

SECURITIES AND EXCHANGE COMMISSION  
(Release No. 34-86742; File No. SR-CboeBYX-2019-014)

August 23, 2019

Self-Regulatory Organizations; Cboe BYX Exchange, Inc.; Notice of Filing of a Proposed Rule Change to Make Permanent Rule 11.24, Which Sets Forth the Exchange's Pilot Retail Price Improvement Program

Pursuant to Section 19(b)(1) of the Securities Exchange Act of 1934 (the "Act"),<sup>1</sup> and Rule 19b-4 thereunder,<sup>2</sup> notice is hereby given that on August 22, 2019, Cboe BYX Exchange, Inc. (the "Exchange" or "BYX") filed with the Securities and Exchange Commission (the "Commission" or "SEC") the proposed rule change as described in Items I, II, and III below, which Items have been prepared by the Exchange. The Commission is publishing this notice to solicit comments on the proposed rule change from interested persons.

I. Self-Regulatory Organization's Statement of the Terms of Substance of the Proposed Rule Change

Cboe BYX Exchange, Inc. ("BYX" or the "Exchange") is filing with the Securities and Exchange Commission (the "Commission") a proposed rule change to make permanent Rule 11.24, which sets forth the Exchange's pilot Retail Price Improvement Program. The text of the proposed rule change is provided in Exhibit 5.

The text of the proposed rule change is also available on the Exchange's website ([http://markets.cboe.com/us/equities/regulation/rule\\_filings/byx/](http://markets.cboe.com/us/equities/regulation/rule_filings/byx/)), at the Exchange's Office of the Secretary, and at the Commission's Public Reference Room.

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<sup>1</sup> 15 U.S.C. 78s(b)(1).

<sup>2</sup> 17 CFR 240.19b-4.

II. Self-Regulatory Organization’s Statement of the Purpose of, and Statutory Basis for, the Proposed Rule Change

In its filing with the Commission, the Exchange included statements concerning the purpose of and basis for the proposed rule change and discussed any comments it received on the proposed rule change. The text of these statements may be examined at the places specified in Item IV below. The Exchange has prepared summaries, set forth in sections A, B, and C below, of the most significant aspects of such statements.

A. Self-Regulatory Organization’s Statement of the Purpose of, and Statutory Basis for, the Proposed Rule Change

1. Purpose

The purpose of the proposed rule change is to amend Rule 11.24 to make permanent the Retail Price Improvement Program (the “Program”), which is currently offered on a pilot basis. The Exchange has operated the pilot for a six year period and believes that it has been successful in its stated goal of providing price improvement opportunities to retail investors. The analysis conducted by the Exchange shows that retail investors have been provided a total of \$4.5 million of price improvement during the 2.5 year period reviewed from January 2016 through June 2018. In addition, the Exchange’s analysis shows that the Program has provided these benefits to retail investors without having an adverse impact on the broader market. The proposal provides an analysis of the economic benefits to retail investors and the marketplace flowing from operation of the Program, which the Exchange believes supports making the Program permanent.

Background

In November 2012, the Commission approved the Program on a pilot basis.<sup>3</sup> The Program is designed to attract retail order flow to the Exchange, and allow such order flow to

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<sup>3</sup> See Securities Exchange Act Release No. 68303 (November 27, 2012), 77 FR 71652

receive potential price improvement. The Program is currently limited to trades occurring at prices equal to or greater than \$1.00 per share.<sup>4</sup> Under the Program, a class of market participant called a Retail Member Organization (“RMO”) is eligible to submit certain retail order flow (“Retail Orders”) to the Exchange. Users<sup>5</sup> are permitted to provide potential price improvement for Retail Orders<sup>6</sup> in the form of non-displayed interest that is better than the national best bid that is a Protected Quotation (“Protected NBB”) or the national best offer that is a Protected Quotation (“Protected NBO”, and together with the Protected NBB, the “Protected NBBO”).<sup>7</sup> The Program was approved by the Commission on a pilot basis running one-year from the date of implementation.<sup>8</sup> The Commission approved the Program on November 27, 2012.<sup>9</sup> The

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(December 3, 2012) (“RPI Approval Order”) (SR-BYX-2012-019).

<sup>4</sup> The Exchange will periodically notify the membership regarding the securities included in the Program through an information circular.

<sup>5</sup> A “User” is defined in Rule 1.5(cc) as any member or sponsored participant of the Exchange who is authorized to obtain access to the System.

<sup>6</sup> A “Retail Order” is defined in Rule 11.24(a)(2) as an agency order that originates from a natural person and is submitted to the Exchange by a RMO, provided that no change is made to the terms of the order with respect to price or side of market and the order does not originate from a trading algorithm or any computerized methodology. See Rule 11.24(a)(2).

<sup>7</sup> The term Protected Quotation is defined in BYX Rule 1.5(t) and has the same meaning as is set forth in Regulation NMS Rule 600(b)(58). The terms Protected NBB and Protected NBO are defined in BYX Rule 1.5(s). The Protected NBB is the best-priced protected bid and the Protected NBO is the best-priced protected offer. Generally, the Protected NBB and Protected NBO and the national best bid (“NBB”) and national best offer (“NBO”, together with the NBB, the “NBBO”) will be the same. However, a market center is not required to route to the NBB or NBO if that market center is subject to an exception under Regulation NMS Rule 611(b)(1) or if such NBB or NBO is otherwise not available for an automatic execution. In such case, the Protected NBB or Protected NBO would be the best-priced protected bid or offer to which a market center must route interest pursuant to Regulation NMS Rule 611.

<sup>8</sup> See RPI Approval Order, supra note 3 at 71652.

<sup>9</sup> Id.

Exchange implemented the Program on January 11, 2013, and has extended the pilot period seven times.<sup>10</sup> The pilot period for the Program is scheduled to expire on September 30, 2019.

The Exchange believes that the Program has been successful in its goal of providing price improvement to Retail Orders, and is therefore proposing to amend Rule 11.24 to make this pilot permanent so that retail investors can continue to reap the benefits of the Program.<sup>11</sup>

The SEC approved the Program on a pilot basis, in part, because it concluded, “the Program is reasonably designed to benefit retail investors by providing price improvement to retail order flow.”<sup>12</sup> The Commission also found that “while the Program would treat retail order flow differently from order flow submitted by other market participants, such segmentation would not be inconsistent with Section 6(b)(5) of the Act, which requires that the rules of an exchange are not designed to permit unfair discrimination.”<sup>13</sup> As the SEC acknowledged, the retail order segmentation was designed to create greater retail order flow competition and thereby increase the amount of this flow to transparent and well-regulated exchanges. This would help to ensure that retail investors benefit from competitive price improvement that exchange-based liquidity providers provide. As discussed below, the Exchange believes that the Program data supports the conclusion that it provides valuable price improvement to retail investors that

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<sup>10</sup> See Securities Exchange Act Release Nos. 71249 (January 7, 2014), 79 FR 2229 (January 13, 2014) (SR-BYX-2014-001); 74111 (January 22, 2015), 80 FR 4598 (January 28, 2015) (SR-BYX-2015-05); 76965 (January 22, 2016), 81 FR 4682 (January 27, 2016) (SR-BYX-2016-01); 78180 (June 28, 2016), 81 FR 43306 (July 1, 2016) (SR-BatsBYX-2016-15); 81368 (August 10, 2017), 82 FR 38960 (August 16, 2017) (SR-BatsBYX-2017-18); 84830 (December 17, 2018), 83 FR 65769 (December 21, 2018) (SR-CboeBYX-2018-025); 86206 (June 26, 2019), 84 FR 31650 (July 2, 2019) (SR-CboeBYX-2019-010).

<sup>11</sup> The Program will continue to only apply to trades occurring at prices equal to or greater than \$1.00 per share.

<sup>12</sup> See RPI Approval Order, supra note 3 at 71655.

<sup>13</sup> Id.

they may not otherwise have received, and that it is therefore appropriate to make the Program permanent.

### Definitions

The Exchange adopted the following definitions under Rule 11.24(a):

First, the term “Retail Member Organization” is defined as a Member (or a division thereof) that has been approved by the Exchange to submit Retail Orders.

Second, the term “Retail Order” is defined as an agency order or riskless principal that meets the criteria of FINRA Rule 5320.03<sup>14</sup> that originates from a natural person and is submitted to the Exchange by a Retail Member Organization, provided that no change is made to the terms of the order with respect to price or side of market and the order does not originate from a trading algorithm or any other computerized methodology. A Retail Order is an Immediate or Cancel (“IOC”) Order and shall operate in accordance with Rule 11.24(f). A Retail Order may be an odd lot, round lot, or mixed lot.

Finally, the term “Retail Price Improvement Order” or “RPI Order” consists of non-displayed interest on the Exchange that is priced better than the Protected NBB or Protected NBO by at least \$0.001 and that is identified as such (“RPI interest”).<sup>15</sup> The System<sup>16</sup> will

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<sup>14</sup> FINRA Rule 5320.03 clarifies that an RMO may enter Retail Orders on a riskless principal basis, provided that (i) the entry of such riskless principal orders meet the requirements of FINRA Rule 5320.03, including that the RMO maintains supervisory systems to reconstruct, in a time-sequenced manner, all Retail Orders that are entered on a riskless principal basis; and (ii) the RMO submits a report, contemporaneously with the execution of the facilitated order, that identifies the trade as riskless principal.

<sup>15</sup> Exchange systems prevent Retail Orders from interacting with RPI Orders if the RPI Order is not priced at least \$0.001 better than the Protected NBBO. The Exchange notes, however, that price improvement of \$0.001 would be a minimum requirement and Users could enter RPI Orders that better the Protected NBBO by more than \$0.001. Exchange systems will accept RPI Orders without a minimum price improvement value; however, such interest will execute at its floor or ceiling price only if such floor or ceiling price is

monitor whether RPI buy or sell interest, adjusted by any offset and subject to the ceiling or floor price, is eligible to interact with incoming Retail Orders. An RPI Order remains non-displayed in its entirety (the buy or sell interest, the offset, and the ceiling or floor). An RPI Order may also be entered in a sub-penny increment with an explicit limit price. Any User is permitted, but not required, to submit RPI Orders. An RPI Order may be an odd lot, round lot or mixed lot.

The price of an RPI Order is determined by a User's entry of the following into the Exchange: (1) RPI buy or sell interest; (2) an offset, if any; and (3) a ceiling or floor price. RPI Orders submitted with an offset are similar to other peg orders available to Users in that the order is tied or "pegged" to a certain price, and would have its price automatically set and adjusted upon changes in the Protected NBBO, both upon entry and any time thereafter. RPI buy or sell interest is typically entered to track the Protected NBBO, that is, RPI Orders are typically submitted with an offset. The offset is a predetermined amount by which the User is willing to improve the Protected NBBO, subject to a ceiling or floor price. The ceiling or floor price is the amount above or below which the User does not wish to trade. RPI Orders in their entirety (the buy or sell interest, the offset, and the ceiling or floor) will remain non-displayed. The Exchange also allows Users to enter RPI Orders that establish the exact limit price, which is similar to a non-displayed limit order currently accepted by the Exchange except the Exchange accepts sub-penny limit prices on RPI Orders in increments of \$0.001. The Exchange monitors whether RPI buy or sell interest, adjusted by any offset and subject to the ceiling or floor price, is eligible to interact with incoming Retail Orders.

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better than the Protected NBBO by \$0.001 or more.

<sup>16</sup> The "System" is defined in BYX Rule 1.5(aa) as "the electronic communications and trading facility designated by the Board through which securities orders of Users are consolidated for ranking, execution and, when applicable, routing away."

Users and RMOs may enter odd lots, round lots or mixed lots as RPI Orders and as Retail Orders respectively. As discussed below, RPI Orders are ranked and allocated according to price and time of entry into the System consistent with Rule 11.12 and therefore without regard to whether the size entered is an odd lot, round lot or mixed lot amount. Similarly, Retail Orders interact with RPI Orders according to the Priority and Allocation rules of the Program and without regard to whether they are odd lots, round lots or mixed lots. Finally, Retail Orders are designated as Type 1 or Type 2 without regard to the size of the order.

RPI Orders interact with Retail Orders as follows. Assume a User enters RPI sell interest with an offset of \$0.001 and a floor of \$10.10 while the Protected NBO is \$10.11. The RPI Order could interact with an incoming buy Retail Order at \$10.109. If, however, the Protected NBO was \$10.10, the RPI Order could not interact with the Retail Order because the price required to deliver the minimum \$0.001 price improvement (\$10.099) would violate the User's floor of \$10.10. If a User otherwise enters an offset greater than the minimum required price improvement and the offset would produce a price that would violate the User's floor, the offset would be applied only to the extent that it respects the User's floor. By way of illustration, assume RPI buy interest is entered with an offset of \$0.005 and a ceiling of \$10.112 while the Protected NBB is at \$10.11. The RPI Order could interact with an incoming sell Retail Order at \$10.112, because it would produce the required price improvement without violating the User's ceiling, but it could not interact above the \$10.112 ceiling. Finally, if a User enters an RPI Order without an offset (i.e., an explicitly priced limit order), the RPI Order will interact with Retail Orders at the level of the User's limit price as long as the minimum required price improvement is produced. Accordingly, if RPI sell interest is entered with a limit price of \$10.098 and no offset while the Protected NBO is \$10.11, the RPI Order could interact with the Retail Order at

\$10.098, producing \$0.012 of price improvement. The System will not cancel RPI interest when it is not eligible to interact with incoming Retail Orders; such RPI interest will remain in the System and may become eligible again to interact with Retail Orders depending on the Protected NBBO.

#### RMO Qualifications and Application Process

Under Rule 11.24(b), any Member may qualify as an RMO if it conducts a retail business or routes retail orders on behalf of another broker-dealer. For purposes of Rule 11.24(b), conducting a retail business shall include carrying retail customer accounts on a fully disclosed basis. Any Member that wishes to obtain RMO status is required to submit: (1) an application form; (2) supporting documentation sufficient to demonstrate the retail nature and characteristics of the applicant's order flow; and (3) an attestation, in a form prescribed by the Exchange, that substantially all orders submitted as Retail Orders will qualify as such under Rule 11.24.<sup>17</sup> The Exchange shall notify the applicant of its decision in writing.

An RMO is required to have written policies and procedures reasonably designed to assure that it will only designate orders as Retail Orders if all requirements of a Retail Order are met. Such written policies and procedures must require the Member to (i) exercise due diligence before entering a Retail Order to assure that entry as a Retail Order is in compliance with the requirements of this rule, and (ii) monitor whether orders entered as Retail Orders meet the applicable requirements. If the RMO represents Retail Orders from another broker-dealer customer, the RMO's supervisory procedures must be reasonably designed to assure that the

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<sup>17</sup> For example, a prospective RMO could be required to provide sample marketing literature, website screenshots, other publicly disclosed materials describing the retail nature of their order flow, and such other documentation and information as the Exchange may require to obtain reasonable assurance that the applicant's order flow would meet the requirements of the Retail Order definition.



orders it receives from such broker-dealer customer that it designates as Retail Orders meet the definition of a Retail Order. The RMO must (i) obtain an annual written representation, in a form acceptable to the Exchange, from each broker-dealer customer that sends it orders to be designated as Retail Orders that entry of such orders as Retail Orders will be in compliance with the requirements of this rule, and (ii) monitor whether its broker-dealer customers' Retail Order flow continues to meet the applicable requirements.<sup>18</sup>

If the Exchange disapproves the application, the Exchange provides a written notice to the Member. The disapproved applicant could appeal the disapproval by the Exchange as provided in Rule 11.24(d), and/or reapply for RMO status 90 days after the disapproval notice is issued by the Exchange. An RMO also could voluntarily withdraw from such status at any time by giving written notice to the Exchange.

#### Failure of RMO to Abide by Retail Order Requirements

Rule 11.24(c) addresses an RMO's failure to abide by Retail Order requirements. If an RMO designates orders submitted to the Exchange as Retail Orders and the Exchange determines, in its sole discretion, that those orders fail to meet any of the requirements of Retail Orders, the Exchange may disqualify a Member from its status as an RMO. When disqualification determinations are made, the Exchange provides a written disqualification notice to the Member. A disqualified RMO may appeal the disqualification as provided in Rule 11.24(d) and/or reapply for RMO status 90 days after the disqualification notice is issued by the Exchange.

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<sup>18</sup> The Exchange or another self-regulatory organization on behalf of the Exchange will review an RMO's compliance with these requirements through an exam-based review of the RMO's internal controls.

### Appeal of Disapproval or Disqualification

Rule 11.24(d) provides appeal rights to Members. If a Member disputes the Exchange's decision to disapprove it as an RMO under Rule 11.24(b) or disqualify it under Rule 11.24(c), such Member ("appellant") may request, within five business days after notice of the decision is issued by the Exchange, that the Retail Price Improvement Program Panel ("RPI Panel") review the decision to determine if it was correct.

The RPI Panel consists of the Exchange's Chief Regulatory Officer ("CRO"), or a designee of the CRO, and two officers of the Exchange designated by the Chief Operating Officer ("COO"). The RPI Panel reviews the facts and render a decision within the time frame prescribed by the Exchange. The RPI Panel may overturn or modify an action taken by the Exchange and all determinations by the RPI Panel constitute final action by the Exchange on the matter at issue.

### Retail Liquidity Identifier

Under Rule 11.24(e), the Exchange disseminates an identifier when RPI interest priced at least \$0.001 better than the Exchange's Protected Bid or Protected Offer for a particular security is available in the System ("Retail Liquidity Identifier"). The Retail Liquidity Identifier is disseminated through consolidated data streams (i.e., pursuant to the Consolidated Tape Association Plan/Consolidated Quotation Plan, or CTA/CQ, for Tape A and Tape B securities, and the Nasdaq UTP Plan for Tape C securities) as well as through proprietary Exchange data feeds.<sup>19</sup> The Retail Liquidity Identifier reflects the symbol and the side (buy or sell) of the RPI

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<sup>19</sup> The Exchange notes that the Retail Liquidity Identifier for Tape A and Tape B securities are disseminated pursuant to the CTA/CQ Plan. The identifier is also available through the consolidated public market data stream for Tape C securities. The processor for the Nasdaq UTP quotation stream disseminates the Retail Liquidity Identifier and analogous

interest, but does not include the price or size of the RPI interest. In particular, CQ and UTP quoting outputs include a field for codes related to the Retail Liquidity Identifier. The codes indicate RPI interest that is priced better than the Exchange's Protected Bid or Protected Offer by at least the minimum level of price improvement as required by the Program.

#### Retail Order Designations

Under Rule 11.24(f), an RMO can designate how a Retail Order would interact with available contra-side interest as follows:

A Type 1-designated Retail Order will interact with available contra-side RPI Orders and other price improving contra-side interest but will not interact with other available contra-side interest in the System that is not offering price improvement or route to other markets. The portion of a Type 1-designated Retail Order that does not execute against contra-side RPI Orders or other price improving liquidity will be immediately and automatically cancelled.

A Type 2-designated Retail Order will interact first with available contra-side RPI Orders and other price improving liquidity and then any remaining portion of the Retail Order will be executed as an Immediate-or-Cancel ("IOC") Order pursuant to Rule 11.9(b)(1). A Type 2-designated Retail Order can either be submitted as a BYX Only Order<sup>20</sup> or as an order eligible for routing pursuant to Rule 11.13(a)(2).

#### Priority and Order Allocation

Under Rule 11.24(g), competing RPI Orders in the same security are ranked and allocated according to price then time of entry into the System. Executions occur in price/time priority in accordance with Rule 11.12. Any remaining unexecuted RPI interest remains

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identifiers from other market centers that operate programs similar to the RPI Program.

