: listing status (single market vs. interlisted), liquidity status (highly liquid vs. medium liquid), firm size (market capitalization), price, and dollar trading volume, with the last three characteristics averaged over the month preceding the selection date. The list of Pilot securities will be made public as soon as it is finalized.

An appropriately-sized sample that is representative of the universe of Canadian publicly listed firms must include the interlisted stocks. We have submitted a comment letter to the SEC to formally request that the Pilot and the SEC Pilot are coordinated so that the interlisted stocks are treated in the same manner in Canada and the U.S.[19] For instance, if Barrick Gold, ABX, is a treated security in the Pilot, then it should also be included in Group 3 in the SEC Pilot as currently proposed. Similarly, the interlisted stocks used as controls in the Pilot must be in the control group (currently Group 4) in the SEC Pilot.

C. Matching Procedure

We will follow the approach known as *the nearest-neighbor matching*. Specifically, for each possible pair of securities *i* and *j*, we will compute the pairwise scaled matching error as follows:

$$matcherror_{ij} = \sum_{k=1}^{M} \left(\frac{C_k^i - C_k^j}{C_k^i + C_k^j} \right)^2, \tag{1}$$

where C_k is one of the above-mentioned matching characteristics, e.g., firm size, price, and trading volume. We will then sequentially select pairs with the lowest matching errors until all stocks are allocated a pair. Finally, we will randomly assign one stock in each pair for treatment and retain the other stock as a control.

IV. Empirical Measures and Analysis

A. Empirical Measures

Quoted Liquidity. The quoted spread will be computed as the difference between the Canada-wide best ask and bid prices (the CBBO). We will compute this metric in two ways: (i) across all markets and (ii) only for the markets with protected quotes. The quoted spread at time *t* for security *i* is defined as:

$$qs_{it} = ask_{it} - bid_{it}. \tag{2}$$

We will drop instances of locked markets, when the bid and the ask are equal, and instances of crossed markets, when the bid is greater than the ask.

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[19] https://www.sec.gov/comments/s7-05-18/s70518-4465710-175825.pdf

Spreads usually vary in the stock price, and as such it is a common practice to compute the proportional spread as:

$$qsp_{it} = \frac{qs_{it}}{m_{it}}, \tag{3}$$

where m_{it} is the CBBO mid-quote defined as:

$$m_{it} = \frac{ask_{it} + bid_{it}}{2}. \tag{4}$$

To aggregate the spread metrics to the daily level, we will compute the *time-weighted* quoted spread on day d as follows:

$$twqsp_{id} = \frac{1}{\sum_t \Delta_{t,t+1}} \times \sum_t \Delta_{t,t+1} \; qsp_{it}, \tag{5}$$

where $\Delta_{t,t+1}$ is the number of time units during which the quote is active. For instance, if a quote is active from 14:35:00.002 to 14:35:08.004, then $\Delta_{t,t+1} = 8{,}002$ milliseconds (ms).

Some of the stocks in our sample will likely be constrained by the minimum tick size of one cent. To account for this possibility, we will compute the fraction of the day that a stock is quoted with a one-cent spread.

We will compute *quoted depth* as the sum of the number of shares posted at both sides of the CBBO. We will compute *quoted dollar depth* as the sum of the dollar value of shares posted at both sides of the CBBO. We will time-weight both depth metrics.

Price Efficiency. The finance literature has developed a number of metrics that capture the speed with which (and the extent to which) prices incorporate new information. Generally speaking, the faster the price discovery process, the more informationally efficient are the prices.

Autocorrelation of Returns. Similarly to Hendershott and Jones (2005), we will compute the autocorrelation of midquote returns for 30-second, 1-minute, and 5-minute intervals. A lower absolute value of autocorrelation is associated with greater market efficiency as prices better resemble a random walk.

Variance Ratios. If prices are efficient and follow a random walk, the variance of midquotes is linear in the time horizon. Campbell, Lo, and MacKinlay (1997) define the scaled ratio of variances over k time horizons as: $|(\sigma_{tk}/k\sigma_t) - 1|$ and suggest that the closer this ratio is to 0, the more efficient is the market. We will follow the existing literature and compute the variance ratios for two intervals: 30-second to 1-minute and 1-minute to 5-minute.

Intra-Day Volatility. We will compute two volatility metrics: range-based and variance-based. The range-based metric is the daily average of the high-low price range computed over ten-minute intervals, scaled by the interval's mid-quote defined in equation (4) above. Aggregated over many

securities, this metric is usually strongly correlated with overall market volatility as measured by the VIX.[20] The variance-based metric is the standard deviation of the one-minute mid-quote returns for the day.

Activity Levels. To measure market activity, we will compute several trading volume metrics such as volume at the open and close, volume during the continuous market, volume in intentional crosses, and dark volume.

We will further compute a set of order-related metrics such as the number of orders and their value, the proportion of canceled and executed orders, the proportion of executed order value, the number of orders that match or improve the CBBO, and the proportion of orders one and two cents away from the best quotes, as well as one percent and five percent of the mid-quote away from the best quotes.

We note that there are no agreed-upon economic measures that determine whether a change in market activity levels is beneficial or harmful. Therefore, volume and order submission figures must be interpreted with caution.

Effective Spreads. Effective spreads measure the costs that market participants incur when they trade. It is conventional to base the computation of effective spreads on the mid-quote of the prevailing CBBO. For security i, the proportional effective spread for a trade at time t is defined as:

$$esp_{it} = 2 \times q_{it} \times \frac{p_{it} - m_{it}}{m_{it}}, \tag{6}$$

where p_{it} is the transaction price, m_{it} is the mid-quote of the CBBO prevailing at the time of the trade, and q_{it} is an indicator variable that equals 1 if the trade is buyer-initiated and -1 if the trade is seller-initiated. The factor 2 is used to make the estimate comparable to the quoted spread by capturing the cost of a round-trip transaction.

To obtain a daily effective spread estimate, it is common to volume-weight transaction-specific estimates, i.e., for trades of volumes $v_{it,}$ the effective spread on day d is the sum of the trades' effective spreads weighted by the trades' shares of total daily volume:

$$vwesp_{id} = \frac{1}{\sum_t v_{it}} \times \sum_t v_{it} esp_{it}. \tag{7}$$

The purpose of the Pilot is to understand the impact of a prohibition of rebates and we will therefore compute the "cum fee" effective spread (often referred to in the industry as the "economic" spread):[21]

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[20] The CBOE Volatility Index (VIX) is a calculation designed to produce a measure of constant, 30-day expected volatility of the U.S. stock market, derived from real-time, mid-quote prices of S&P 500 Index call and put options.
[21] This measure will be computed per transaction. We caution that it will be difficult to determine precisely which fees apply; dark, lit, and post-only orders may all command different fees, market-makers may receive bulk-discounts, etc. We will apply a uniform rule by employing only the "most common" fee that applies on the specific venue.

$$cum \ fee \ esp_{it} = esp_{it} + 2 \times taker \ fee_{it}/m_{it}. \qquad (8)$$

Price Impact and Realized Spread. It is common practice to decompose the effective spread into two components: the *price impact* and the *realized spread*. The price impact measures by how much the trade moves the price and is formally defined as:

$$primp_{it} = 2 \times q_{it} \times \frac{m_{i,t+\tau} - m_{it}}{m_{it}}, \qquad (9)$$

where $m_{i,t+\tau}$ is the CBBO midpoint τ time units after the trade. The idea behind this measure is that trades reveal information about the fundamental value of the underlying security, and the market needs time to incorporate this information into prices. The time horizon τ is set according to the frequency with which a security trades and varies between one second for the frequently traded stocks to five seconds for the less frequently traded ones.

The price impact is directly related to the realized spread, which is defined as:

$$rsp_{it} = esp_{it} - primp_{it} \qquad (10)$$

and is interpreted as the revenue that liquidity providers receive net of the adverse selection costs captured by the price impact. Analogously to the cum fee effective spreads, we will account for the rebates that liquidity providers are eligible to receive and will compute the cum rebate realized spreads as follows:

$$cum \ fee \ rsp_{it} = rsp_{it} + 2 \times maker \ rebate/m_{it}. \qquad (11)$$

Implementation Shortfall. Buy-side institutions often trade amounts that are larger than the depth available at the best prices and therefore commonly slice large "parent" orders into smaller "child" orders. The child orders may move market prices away from the price prevalent at the beginning of the large trade and as such increase the total cost of the parent order. Buy-side traders therefore worry about the total cost of their parent orders, which is usually measured by the implementation shortfall (IS).