<sup>20</sup> A BYX Only Order is defined in BYX Rule 11.9(c)(4) and includes orders that are not eligible for routing to other trading centers.

available to interact with other incoming Retail Orders if such interest is at an eligible price. Any remaining unexecuted portion of the Retail Order will cancel or execute in accordance with Rule 11.24(f). The following example illustrates this method:

- Protected NBBO for security ABC is \$10.00 — \$10.05
- User 1 enters an RPI Order to buy ABC at \$10.015 for 500
- User 2 then enters an RPI Order to buy ABC at \$10.02 for 500
- User 3 then enters an RPI Order to buy ABC at \$10.035 for 500

An incoming Retail Order to sell ABC for 1,000 executes first against User 3's bid for 500 at \$10.035, because it is the best priced bid, then against User 2's bid for 500 at \$10.02, because it is the next best priced bid. User 1 is not filled because the entire size of the Retail Order to sell 1,000 is depleted. The Retail Order executes against RPI Orders in price/time priority.

However, assume the same facts above, except that User 2's RPI Order to buy ABC at \$10.02 is for 100. The incoming Retail Order to sell 1,000 executes first against User 3's bid for 500 at \$10.035, because it is the best priced bid, then against User 2's bid for 100 at \$10.02, because it is the next best priced bid. User 1 then receives an execution for 400 of its bid for 500 at \$10.015, at which point the entire size of the Retail Order to sell 1,000 is depleted.

As a final example, assume the same facts as above, except that User 3's order was not an RPI Order to buy ABC at \$10.035, but rather, a non-displayed order to buy ABC at \$10.03. The result would be similar to the result immediately above, in that the incoming Retail Order to sell 1,000 executes first against User 3's bid for 500 at \$10.03, because it is the best priced bid, then against User 2's bid for 100 at \$10.02, because it is the next best priced bid. User 1 then receives

an execution for 400 of its bid for 500 at \$10.015, at which point the entire size of the Retail Order to sell 1,000 is depleted.

### Eligible Securities

All Regulation NMS securities traded on the Exchange are eligible for inclusion in the RPI Program. The Exchange limits the Program to trades occurring at prices equal to or greater than \$1.00 per share. Toward that end, Exchange trade validation systems prevent the interaction of RPI buy or sell interest (adjusted by any offset) and Retail Orders at a price below \$1.00 per share.<sup>21</sup> For example, if there is RPI buy interest tracking the Protected NBB at \$0.99 with an offset of \$0.001 and a ceiling of \$1.02, Exchange trade validation systems would prevent the execution of the RPI Order at \$0.991 with a sell Retail Order with a limit of \$0.99. However, if the Retail Order was Type 2 as defined the Program,<sup>22</sup> it would be able to interact at \$0.99 with liquidity outside the Program in the Exchange's order book. In addition to facilitating an orderly<sup>23</sup> and operationally intuitive program, the Exchange believes that limiting the Program to trades equal to or greater than \$1.00 per share enabled it better to focus its efforts to monitor price competition and to assess any indications that data disseminated under the Program is

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<sup>21</sup> As discussed above, the price of an RPI is determined by a User's entry of buy or sell interest, an offset (if any) and a ceiling or floor price. RPI sell or buy interest typically tracks the Protected NBBO.

<sup>22</sup> Type 2 Retail Orders are treated as IOC orders that execute against displayed and non-displayed liquidity in the Exchange's order book where there is no available liquidity in the Program. Type 2 Retail Orders can either be designated as eligible for routing or as BYX Only Orders, and thus non-routable, as described above.

<sup>23</sup> Given the limitation, the Program would have no impact on the minimum pricing increment for orders priced less than \$1.00 and therefore no effect on the potential of markets executing those orders to lock or cross. In addition, the non-displayed nature of the liquidity in the Program simply has no potential to disrupt displayed, protected quotes. In any event, the Program would do nothing to change the obligation of exchanges to avoid and reconcile locked and crossed markets under NMS Rule 610(d).

potentially disadvantaging retail orders. As part of that review, the Exchange produced data throughout the pilot, which included statistics about participation, the frequency and level of price improvement provided by the Program, and any effects on the broader market structure.

#### Rationale for Making the Program Pilot Permanent

The Exchange established the Program in an attempt to attract retail order flow to the Exchange by providing an opportunity for price improvement to such order flow. The Exchange believes that the Program promotes transparent competition for retail order flow by allowing Exchange members to submit RPI Orders to interact with Retail Orders. As the Commission stated in the RPI Approval Order, such competition “promote[s] efficiency by facilitating the price discovery process” and “may generate additional investor interest in trading securities, thereby promoting capital formation.” The Program will continue to be limited to trades occurring at prices equal to or greater than \$1.00 per share.

In accordance with its filing establishing the pilot, the Exchange did “produce data throughout the pilot, which will include statistics about participation, the frequency and level of price improvement provided by the Program, and any effects on the broader market structure.”<sup>24</sup> The Exchange has fulfilled this obligation through the reports and assessments it has submitted to the Commission since the implementation of the pilot Program. The Exchange believes that its analysis of data provided to the Commission to date, as well as the data being provided in this proposed rule change, support the continued operation of the Program on a permanent basis.

The SEC stated in the RPI Approval Order that the Program could promote competition for retail order flow among execution venues, and that this could benefit retail investors by creating additional well-regulated and transparent price improvement opportunities for

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<sup>24</sup> RPI Approval Order, 77 FR at 71655.

marketable retail order flow, most of which is currently executed in the Over-the-Counter (“OTC”) markets without ever reaching a public exchange.<sup>25</sup> The Exchange believes that it has achieved its goal of attracting retail order flow to the Exchange. As the Exchange’s analysis of the Program data below demonstrates, there has been consistent retail investor interest in the Program, which has provided tangible price improvement to those retail investors through a competitive pricing process over the course of the pilot. The data also demonstrates that the Program had an overall negligible impact on broader market quality outside of the Program. The Exchange has not received any complaints or negative feedback concerning the Program.

## **I. Overall Analysis of the Program**

Brokers route retail orders to a wide range of different trading systems. The Program offers a transparent and well-regulated option, providing meaningful competition and price improvement. As explained above, the purpose of the Program is to attract retail order flow to the Exchange by providing an opportunity for retail investors to receive price improvement. The Exchange believes that the Program has satisfied this goal, having provided a total of \$4.5 million of price improvement, or approximately \$153,000 per month, in the 2.5 year period analyzed. Furthermore, to ensure that the price improvement opportunities for Retail Orders under the Program are meaningful, the Exchange compared the volume weighted average price improvement in basis points received in the Program to the same metric for marketable orders executed on the BYX Book. As Shown in Table A, retail investors have benefited from

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<sup>25</sup> Id. See also Concept Release on Equity Market Structure, Securities Exchange Act Release No. 61358 (January 14, 2010), 75 FR 3593, 3600 (January 21, 2010) (File No. S7-02-10) (“A review of the order routing disclosures required by Rule 606 of Regulation NMS of eight broker-dealers with significant retail customer accounts reveals that nearly 100% of their customer market orders are routed to OTC market makers.”).

significantly higher price improvement by participating in the Program, including when assessed across different liquidity groupings.<sup>26</sup>

**Table A: Retail Price Improvement Compared to BYX Book (May 2018 – Oct. 2018)**

	<b>CADV 500,000 or more</b>		<b>CADV Between 50,000 and 500,000</b>	
<b>Volume Weighted Avg. Price Improvement (bps)</b>	Retail	2.947	Retail	4.502
	BYX Book	0.649	BYX Book	3.574

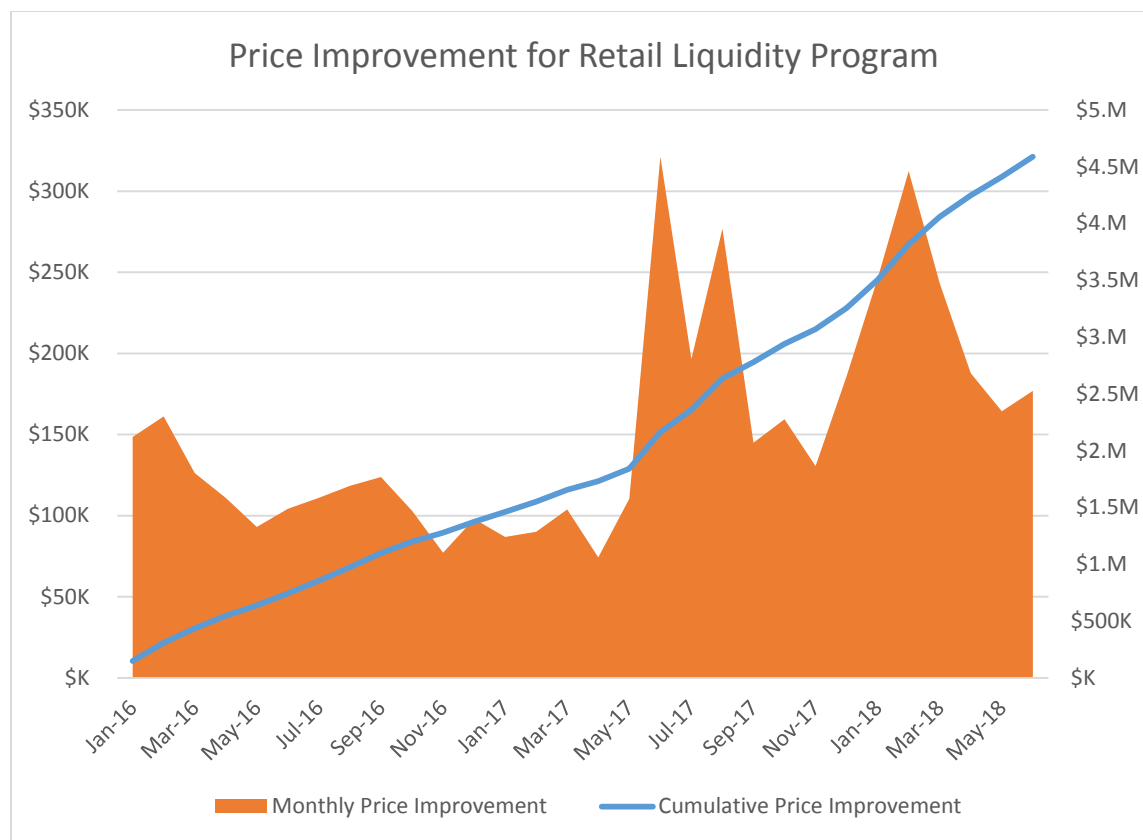
Furthermore, while the amount of price improvement provided in the Program varies month to month, the amount of price improvement provided in recent months has generally increased relative to prior months due to additional participation in the Program by market participants with retail order flow. The Exchange believes that this supports permanent approval of the pilot as retail investors continue to reap the benefits afforded by the Program. The amount of monthly and cumulative price improvement provided in the Program is illustrated in Chart 1 below.

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<sup>26</sup> The two liquidity categories used for this analysis correspond to the liquidity profiles described in the Exchange’s analysis of the market structure impact of the Program.



**Chart 1: Price Improvement Summary**



Furthermore, Retail Order volume executed in the Program accounted for between 0.86% and 2.32% of total BYX volume from January 2017 to June 2018, as shown in Chart 2 below, and between 0.05% and 0.11% of total consolidated volume, as shown in Chart 3 below. Despite its size relative to total volume executed on the Exchange or the broader market, the Program has continued to provide considerable price improvement each month to retail investors that participated in the Program. In addition, the Exchange believes that the relatively modest volume executed in the Program relative to total BYX volume and total consolidated volume limits the potential impact of the Program on broader market quality on the Exchange.<sup>27</sup> The

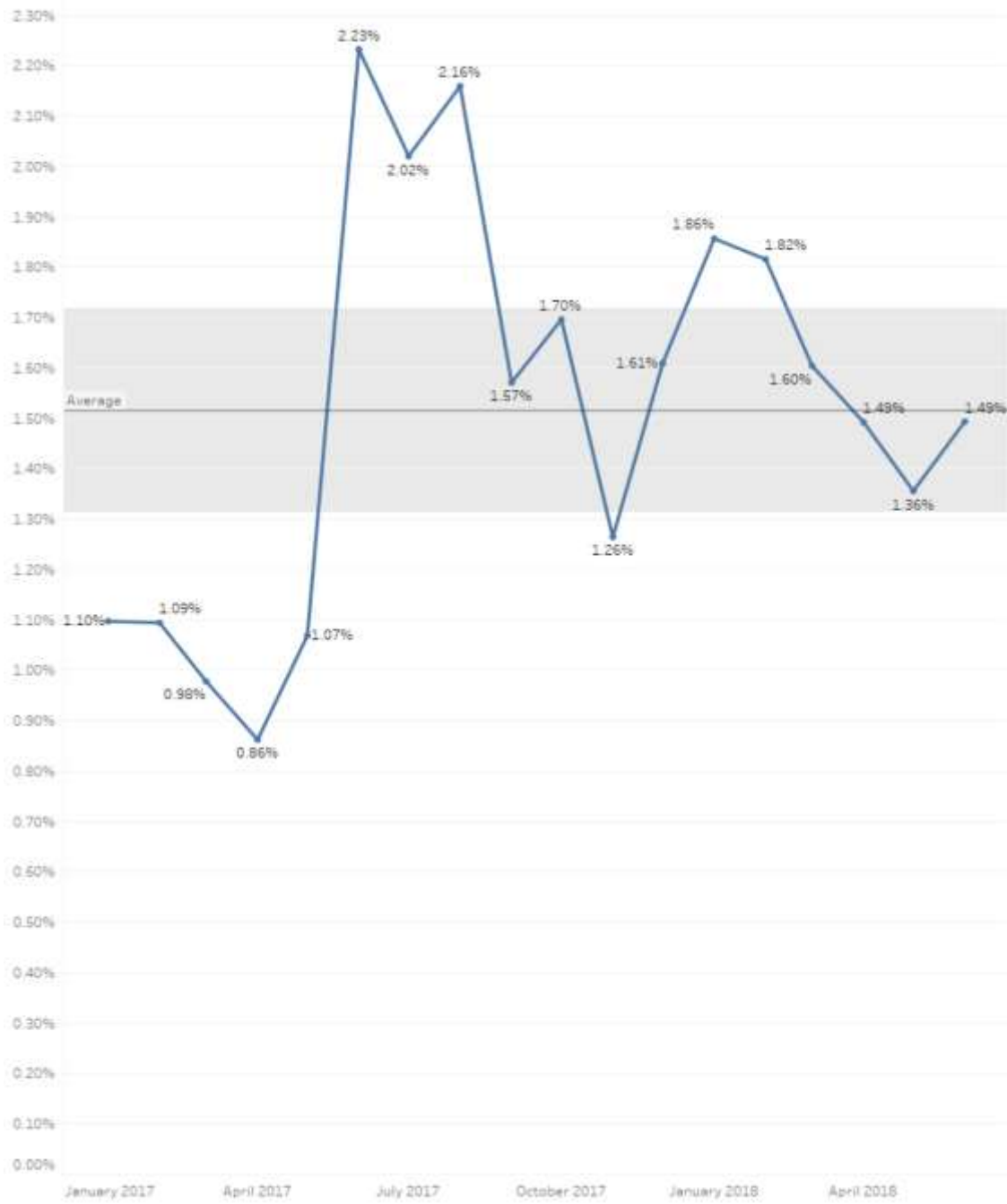
<sup>27</sup> The Exchange has also performed an analysis of the impact of the Program on other market quality indicators, which found that the Program did not have a significant impact on market quality in the broader market. See Section III below.

Exchange therefore believes that the Program has demonstrated the effectiveness of a transparent, on-exchange retail order price improvement functionality, notwithstanding that the majority of retail volume is still traded off-exchange.<sup>28</sup>

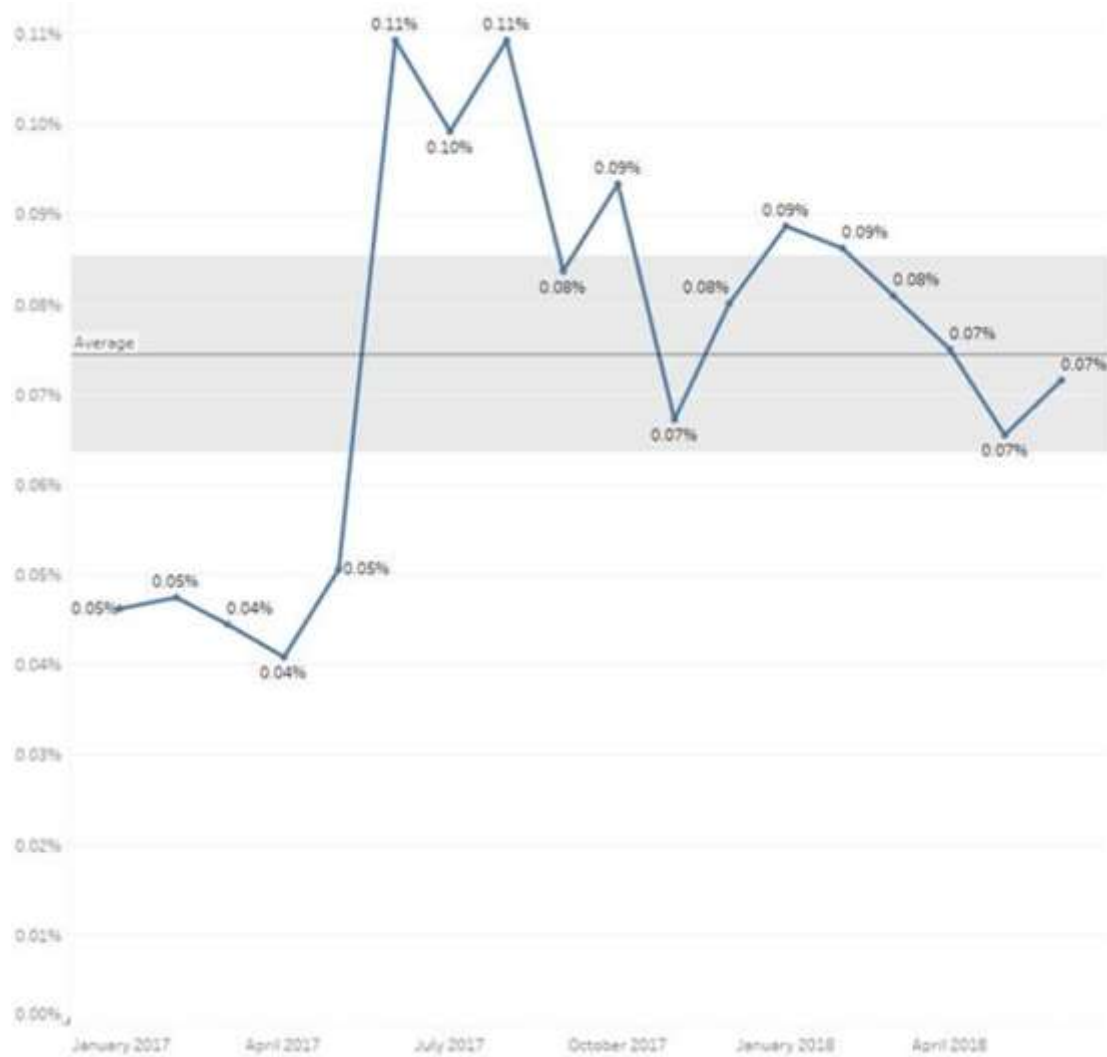
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<sup>28</sup> See supra note 25.

**Chart 2: RPI Volume as a Percentage of Total BYX Volume**



**Chart 3: RPI Volume as a Percentage of Total Consolidated Volume**



Retail Orders are routed by sophisticated brokers using systems that seek the highest fill rates and amounts of price improvement. These brokers have many choices of execution venues for this order flow. When they choose to route to the Program, they have determined that it is the best opportunity for fill rate and price improvement at that time. As shown in Table 1 below, Retail Order average daily volume (“ADV”) executed in the Program averaged between 2 and 7 million shares from January 2016 to June 2018. Increased volatility in February 2018 likely contributed to the increased Retail Order shares executed in the Program that month. Fill rates for the majority of the period studied ranged from 11% – 19% with fill rates declining below

10% starting in December 2017, likely due to additional participation in the Program that resulted in a significant increase in the Retail Order volume entered on the Exchange. Retail Orders also continue to receive more than the minimum \$0.001 price improvement required of a liquidity providing RPI Order, with the monthly average price improvement provided to Retail Orders ranging from \$0.0011 – \$0.0014 per share, and the monthly effective/quoted spread ratio ranging from 0.77 – 0.90. The Exchange believes that this data supports permanent approval of the Program as this would allow retail investors to continue to execute their orders with price improvement in the Program.

**Table 1: Summary Statistics on the Program**

<b>Date</b>	<b>Retail Shares Executed ADV</b>	<b>Retail Orders Placed ADV</b>	<b>Effective Spread BPS</b>	<b>Quoted Spread BPS</b>	<b>Effective/Quoted Spread Ratio</b>	<b>Price Improvement</b>	<b>Fill Rate</b>
Jan-16	4,666,052	20,560	19	22	0.89	\$0.0011	16.09%
Feb-16	4,083,670	18,025	19	22	0.87	\$0.0011	16.10%
Mar-16	3,474,997	15,103	21	24	0.90	\$0.0011	17.50%
Apr-16	3,216,923	14,126	18	21	0.88	\$0.0011	19.23%
May-16	2,912,160	12,980	18	21	0.87	\$0.0011	19.73%
Jun-16	3,144,024	13,924	16	18	0.89	\$0.0011	19.65%
Jul-16	4,009,916	17,257	18	20	0.90	\$0.0011	19.97%
Aug-16	3,906,624	17,135	19	21	0.90	\$0.0011	17.66%
Sep-16	4,887,221	20,708	17	19	0.88	\$0.0011	17.28%
Oct-16	3,595,900	15,922	24	27	0.90	\$0.0012	17.19%
Nov-16	2,273,885	8,972	29	33	0.88	\$0.0013	12.71%
Dec-16	3,192,065	12,768	36	41	0.88	\$0.0013	14.82%
Jan-17	3,122,721	16,951	31	36	0.88	\$0.0013	16.09%
Feb-17	3,262,046	21,151	31	35	0.88	\$0.0013	14.71%

Mar-17	3,068,930	20,921	33	38	0.88	\$0.0014	13.85%
Apr-17	2,680,646	18,518	34	38	0.88	\$0.0013	13.97%
May-17	3,407,603	23,437	29	33	0.87	\$0.0013	16.88%
Jun-17	7,896,833	46,398	28	32	0.88	\$0.0013	17.07%
Jul-17	5,966,961	36,717	27	31	0.88	\$0.0012	16.43%
Aug-17	6,467,615	38,608	23	26	0.88	\$0.0013	16.24%
Sep-17	5,237,243	33,314	27	31	0.87	\$0.0013	15.76%
Oct-17	5,702,759	33,578	34	40	0.84	\$0.0012	16.77%
Nov-17	4,427,779	62,352	33	40	0.83	\$0.0012	11.61%
Dec-17	5,131,502	142,810	34	41	0.84	\$0.0012	8.30%
Jan-18	6,359,122	167,730	29	36	0.82	\$0.0013	7.98%
Feb-18	7,230,230	227,980	21	27	0.79	\$0.0012	8.29%
Mar-18	5,967,844	202,050	23	31	0.73	\$0.0011	7.69%
Apr-18	4,976,642	178,009	20	27	0.75	\$0.0011	7.90%
May-18	4,367,743	169,085	23	28	0.83	\$0.0011	7.02%
Jun-18	5,211,044	202,601	23	31	0.77	\$0.0011	7.19%

## II. Analysis of Retail Orders by Order Size

Tables 2, 3, and 4 show the distribution of Retail Orders entered and executed in the Program for the period from January 2017 to June 2018. As shown in Table 2, a majority of all Retail Orders entered to participate in the Program from January 2016 to June 2018 were for a round lot or fewer shares. Specifically, Retail Orders of one round lot or fewer shares accounted for an average of approximately 56% of the total number of Retail Orders entered. More than 73% of Retail Orders entered were for 300 shares or less. Very large orders of more than 7,500 shares accounted for only 1.9% of Retail Orders submitted to the Program but accounted for a significant portion (approximately 40%) of the shares entered, as shown in Table 3. In addition, despite lower fill rates, large orders account for a reasonable portion (approximately 9%) of the

shares executed in the Program, as shown in Table 4. The Program also receives a significantly large number of odd lot and single lot sized shares, which could be representative of retail marketable orders from retail customers. By providing price improvement to these orders, retail customers would continue to benefit from the Program.

**Table 2: Distribution of Retail Orders Entered by Order Size**

<b>Date</b>	<b>≤ 100</b>	<b>101 - 300</b>	<b>301 - 500</b>	<b>501 - 1,000</b>	<b>1,001 - 2,000</b>	<b>2,001 - 4,000</b>	<b>4,001 - 7,500</b>	<b>7,500 - 15,000</b>	<b>&gt; 15000</b>
Jan-17	44.90%	18.45%	8.60%	10.12%	6.84%	4.90%	3.10%	1.93%	1.16%
Feb-17	47.80%	18.04%	8.21%	9.61%	6.27%	4.41%	2.82%	1.75%	1.09%
Mar-17	47.60%	17.76%	8.16%	9.67%	6.36%	4.60%	3.01%	1.78%	1.05%
Apr-17	48.82%	17.30%	7.88%	9.48%	6.19%	4.61%	2.88%	1.82%	1.02%
May-17	52.39%	18.69%	7.13%	8.13%	5.21%	3.81%	2.40%	1.41%	0.83%
Jun-17	55.32%	13.89%	6.67%	8.08%	5.35%	4.47%	3.24%	2.03%	0.95%
Jul-17	53.18%	15.12%	7.32%	8.85%	5.86%	4.12%	2.71%	1.79%	1.05%
Aug-17	49.41%	16.53%	8.00%	9.65%	6.33%	4.49%	2.75%	1.76%	1.08%
Sep-17	49.88%	16.51%	7.94%	9.50%	6.27%	4.49%	2.71%	1.71%	1.00%
Oct-17	49.92%	16.17%	7.73%	9.45%	6.49%	4.67%	2.76%	1.79%	1.02%
Nov-17	61.01%	17.66%	5.65%	6.33%	3.86%	2.54%	1.39%	0.98%	0.59%
Dec-17	61.48%	18.49%	6.31%	6.65%	3.40%	1.97%	0.93%	0.49%	0.28%
Jan-18	61.20%	17.06%	6.54%	7.14%	3.84%	2.25%	1.06%	0.58%	0.33%
Feb-18	66.63%	15.79%	5.61%	5.80%	2.98%	1.70%	0.80%	0.43%	0.25%
Mar-18	66.11%	15.39%	5.82%	6.22%	3.25%	1.76%	0.78%	0.41%	0.24%
Apr-18	67.41%	15.45%	5.40%	6.06%	3.10%	1.43%	0.59%	0.34%	0.22%
May-18	66.09%	16.12%	5.43%	6.30%	3.41%	1.47%	0.59%	0.35%	0.24%
Jun-18	66.29%	16.17%	5.59%	6.14%	3.20%	1.46%	0.59%	0.35%	0.22%

**Table 3: Distribution of Shares Entered by Order Size**

<b>Date</b>	<b>≤ 100</b>	<b>101 - 300</b>	<b>301 - 500</b>	<b>501 - 1,000</b>	<b>1,001 - 2,000</b>	<b>2,001 - 4,000</b>	<b>4,001 - 7,500</b>	<b>7,500 - 15,000</b>	<b>&gt; 15000</b>
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		<b>300</b>	<b>500</b>	<b>1,000</b>	<b>2,000</b>	<b>4,000</b>	<b>7,500</b>	<b>15,000</b>	
Jan-17	2.15%	3.45%	3.27%	7.03%	9.15%	12.48%	14.61%	17.00%	30.87%
Feb-17	2.36%	3.64%	3.40%	7.30%	9.16%	12.29%	14.52%	16.80%	30.53%
Mar-17	2.25%	3.55%	3.36%	7.32%	9.21%	12.68%	15.38%	16.92%	29.33%
Apr-17	2.36%	3.54%	3.32%	7.32%	9.17%	13.00%	14.92%	17.45%	28.91%
May-17	3.44%	4.59%	3.60%	7.51%	9.25%	12.92%	15.02%	16.32%	27.35%
Jun-17	1.89%	2.89%	2.92%	6.64%	8.44%	13.27%	17.56%	20.05%	26.34%
Jul-17	1.98%	3.18%	3.22%	7.24%	9.17%	12.23%	14.73%	18.29%	29.96%
Aug-17	1.92%	3.36%	3.39%	7.59%	9.57%	12.76%	14.33%	17.21%	29.87%
Sep-17	2.15%	3.49%	3.43%	7.55%	9.70%	13.15%	14.55%	17.27%	28.70%
Oct-17	1.97%	3.34%	3.30%	7.41%	9.91%	13.48%	14.54%	17.90%	28.16%
Nov-17	6.28%	5.19%	3.86%	7.92%	9.53%	12.10%	12.18%	16.22%	26.72%
Dec-17	9.96%	7.34%	5.96%	11.51%	11.24%	12.70%	11.15%	11.31%	18.83%
Jan-18	8.56%	6.29%	5.64%	11.27%	11.49%	13.17%	11.61%	12.18%	19.79%
Feb-18	11.33%	7.16%	6.01%	11.31%	11.12%	12.42%	10.99%	11.30%	18.37%
Mar-18	11.06%	6.96%	6.10%	12.00%	11.88%	12.69%	10.62%	10.82%	17.88%
Apr-18	12.30%	7.46%	5.95%	12.51%	12.19%	11.17%	8.89%	9.73%	19.80%
May-18	12.14%	7.50%	5.74%	12.40%	12.76%	11.08%	8.53%	9.67%	20.17%
Jun-18	12.39%	7.77%	6.12%	12.60%	12.60%	11.42%	8.76%	9.89%	18.45%



**Table 4: Distribution of Shares Executed by Order Size**

<b>Date</b>	<b>≤ 100</b>	<b>101 - 300</b>	<b>301 - 500</b>	<b>501 - 1,000</b>	<b>1,001 - 2,000</b>	<b>2,001 - 4,000</b>	<b>4,001 - 7,500</b>	<b>7,500 - 15,000</b>	<b>&gt; 15000</b>
Jan-17	11.39%	14.06%	10.40%	18.41%	15.88%	12.34%	8.41%	5.26%	3.86%
Feb-17	13.96%	15.27%	10.48%	17.77%	14.54%	11.44%	7.82%	5.15%	3.60%
Mar-17	14.14%	14.99%	10.15%	17.53%	14.74%	11.80%	8.15%	5.02%	3.48%
Apr-17	14.69%	14.83%	10.01%	17.80%	14.84%	11.55%	7.85%	5.00%	3.42%
May-17	17.86%	18.10%	9.98%	16.46%	13.17%	10.48%	6.94%	4.23%	2.78%
Jun-17	9.74%	11.25%	8.91%	16.71%	14.58%	14.86%	12.03%	7.97%	3.95%
Jul-17	10.37%	12.33%	9.91%	18.84%	16.17%	12.75%	8.96%	6.56%	4.11%
Aug-17	9.39%	12.34%	10.01%	18.97%	16.70%	13.36%	8.77%	6.15%	4.31%
Sep-17	10.60%	12.93%	10.22%	18.87%	16.28%	13.00%	8.56%	5.74%	3.79%
Oct-17	9.40%	12.40%	10.16%	19.36%	17.12%	13.45%	8.58%	5.86%	3.66%
Nov-17	12.42%	13.48%	9.27%	16.56%	15.84%	13.24%	7.98%	6.63%	4.56%
Dec-17	14.98%	15.80%	10.29%	16.77%	14.92%	11.67%	6.98%	5.04%	3.55%
Jan-18	14.27%	14.96%	10.28%	17.53%	15.27%	11.90%	7.12%	5.16%	3.50%
Feb-18	16.74%	15.75%	10.78%	17.05%	14.27%	11.08%	6.48%	4.57%	3.30%
Mar-18	17.27%	15.97%	10.58%	16.87%	13.81%	10.51%	6.66%	4.63%	3.70%
Apr-18	17.12%	15.58%	10.24%	16.30%	13.60%	10.04%	6.71%	5.37%	5.03%
May-18	18.24%	16.29%	10.18%	15.89%	12.80%	9.80%	6.25%	5.25%	5.31%
Jun-18	18.93%	17.28%	10.59%	16.16%	12.96%	9.64%	5.66%	4.95%	3.84%

The Exchange also analyzed fill rates across the different order size buckets and found that while fill rates are higher for smaller orders as expected, large size orders are still able to access liquidity and therefore receive price improvement in the Program. Moreover, overall fill rates indicate that market participants that provide liquidity are responding with quote depth when the contra side order is looking for a fill. While fill rates decreased starting in November 2017, the Exchange believes that this is due to new Retail Order flow being routed to the

Program, rather than a decrease in the available liquidity. Monthly volume executed in the Program, as shown in Table 1, has therefore remained constant or increased since November 2017 despite the lower overall fill rates for those months. The Exchange therefore believes that the Program is an attractive option for market participants looking to fill Retail Orders with price improvement.

**Table 5: Fill Rates**

<b>Date</b>	<b>≤ 100</b>	<b>101 - 300</b>	<b>301 - 500</b>	<b>501 - 1,000</b>	<b>1,001 - 2,000</b>	<b>2,001 - 4,000</b>	<b>4,001 - 7,500</b>	<b>7,500 - 15,000</b>	<b>&gt; 15000</b>
Jan-17	85.19%	65.62%	51.13%	42.16%	27.93%	15.91%	9.26%	4.98%	2.01%
Feb-17	87.21%	61.69%	45.31%	35.83%	23.36%	13.69%	7.92%	4.51%	1.73%
Mar-17	87.04%	58.53%	41.87%	33.20%	22.18%	12.89%	7.34%	4.11%	1.65%
Apr-17	86.90%	58.46%	42.12%	33.97%	22.59%	12.40%	7.35%	4.00%	1.65%
May-17	87.53%	66.54%	46.75%	36.99%	24.03%	13.69%	7.80%	4.38%	1.71%
Jun-17	87.78%	66.50%	52.07%	42.98%	29.48%	19.12%	11.70%	6.78%	2.56%
Jul-17	85.99%	63.63%	50.52%	42.77%	28.96%	17.12%	9.99%	5.89%	2.25%
Aug-17	79.61%	59.74%	48.02%	40.59%	28.33%	17.00%	9.94%	5.81%	2.34%
Sep-17	77.55%	58.32%	46.98%	39.39%	26.44%	15.58%	9.27%	5.24%	2.08%
Oct-17	80.19%	62.29%	51.71%	43.82%	28.97%	16.73%	9.90%	5.49%	2.18%
Nov-17	22.78%	29.93%	27.66%	24.11%	19.16%	12.61%	7.55%	4.71%	1.97%
Dec-17	12.14%	17.37%	13.96%	11.77%	10.72%	7.42%	5.05%	3.60%	1.52%
Jan-18	12.84%	18.31%	14.06%	11.98%	10.24%	6.96%	4.72%	3.26%	1.36%
Feb-18	11.79%	17.56%	14.32%	12.03%	10.24%	7.12%	4.70%	3.23%	1.43%
Mar-18	11.56%	17.00%	12.85%	10.42%	8.60%	6.13%	4.64%	3.17%	1.53%
Apr-18	10.61%	15.91%	13.11%	9.93%	8.50%	6.85%	5.76%	4.21%	1.94%
May-18	10.11%	14.61%	11.93%	8.62%	6.75%	5.95%	4.93%	3.65%	1.77%
Jun-18	10.57%	15.39%	11.98%	8.88%	7.12%	5.84%	4.47%	3.46%	1.44%

### **III. Impact of the Program on Broader Market Quality**

As shown in Charts 2 and 3 above, Retail Order volume executed in the Program is a small percentage of both total volume executed on the Exchange and total consolidated volume. While the Program has better depth available for Retail Orders, it does not significantly affect the market volume of BYX. The average volume within the 95<sup>th</sup> percentile is between 1.3% and 1.7%. With the Program volume mostly below 2.5% of BYX volume, the Exchange does not believe that it is able to significantly impact BYX market quality. Nevertheless, to test the impact of the Program on broader market quality, the Exchange: (1) reviewed the correlation between metrics that are tied to overall market quality with relevant Program metrics over both 2017 and 2018, and (2) performed a difference-in-difference analysis to analyze the potential impact of the Program on a number of important market quality indicators. Based on the results of this analysis, the Exchange does not believe that the Program has had any significant impact on broader market quality. The Exchange therefore believes that the Program can continue on a permanent basis – and thereby provide increased price improvement opportunities to retail investors on a transparent well-regulated exchange – without degrading market quality outside of the Program.

#### *Correlation Analysis*

As shown in Table 6 below, the Exchange's correlation analysis shows that: (1) inside size in the broader market is not correlated with either RPI effective spreads or the percentage of volume executed in the Program, which suggests that market participants are not moving volume from the regular market to the Program as effective spreads narrow or volume executed in the Program increases; (2) effective spreads in the broader market are not correlated with the percentage of volume executed in the Program, which suggests that spreads are not widening as a

result of more Retail Order flow being executed in the Program; (3) midpoint volume executed is not correlated with effective spreads in the Program, which suggests that market participants are not moving midpoint liquidity from the regular market to instead receive price improvement in the Program; and (4) displayed volume executed is not correlated with quoted spreads in the Program, which suggest that market participants are not entering non-displayed retail price improving interest in the Program as an alternative to displaying interest on an order book.

**Table 6: BYX Market Quality Correlation Analysis**

	Date	
	2017	2018
Correlation of RPI Effective Spread to Average Inside Size across all Equities Exchanges <sup>29</sup>	-0.0145	-0.0096
Correlation of RPI Volume as a Percent of Total Volume to Average Inside Size across all Equities Exchanges	-0.0217	-0.0056
Correlation of RPI Volume as a Percent of Total Volume to Average Effective Spread across all Venues	0.1175	0.0134
Correlation of RPI Effective Spread to Total Midpoint Volume across all Venues	-0.1438	-0.1366
Correlation of RPI Quoted Spread to Total Protected Lit Volume across all Equities Exchanges	-0.1221	-0.0999

*Difference in Difference Analysis*

The aim of this analysis was to compare the values of a set of general market metrics prior to the introduction of the Program to those prevailing after. The Exchange follows what is commonly termed the ‘difference-in-difference’ approach (“DnD”). A DnD analysis involves

<sup>29</sup> Inside size is the average bid or ask size when the venue is at the NBB or NBO.

identifying a group of subjects (stocks in this case) that receive a given ‘treatment.’ In this case, the ‘treatment’ is the introduction of the Program. The Exchange would then observe the change (difference) in a set of empirical indicia of market quality, before and after Program introduction. The analysis is enhanced by observing the intertemporal change in the same indicia for a set of stocks that did not receive the treatment. The non-treated stocks would serve as ‘controls.’ The impact of the Program could therefore be assessed by comparing the pre/post changes in the treated stocks with those from the control stocks, hence the difference in differences. Observed changes in the control stocks would account for environmental effects, such as changes in general market volatility, that are unrelated to the introduction of the Program.