While we likely cannot identify the buy-side trades directly, we will proxy for parent orders by identifying instances where a single trader executes several trades in the same direction on a given day and trades only in that direction. The total cost associated with such a string of trades will be measured by the implementation shortfall defined as:

$$IS_{it} = q_{it} \times (\$vol_{it} - p_{i0} \times vol_{it}), \qquad (12)$$

where q_{it} is +1 for a string of buys and −1 for a string of sales that begins at time t in stock i, $\$vol_{it}$ is the total dollar volume for the string, p_{i0} is the prevailing mid-quote at the time of the first trade in the string, and vol_{it} is the total share volume for the string.

A positive shortfall indicates that prices move in the same direction as the parent order. In our reporting, the aggregate shortfall will be computed in basis points of the aggregate dollar volume

traded. We will consider two types of trade strings: (i) those that originate from marketable orders only and (ii) those that originate from marketable and non-marketable orders.

Passive Order Execution Quality. For retail orders and for large trade strings, we will compute the resting time of non-marketable orders. We will specifically focus on orders with prices that suggest that the submitter is interested in a timely execution. As such, we will consider only orders that are submitted at prices that match or improve the CBBO.

For large trade strings, we will also report the average fraction of volume that is traded with marketable orders. A change in this measure captures the possibility that institutional investors may change their strategies and choose to "cross the spread" more/less often.

Finally, we will examine the ratio of traded to submitted orders; this ratio captures how many orders an institution needs to submit to fill a position. We will consider only the orders submitted at prices matching or improving the CBBO. We will also compute this ratio for share volume.

B. Statistical Analysis

The basis of our statistical approach is a conventional difference-in-differences analysis of a panel dataset (securities×days). Analyses of this kind usually rely on two approaches to examine the treatment effect (i.e., the effect of rebate prohibition). We discuss these approaches below using the bid-ask spread as an example.

In the first approach, the dependent variable ΔDV_{it} is the value of the bid-ask spread for the treated security i at time t less the value for the matched security. Using this dependent variable, we will estimate the following regression:

$$\Delta DV_{it} = \alpha \cdot pilot_t + controls_t + \delta_i + \varepsilon_{it}, \tag{13}$$

where $Pilot_t$ is an indicator variable set to 1 on the Pilot start date, $controls_t$ are time series controls such as the VIX, and $\underline{\delta_i}$ are security-pair fixed effects. The coefficient of interest α captures the effect of the Pilot on treated securities.[22]

In the second approach, the dependent variable DV_{it} is the value of the bid-ask spread for each security from the treatment and control groups. Using this dependent variable, we will estimate the following regression:

$$\Delta DV_{it} = \alpha_1 \cdot pilot_t + \alpha_2 \cdot pilot_t \times treated_i + \alpha_3 \cdot treated_i + controls_t + \delta_i + \varepsilon_{it}, \tag{14}$$

where $Pilot_t$ is the indicator variable set to 1 on the Pilot start date, $treated_i$ is 1 if the security is from the treatment group and 0 otherwise, $controls_t$ are time series controls such as the VIX, and $\underline{\delta_i}$ are security fixed effects. The coefficient of interest is α_2; it estimates the incremental effect of the Pilot on the treated securities. For instance, with quoted spread as the dependent variable, a positive α_2 will indicate that the spreads for the treatment group increased relative to the control group.

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[22] This regression methodology is similar to that in Hendershott and Moulton (2011) and Malinova and Park (2015).

We will conduct inference in all regressions using double-clustered Cameron, Gelbach, and Miller (2011) standard errors, which are robust to cross-sectional correlation and idiosyncratic time-series persistence.[23]

Each approach will use two controls for the market-wide effects that are known to affect trader behaviour and market quality. First, we will use the U.S. volatility index, VIX, to control for the level of market-wide volatility. We acknowledge that Canada has its own volatility index, but note that this index may be directly affected by trading in the sample securities, while the U.S. VIX is less likely to be similarly affected. Second, we will use the cumulative return for the S&P GSCI commodity index. Comerton-Forde, Malinova, and Park (2018) show that this index is highly correlated with the Canadian TSX Composite index, but is unlikely to be significantly affected by trading in Canada and therefore serves as a proxy for Canadian market-wide returns.

V. Anticipated Challenges

We caution that several possible scenarios may affect our ability to deliver meaningful conclusions. First, individual firms in the sample may experience events during the Pilot that render them unusable for the subsequent statistical analyses (e.g., mergers, bankruptcies, or delistings). We will mitigate the impact of such events by building the final sample as close as possible to the start of the Pilot. This said, if one of the above-mentioned events occurs after the sample is finalized, we may omit the affected security and its match from further analyses.

Second, all securities may be affected by major market-wide confounding events. Examples are a failure of a major financial institution, a market crash, or a political event. While a staggered introduction, the use of control groups, and a sufficiently long Pilot period alleviate some of the concerns regarding such events, the CSA will reserve the right to extend the Pilot or to delay the start of the Pilot if necessary.

Third, the marketplaces may develop workarounds for rebate prohibitions that undermine the Pilot, e.g., differentiated fees, bulk discounts, new order types, new venues or order books, etc. Possible effects of such developments will be evaluated by the CSA prior to their approval, with the focus on preserving the scientific integrity of the Pilot.

VI. Timing

We propose that the Pilot match the duration of the SEC Pilot. We also propose that the Pilot proceed in two stages: (i) non-interlisted stocks first and (ii) interlisted stocks second (together with the SEC Pilot), with a three- to six-month separation between the stages, should timing of the SEC Pilot permit.

As we mention earlier, the staggered introduction may alleviate concerns should the Pilot begin around the time of an unexpected market-wide event. For example, in July 2011, the SEC adopted

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[23] Cameron, Gelbach, and Miller (2011) and Thompson (2011) developed the double-clustering approach simultaneously. See also Petersen (2009) for a detailed discussion of (double-)clustering techniques.

a new rule that restricted some aspects of direct market access (DMA). Several research teams endeavored to analyze this event. Unfortunately, about two weeks after the DMA rule adoption, the U.S. credit rating was downgraded, creating a substantial amount of noise in the data. No research team has been able to produce meaningful conclusions, since the noise completely confounded the results. We caution that a similarly unpredictable event may confound the results of the Pilot if all stocks are introduced at once.

Our conversations with market participants suggest that they share this concern, and we received feedback that the difference between the two-stage and all-at-once alternatives is immaterial in terms of technical implementation.

VII. Communication and Transparency

We believe that transparency is integral when conducting studies and commit to providing timely and comprehensive updates to the CSA for disclosure to market participants.

For the data preparation and analysis stages of our work, we will use SAS, SQL, and Stata coding packages. In the interest of transparency, we will make all codes publicly available via GitHub (the online code depository). Comments for code improvement will be welcome; GitHub includes a comment function. Where possible, we will also provide the data (e.g., the non-proprietary data that will be used for the matching process). We believe that this level of transparency will bring added trust in the integrity of our analysis.

Further, we welcome suggestions for improvement of the proposed Pilot structure and analyses. We recognize the importance of consultation with market participants and coordination with other regulatory bodies and are prepared to consider alternative designs. We have received excellent feedback from the CSA, the members of the OSC Market Structure Advisory Committee, the Canadian Securities Traders Association, and participants at the Rotman Capital Markets Institute Panel Discussion. This report reflects this feedback.

Appendix I: A Sample Matching Procedure

This appendix provides an example of the matching procedure used to assign Canadian stocks interlisted in the U.S. into the treatment and control groups.

Trading volume, price, and market capitalization figures are the latest available from the Canadian Financial Markets Research Centre (CFMRC) database.[24] Trading volume is the average daily dollar volume, price is the closing price, and market capitalization is the product of the price and the number of shares outstanding. We use Canadian dollars for variables that require a price component.

We arrive at the matched sample using the following procedure:

1. We begin with a sample of 181 Canadian securities listed on the Toronto Stock Exchange (TSX) that are also interlisted on the NYSE, NYSE Arca, NYSE MKT, Nasdaq GM, and Nasdaq CM.