The introduction of the Program applied to all stocks traded on the Exchange. Thus, control stocks in the strict sense are not available. The Exchange applies therefore a fallback approach, in which it identifies stocks with relatively high levels of participation in the Program and use these as the ‘treatment’ stocks. Those for which Program participation was light serve as the ‘control’ stocks. The approach suffers from the limitation that Program participation is a determined by endogenous choice. It is possible that stocks with high levels of participation are systematically different from those with low participation. That is, the controls may be different from the treated stocks in important ways. With this caveat in mind, it is nevertheless of interest to see differences in outcomes between the two groups of stocks.

While the treatment and control stocks differ substantially in terms of participation in the Program, the validity of the DnD analysis is enhanced to the extent that the two groups are otherwise as similar to each other as possible. To achieve this objective, the Exchange first breaks its analysis into two parts: one dealing with active securities, the other with less active securities. The Exchange’s set of active securities are those with consolidated average daily

volume (“CADV”) of 500,000 shares or more after Program introduction. The less active group have CADV between 50,000 and 500,000 shares after Program introduction. Then, within each volume grouping, the Exchange conducts a ‘matched pairs’ process to identify a smaller set of treatment and control groups that are as close to each other as possible across three dimensions: consolidated average daily share volume, average price, and average BBO spread across exchanges. The values of these variables prior to Program introduction were used.

Data from the pre-treatment period was obtained from trading during the three months of October through December 2012. The Exchange looks at two post-treatment periods. The first is based on trading from January through December 2013. The second is based on trading from the two years from January 2017 through December 2018.

The overall set of four DnD analyses can be represented and hereafter labeled as follows:

<b>CADV</b>	<b>Post-Period Dates</b>	
	2013	2017-2018
500,000 or more	I 2012 pair 2013 pair	III 2012 pair 2017-18 pair
Between 50,000 and 500,000	II 2012 pair 2013 pair	IV 2012 pair 2017-18 pair

For each of the four DnD analyses, the specific matched-pairs process employed the following steps:

1. Daily averages for a set of variables are computed for each stock for the appropriate pre/post time frames.

2. The initial universe of stocks are identified as having, in the post period, the appropriate CADV, an average share price greater than \$2, and positive average daily BYX share volume.
3. These stocks are ranked on the percentage of consolidated volume that was done in the Program (in the post period). Selection of the treatment stocks starts with the top 100 stocks in terms of post-introduction RPI Program volume for analysis I, II and III, and top 200 stocks are selected for analysis IV in order to generate sufficient number of pairs in the sample set.
4. Pre-period data for the provisional treatment stocks is obtained. During the pre-period, the treatment stocks must also have the appropriate CADV level, an average price greater than \$2, positive BYX share volume, and listed during the entire pre-period. This process will generally result in fewer than 1000 remaining treatment candidates.
5. The candidate control stocks are selected from those with low RPI Program volume, where the control stocks were selected from stocks whose RPI volume was less than one-tenth that of the lowest RPI volume from the treatment stocks.
6. The control stocks must also have similar restrictions to the treatment stocks in both pre- and post-periods: CADV in the appropriate range, price greater than \$2, and positive BYX volume.
7. Each treatment stock was compared with each candidate control stock. Using pre-period data, a discrepancy score was computed as:

*score*

$$= \left| \log\left(\frac{CADV_{Training}}{CADV_{Control}}\right) \right| + \left| \log\left(\frac{Price_{Training}}{Price_{Control}}\right) \right| + \left| \log\left(\frac{Spread_{Training}}{Spread_{Control}}\right) \right|$$

In words, the score is the sum of the absolute value of the percentage differences in the indicated values. The lower the score, the closer the match.

8. Each treatment stock was paired with the best possible match, subject to the constraint that a given control stock could be used only once (often termed ‘sampling without replacement’).
9. Finally, only stock pairs with reasonable discrepancy scores, which were 2.0 and lower, were retained.

Once a set of matched pairs was determined for a given analysis, the Exchange computed the DnD result using a standard linear regression framework. A DnD regression model can be expressed as:

$$y_{i,t} = a + b \textit{Group} + c \textit{Period} + d \textit{Group} \times \textit{Period} + \varepsilon_{i,t}$$

$$\textit{where, Group} = \begin{cases} 1, & \textit{if stock } i \textit{ is in treatment group} \\ 0, & \textit{if stock } i \textit{ is in control group} \end{cases}$$

$$\textit{Period} = \begin{cases} 1, & \textit{if } t = \textit{post - pilot} \\ 0, & \textit{if } t = \textit{pre - pilot} \end{cases}$$

The Exchange considered ten metrics of interest, all of which were computed during standard 9:30 a.m. – 4:00 p.m. (Eastern time) trading hours: (1) average BBO spread across exchanges in dollars; (2) average BBO spread across exchanges in basis points; (3) average BYX spread in dollars; (4) average BYX spread in basis points; (5) average inside ask size across exchanges in round lots; (6) average inside bid size across exchanges in round lots; (7) average



inside ask size on BYX in round lots; (8) average inside bid size on BYX in round lots; (9) BYX volume compared to total consolidated volume (“TCV”) in basis points; (10) trade reporting facility (“TRF”) volume as a percentage of Symbol Total Volume.

In assessing the results of the DnD analysis, certain caveats are worth bearing in mind. As shown above, BYX RPI volume represents a very small fraction of consolidated volume. Further, the Program was introduced at a time when similar exchange-based retail price improvement programs were introduced by other exchanges. It is also important to recognize that much, if not most, marketable retail order flow is routed to off-exchange market makers. For example, the Exchange examined Rule 606 disclosures for the second quarter of 2019 from four prominent retail brokerages: E-Trade, TD Ameritrade, Charles Schwab, and Fidelity. Only Fidelity reported routing any market orders to national securities exchanges, and its total exchange percentage was less than 2.5% for each of Tape A, B, and C securities. This practice of routing retail marketable orders to off-exchange venues has been in place for a long time, both before and after the introduction of the Program. Considering the smallness of the Program, the existence of similar programs on other national securities exchanges, and the continuing prevalence of off-exchange trading of retail orders, the incremental impact of the Program on market quality generally would not be expected to be large.

Furthermore, BYX RPI activity is itself somewhat anomalous in the first place since the majority of retail market orders are routed off-exchange for execution. Why some retail flow reaches exchanges via the Program (or that of similar exchange programs), and why it varies across stocks is not clear. Since treatment and control stocks are determined on the basis of observed RPI usage—resulting from participant choice—they may be different in important ways. The DnD study attempts to take into account differences in average share volume, price,

and spread in the pre-period. If, however, the two groups of stocks are nevertheless still not properly fully matched, it is possible that results drawn from the DnD may be spurious.

‘Spurious’ in this context means a result that is robust statistically, but nevertheless does not indicate the impact of the intended factor. In other words, a spurious result is caused by some extraneous factor.

### Matching Summary

The full set of matched pairs data for each of the four analyses will be provided below, but the following table provides summary information. Shown are the number of matched pairs, and sample averages for the three matching variables. Also shown is the average of the discrepancy score used in the matching process.

			Treatment				Control			
Analysis	Score	# of pairs	Price	Post Period RPI Pct	CADV	Spread	Price	Post Period RPI Pct	CADV	Spread
I	1.01	58	\$ 44.93	0.034%	8,216,026	38	\$ 37.76	0.004%	3,608,540	40
II	0.5	78	\$ 17.70	0.184%	186,708	262	\$ 17.35	0.011%	191,422	233
III	0.87	51	\$ 40.29	0.154%	4,820,112	50	\$ 34.46	0.020%	3,048,311	45
IV	0.58	34	\$ 12.80	0.328%	216,895	530	\$ 13.42	0.029%	191,580	382

The table again illustrates the low level of Program participation, even for the treatment stocks. The RPI percentages are especially low for the higher volume samples (I and III). As intended, the RPI percentages for the control stocks are much lower still, averaging at least an order of magnitude lower than the treatment stocks.

Other than these differences, the pairs exhibit strong average similarity in terms of the values of the pre-period matching variables.

### Regression Results

The following table provides the estimated coefficients for the DnD regressions for the indicated market indicator and sample. In addition to the estimated coefficient, the p-value is provided. This value can be used to gauge the statistical significance of the coefficient—the confidence that the true value of the coefficient is different than zero. The results are accompanied, as appropriate, with a set of asterisks indicating the associated level of significance: \* = 10%, \*\* = 5%, and \*\*\* = 1%.

		<b>Spreads</b>			
		<b>Avg. BBO Spread for All Exchanges (bps)</b>	<b>Avg. BYX Spread (bps)</b>	<b>Avg. BBO Spread for All Exchanges (dollars)</b>	<b>Avg. BYX Spread (dollars)</b>
I	coef	-2.77	-9.63	-0.01	0.03
	p value	0.823	0.722	0.887	0.819
II	coef	-50.87	-54.69	-0.10	-0.04
	p value	0.287	0.531	0.212	0.835
III	coef	40.95	-11.06	-0.03	-0.27*
	p value	0.148	0.781	0.797	0.098
IV	coef	166.71	211.50	-2.18	-0.42**
	p value	0.219	0.316	0.207	0.018

Four measures were analyzed to assess the potential impact that the Program had on spreads: average BBO spreads across all exchanges and BYX quoted spreads were both measured in both basis points and dollar terms. The table above shows limited impact of the Program on spreads on BYX and the broader market. The only statistically significant changes identified were to BYX spreads measured in dollar terms when using a post-period treatment group from 2017 - 2018. Specifically, the Exchange observed a relative narrowing of average BYX spreads in treatment securities that is equivalent to: \$0.27 for the more liquid symbols in

Sample III, and \$0.42 for the less liquid symbols contained in Sample IV, indicating an improvement in market quality on BYX in securities with more volume traded in the Program. While the Exchange’s analysis does not prove that the observed improvements in BYX spreads could necessarily be attributed to the Program rather than other factors, this result supports the overall conclusion that the Program did not result in spreads widening.

		<b>Depth in Round Lots</b>			
		<b>Avg. Inside Bid Size for All Exchanges</b>	<b>Avg. BYX Bid Size</b>	<b>Avg. Inside Ask Size for All Exchanges</b>	<b>Avg. BYX Ask Size</b>
I	coef	1.30	-4.85	4.66	1.03
	p value	0.926	0.538	0.840	0.948
II	coef	-2.79	-2.10	0.11	-1.40
	p value	0.505	0.170	0.984	0.331
III	coef	4.75	-3.76	3.23	-7.03
	p value	0.699	0.556	0.813	0.406
IV	coef	-15.18	-16.54*	-6.19	-13.22*
	p value	0.105	0.052	0.277	0.065

Similar to the analysis of spreads, four size measures are analyzed, including inside bid and ask sizes both on BYX and across all exchanges. Here, the Exchange found only two statistically significant changes in the available size. Specifically, the Exchange found a relative decrease in the average bid and ask size on BYX in treatment securities when looking at the results for Sample IV, which includes less liquid securities with a post-period treatment group of 2017 – 2018. For the bid side of the market, the Exchange found that the average size on BYX for treatment securities decreased by 16.54 round lots (i.e., 1654 shares) relative to the control group. Similarly, for the offer side of the market, the Exchange found that the average size on BYX for treatment securities decreased by 13.22 round lots (i.e., 1322 shares) relative to the

control group. While available bid and offer sizes on BYX in the treatment group decreased relative to the control group, the Exchange believes that this change may have been caused by factors unrelated to the Program. In fact, the average BYX bid and ask sizes materially increased during the duration of the Program for securities included in both the treatment and control groups. For example, the average BYX bid size for Sample IV increased from 3.49 round lots in the pre-period to 4.91 round lots in the post-period, an approximately 40% improvement. Similarly, the average BYX ask size for Sample IV increased from 3.74 round lots in the pre-period to 5.16 round lots in the post-period, an approximately 38% improvement. The Program results simply indicate a larger increase in size for the control groups was observed. The same statistics for the control group indicate 791% increase in BYX bid size and a 1014% increase in BYX ask size. The Exchange therefore believes the results are largely due to outlier stocks in the control group that experienced a significant increase in depth that was most likely related to outside factors rather than the lack of Program participation. Given the significant increase in depth across stocks in both the control and treatment groups, the Exchange believes that the results are consistent with a finding that the Program did not materially harm depth on BYX.

		<b>Volume</b>	
		<b>BYX Volume as % of TCV (bps)</b>	<b>TRF Volume as % of Symbol Total Volume</b>
I	coef	0.43*	1.10%
	p value	0.051	0.522
II	coef	0.38	1.09%
	p value	0.112	0.641
III	coef	-1.11*	7.43%***
	p value	0.051	0.002
IV	coef	-1.72*	7.95%**
	p value	0.068	0.033

### Market Share

To assess the impact of the Program on market share the Exchange explored measures related to both BYX volume as a percentage of TCV and TRF volume as a percentage of Symbol Total Volume. The BYX market share coefficients shown in the table are expressed in market share basis point. For example, a value of 100 means that market share increased by one point (e.g., 30% to 31%). Many of the results related to market share are statically significant, suggesting shifts in both BYX and TRF market share in the years following the introduction of the Program. Sample I, for example, suggests a statistically significant relative increase in BYX volume in more liquid treatment securities immediately following the introduction of the Program, but Samples III and IV suggest that any such increases were temporary with BYX volume as a percentage of TCV decreasing relative to the control group in both of the later samples. In addition, Samples III and IV also reflect a large and statistically significant relative increase in TRF share for securities with more volume executed in the Program. Collectively, it

can be safely stated that the introduction of the Program did not work towards decreasing TRF share. More likely what the results tell us is that the treatment stocks with relatively high volume executed in the Program also had high levels of retail interest generally. Such retail interest is executed largely off-exchange, hence the increase in TRF share.

**I. Active Stocks (CADV > 500,000) and Post-Period = 2013**

For this sample, there were 58 matched pairs that emerged from this process. The pairs, along with values of selected variables, pre- and post-Program introduction, are shown as follows:

Table 1A: Retail Program Matched Sample CADV &gt; 500,000 (Oct-Nov 2012)

Treatment Stocks					Control Stocks				
Symbol	CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)	Symbol	CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)
AA	15,460,924	\$ 8.65	\$ 0.01	12.61	DELL	20,372,498	\$ 9.77	\$ 0.01	11.56
ABX	7,031,473	\$ 36.66	\$ 0.03	7.33	XLY	5,528,936	\$ 46.78	\$ 0.03	5.52
AGNC	7,114,187	\$ 31.42	\$ 0.03	8.00	STI	5,411,184	\$ 28.00	\$ 0.02	9.00
AIG	22,573,053	\$ 34.21	\$ 0.02	6.42	NWSA	14,348,224	\$ 24.47	\$ 0.02	6.95
AMZN	3,084,678	\$ 241.90	\$ 0.69	28.28	IVV	3,677,223	\$ 142.73	\$ 0.31	21.73
ARIA	2,393,958	\$ 21.94	\$ 0.05	24.69	FNF	2,265,083	\$ 22.80	\$ 0.05	23.27
BA	4,242,510	\$ 72.68	\$ 0.09	12.80	DHR	3,498,381	\$ 53.73	\$ 0.11	20.06
BIDU	4,759,554	\$ 102.77	\$ 0.33	31.94	EWW	2,221,452	\$ 67.25	\$ 0.34	51.45
BKLN	968,969	\$ 24.86	\$ 0.08	32.20	DEI	939,939	\$ 23.28	\$ 0.08	33.81
BRCM	6,694,285	\$ 32.69	\$ 0.03	8.36	XHB	6,260,362	\$ 25.77	\$ 0.02	8.34
C	36,577,562	\$ 36.62	\$ 0.02	4.68	XLI	10,044,466	\$ 36.88	\$ 0.02	4.63
CLF	7,716,672	\$ 36.79	\$ 0.13	34.96	VRSN	4,299,024	\$ 39.74	\$ 0.11	27.69
CREE	1,474,853	\$ 30.08	\$ 0.08	27.52	RDC	1,474,746	\$ 32.31	\$ 0.09	26.55
CRM	1,629,197	\$ 153.58	\$ 0.78	50.20	SHW	987,435	\$ 149.98	\$ 0.64	42.03
CSCO	35,875,238	\$ 18.59	\$ 0.01	6.02	XLK	9,377,430	\$ 29.20	\$ 0.01	4.60
CVX	5,402,199	\$ 110.19	\$ 0.15	13.78	XRT	3,667,753	\$ 62.34	\$ 0.15	24.06
DAL	10,344,011	\$ 10.34	\$ 0.02	16.70	AES	4,729,487	\$ 10.53	\$ 0.01	13.99
DDD	1,590,675	\$ 42.75	\$ 0.47	108.10	EWY	1,703,520	\$ 59.20	\$ 0.52	88.29
DUST	947,887	\$ 29.39	\$ 0.25	81.70	FRAN	1,050,577	\$ 26.74	\$ 0.25	94.03
EBAY	9,256,736	\$ 49.53	\$ 0.06	11.51	XOP	3,989,057	\$ 54.16	\$ 0.06	11.74
EMC	17,419,699	\$ 25.06	\$ 0.01	5.34	AMX	7,078,514	\$ 24.48	\$ 0.02	7.97
FCX	17,727,453	\$ 36.43	\$ 0.02	6.53	XLP	5,944,396	\$ 35.46	\$ 0.02	4.29
FSLR	4,629,287	\$ 25.44	\$ 0.12	45.05	HCA	3,903,420	\$ 31.67	\$ 0.08	24.21
GDX	11,107,693	\$ 49.24	\$ 0.06	12.86	LYB	4,161,826	\$ 52.08	\$ 0.07	13.34
GILD	6,289,115	\$ 70.85	\$ 0.10	14.44	ASML	2,912,489	\$ 55.72	\$ 0.11	19.94
GLW	13,591,377	\$ 12.35	\$ 0.01	9.27	BSBR	4,807,311	\$ 7.05	\$ 0.01	17.65
GRPN	17,090,991	\$ 4.07	\$ 0.02	43.92	KCG	3,710,317	\$ 3.17	\$ 0.02	54.59
GS	3,806,548	\$ 120.85	\$ 0.23	19.08	ORLY	1,395,072	\$ 86.43	\$ 0.22	24.83
HIMX	259,352	\$ 2.19	\$ 0.04	193.54	CMLS	196,177	\$ 2.48	\$ 0.07	279.21
IAU	5,785,889	\$ 16.77	\$ 0.01	7.65	AMTD	3,326,056	\$ 16.05	\$ 0.02	9.67
IBM	3,597,646	\$ 195.97	\$ 0.29	14.85	ALXN	1,246,135	\$ 97.69	\$ 0.26	26.97
JCP	8,798,098	\$ 20.68	\$ 0.06	26.15	NRG	4,330,499	\$ 22.01	\$ 0.06	26.70
LINE	1,186,502	\$ 38.91	\$ 0.23	59.67	PENN	956,439	\$ 46.23	\$ 0.22	49.50
LNKD	1,904,735	\$ 108.08	\$ 0.53	48.68	LMCA	1,001,163	\$ 109.44	\$ 0.52	47.27
MCP	6,716,181	\$ 9.31	\$ 0.05	54.76	MDRX	3,888,106	\$ 11.65	\$ 0.04	31.40
MS	18,081,192	\$ 17.43	\$ 0.01	7.93	UBS	2,949,981	\$ 14.89	\$ 0.01	9.55
MU	22,809,534	\$ 5.93	\$ 0.01	21.89	DCT	3,656,749	\$ 6.36	\$ 0.01	19.92
NEM	4,966,157	\$ 49.25	\$ 0.09	17.44	STT	3,676,928	\$ 44.18	\$ 0.06	14.37
NFLX	4,891,890	\$ 73.77	\$ 0.29	37.38	IWD	1,912,933	\$ 72.07	\$ 0.40	55.25
NQ	305,712	\$ 6.33	\$ 0.12	185.14	SGYP	322,816	\$ 4.79	\$ 0.12	262.18
NUGT	5,504,781	\$ 12.97	\$ 0.03	23.43	PBI	4,042,584	\$ 11.91	\$ 0.03	24.32
OPK	1,216,778	\$ 4.46	\$ 0.02	48.15	MTOR	1,083,068	\$ 4.44	\$ 0.02	51.16
P	4,606,434	\$ 8.65	\$ 0.03	38.24	CPWR	3,269,062	\$ 9.20	\$ 0.02	23.89
POT	3,745,760	\$ 40.29	\$ 0.03	6.85	XME	3,208,814	\$ 44.08	\$ 0.05	12.02
QCOM	10,959,813	\$ 61.35	\$ 0.05	7.52	DISH	3,010,583	\$ 35.35	\$ 0.05	13.85
SBUX	7,945,336	\$ 49.93	\$ 0.05	9.61	STJ	3,929,838	\$ 36.32	\$ 0.07	17.51
SCTY	218,067	\$ 11.12	\$ 0.45	387.20	RPRX	187,841	\$ 14.53	\$ 0.38	219.77
SDS	10,084,954	\$ 49.47	\$ 0.04	7.51	UN	1,872,458	\$ 37.07	\$ 0.04	10.38
SPXU	5,029,770	\$ 39.39	\$ 0.06	15.37	ABC	2,220,388	\$ 41.18	\$ 0.06	14.05
TNA	8,931,585	\$ 57.25	\$ 0.07	11.55	PCAR	2,300,080	\$ 42.77	\$ 0.07	17.36
TSLA	967,259	\$ 31.22	\$ 0.20	64.91	GNRC	886,092	\$ 32.28	\$ 0.18	57.29
TZA	17,391,045	\$ 15.46	\$ 0.02	15.57	SEE	2,732,827	\$ 16.50	\$ 0.02	14.46
UVXY	7,906,931	\$ 25.64	\$ 0.10	37.72	USG	1,989,789	\$ 25.00	\$ 0.10	40.02
WLT	3,562,092	\$ 34.34	\$ 0.10	30.42	DLPH	2,594,898	\$ 34.09	\$ 0.11	34.01
X	8,340,519	\$ 21.59	\$ 0.03	14.26	NWL	2,815,829	\$ 20.89	\$ 0.04	18.57
XIV	11,815,441	\$ 17.51	\$ 0.03	19.14	OCI	2,788,370	\$ 17.73	\$ 0.03	19.65
XOM	11,270,051	\$ 89.48	\$ 0.12	13.80	ITW	2,284,000	\$ 60.53	\$ 0.12	20.23
YELP	929,218	\$ 21.33	\$ 0.24	110.44	WWAV	854,677	\$ 16.52	\$ 0.24	154.83
Avg	8,216,026	\$ 44.93	\$ 0.13	38.29	Avg	3,608,540	\$ 37.76	\$ 0.12	39.51