2. Among these, we identify 18 securities that trade at prices below $1 and refer to them as low-priced (LP). Price volatility in such securities is rather high, and as we mention previously, LPs are usually excluded from research samples.

3. Among the remaining securities, we identify 107 that are on IIROC's "highly liquid" list. We refer to these as HL stocks, and the remaining 56 securities are nHL (not highly liquid). We match HL stocks to HL stocks and nHL stocks to nHL stocks.

4. For each possible pair of i and j securities, we estimate a match error as follows:

$$matcherror_{ij} = \sum_{k=1}^{3} \left(\frac{C_k^i - C_k^j}{C_k^i + C_k^j} \right)^2 ,$$

    where C_k are natural logs of trading volume, price, and market capitalization as defined above.

5. From the matrix of match errors that spans all stock pairs, we then select stock pairs with the lowest errors, for a total of 53 HL pairs, 28 nHL pairs, and 9 LP pairs.

6. Finally, to assign stocks into the treated and control groups, for each pair we generate a random number between 0 and 1. If this number is below 0.5, we assign the first stock in the pair to be treated and vice versa.

Figure 1 provides an illustration of match quality. The horizontal and vertical axes represent logarithms of market capitalization, dollar volume, and stock price for pairs of securities, with a

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[24] http://clouddc.chass.utoronto.ca/ds/cfmrc. In rare cases when CFMRC does not have a valid record for a security, we obtain the missing data from https://www.tmxmoney.com/en/index.html

random assignment of one member in the pair to the treatment and the other to the control group. A good match obtains if the points are on or close to the 45-degree line. A formal t-test shows no evidence that the treatment and control samples are different for any of the matching criteria.

Appendix II: Questions for Market Participants

1. We propose to define a security as medium-liquid if it trades at least 50 times a day on average and more than $50,000 on average per trading day over the past month. Do you believe that this definition is appropriate? If not, please provide an alternative definition and supporting data, if available, to illustrate which securities your definition captures.

2. We propose to introduce the Pilot in two stages, with non-interlisted securities first, followed by interlisted securities. Do you believe that such staggered introduction will cause material problems for the statistical analysis and the results of the Pilot? If so, please describe your concerns in detail.

3. Several Canadian marketplaces offer formal programs that reward market makers with enhanced rebates in return for liquidity provision obligations. On the one hand, such programs may benefit liquidity. One the other hand, one of the primary objectives of the Pilot is to understand if rebates cause excessive intermediation. In your opinion, should exchanges be allowed to continue using rebates or similar arrangements for market making programs during the Pilot? Do you believe any constraints on such programs during the Pilot to be appropriate?

4. We propose to compute price impacts at the one- and five-second horizons. Do you believe that we should consider other horizons? If so, which ones?

5. We propose to compute time-to-execution for limit orders posted at the CBBO prices or improving these prices. Do you believe that we should consider different price levels? If so, which ones? Please provide supporting data and analysis, if available, to demonstrate the empirical importance of order postings at other levels.

6. We propose a number of market quality metrics. Do you believe that we should consider additional metrics? If so, please outline these metrics and provide supporting data and analysis, if available, to demonstrate their empirical importance.

7. We have had extensive discussions with a number of market participants on whether to include exchange-traded products (ETPs) in the Pilot, and some participants suggest that such an inclusion is warranted. Nevertheless, others point out that trading characteristics of ETPs are substantially different from those of corporate equities and including ETPs will present significant challenges in the matching stage and will likely confound the results in the analysis stage.

   These participants and our own research identify the following concerns:

   - most liquidity in ETPs is determined and provided by contracted market makers, and the ETP creation/redemption process represents its own source of liquidity;

- matching characteristics that we propose to use for corporate equities do not have the same meaning for ETPs. For instance, ETP fund size is not a relevant metric, and ETP trading volume is usually not correlated with quoting activity or liquidity;

- spillover effects of two types may confound the results. First, liquidity in ETPs relates to liquidity of the underlying basket of securities, and if the basket is significantly affected by the Pilot, the ETP will be affected too. Second, ETPs that follow the same baskets may be viewed not only as good matches, but also as substitutes for investment, hedging, and trading purposes. If one of them is selected to be treated, and the other is not, market participants may move between products, potentially confounding the results of the Pilot.

The above-mentioned concerns make finding matched ETP pairs a uniquely challenging task. To the best of our knowledge, there is no established procedure for matching ETPs to study their trading costs.

As such, in relation to ETP inclusion, we ask that market participants consider the following questions: Given the challenges that ETP matching presents, can the goals of the Pilot be achieved without including ETPs in the sample? If ETP inclusion is important, can you propose a way to construct a matched sample that addresses the concerns identified above?

Appendix III: Responses to Received Questions

The Capital Markets Institute held an open forum on the Pilot at the Rotman School of Management on September 12, 2018.[25] The event included a panel of industry experts who had been asked to comment on various aspects of the Pilot's design. Prior to and during the event as well as in the weeks that followed, we received a number of thoughtful questions and comments from market participants and are grateful for their time and advice. We believe that this design report addresses most of the issues raised during these discussions. We list the most common comments here for reference.

- **Inclusion of less liquid securities.** In our presentation, focusing mainly on statistical considerations, we proposed that the Pilot only examine highly liquid securities. The participant consensus however was to include a broader set of securities. The current version of the design report proposes including a set of securities with medium levels of liquidity. We caution that due to statistical noise the analysis of these securities may be inconclusive. To ensure that the less liquid securities do not contaminate the analysis of liquid securities, we will treat them separately both during the matching and the analysis stages.

- **Rebate prohibition vs. symmetric fees.** Our presentation and several market participants point out that some aspects of the current rebate economics are preserved even if rebates are prohibited. Specifically, some venues may begin charging liquidity makers no fees and charging the takers positive fees, while others may do the opposite. We believe that symmetric "take-take" fees are the only way to entirely eliminate potential conflicts of interest identified in the academic literature (Battalio, Corwin, and Jennings, 2016). The CSA has discussed the possibility of mandating symmetric fees and has decided to pursue only rebate prohibition at this time.

- **Replication of the SEC Pilot buckets.** Several participants suggested that we follow the SEC Pilot structure and use three treatment buckets with varying caps on fees. Unfortunately, there are too few Canadian securities to populate such buckets and to conduct an analysis that allows for meaningful policy advice. For instance, there are only about 100-120 highly liquid interlisted securities. Splitting them into three treatment buckets and one control bucket will result in only 25-30 securities per bucket, leading to statistical estimation problems.

- **Staggered introduction.** We have received several distinct proposals for the staggered introduction of stocks into the Pilot, including, for instance, a step-wise lowering of rebates. We believe that the current design that proposes to treat non-interlisted securities first and interlisted securities second with the SEC Pilot, provides the best compromise between cost/risk considerations and an economically meaningful analysis.

- **Suggestions for the analysis.** Several market participants have made suggestions as to which aspects of market quality we should pay attention to. These include the cost of executing large orders, dealer routing and posting behaviors, dark trading, time to execution, and levels of

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[25] Presentation slides are available at https://slides.com/ap248/cmi_csa_tickpilot_slides#/

intermediation. We are grateful for these comments and have incorporated them into the report. We are open to further suggestions that may enhance the analysis.