Table 1B: Retail Program Matched Sample CADV &gt; 500,000 (2013)

Treatment Stocks							Control Stocks						
Symbol	RPI ADV	CADV	RPI Volume as % of Symbol CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)	Symbol	RPI ADV	CADV	RPI Volume as % of Symbol CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)
AA	5,089	19,327,285	0.026%	\$ 8.61	\$ 0.01	14.40	DELL	116	19,152,126	0.001%	\$ 13.38	\$ 0.01	8.61
ABX	1,557	15,953,498	0.010%	\$ 20.06	\$ 0.02	9.46	XLY	107	5,154,772	0.002%	\$ 57.53	\$ 0.05	8.55
AGNC	1,385	7,041,473	0.020%	\$ 25.97	\$ 0.03	13.93	STI	120	4,006,496	0.003%	\$ 31.01	\$ 0.03	8.60
AIG	1,369	12,833,957	0.011%	\$ 42.64	\$ 0.04	8.05	NWSA	95	10,512,361	0.001%	\$ 27.19	\$ 0.02	10.85
AMZN	2,114	2,723,141	0.078%	\$ 295.67	\$ 0.73	24.11	IVV	113	3,929,837	0.003%	\$ 166.41	\$ 0.19	12.07
ARIA	2,629	8,386,567	0.031%	\$ 8.97	\$ 0.06	43.16	DNF	52	2,495,225	0.002%	\$ 26.17	\$ 0.06	22.51
BA	1,617	4,814,559	0.034%	\$ 98.12	\$ 0.15	14.43	DHR	101	2,430,560	0.004%	\$ 64.45	\$ 0.12	18.42
BIDU	1,525	3,882,586	0.039%	\$ 118.43	\$ 0.41	32.32	EWV	97	3,015,333	0.003%	\$ 67.58	\$ 0.49	71.11
BKLN	1,406	2,646,507	0.053%	\$ 24.91	\$ 0.01	5.78	DEI	11	829,626	0.001%	\$ 24.36	\$ 0.06	22.10
BRCM	1,376	7,939,915	0.017%	\$ 30.47	\$ 0.04	12.37	XHB	90	5,568,958	0.002%	\$ 29.77	\$ 0.03	9.58
C	5,212	25,337,493	0.021%	\$ 47.55	\$ 0.03	5.42	XLI	109	9,303,679	0.001%	\$ 44.29	\$ 0.02	4.05
CLF	1,630	9,016,378	0.018%	\$ 23.99	\$ 0.05	22.86	VRSN	57	1,553,443	0.004%	\$ 46.18	\$ 0.09	18.76
CREE	1,237	2,201,209	0.056%	\$ 56.62	\$ 0.18	31.50	RDC	69	1,065,938	0.006%	\$ 34.97	\$ 0.07	21.42
CRM	1,504	4,086,334	0.037%	\$ 63.48	\$ 0.28	26.71	SHW	79	689,924	0.011%	\$ 174.90	\$ 0.99	56.39
CSCO	4,176	35,628,973	0.012%	\$ 22.46	\$ 0.01	6.05	XLK	121	7,022,095	0.002%	\$ 31.51	\$ 0.01	4.34
CVX	1,275	4,874,429	0.026%	\$ 119.26	\$ 0.14	11.88	XRT	50	3,708,101	0.001%	\$ 74.92	\$ 0.17	22.93
DAL	1,598	12,649,874	0.013%	\$ 19.20	\$ 0.03	15.51	AES	80	4,919,917	0.002%	\$ 12.66	\$ 0.02	13.20
DDD	2,108	4,087,704	0.052%	\$ 55.88	\$ 0.31	63.22	EWY	100	2,154,060	0.005%	\$ 59.81	\$ 0.43	73.77
DUST	1,288	2,033,045	0.063%	\$ 39.23	\$ 0.64	95.66	FRAN	108	1,132,272	0.009%	\$ 24.15	\$ 0.20	77.58
EBAY	2,159	9,990,357	0.022%	\$ 53.07	\$ 0.08	15.11	XOP	52	4,168,354	0.001%	\$ 62.89	\$ 0.12	17.96
EMC	1,510	20,094,594	0.008%	\$ 24.38	\$ 0.02	6.16	AMX	69	7,803,820	0.001%	\$ 21.41	\$ 0.02	9.78
FCX	1,315	12,770,837	0.010%	\$ 32.42	\$ 0.03	7.68	XLP	62	8,074,577	0.001%	\$ 40.50	\$ 0.02	4.15
FSLR	1,569	5,399,123	0.029%	\$ 43.90	\$ 0.16	36.28	HCA	104	3,440,450	0.003%	\$ 39.28	\$ 0.08	20.38
GDX	2,902	24,062,085	0.012%	\$ 27.60	\$ 0.03	9.14	LYB	21	3,467,854	0.003%	\$ 65.32	\$ 0.15	22.90
GILD	2,234	8,738,215	0.026%	\$ 59.18	\$ 0.15	21.61	ASML	33	1,223,661	0.003%	\$ 77.06	\$ 0.24	28.88
GLW	1,603	11,891,093	0.013%	\$ 14.46	\$ 0.01	9.90	BSBR	85	4,735,874	0.002%	\$ 6.83	\$ 0.01	18.79
GRPN	2,182	17,468,620	0.012%	\$ 8.17	\$ 0.03	33.84	KCG	3	904,126	0.000%	\$ 4.19	\$ 0.10	76.25
GS	1,752	3,263,149	0.054%	\$ 156.61	\$ 0.26	16.47	ORLY	39	702,515	0.006%	\$ 112.00	\$ 0.35	30.75
HIMX	2,788	6,274,131	0.044%	\$ 7.94	\$ 0.04	68.82	CMLS	106	769,675	0.014%	\$ 5.31	\$ 0.03	83.10
IAU	2,450	6,211,410	0.039%	\$ 14.40	\$ 0.01	8.43	AMTD	66	2,911,901	0.002%	\$ 22.50	\$ 0.04	14.80
IBM	1,804	3,759,508	0.048%	\$ 192.21	\$ 0.25	13.01	ALXN	104	1,327,646	0.008%	\$ 101.58	\$ 0.50	46.65
JCP	5,901	21,590,936	0.027%	\$ 12.37	\$ 0.03	20.25	NRG	10	3,194,624	0.000%	\$ 26.25	\$ 0.05	20.16
LINE	1,437	2,520,248	0.057%	\$ 31.13	\$ 0.24	74.83	PENN	84	1,013,611	0.008%	\$ 39.73	\$ 0.21	43.01
LNKD	1,410	2,050,887	0.069%	\$ 197.34	\$ 0.95	46.49	LMCA	32	559,391	0.006%	\$ 131.63	\$ 1.21	92.15
MCP	1,707	7,381,103	0.023%	\$ 6.51	\$ 0.02	35.30	MDRX	100	2,165,684	0.005%	\$ 12.94	\$ 0.03	23.26
MS	1,542	15,789,813	0.010%	\$ 24.78	\$ 0.02	6.66	UBS	24	2,304,735	0.001%	\$ 17.80	\$ 0.02	9.39
MU	7,688	36,337,447	0.021%	\$ 12.91	\$ 0.02	13.97	DCT	41	4,284,970	0.001%	\$ 7.29	\$ 0.01	17.97
NEM	1,277	8,076,015	0.016%	\$ 32.17	\$ 0.04	13.96	STT	86	2,600,981	0.003%	\$ 61.70	\$ 0.10	16.11
NFLX	2,741	3,755,666	0.073%	\$ 248.87	\$ 0.85	33.10	IWD	53	1,469,139	0.004%	\$ 82.04	\$ 0.48	56.58
NQ	1,979	2,701,609	0.073%	\$ 13.71	\$ 0.19	171.57	SGYP	46	585,711	0.008%	\$ 5.03	\$ 0.07	128.16
NUGT	3,955	10,874,913	0.036%	\$ 13.53	\$ 0.09	35.64	PBI	114	3,876,529	0.003%	\$ 16.62	\$ 0.03	16.88
OPK	1,345	2,948,125	0.046%	\$ 8.38	\$ 0.03	35.91	MTOR	111	1,359,251	0.008%	\$ 6.58	\$ 0.03	43.48
P	2,279	7,375,842	0.031%	\$ 19.68	\$ 0.05	26.90	CPWR	29	1,666,679	0.002%	\$ 11.13	\$ 0.04	40.21
POT	1,339	7,014,303	0.019%	\$ 35.47	\$ 0.02	6.98	XME	47	2,939,668	0.002%	\$ 38.51	\$ 0.04	11.04
QCOM	1,660	10,562,162	0.016%	\$ 65.91	\$ 0.06	9.60	DISH	93	2,437,809	0.004%	\$ 42.20	\$ 0.13	29.63
SBUX	1,674	4,272,242	0.039%	\$ 65.36	\$ 0.08	10.74	STJ	56	2,095,989	0.003%	\$ 45.53	\$ 0.08	15.70
SCTY	1,407	2,573,357	0.055%	\$ 44.99	\$ 0.48	159.00	RPRX	51	605,702	0.008%	\$ 17.59	\$ 0.27	153.41
SDS	3,036	9,854,917	0.031%	\$ 38.97	\$ 0.02	5.32	UN	70	1,580,186	0.004%	\$ 39.57	\$ 0.05	11.77
SPXU	1,480	5,426,773	0.027%	\$ 23.25	\$ 0.02	9.63	ABC	123	1,838,151	0.007%	\$ 54.52	\$ 0.11	20.08
TNA	4,341	8,453,861	0.051%	\$ 57.66	\$ 0.06	8.95	PCAR	59	1,407,077	0.004%	\$ 51.62	\$ 0.11	20.31
TSLA	6,713	8,081,710	0.083%	\$ 129.90	\$ 0.59	56.68	GNRC	77	783,683	0.010%	\$ 41.73	\$ 0.19	47.36
TZA	7,311	12,648,252	0.058%	\$ 23.26	\$ 0.02	10.23	SEE	103	1,942,673	0.005%	\$ 24.81	\$ 0.04	16.74
UVXY	1,836	14,172,673	0.013%	\$ 17.58	\$ 0.08	28.95	USG	111	1,705,248	0.007%	\$ 27.01	\$ 0.08	31.39
WLT	3,012	6,675,126	0.045%	\$ 17.78	\$ 0.07	35.25	DLPH	50	1,890,092	0.003%	\$ 47.89	\$ 0.14	28.05
X	1,289	7,221,072	0.018%	\$ 21.41	\$ 0.03	15.73	NWL	29	2,179,887	0.001%	\$ 25.99	\$ 0.05	18.27
XIV	1,630	13,271,663	0.012%	\$ 25.25	\$ 0.05	22.36	GCI	105	2,536,184	0.004%	\$ 23.49	\$ 0.11	17.79
XOM	2,026	11,009,725	0.018%	\$ 90.32	\$ 0.10	10.65	ITW	119	1,790,165	0.007%	\$ 68.25	\$ 0.14	20.42
YELP	1,344	2,222,779	0.060%	\$ 48.92	\$ 0.30	72.17	WVAV	104	1,247,342	0.008%	\$ 18.81	\$ 0.18	102.67
Avg	2,374	9,659,505	0.034%	\$ 53.16	\$ 0.15	28.97	Avg	77	3,107,523	0.004%	\$ 44.08	\$ 0.15	32.95

## II. Less Active Stocks (CADV between 50,000 and 500,000) and Post-Period = 2013

For this sample, there were 78 matched pairs that emerged from this process. The pairs, along with values of selected variables, pre- and post-Program introduction, are shown as follows:

Treatment Stocks					Control Stocks				
Symbol	CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)	Symbol	CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)
ADEP	28,679	\$ 3.21	\$ 0.29	899.25	NCTY	28,661	\$ 3.52	\$ 0.28	797.70
AFOP	27,526	\$ 11.06	\$ 0.54	498.32	LBAI	25,475	\$ 9.84	\$ 0.53	535.93
AGEN	71,459	\$ 4.21	\$ 0.21	521.71	PBTH	68,052	\$ 4.81	\$ 0.21	443.55
AMPE	172,321	\$ 3.70	\$ 0.10	258.42	LPHI	211,463	\$ 2.51	\$ 0.10	373.60
ANFI	229,063	\$ 8.58	\$ 0.40	506.60	CARB	104,257	\$ 8.28	\$ 0.37	437.19
ANIK	68,860	\$ 11.77	\$ 0.37	329.27	RLOC	69,380	\$ 11.76	\$ 0.41	344.67
ARWR	70,645	\$ 2.33	\$ 0.28	1029.30	LCAV	63,221	\$ 3.45	\$ 0.39	990.97
AXU	230,586	\$ 3.88	\$ 0.04	113.49	CDR	233,355	\$ 5.28	\$ 0.05	95.19
BALT	80,703	\$ 3.04	\$ 0.13	396.67	ATNY	107,266	\$ 2.76	\$ 0.12	433.96
BIOD	26,981	\$ 2.68	\$ 0.28	1233.26	MCBC	30,629	\$ 3.01	\$ 0.34	946.30
BITA	46,794	\$ 6.50	\$ 0.46	771.90	ARX	55,242	\$ 6.31	\$ 0.33	497.52
BSCE	29,793	\$ 21.29	\$ 0.09	42.61	IAT	57,855	\$ 24.54	\$ 0.13	54.06
BSCF	32,166	\$ 21.83	\$ 0.14	62.66	EEV	97,173	\$ 24.30	\$ 0.14	58.57
BSCG	31,031	\$ 22.25	\$ 0.20	91.53	TTT	44,481	\$ 17.22	\$ 0.29	169.01
BTT	151,527	\$ 24.63	\$ 1.10	438.77	SXE	153,198	\$ 22.86	\$ 0.82	350.04
CSQ	432,638	\$ 9.97	\$ 0.09	95.58	CEL	350,429	\$ 9.00	\$ 0.08	83.13
CVY	174,542	\$ 22.08	\$ 0.40	179.26	GXG	217,768	\$ 21.16	\$ 0.37	174.03
CWB	235,888	\$ 39.79	\$ 0.30	75.59	BDC	230,320	\$ 38.72	\$ 0.31	81.05
CYTX	382,146	\$ 3.39	\$ 0.07	192.88	PLXT	473,016	\$ 4.41	\$ 0.04	91.50
DGS	153,899	\$ 46.91	\$ 0.69	145.62	NILE	155,239	\$ 38.76	\$ 0.76	192.77
DHF	278,036	\$ 4.22	\$ 0.03	82.55	BIRT	279,488	\$ 5.61	\$ 0.04	72.50
DHY	378,011	\$ 3.22	\$ 0.02	53.64	CLS	315,718	\$ 7.38	\$ 0.03	39.70
DJP	263,902	\$ 42.15	\$ 0.28	68.05	ITRI	261,108	\$ 41.87	\$ 0.27	64.94
DNP	601,848	\$ 9.57	\$ 0.09	94.41	RATE	627,537	\$ 11.86	\$ 0.12	97.69
DSCO	285,432	\$ 2.42	\$ 0.05	209.88	MPG	201,992	\$ 3.04	\$ 0.05	164.12
DWX	204,097	\$ 45.73	\$ 0.58	125.27	CEB	194,130	\$ 46.36	\$ 0.50	109.34
EVV	290,037	\$ 16.90	\$ 0.23	138.83	RXN	265,450	\$ 19.83	\$ 0.21	110.63
FENG	75,634	\$ 3.41	\$ 0.15	406.47	NOA	59,429	\$ 3.28	\$ 0.15	454.69
FONR	140,123	\$ 5.29	\$ 0.22	438.29	PSP	132,197	\$ 9.71	\$ 0.24	242.03
GGG	75,042	\$ 4.16	\$ 0.22	508.22	CPIX	58,545	\$ 4.72	\$ 0.23	439.45
GIM	287,120	\$ 9.45	\$ 0.13	133.03	GTIV	221,813	\$ 10.39	\$ 0.12	113.61
GSVC	199,122	\$ 7.97	\$ 0.11	141.25	IPHI	222,621	\$ 8.58	\$ 0.11	128.22
IEP	6,871	\$ 39.45	\$ 3.40	834.31	GK	11,763	\$ 34.38	\$ 2.17	543.46
IGR	350,131	\$ 8.71	\$ 0.11	120.60	OFG	327,395	\$ 11.67	\$ 0.10	87.36
IPCI	22,568	\$ 2.59	\$ 0.27	1003.85	UCFC	20,760	\$ 3.38	\$ 0.27	825.80
JPS	317,131	\$ 9.27	\$ 0.16	161.08	BAK	314,601	\$ 13.43	\$ 0.13	97.97
MEMP	225,059	\$ 17.65	\$ 0.57	293.19	CAF	216,657	\$ 20.10	\$ 0.46	227.10