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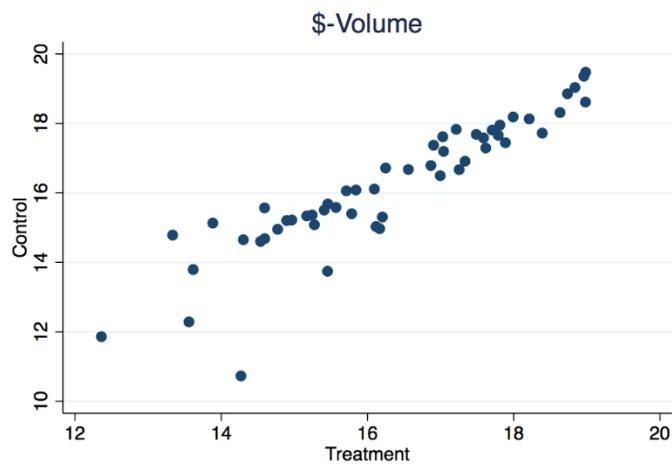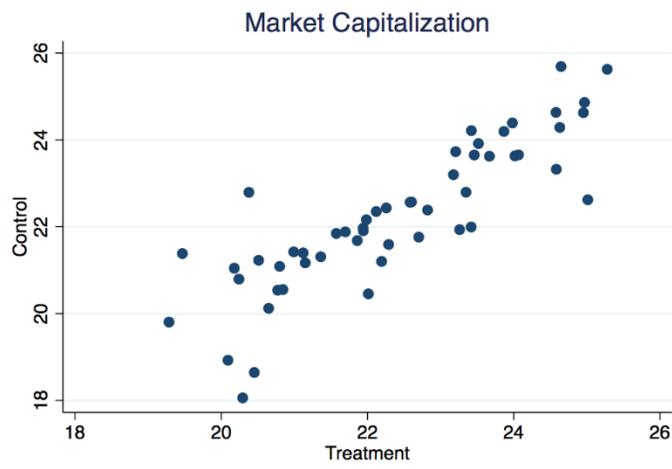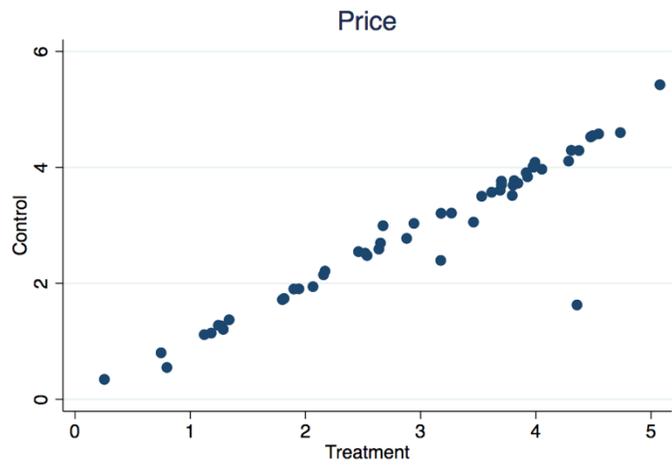
Figure 1

MODEL DRAFT ORDER

IN THE MATTER OF THE SECURITIES ACT, RSO 1990, CHAPTER S5, AS AMENDED

(the "Act")

AND

**IN THE MATTER OF
[INSERT EXCHANGE/ATS]**

([Exchange/ATS short form])

ORDER (Subsection 21(5)/Section 21.0.1 of the Act)

WHEREAS [Exchange/ATS short form] is an exchange/alternative trading system (ATS) carrying on business in Ontario;

AND WHEREAS if it considers it to be in the public interest, the Ontario Securities Commission (Commission) has the authority to make any decision with respect to the manner in which a recognized exchange/an alternative trading system carries on business;

AND WHEREAS the payment of rebates by a marketplace may be changing behaviours of marketplace participants and creating unnecessary conflicts of interest for dealer routing decisions that may be difficult to manage, contributing to increased segmentation of order flow, and/or contributing to increased intermediation on highly liquid securities;

AND WHEREAS in light of the information set out in the paragraph above, it is the Commission's opinion that it is in the public interest to conduct a pilot study on the prohibition of the payment of rebates by marketplaces for a sample of securities (the Pilot);

AND WHEREAS the Pilot will apply to [insert number] of securities;

AND WHEREAS the objective of the Pilot is to gain a better understanding of the effects of the prohibition of rebate payments by Canadian marketplaces (the Objective) to determine whether the Commission should facilitate the transition to an amended rule regarding the payment of rebates by marketplaces;

IT IS ORDERED that, pursuant to subsection 21(5)/section 21.0.1 of the Act:

1. On [insert Pilot start date], [insert Exchange/ATS] shall implement the Pilot according to the design set out at Appendix A appended to this Order, by eliminating rebates for those securities set out at [insert where treated securities listed] in Appendix A until [insert Pilot end date].

2. Between [insert Pilot start date] and [insert Pilot end date], if [insert Exchange/ATS] seeks any amendment to its Form 21-101F1/2, including the exhibits thereto (the Proposed Amendments), [insert Exchange/ATS] shall file submissions which satisfy the Commission that the Proposed Amendments do not negatively impact the Objective of the Pilot.

DATED this __ day of _____, 201_, to take effect _____, 201_.

_____   _____
[Name]   [Name]
[Title]   [Title]
Ontario Securities Commission   Ontario Securities Commission