MILL	192,485	\$ 4.35	\$ 0.12	272.73	WHX	250,302	\$ 5.92	\$ 0.14	243.22
MINT	202,353	\$ 101.53	\$ 0.13	13.09	SOXX	188,580	\$ 50.88	\$ 0.11	21.26
NEA	49,243	\$ 15.51	\$ 0.39	255.53	STBZ	51,439	\$ 15.77	\$ 0.41	260.73
NIO	183,776	\$ 15.54	\$ 0.31	199.61	PID	161,742	\$ 15.38	\$ 0.32	204.19
NMM	360,092	\$ 13.58	\$ 0.16	115.41	ELGX	398,712	\$ 13.42	\$ 0.13	93.82
NOAH	34,634	\$ 5.12	\$ 0.32	609.39	IVAC	39,794	\$ 4.93	\$ 0.29	563.46
NPP	128,938	\$ 16.57	\$ 0.41	246.03	AGX	141,983	\$ 17.83	\$ 0.50	281.64
NUV	337,974	\$ 10.40	\$ 0.16	157.16	ONE	496,710	\$ 10.29	\$ 0.14	120.40
NWBO	59,045	\$ 3.34	\$ 0.17	530.24	SPAR	72,062	\$ 4.91	\$ 0.15	310.40
ONCY	244,772	\$ 3.02	\$ 0.04	183.58	ATSG	155,981	\$ 3.81	\$ 0.06	157.94
PBP	149,605	\$ 20.46	\$ 0.30	144.28	PATK	152,662	\$ 17.46	\$ 0.30	173.98
PHB	776,071	\$ 19.15	\$ 0.02	12.37	KT	717,123	\$ 17.06	\$ 0.03	16.24
PRAN	105,056	\$ 2.39	\$ 0.12	498.26	CXPO	96,231	\$ 3.30	\$ 0.09	258.53
PTY	225,663	\$ 20.17	\$ 0.36	177.80	VCRA	205,330	\$ 26.37	\$ 0.35	131.70
PXLW	39,372	\$ 2.53	\$ 0.19	755.04	UPI	32,755	\$ 3.44	\$ 0.30	872.99
REE	287,101	\$ 3.80	\$ 0.04	111.28	FCF	380,940	\$ 6.68	\$ 0.04	58.69
ROYT	84,784	\$ 17.86	\$ 0.65	365.66	EMO	87,492	\$ 20.36	\$ 0.64	317.65
SA	316,552	\$ 17.35	\$ 0.13	78.89	ACXM	284,748	\$ 17.72	\$ 0.13	76.12
SCHA	162,128	\$ 37.08	\$ 0.33	89.41	HTSI	178,373	\$ 37.61	\$ 0.31	82.84
SCHB	376,299	\$ 34.25	\$ 0.14	42.54	ATO	335,203	\$ 35.25	\$ 0.16	44.49
SCHD	193,913	\$ 28.39	\$ 0.13	46.85	NICE	221,804	\$ 33.01	\$ 0.13	40.22
SCHE	233,255	\$ 25.22	\$ 0.18	71.11	CATM	239,553	\$ 25.21	\$ 0.17	66.62
SCHF	252,269	\$ 26.32	\$ 0.27	101.37	PLXS	239,438	\$ 25.10	\$ 0.24	98.08
SCHG	99,757	\$ 34.18	\$ 0.21	63.09	LTC	124,907	\$ 32.80	\$ 0.21	65.18
SCHH	117,462	\$ 30.02	\$ 0.21	70.78	SNX	126,121	\$ 32.62	\$ 0.23	69.41
SCHM	101,314	\$ 27.28	\$ 0.24	91.25	CBU	108,415	\$ 27.21	\$ 0.25	91.75
SCHO	48,841	\$ 50.52	\$ 0.34	66.15	LWC	52,421	\$ 42.05	\$ 0.33	79.36
SCHP	59,054	\$ 58.62	\$ 0.80	136.73	BOKF	56,926	\$ 56.90	\$ 0.85	151.09
SCHV	105,018	\$ 31.92	\$ 0.11	34.41	EUM	98,101	\$ 28.46	\$ 0.08	28.86
SCHX	263,109	\$ 33.75	\$ 0.59	200.28	VPRT	298,211	\$ 32.19	\$ 0.45	136.89
SCHZ	87,073	\$ 52.61	\$ 0.73	138.97	IEZ	85,177	\$ 50.01	\$ 0.87	170.15
SDR	265,167	\$ 17.72	\$ 0.34	185.12	GOVT	304,639	\$ 25.30	\$ 0.32	126.27
SWIR	33,486	\$ 7.94	\$ 0.12	156.77	TPGI	36,310	\$ 5.47	\$ 0.23	423.29
TAN	41,956	\$ 15.23	\$ 0.48	311.37	CPF	46,500	\$ 14.59	\$ 0.49	298.28
TEU	147,033	\$ 5.07	\$ 0.09	170.02	AGD	148,836	\$ 5.58	\$ 0.09	167.86
TGB	332,524	\$ 2.92	\$ 0.02	72.44	STEC	590,413	\$ 5.10	\$ 0.04	77.41
TRX	263,757	\$ 4.70	\$ 0.04	93.17	TVL	295,806	\$ 6.31	\$ 0.09	150.58
UBNT	285,443	\$ 11.81	\$ 0.27	217.75	CMRE	335,461	\$ 13.71	\$ 0.23	165.20
UVE	92,174	\$ 4.07	\$ 0.12	308.00	JRN	93,516	\$ 5.46	\$ 0.11	209.58
VMO	177,994	\$ 15.16	\$ 0.34	223.54	MANU	120,036	\$ 13.03	\$ 0.33	247.68
VNR	369,297	\$ 27.88	\$ 0.28	101.52	ETH	372,466	\$ 27.04	\$ 0.22	80.77
Avg	186,708	\$ 17.70	\$ 0.30	261.73	Avg	191,422	\$ 17.35	\$ 0.28	233.39

Table 2B: Retail Program Matched Sample CADV Between 50,000 and 500,000 (2013)													
Treatment Stocks							Control Stocks						
Symbol	RPI ADV	CADV	RPI Volume as % of Symbol CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)	Symbol	RPI ADV	CADV	RPI Volume as % of Symbol CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)
ADEP	259	118,689	0.218%	\$ 9.36	\$ 0.25	619.38	NCTY	23	59,298	0.040%	\$ 2.96	\$ 0.19	643.60
AFOP	702	361,379	0.194%	\$ 21.90	\$ 0.47	268.39	LBAI	10	66,322	0.015%	\$ 10.57	\$ 0.30	278.89
AGEN	347	329,671	0.105%	\$ 3.18	\$ 0.14	346.84	PBTH	11	180,748	0.006%	\$ 6.14	\$ 0.19	343.18
AMPE	277	304,243	0.091%	\$ 6.51	\$ 0.13	236.72	LPHI	18	53,455	0.034%	\$ 2.98	\$ 0.17	619.43
ANFI	250	159,596	0.157%	\$ 10.96	\$ 0.37	437.40	CARB	24	107,764	0.022%	\$ 12.10	\$ 0.50	457.39
ANIK	252	160,054	0.157%	\$ 25.56	\$ 0.45	280.64	RLOC	12	88,923	0.013%	\$ 13.37	\$ 0.43	324.00
ARWR	309	304,762	0.101%	\$ 6.69	\$ 0.19	599.17	LCAV	21	60,222	0.035%	\$ 3.35	\$ 0.43	817.94
AXU	262	337,096	0.078%	\$ 2.03	\$ 0.04	212.12	CDR	11	280,520	0.004%	\$ 5.67	\$ 0.08	65.16
BALT	391	423,102	0.092%	\$ 5.03	\$ 0.14	348.94	ATNY	22	53,665	0.042%	\$ 2.88	\$ 0.17	578.25
BIOD	286	390,665	0.073%	\$ 3.75	\$ 0.15	514.48	MCBC	20	78,638	0.025%	\$ 5.21	\$ 0.23	462.74
BITA	540	430,309	0.126%	\$ 23.25	\$ 0.48	408.67	ARX	9	57,610	0.016%	\$ 7.57	\$ 0.43	533.62
BCE	347	107,963	0.321%	\$ 21.29	\$ 0.15	70.08	IAT	7	112,186	0.007%	\$ 29.26	\$ 0.21	62.05
BSCF	242	128,294	0.189%	\$ 21.84	\$ 0.16	71.61	EEV	8	222,972	0.003%	\$ 23.19	\$ 0.48	106.96
BSCG	265	118,991	0.223%	\$ 22.23	\$ 0.20	89.04	TTT	18	81,312	0.023%	\$ 62.53	\$ 1.39	209.15
BTT	311	294,021	0.106%	\$ 19.02	\$ 0.52	249.64	SXE	19	51,716	0.036%	\$ 20.88	\$ 1.10	519.73
CSQ	301	389,939	0.077%	\$ 10.46	\$ 0.07	70.62	CEL	21	144,276	0.014%	\$ 9.32	\$ 0.12	119.65
CVY	390	227,687	0.171%	\$ 23.94	\$ 0.32	134.99	GXG	4	142,111	0.003%	\$ 20.97	\$ 0.45	224.96
CWB	359	397,543	0.090%	\$ 44.05	\$ 0.39	91.20	BDC	5	218,199	0.002%	\$ 55.31	\$ 0.50	86.83
CYTX	252	389,085	0.065%	\$ 2.62	\$ 0.05	176.01	PLXT	24	321,600	0.007%	\$ 4.99	\$ 0.03	57.98
DGS	242	203,722	0.119%	\$ 47.74	\$ 0.58	117.42	NILE	11	157,435	0.007%	\$ 36.31	\$ 0.68	180.52
DHF	246	253,663	0.097%	\$ 4.24	\$ 0.02	49.86	BIRT	14	187,631	0.007%	\$ 6.68	\$ 0.05	67.92
DHY	269	430,972	0.062%	\$ 3.18	\$ 0.02	50.70	CLS	9	264,069	0.003%	\$ 9.47	\$ 0.03	31.36
DJP	346	383,945	0.090%	\$ 38.95	\$ 0.18	47.37	ITRI	18	280,396	0.006%	\$ 42.57	\$ 0.30	70.27
DNP	252	381,104	0.066%	\$ 9.97	\$ 0.07	70.78	RATE	11	483,264	0.002%	\$ 16.11	\$ 0.17	108.86
DSCO	290	496,619	0.058%	\$ 2.06	\$ 0.03	166.14	MPG	7	483,833	0.001%	\$ 3.07	\$ 0.03	105.62
DWX	288	207,589	0.139%	\$ 47.29	\$ 1.17	129.97	CEB	4	117,449	0.003%	\$ 60.44	\$ 0.87	135.61
EVV	352	346,524	0.102%	\$ 16.24	\$ 0.23	146.01	RXN	12	201,093	0.006%	\$ 20.06	\$ 0.29	142.56
FENG	468	490,075	0.096%	\$ 9.66	\$ 0.12	240.50	NOA	12	69,570	0.018%	\$ 4.62	\$ 0.20	409.87
FONR	264	107,948	0.244%	\$ 13.91	\$ 0.39	564.67	PSP	10	273,290	0.004%	\$ 11.41	\$ 0.22	186.24
GGG	248	279,537	0.089%	\$ 2.73	\$ 0.08	259.26	CPX	19	57,420	0.032%	\$ 4.70	\$ 0.23	485.24
GIM	450	369,761	0.122%	\$ 8.81	\$ 0.10	110.12	GTIV	19	212,930	0.009%	\$ 10.95	\$ 0.19	144.50
GSVC	389	432,081	0.090%	\$ 11.83	\$ 0.16	152.99	IPHI	19	167,025	0.011%	\$ 11.23	\$ 0.19	168.23
IEP	285	196,075	0.146%	\$ 97.17	\$ 2.38	317.29	GK	14	52,978	0.026%	\$ 49.87	\$ 1.98	398.16
IGR	416	416,278	0.100%	\$ 8.89	\$ 0.08	86.43	OFG	21	276,658	0.008%	\$ 16.33	\$ 0.25	146.98
IPCI	383	377,771	0.101%	\$ 4.01	\$ 0.21	974.14	UCFC	8	55,822	0.014%	\$ 4.08	\$ 0.17	446.76
JPS	284	367,636	0.077%	\$ 8.71	\$ 0.13	130.78	BAK	10	289,968	0.003%	\$ 15.64	\$ 0.13	86.25
MEMP	305	404,684	0.075%	\$ 19.46	\$ 0.26	131.29	CAF	13	200,701	0.007%	\$ 23.39	\$ 0.47	206.56
MILL	274	405,037	0.068%	\$ 6.55	\$ 0.11	238.23	WHX	12	384,622	0.003%	\$ 5.64	\$ 0.14	268.25
MINT	284	401,362	0.071%	\$ 101.48	\$ 0.20	19.66	SOXX	7	158,763	0.004%	\$ 60.81	\$ 0.18	30.18
NEA	250	233,989	0.107%	\$ 12.47	\$ 0.30	223.28	STBZ	4	75,107	0.005%	\$ 16.20	\$ 0.43	270.67
NIO	364	275,123	0.132%	\$ 13.52	\$ 0.25	172.44	PID	17	221,480	0.008%	\$ 16.93	\$ 0.11	63.81
NMM	282	411,126	0.069%	\$ 15.03	\$ 0.26	173.94	ELGX	15	392,499	0.004%	\$ 15.53	\$ 0.14	89.57
NOAH	351	368,566	0.095%	\$ 16.83	\$ 0.44	393.26	IVAC	10	67,168	0.015%	\$ 5.65	\$ 0.21	391.97
NPP	290	170,919	0.170%	\$ 14.09	\$ 0.33	219.66	AGX	23	64,336	0.035%	\$ 18.98	\$ 0.67	364.96
NUV	327	494,727	0.066%	\$ 9.61	\$ 0.09	93.02	ONE	17	229,552	0.007%	\$ 9.88	\$ 0.15	153.67
NWBO	440	335,522	0.131%	\$ 4.16	\$ 0.16	409.23	SPAR	13	83,083	0.015%	\$ 5.83	\$ 0.17	286.80
ONCY	279	432,947	0.064%	\$ 3.02	\$ 0.03	110.29	ATSG	12	145,601	0.008%	\$ 6.08	\$ 0.10	167.32
PBP	282	94,306	0.299%	\$ 20.33	\$ 0.28	139.94	PATK	24	73,632	0.033%	\$ 20.87	\$ 1.00	425.04
PHB	368	435,895	0.085%	\$ 19.17	\$ 0.15	24.11	KT	1	489,676	0.000%	\$ 16.39	\$ 0.04	26.49
PRAN	585	413,704	0.141%	\$ 4.98	\$ 0.14	447.02	CXPO	5	77,465	0.006%	\$ 3.07	\$ 0.14	439.44
PTY	329	301,847	0.109%	\$ 19.31	\$ 0.40	206.00	VCRA	13	249,886	0.005%	\$ 17.95	\$ 0.27	144.66
PXLW	305	267,829	0.114%	\$ 4.31	\$ 0.14	500.08	UPI	14	56,551	0.025%	\$ 2.87	\$ 0.20	735.96
REE	604	373,960	0.162%	\$ 2.26	\$ 0.04	190.13	FCF	16	362,850	0.004%	\$ 7.74	\$ 0.03	39.61
ROYT	251	197,606	0.127%	\$ 15.73	\$ 0.48	274.23	EMO	5	78,223	0.006%	\$ 23.22	\$ 0.86	378.04
SA	279	473,242	0.059%	\$ 11.36	\$ 0.11	91.52	ACXM	12	369,619	0.003%	\$ 25.78	\$ 0.22	90.96
SCHA	1,119	251,719	0.445%	\$ 47.25	\$ 0.65	134.98	HTSI	5	478,320	0.001%	\$ 46.92	\$ 0.25	56.91
SCHB	813	410,458	0.198%	\$ 39.58	\$ 0.15	36.51	ATO	17	387,927	0.004%	\$ 41.17	\$ 0.20	47.68
SCHD	1,218	312,113	0.390%	\$ 34.03	\$ 0.19	55.20	NICE	22	159,002	0.014%	\$ 37.28	\$ 0.21	55.93
SCHF	1,953	324,806	0.601%	\$ 24.74	\$ 0.29	119.45	CATM	21	238,221	0.009%	\$ 31.77	\$ 0.29	88.39
SCHF	1,777	326,316	0.545%	\$ 30.24	\$ 0.31	107.28	PLXS	10	170,432	0.006%	\$ 30.44	\$ 0.36	110.85
SCHG	560	119,371	0.469%	\$ 42.38	\$ 0.35	86.39	LTC	21	138,686	0.015%	\$ 39.77	\$ 0.43	110.01
SCHH	725	142,411	0.509%	\$ 31.11	\$ 0.43	134.72	SNX	4	166,928	0.002%	\$ 45.68	\$ 0.55	107.93
SCHM	642	179,045	0.358%	\$ 34.36	\$ 1.05	246.30	CBU	7	122,481	0.006%	\$ 31.65	\$ 0.34	105.84
SCHO	1,012	92,286	1.096%	\$ 50.51	\$ 0.29	56.86	LWC	1	53,345	0.001%	\$ 39.99	\$ 0.62	161.30
SCHP	322	64,319	0.500%	\$ 53.71	\$ 0.95	173.26	BOKF	21	59,757	0.035%	\$ 62.34	\$ 1.33	210.52
SCHV	534	111,498	0.479%	\$ 37.85	\$ 0.20	53.63	EUM	14	246,768	0.006%	\$ 28.20	\$ 0.14	49.70
SCHX	581	318,590	0.182%	\$ 40.11	\$ 0.21	53.55	VPRT	11	265,421	0.004%	\$ 46.26	\$ 0.69	143.71

SCHZ	749	76,184	0.983%	\$ 50.75	\$ 0.88	171.01	IEZ	4	102,633	0.004%	\$ 59.61	\$ 0.29	53.00
SDR	297	357,112	0.083%	\$ 13.03	\$ 0.18	139.17	GOVT	2	66,994	0.003%	\$ 24.57	\$ 0.26	103.85
SWIR	571	261,320	0.218%	\$ 16.05	\$ 0.17	136.73	TPGI	4	65,759	0.006%	\$ 5.97	\$ 0.19	334.24
TAN	336	305,400	0.110%	\$ 32.92	\$ 0.56	222.44	CPF	7	85,592	0.008%	\$ 17.96	\$ 0.92	291.45
TEU	277	203,396	0.136%	\$ 4.38	\$ 0.13	310.91	AGD	17	153,659	0.011%	\$ 4.90	\$ 0.10	203.71
TGB	366	410,076	0.089%	\$ 2.31	\$ 0.02	95.11	STEC	15	477,704	0.003%	\$ 6.29	\$ 0.04	76.58
TRX	264	423,943	0.062%	\$ 3.12	\$ 0.04	146.71	TVL	5	274,513	0.002%	\$ 12.96	\$ 0.15	119.80
UBNT	262	492,576	0.053%	\$ 30.73	\$ 0.31	153.12	CMRE	15	146,718	0.010%	\$ 16.70	\$ 1.82	205.88
UVE	246	283,395	0.087%	\$ 8.61	\$ 0.10	155.25	JRN	20	190,455	0.010%	\$ 7.27	\$ 0.12	163.86
VMO	249	226,333	0.110%	\$ 12.51	\$ 0.21	159.64	MANU	4	73,396	0.006%	\$ 17.17	\$ 0.75	441.69
VNR	265	451,327	0.059%	\$ 27.80	\$ 0.40	141.99	ETH	13	257,439	0.005%	\$ 28.75	\$ 0.30	101.78
Avg	428	304,497	0.184%	\$ 20.52	\$ 0.29	204.97	Avg	13	181,735	0.011%	\$ 20.63	\$ 0.38	227.50

### III. Active Stocks (CADV > 500,000) and Post-Period = 2017-208

For this sample, there were 51 matched pairs that emerged from this process. The pairs, along with values of selected variables, pre- and post-Program introduction, are shown as follows:

Table 3A: Retail Program Matched Sample CADV > 500,000 (Oct-Nov 2012)

Treatment Stocks					Control Stocks				
Symbol	CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)	Symbol	CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)
AKS	8,695,695	\$ 4.51	\$ 0.01	28.32	SID	6,406,260	\$ 5.36	\$ 0.01	22.61
AMAT	11,320,196	\$ 10.89	\$ 0.01	12.04	EWT	5,835,244	\$ 13.14	\$ 0.01	9.31
AML	2,227,771	\$ 16.21	\$ 0.03	15.92	HOLX	2,592,724	\$ 20.05	\$ 0.04	18.31
AMRN	4,813,167	\$ 10.78	\$ 0.04	40.16	MAS	4,458,288	\$ 15.70	\$ 0.02	13.96
ATVI	8,718,795	\$ 11.09	\$ 0.01	11.65	PBCT	3,056,198	\$ 12.06	\$ 0.01	12.03
AUY	5,377,436	\$ 18.64	\$ 0.03	13.51	HIG	5,758,691	\$ 21.40	\$ 0.02	8.70
AVEO	346,635	\$ 7.26	\$ 0.10	131.02	MTDR	275,470	\$ 8.64	\$ 0.20	223.92
BMY	8,031,212	\$ 32.88	\$ 0.02	5.18	SE	3,203,645	\$ 28.08	\$ 0.03	11.18
CAT	6,042,629	\$ 85.44	\$ 0.12	13.57	MON	2,350,388	\$ 89.50	\$ 0.14	15.96
CELG	2,512,679	\$ 77.63	\$ 0.14	18.10	CTXS	2,660,668	\$ 64.53	\$ 0.11	17.71
CHK	11,564,069	\$ 18.31	\$ 0.02	11.07	EWB	3,865,117	\$ 18.73	\$ 0.02	9.75
CLSN	1,214,021	\$ 5.90	\$ 0.10	161.64	INVN	981,021	\$ 11.12	\$ 0.14	125.44
CMCSA	10,790,890	\$ 36.66	\$ 0.02	6.02	EWG	3,725,160	\$ 23.19	\$ 0.02	7.79
COP	5,213,886	\$ 57.22	\$ 0.08	14.24	AET	4,120,054	\$ 43.42	\$ 0.04	9.11
CTL	4,303,396	\$ 38.85	\$ 0.03	7.82	SLW	3,740,709	\$ 38.10	\$ 0.05	13.28
CVS	5,899,108	\$ 47.08	\$ 0.03	6.54	DD	5,792,275	\$ 45.42	\$ 0.04	9.06
DGAZ	216,835	\$ 16.34	\$ 0.42	252.80	FANG	214,720	\$ 17.81	\$ 1.32	764.44
DIS	7,797,343	\$ 49.80	\$ 0.03	5.65	BTU	7,674,184	\$ 26.26	\$ 0.05	19.53
FTR	9,941,706	\$ 4.59	\$ 0.01	27.33	BRCD	4,956,291	\$ 5.57	\$ 0.01	22.66
GM	9,209,293	\$ 25.32	\$ 0.03	10.02	LNC	2,992,968	\$ 24.70	\$ 0.04	15.00
HAL	10,599,360	\$ 33.14	\$ 0.02	7.18	EPI	3,415,673	\$ 18.67	\$ 0.02	8.74
HD	7,695,187	\$ 62.03	\$ 0.05	7.99	BHI	3,947,283	\$ 42.88	\$ 0.08	17.92
HTZ	6,114,178	\$ 15.06	\$ 0.03	17.76	MPEL	4,251,767	\$ 14.69	\$ 0.02	16.32
KMI	4,807,113	\$ 34.35	\$ 0.03	9.44	MMC	2,187,478	\$ 34.58	\$ 0.03	9.83
KR	4,631,297	\$ 25.10	\$ 0.03	10.14	JBL	3,512,918	\$ 18.00	\$ 0.02	11.13
M	4,998,931	\$ 39.28	\$ 0.04	9.21	ITB	3,248,593	\$ 20.37	\$ 0.03	12.85
MNKD	2,549,541	\$ 2.08	\$ 0.01	65.68	SNV	7,137,885	\$ 2.39	\$ 0.01	50.16
MO	9,245,096	\$ 32.59	\$ 0.02	4.81	EWC	1,705,707	\$ 28.23	\$ 0.02	8.14
MRO	6,056,290	\$ 30.40	\$ 0.03	8.62	ARIA	2,393,958	\$ 21.94	\$ 0.05	21.70
NKE	2,206,389	\$ 93.20	\$ 0.21	23.06	FFIV	1,676,420	\$ 93.31	\$ 0.31	32.85
NVDA	9,984,860	\$ 12.35	\$ 0.02	14.84	RRD	2,894,620	\$ 9.71	\$ 0.02	18.14
PG	7,740,689	\$ 68.92	\$ 0.05	7.37	IYR	8,227,543	\$ 63.77	\$ 0.07	11.06
QID	4,797,906	\$ 30.10	\$ 0.05	16.53	PAY	2,615,150	\$ 30.32	\$ 0.06	20.75
QLD	3,096,656	\$ 54.86	\$ 0.16	29.40	TSO	3,229,689	\$ 40.06	\$ 0.21	54.91
RIG	2,584,714	\$ 46.23	\$ 0.09	18.62	KLAC	1,986,996	\$ 46.35	\$ 0.06	13.39
SLB	5,682,978	\$ 70.82	\$ 0.15	20.97	HLF	4,183,222	\$ 37.99	\$ 0.19	42.52
SPXL	689,476	\$ 86.93	\$ 0.20	22.82	IVW	645,836	\$ 75.91	\$ 0.07	9.04
SPXS	2,082,157	\$ 17.67	\$ 0.04	25.26	JEF	2,515,938	\$ 16.11	\$ 0.04	28.07
SQQQ	1,870,893	\$ 41.94	\$ 0.13	30.62	BMRN	1,467,136	\$ 44.51	\$ 0.11	24.86
SVXY	444,604	\$ 72.62	\$ 0.53	75.15	WLK	504,877	\$ 75.42	\$ 0.90	119.52
SWN	3,692,718	\$ 34.98	\$ 0.07	21.28	EWA	2,571,111	\$ 24.57	\$ 0.05	18.72
TEVA	4,150,411	\$ 39.84	\$ 0.07	16.62	CRUS	3,046,303	\$ 32.48	\$ 0.09	27.81
TGT	4,206,552	\$ 62.17	\$ 0.05	8.72	SYK	1,905,028	\$ 53.71	\$ 0.08	15.48
TQQQ	2,452,505	\$ 50.95	\$ 0.27	52.04	ADT	2,633,727	\$ 40.80	\$ 0.94	222.95
UA	1,518,310	\$ 52.54	\$ 0.19	35.79	ILMN	1,717,544	\$ 50.41	\$ 0.15	29.17
UGAZ	289,195	\$ 30.72	\$ 0.70	214.58	SCHX	263,109	\$ 33.75	\$ 0.06	16.88
UPRO	1,859,270	\$ 86.39	\$ 0.17	19.29	TDC	1,822,857	\$ 66.32	\$ 0.16	24.00
V	2,524,630	\$ 143.43	\$ 0.19	13.33	IWF	2,061,355	\$ 65.45	\$ 0.04	6.24
VRX	1,294,018	\$ 56.76	\$ 0.10	17.00	DRI	1,408,747	\$ 50.33	\$ 0.10	20.55
VSTM	23,199	\$ 7.58	\$ 0.71	906.19	BANC	20,248	\$ 11.67	\$ 0.68	581.08
WLL	1,699,845	\$ 44.23	\$ 0.12	27.05	EMN	1,605,066	\$ 59.75	\$ 0.24	40.92
Avg	4,820,112	\$ 40.29	\$ 0.11	50.00	Avg	3,048,311	\$ 34.46	\$ 0.14	56.58

Table 3B: Retail Program Matched Sample CADV >500,000 (2017-2018)													
Treatment Stocks							Control Stocks						
Symbol	RPI ADV	CADV	RPI Volume as % of Symbol CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)	Symbol	RPI ADV	CADV	RPI Volume as % of Symbol CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)
AKS	10.927	15,639,776	0.070%	\$ 5.44	\$ 0.03	53.30	SID	375	2,510,559	0.015%	\$ 2.68	\$ 0.02	62.72
AMAT	12.020	10,389,776	0.116%	\$ 44.85	\$ 0.35	72.88	EWT	95	4,513,048	0.002%	\$ 35.45	\$ 0.02	4.53
AMPL	6.775	13,624,887	0.050%	\$ 10.63	\$ 0.02	16.62	HOLX	400	2,141,270	0.019%	\$ 40.37	\$ 0.19	46.07
AMRN	8.703	4,062,849	0.214%	\$ 8.20	\$ 0.09	106.09	MAS	450	2,752,589	0.016%	\$ 37.07	\$ 0.19	49.11
ATVI	4.881	6,160,439	0.079%	\$ 59.97	\$ 0.60	90.82	PBCT	421	2,569,773	0.016%	\$ 17.85	\$ 0.03	15.83
AUY	4.853	10,659,756	0.046%	\$ 2.79	\$ 0.02	58.52	HIG	477	2,014,773	0.024%	\$ 51.13	\$ 0.21	40.56
AVEO	9.607	2,496,205	0.385%	\$ 2.55	\$ 0.05	429.01	MTDR	253	1,375,252	0.018%	\$ 26.51	\$ 0.33	115.69
BMY	6.220	6,858,944	0.091%	\$ 56.85	\$ 0.37	63.67	SE	235	1,215,332	0.019%	\$ 23.66	\$ 0.16	119.60
CAT	5.487	4,307,581	0.127%	\$ 130.63	\$ 1.79	137.18	MON	332	1,554,968	0.021%	\$ 119.09	\$ 1.30	115.70
CELG	6.561	4,772,371	0.137%	\$ 102.65	\$ 1.19	123.39	CTXS	163	1,260,537	0.013%	\$ 92.06	\$ 0.91	94.57
CHK	24.960	32,603,625	0.077%	\$ 4.31	\$ 0.03	50.88	EWI	175	3,987,617	0.004%	\$ 24.18	\$ 0.02	7.48
CLSN	4.875	1,241,307	0.393%	\$ 2.86	\$ 0.12	716.66	INVN	64	828,461	0.008%	\$ 12.69	\$ 0.04	33.44
CMCSA	6.112	18,127,151	0.034%	\$ 37.17	\$ 0.12	31.49	EWG	210	3,510,465	0.006%	\$ 30.43	\$ 0.02	7.73
COP	5.829	5,825,648	0.100%	\$ 54.01	\$ 0.42	69.40	AET	446	1,933,012	0.023%	\$ 171.08	\$ 1.72	98.50
CTL	6.118	9,429,069	0.065%	\$ 19.71	\$ 0.06	28.66	SLW	656	1,510,152	0.043%	\$ 20.73	\$ 0.06	31.43
CVS	8.086	6,647,472	0.122%	\$ 73.99	\$ 0.59	80.86	DD	528	1,447,341	0.036%	\$ 79.68	\$ 0.64	80.84
DGAZ	10.932	9,084,225	0.120%	\$ 11.36	\$ 0.54	190.26	FANG	286	1,454,441	0.020%	\$ 110.58	\$ 1.22	107.18
DIS	7.882	6,491,364	0.121%	\$ 107.13	\$ 0.70	64.15	BTU	63	883,231	0.007%	\$ 34.10	\$ 0.60	166.13
FTR	5.315	10,659,192	0.050%	\$ 3.16	\$ 0.12	97.46	BRCD	365	4,881,730	0.007%	\$ 12.39	\$ 0.01	9.27
GM	7.860	10,945,311	0.072%	\$ 37.81	\$ 0.26	65.44	LNC	357	1,350,545	0.026%	\$ 68.62	\$ 0.43	63.09
HAL	5.129	7,839,425	0.065%	\$ 43.58	\$ 0.46	103.12	EPI	144	1,944,146	0.007%	\$ 25.01	\$ 0.02	9.90
HD	5.818	3,924,834	0.148%	\$ 174.08	\$ 1.38	77.10	BHI	235	1,150,440	0.020%	\$ 58.98	\$ 0.32	53.74
HTZ	6.018	4,353,477	0.138%	\$ 16.90	\$ 0.20	109.28	MPER	142	950,705	0.015%	\$ 17.26	\$ 0.06	35.40
KMI	5.849	11,512,513	0.051%	\$ 18.01	\$ 0.06	28.21	MMC	426	1,497,086	0.028%	\$ 79.43	\$ 0.38	47.18
KR	6.466	9,751,318	0.066%	\$ 26.33	\$ 0.15	55.89	JBL	393	1,629,101	0.024%	\$ 27.67	\$ 0.09	32.67
M	5.197	8,755,161	0.059%	\$ 27.38	\$ 0.21	74.57	ITB	222	2,667,541	0.008%	\$ 35.66	\$ 0.05	12.91
MNKD	8.320	3,723,798	0.223%	\$ 2.36	\$ 0.09	252.80	SNV	130	869,544	0.015%	\$ 45.01	\$ 0.26	57.09
MO	6.910	6,350,096	0.109%	\$ 63.69	\$ 0.36	57.08	EWC	230	2,576,525	0.009%	\$ 27.79	\$ 0.02	6.03
MRO	7.197	11,747,548	0.061%	\$ 16.29	\$ 0.05	26.15	ARIA	209	1,724,630	0.012%	\$ 23.55	\$ 0.02	11.39
NKE	5.730	7,314,237	0.078%	\$ 61.48	\$ 0.47	70.55	FFIV	164	620,758	0.026%	\$ 145.45	\$ 1.87	125.53
NVDA	31.762	14,116,672	0.225%	\$ 183.69	\$ 2.59	129.18	RRD	294	907,658	0.032%	\$ 9.49	\$ 0.06	64.95
PG	5.893	6,751,513	0.087%	\$ 86.03	\$ 0.32	38.07	IYR	255	6,565,856	0.004%	\$ 78.85	\$ 0.07	8.53
QID	7.896	3,469,547	0.228%	\$ 20.71	\$ 0.19	49.75	PAY	252	1,265,358	0.020%	\$ 20.07	\$ 0.06	32.97
QLD	5.289	1,350,765	0.392%	\$ 84.13	\$ 1.54	175.92	TSO	508	1,175,360	0.043%	\$ 85.31	\$ 0.42	49.83
RIG	6.268	13,126,392	0.048%	\$ 10.78	\$ 0.07	56.84	KLAC	403	1,195,514	0.034%	\$ 101.69	\$ 1.11	107.81
SLB	6.582	6,978,354	0.094%	\$ 65.53	\$ 0.55	83.05	HLF	322	1,063,746	0.030%	\$ 66.37	\$ 0.88	132.50
SPXL	25.345	2,934,698	0.864%	\$ 45.26	\$ 0.56	115.96	IVW	74	760,113	0.010%	\$ 153.06	\$ 0.45	27.96
SPXS	8.473	3,533,077	0.240%	\$ 24.60	\$ 0.08	29.27	JEF	90	1,081,974	0.008%	\$ 21.57	\$ 0.08	35.25
SQQQ	37.752	13,391,485	0.282%	\$ 16.71	\$ 0.04	21.02	BMRN	298	1,048,100	0.028%	\$ 90.29	\$ 1.14	125.94
SVXY	7.971	6,797,318	0.117%	\$ 32.22	\$ 0.35	36.24	WLK	118	739,423	0.016%	\$ 86.28	\$ 0.74	82.98
SWN	6.333	17,373,481	0.036%	\$ 5.55	\$ 0.02	32.31	EWA	173	2,067,011	0.008%	\$ 22.16	\$ 0.02	7.65
TEVA	8.457	13,635,469	0.062%	\$ 19.94	\$ 0.23	96.53	CRUS	384	977,604	0.039%	\$ 49.30	\$ 0.92	205.13
TGT	6.651	5,606,069	0.119%	\$ 66.84	\$ 0.62	91.46	SYK	447	1,026,348	0.044%	\$ 153.83	\$ 1.17	73.75
TQQQ	28.012	6,914,269	0.405%	\$ 86.59	\$ 0.96	127.19	ADT	708	3,111,301	0.023%	\$ 9.01	\$ 0.10	100.29
UA	4.822	3,780,807	0.128%	\$ 16.71	\$ 0.11	67.91	ILMN	298	811,645	0.037%	\$ 233.26	\$ 4.74	192.78
UGAZ	6.854	6,988,878	0.098%	\$ 23.54	\$ 1.33	211.34	SCHX	230	939,059	0.024%	\$ 63.23	\$ 0.08	12.19
UPRO	7.626	2,507,297	0.304%	\$ 81.05	\$ 1.09	168.20	TDC	142	1,162,863	0.012%	\$ 34.31	\$ 0.22	59.05
V	6.258	6,321,460	0.099%	\$ 116.08	\$ 0.98	79.13	IWF	344	1,626,114	0.021%	\$ 133.18	\$ 0.51	35.50
VRX	11.634	11,277,226	0.103%	\$ 15.46	\$ 0.14	75.04	DRI	461	1,347,432	0.034%	\$ 91.86	\$ 0.60	62.85
VSTM	5.046	1,342,946	0.376%	\$ 5.40	\$ 0.21	416.42	BANC	247	735,845	0.034%	\$ 19.67	\$ 0.12	65.50
WLL	6.482	9,789,906	0.066%	\$ 10.32	\$ 0.23	76.02	EMN	229	981,095	0.023%	\$ 90.16	\$ 0.59	65.41
Avg	9.177	8,299,745	0.154%	\$ 43.99	\$ 0.45	109.38	Avg	293	1,763,039	0.020%	\$ 60.96	\$ 0.50	62.94

**IV. Less Active Stocks (CADV between 50,000 and 500,000) and Post-Period = 2017-2018**

For this sample, there were 34 matched pairs that emerged from this process. The pairs, along with values of selected variables, pre- and post-Program introduction, are shown as follows:

Table 4A: Retail Program Matched Sample CADV Between 50,000 and 500,000 (Oct-Nov 2012)									
Treatment Stocks					Control Stocks				
Symbol	CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)	Symbol	CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)
ALT	11,289	\$ 49.88	\$ 0.83	166.53	SCJ	14,075	\$ 43.20	\$ 0.84	193.16
AWX	2,179	\$ 3.72	\$ 0.55	1363.05	MPAC	5,050	\$ 6.63	\$ 0.50	842.63
AXTI	148,034	\$ 2.97	\$ 0.05	178.64	LIOX	201,793	\$ 3.73	\$ 0.05	131.75
BBOX	41,839	\$ 24.14	\$ 0.74	297.15	AMU	38,519	\$ 24.61	\$ 0.69	275.58
BTX	83,164	\$ 3.39	\$ 0.16	447.46	MEG	73,776	\$ 4.75	\$ 0.16	376.40
CLMT	338,358	\$ 30.87	\$ 0.29	90.53	NSR	344,647	\$ 39.94	\$ 0.25	61.24
CLNT	267,697	\$ 4.14	\$ 0.25	780.34	SYRG	261,547	\$ 4.42	\$ 0.10	231.54
CPLP	233,355	\$ 7.10	\$ 0.11	152.45	TESO	273,224	\$ 10.09	\$ 0.10	97.15
CYCC	343,055	\$ 6.17	\$ 0.30	459.35	CORR	184,055	\$ 5.94	\$ 0.42	575.36
DEST	50,197	\$ 20.58	\$ 0.75	394.31	UFCS	47,666	\$ 22.03	\$ 0.78	345.78
FGP	239,295	\$ 17.76	\$ 0.27	146.41	MPWR	232,887	\$ 19.84	\$ 0.18	91.99
GCAP	46,088	\$ 4.33	\$ 0.22	506.75	PAM	53,193	\$ 3.37	\$ 0.23	672.11
GROW	22,346	\$ 4.82	\$ 0.37	708.36	SYUT	20,858	\$ 4.51	\$ 0.35	775.36
GTXI	63,123	\$ 4.19	\$ 0.27	751.91	ZLTQ	64,418	\$ 5.19	\$ 0.31	589.15
KNDI	58,910	\$ 4.13	\$ 0.21	524.97	SGU	66,946	\$ 4.13	\$ 0.18	427.76
KOPN	81,063	\$ 3.47	\$ 0.09	271.52	FLOW	98,862	\$ 3.42	\$ 0.08	251.71
LBIX	3,351	\$ 4.12	\$ 0.49	1160.60	ARGT	4,246	\$ 8.04	\$ 0.49	561.44
LGCY	370,879	\$ 24.77	\$ 0.32	121.36	ECON	254,618	\$ 25.73	\$ 0.33	136.23
LIFE	1,334,018	\$ 49.36	\$ 0.09	19.18	CSC	1,348,256	\$ 35.84	\$ 0.08	23.77
MITK	336,039	\$ 2.98	\$ 0.10	314.64	NLS	140,148	\$ 3.11	\$ 0.08	253.89
MTSL	110,498	\$ 3.31	\$ 0.21	696.07	CCRN	104,861	\$ 4.44	\$ 0.12	269.74
NMFC	223,844	\$ 14.60	\$ 0.15	102.69	OMCL	191,017	\$ 14.59	\$ 0.14	91.97
PTX	15,194	\$ 7.59	\$ 0.62	815.90	TRR	18,097	\$ 7.32	\$ 0.64	962.69
RCON	141,356	\$ 2.14	\$ 0.23	1513.68	PFSW	51,521	\$ 2.59	\$ 0.21	768.02
RWM	1,218,858	\$ 25.48	\$ 0.07	28.79	CLGX	913,531	\$ 25.32	\$ 0.09	36.65
SBLK	52,411	\$ 5.10	\$ 0.46	737.07	ADUS	30,365	\$ 6.39	\$ 0.45	727.17
SDLP	234,452	\$ 24.56	\$ 0.50	198.39	SIL	283,436	\$ 24.23	\$ 0.49	209.91
SINO	30,072	\$ 2.05	\$ 0.36	1746.57	IBCP	36,642	\$ 3.31	\$ 0.28	864.93
SORL	56,169	\$ 2.25	\$ 0.42	1412.09	HCKT	56,051	\$ 3.84	\$ 0.17	421.49
SSH	87,156	\$ 7.05	\$ 0.41	594.68	BXG	95,593	\$ 8.79	\$ 0.40	536.74
TEAR	148,896	\$ 4.20	\$ 0.11	257.52	FSS	148,600	\$ 6.37	\$ 0.09	152.47
TIS	23,989	\$ 20.11	\$ 1.01	506.79	PICK	23,687	\$ 21.87	\$ 0.88	421.50
VHC	930,026	\$ 31.48	\$ 0.41	131.78	RHP	806,048	\$ 36.40	\$ 0.40	107.44
YANG	27,219	\$ 12.25	\$ 0.52	416.81	NEWS	25,473	\$ 12.31	\$ 0.62	502.43
Avg	216,895	\$ 12.80	\$ 0.35	529.83	Avg	191,580	\$ 13.42	\$ 0.33	381.98



Table 4B: Retail Program Matched Sample CADV Between 50,000 and 500,000 (2017-2018)													
Treatment Stocks							Control Stocks						
Symbol	RPI ADV	CADV	RPI Volume as % of Symbol CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)	Symbol	RPI ADV	CADV	RPI Volume as % of Symbol CADV	Avg. Price	Avg. Quoted Spread Across Exchanges (\$)	Avg. Quoted Spread Across Exchanges (bps)
ALT	965	400,957	0.241%	\$ 2.93	\$ 0.11	477.49	SCJ	8	72,966	0.011%	\$ 77.06	\$ 0.81	108.20
AWX	990	199,539	0.496%	\$ 5.21	\$ 0.21	829.89	MPAC	21	156,057	0.013%	\$ 9.98	\$ 58.76	484.96
AXTI	1,071	480,311	0.223%	\$ 7.36	\$ 0.10	142.87	LIOX	20	94,790	0.021%	\$ 5.73	\$ 0.14	253.48
BBOX	1,337	465,766	0.287%	\$ 3.48	\$ 0.19	505.97	AMU	42	144,724	0.029%	\$ 17.16	\$ 0.17	68.53
BTX	744	390,174	0.191%	\$ 2.47	\$ 0.10	371.04	MEG	6	86,161	0.006%	\$ 18.73	\$ 0.52	275.63
CLMT	1,017	332,022	0.306%	\$ 6.31	\$ 0.13	220.73	NSR	71	321,382	0.022%	\$ 33.23	\$ 0.05	14.87
CLNT	1,116	212,669	0.525%	\$ 6.19	\$ 0.34	1188.10	SYRG	16	448,779	0.003%	\$ 8.63	\$ 0.03	32.80
CPLP	848	484,164	0.175%	\$ 3.24	\$ 6.45	138.12	TESO	89	364,133	0.024%	\$ 5.08	\$ 0.14	227.29
CYCC	1,185	328,044	0.361%	\$ 3.65	\$ 0.26	1087.94	CORR	42	80,703	0.053%	\$ 35.85	\$ 2.33	648.17
DEST	594	162,608	0.365%	\$ 3.62	\$ 0.14	396.76	UFCS	8	55,507	0.015%	\$ 47.51	\$ 5.12	1068.39
FGP	634	356,016	0.178%	\$ 4.34	\$ 0.11	304.26	MPWR	51	272,652	0.019%	\$ 113.29	\$ 2.14	194.44
GCAP	606	493,864	0.123%	\$ 7.64	\$ 0.17	241.92	PAM	40	337,466	0.012%	\$ 47.59	\$ 0.98	184.85
GROW	1,538	279,670	0.550%	\$ 4.24	\$ 0.12	667.96	SYUT	101	53,814	0.187%	\$ 5.82	\$ 0.11	193.14
GTXI	879	355,979	0.247%	\$ 5.08	\$ 0.92	1077.22	ZLTQ	56	423,162	0.013%	\$ 54.29	\$ 0.87	177.66
KNDI	1,161	333,572	0.348%	\$ 5.74	\$ 0.16	339.09	SGU	57	70,467	0.082%	\$ 9.81	\$ 0.62	627.90
KOPN	864	386,839	0.223%	\$ 3.43	\$ 0.07	238.11	FLOW	21	184,662	0.011%	\$ 41.65	\$ 1.49	381.18
LBIX	2,199	256,151	0.858%	\$ 2.42	\$ 0.16	1059.10	ARGT	24	91,142	0.026%	\$ 31.00	\$ 0.22	76.07
LGCY	1,267	440,250	0.288%	\$ 3.65	\$ 0.14	510.29	ECON	28	186,471	0.015%	\$ 24.59	\$ 0.21	87.70
LIFE	688	269,028	0.256%	\$ 2.00	\$ 0.09	423.37	CSC	47	402,296	0.012%	\$ 66.46	\$ 0.37	56.64
MITK	771	331,032	0.233%	\$ 8.37	\$ 0.19	222.84	NLS	42	279,129	0.015%	\$ 15.11	\$ 0.23	151.75
MTSL	1,268	291,021	0.436%	\$ 2.85	\$ 0.64	2437.34	CCRN	51	208,480	0.025%	\$ 12.19	\$ 0.44	374.95
NMFC	599	307,003	0.195%	\$ 13.98	\$ 0.13	91.51	OMCL	41	256,369	0.016%	\$ 49.09	\$ 1.42	264.83
PTX	1,067	301,105	0.354%	\$ 3.17	\$ 0.22	965.72	TRR	31	70,172	0.044%	\$ 16.74	\$ 0.18	159.25
RCON	1,268	358,763	0.353%	\$ 2.42	\$ 0.20	1640.59	PFSW	40	53,102	0.076%	\$ 7.96	\$ 0.89	1139.81
RWM	957	452,230	0.212%	\$ 42.05	\$ 0.11	25.10	CLGX	33	418,773	0.008%	\$ 44.41	\$ 0.38	84.71
SBLK	621	496,086	0.125%	\$ 10.95	\$ 0.31	287.91	ADUS	25	67,340	0.037%	\$ 53.39	\$ 3.32	739.85
SDLP	755	369,603	0.204%	\$ 3.48	\$ 0.08	224.16	SIL	38	121,588	0.031%	\$ 32.82	\$ 0.64	219.97
SINO	715	269,787	0.265%	\$ 2.86	\$ 0.18	1000.85	IBCP	33	81,738	0.040%	\$ 22.95	\$ 1.03	459.47
SORL	1,910	366,295	0.521%	\$ 6.26	\$ 0.25	615.80	HCKT	29	113,945	0.025%	\$ 16.94	\$ 1.19	695.26
SSH	1,261	259,871	0.485%	\$ 2.47	\$ 0.28	1078.26	BXG	12	54,872	0.021%	\$ 18.11	\$ 0.57	305.18
TEAR	1,293	255,960	0.505%	\$ 2.54	\$ 0.21	1134.24	FSS	32	218,361	0.014%	\$ 20.07	\$ 0.53	266.60
TIS	599	248,421	0.241%	\$ 10.00	\$ 0.96	867.87	PICK	16	177,123	0.009%	\$ 31.85	\$ 0.39	127.24
VHC	1,730	392,979	0.440%	\$ 4.04	\$ 0.12	347.36	RHP	47	223,232	0.021%	\$ 71.53	\$ 1.58	220.94
YANG	1,530	464,954	0.329%	\$ 15.85	\$ 0.83	179.60	NEWS	36	132,383	0.027%	\$ 11.28	\$ 0.29	272.36
Avg	1,060	346,845	0.328%	\$ 6.30	\$ 0.43	627.63	Avg	37	185,998	0.029%	\$ 31.70	\$ 2.59	313.06

#### IV. Conclusion

When the Commission approved the initial retail price improvement pilot on the New York Stock Exchange LLC (“NYSE”) and NYSE Amex LLC (“Amex”) it stated that it was not concerned that such a program would “cause a major shift in market structure.”<sup>30</sup> Instead, the Commission explained that the program “should closely replicate the trading dynamics that exist in the OTC markets” and would “simply present another competitive venue for retail order flow execution” that is “not likely to alter the incentives for market participants to post limit orders in a material way.”<sup>31</sup> At the same time, the Commission saw fit to approve such programs on a pilot

<sup>30</sup> See Securities Exchange Act Release No. 67347 (July 3, 2012), 77 FR 40673 (July 10, 2012) (SR-NYSE-2011-55; SR-NYSEAmex-2011-84).

<sup>31</sup> Id.

basis so that it would have the opportunity to monitor the operation of the Program and confirm its expectations about the impact on broader market structure before permanent approval. The Exchange believes that the Commission's expectations that the Program would not have any significant impact on broader market structure is both correct and confirmed by the data. Specifically, based on the Exchange's experience in operating the Program, and the data provided here and during the duration of the pilot, the Exchange believes that the Program has been a positive experiment in attracting retail order flow to a public exchange, and should thus be approved on a permanent basis so that retail investors can continue to reap its benefits.

The data provided by the Exchange describes a valuable service that delivers considerable price improvement to retail investors in a transparent and well-regulated environment. The Program represents just a fraction of retail orders, most of which are executed off-exchange by a wide range of order handling services that have considerably more market share, and which operate pursuant to different rules and regulatory requirements. Specifically, the majority of retail order flow is currently executed off-exchange by various wholesale market makers that are able to offer sub-penny price improvement to retail orders without running afoul of the Sub-Penny Rule under Regulation NMS.<sup>32</sup> Given that retail orders already trade off-exchange in increments of less than one penny, the Exchange believes that the primary impact of the Program is to provide an opportunity for retail investors to receive price improvement on a transparent, well-regulated, exchange venue.

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<sup>32</sup> The Commission has itself opined that OTC market makers appear to handle the vast majority of marketable retail order flow, with the eight retail broker-dealers with significant retail accounts whose Rule 606 order routing disclosures the Commission reviewed routing “nearly 100%” of their customer market orders to OTC market makers. See Securities Exchange Act Release No. 61358 (January 14, 2010), 75 FR 3593, 3600 (January 21, 2010) (Concept Release on Equity Market Structure).

The Exchange believes that this understanding is also supported by the data, which shows that the Program was not likely to have caused any significant harm to broader market quality. The order flow the Program attracted and continues to attract to the Exchange provides tangible price improvement to retail investors through a competitive and transparent pricing process unavailable in non-exchange venues. As such, despite relatively modest volumes, the Exchange believes that the Program has satisfied the twin goals of attracting retail order flow to the Exchange and allowing such order flow to receive potential price improvement. Moreover, the Exchange believes that the data collected supports the conclusion that the Program did not have a negative impact on broader market quality. Although the results of the Program highlight the substantial advantages that broker-dealers retain when managing the benefits of retail order flow, the Exchange believes that the level of price improvement provided by the Program and the scant evidence that the Program negatively impacted the marketplace justifies making the Program permanent.

## 2. Statutory Basis

The Exchange believes the proposed rule change is consistent with the requirements of Section 6(b) of the Act,<sup>33</sup> in general, and Section 6(b)(5) of the Act,<sup>34</sup> in particular, in that it is designed to remove impediments to and perfect the mechanism of a free and open market and a national market system, to promote just and equitable principles of trade, and, in general, to protect investors and the public interest and not to permit unfair discrimination between customers, issuers, brokers, or dealers.

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<sup>33</sup> 15 U.S.C. § 78f(b).

<sup>34</sup> 15 U.S.C. § 78f(b)(5).

The Exchange believes that making the pilot permanent is consistent with these principles because the Program is reasonably designed to attract retail order flow to the exchange environment, while helping to ensure that retail investors benefit from the better price that liquidity providers are willing to give their orders. During the pilot period, the Exchange has provided data and analysis to the Commission. The Exchange believes that this data and analysis, as well as the further analysis provided in this filing, show that the Program has provided the intended benefits to the market, and retail investors in particular, and is therefore consistent with the Act. Furthermore, the Exchange notes that similar programs instituted by NYSE and Nasdaq BX have recently been approved by the Commission to operate on a permanent basis.<sup>35</sup> The Exchange believes that its analysis, as well as the analysis conducted by NYSE and Nasdaq BX in their proposals for permanent approval, show that retail price improvement programs do not negatively impact market structure, and can therefore provide benefits to retail investors without negatively impacting the broader market.

The proposed rule change is designed to facilitate transactions in securities and to remove impediments to, and perfect the mechanisms of, a free and open market and a national market system because making the Program permanent would allow the Exchange to continue to attract retail order flow to a public exchange and allow such order flow to receive potential price improvement. The data provided by the Exchange to the Commission staff demonstrates that the Program provided tangible price improvement to retail investors through a competitive pricing process unavailable in non-exchange venues, and otherwise had an insignificant impact on the broader market. The Exchange believes that making the Program permanent would encourage

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<sup>35</sup> See Securities Exchange Act Release No. 85160 (February 15, 2019), 84 FR 5754 (February 22, 2019) (SR-NYSE-2018-28); 86194 (June 25, 2019), 84 FR 31385 (July 1, 2019) (SR-BX-2019-011).

the additional utilization of, and interaction with, the Exchange and provide retail customers with an additional venue for price discovery, liquidity, competitive quotes, and price improvement. For the same reasons, the Exchange believes that making the Program permanent would promote just and equitable principles of trade and remove impediments to and perfect the mechanism of a free and open market.

Finally, the Exchange also believes that it is subject to significant competitive forces, as described below in the Exchange's statement regarding the burden on competition. For all of these reasons, the Exchange believes that the proposed rule change is consistent with the Act.

**B. Self-Regulatory Organization's Statement on Burden on Competition**

The Exchange does not believe that the proposed rule change will result in any burden on competition that is not necessary or appropriate in furtherance of the purposes of the Act. The Exchange believes that making the Program permanent would continue to promote competition for retail order flow among execution venues and contribute to the public price discovery process. The Exchange believes that the data supplied to the Commission, and experience gained over the life of the pilot, have demonstrated that the Program creates price improvement opportunities for retail orders that are similar to what would be provided under OTC internalization arrangements, thereby benefiting retail investors and increasing competition between execution venues. The Exchange also believes that making the Program permanent will promote competition between execution venues operating their own retail liquidity programs, including competition between the Program and a similar programs currently operated by NYSE and Nasdaq BX on a permanent basis pursuant to a recently approved rule changes.<sup>36</sup> Such competition will lead to innovation within the market, thereby increasing the quality of the

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<sup>36</sup> Id.

national market system and allowing national securities exchanges to compete both with each other and with off-exchange venues for order flow. Such competition ultimately benefits investors, and in this case specifically retail investors by providing multiple potential trading venues for the execution of their order flow, consistent with the principles of Regulation NMS, which was premised on promoting fair competition among markets. Finally, the Exchange notes that it operates in a highly competitive market in which market participants can easily direct their orders to competing venues, including off-exchange venues. In such an environment, the Exchange must continually review, and consider adjusting the services it offers and the requirements it imposes to remain competitive with other U.S. equity exchanges. For the reasons described above, the Exchange believes that the proposed rule change reflects this competitive environment.

C. Self-Regulatory Organization's Statement on Comments on the Proposed Rule Change Received from Members, Participants, or Others

The Exchange has neither solicited nor received written comments on the proposed rule change.

III. Date of Effectiveness of the Proposed Rule Change and Timing for Commission Action

Within 45 days of the date of publication of this notice in the Federal Register or within such longer period up to 90 days (i) as the Commission may designate if it finds such longer period to be appropriate and publishes its reasons for so finding or (ii) as to which the Exchange consents, the Commission will:

- A. by order approve or disapprove such proposed rule change, or
- B. institute proceedings to determine whether the proposed rule change should be disapproved.

#### IV. Solicitation of Comments

Interested persons are invited to submit written data, views, and arguments concerning the foregoing, including whether the proposed rule change is consistent with the Act. Comments may be submitted by any of the following methods:

##### Electronic comments:

- Use the Commission's Internet comment form (<http://www.sec.gov/rules/sro.shtml>); or
- Send an e-mail to [rule-comments@sec.gov](mailto:rule-comments@sec.gov). Please include File Number SR-CboeBYX-2019-014 on the subject line.

##### Paper comments:

- Send paper comments in triplicate to Secretary, Securities and Exchange Commission, 100 F Street, NE, Washington, DC 20549-1090.

All submissions should refer to File Number SR-CboeBYX-2019-014. This file number should be included on the subject line if e-mail is used. To help the Commission process and review your comments more efficiently, please use only one method. The Commission will post all comments on the Commission's Internet website (<http://www.sec.gov/rules/sro.shtml>). Copies of the submission, all subsequent amendments, all written statements with respect to the proposed rule change that are filed with the Commission, and all written communications relating to the proposed rule change between the Commission and any person, other than those that may be withheld from the public in accordance with the provisions of 5 U.S.C. 552, will be available for website viewing and printing in the Commission's Public Reference Room, 100 F Street, NE, Washington, DC 20549 on official business days between the hours of 10:00 a.m. and 3:00 p.m. Copies of the filing also will be available for inspection and copying at the principal office of the Exchange. All comments received will be posted without change.

Persons submitting comments are cautioned that we do not redact or edit personal identifying information from comment submissions. You should submit only information that you wish to make available publicly. All submissions should refer to File Number SR-CboeBYX-2019-014, and should be submitted on or before [insert date 21 days from publication in the Federal Register].

For the Commission, by the Division of Trading and Markets, pursuant to delegated authority.<sup>37</sup>

Jill M. Peterson  
Assistant Secretary

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<sup>37</sup> 17 CFR 200.30-3(a)(12).