

SECURITIES AND EXCHANGE COMMISSION
(Release No. 34-87681; File No. 4-443)

December 9, 2019

Joint Industry Plan; Notice of Filing of Amendment No. 5 to the Plan for the Purpose of Developing and Implementing Procedures Designed to Facilitate the Listing and Trading of Standardized Options to Adopt a Penny Interval Program

I. Introduction

Pursuant to Section 11A(a)(3) of the Securities Exchange Act of 1934 (“Act”)¹ and Rule 608 thereunder,² notice is hereby given that on July 18, 2019, BOX Exchange LLC; Cboe BZX Exchange, Inc.; Cboe C2 Exchange, Inc.; Cboe Exchange, Inc.; Cboe EDGX Exchange, Inc.; Miami International Securities Exchange, LLC; MIAX Emerald, LLC; MIAX PEARL, LLC; Nasdaq BX, Inc.; Nasdaq GEMX, LLC; Nasdaq ISE, LLC; Nasdaq MRX, LLC; Nasdaq PHLX LLC; The Nasdaq Stock Market LLC; NYSE American, LLC; NYSE Arca, Inc. (collectively, “Exchanges”); and The Options Clearing Corporation (“OCC” and together with OCC, “Plan Sponsors”) filed Amendment No. 5 to the Plan for the Purpose of Developing and Implementing Procedures to Facilitate the Listing and Trading of Standardized Options (“OLPP”).³ The

¹ 15 U.S.C. 78k-1(a)(3).

² 17 CFR 242.608.

³ See Letter from BOX Exchange LLC, CBOE BZX Exchange, Inc., CBOE Exchange, Inc., CBOE C2 Exchange, Inc, CBOE EDGX Exchange, Inc., Miami International Securities Exchange, LLC, MIAX Emerald, LLC, MIAX PEARL, LLC, NASDAQ BX, Inc., NASDAQ GEMX, LLC, NASDAQ ISE, LLC, NASDAQ MRX, LLC, NASDAQ PHLX, LLC, The NASDAQ Stock Market LLC, NYSE American, LLC, NYSE Arca, Inc., and the OCC, to Vanessa Countryman, Secretary, Commission, dated July 18, 2019. On July 6, 2001, the Commission approved the OLPP, which was proposed by the American Stock Exchange LLC, Chicago Board Options Exchange, Incorporated, International Securities Exchange LLC, OCC, Philadelphia Stock Exchange, Inc., and Pacific Exchange, Inc. See Securities Exchange Act Release No. 44521, 66 FR 36809 (July 13, 2001). See also Securities Exchange Act Release Nos. 49199 (February 5, 2004), 69 FR 7030 (February 12, 2004) (adding Boston Stock Exchange, Inc. as a Plan Sponsor); 57546 (March 21, 2008), 73 FR 16393 (March 27, 2008) (adding The Nasdaq Stock Market, LLC as a Plan Sponsor); 61528 (February 17, 2010), 75 FR 8415

proposal reflects changes unanimously approved by the Plan Sponsors. The Amendment No. 5 proposes to adopt provisions that (i) establish a Program for quoting certain classes in penny increments; (ii) establish an annual review process to add to and/or remove option classes from the Penny Program; (iii) allow an option class to be added to the Penny Program if it is a newly listed option class and it meets certain criteria; (iv) allow an option class with significant growth in activity to be added to the Penny Program if it meets certain criteria; (v) provide that if a corporate action involves one or more option classes in the Penny Program, all adjusted and unadjusted series of the option class shall be included in the Penny Program; (vi) provide that any series in an option class participating in the Penny Program in which the underlying security has been delisted, or are identified by OCC as ineligible for opening customer transactions, will continue to quote pursuant to the rules of the Penny Program until all such options have expired; and (vii) establish an amendment process for the Penny Program. A copy of a report submitted by the Exchanges in support of the Amendment is attached as Exhibit A hereto. A copy of the Plan, as proposed to be amended, is attached as Exhibit B hereto. The Commission is publishing this notice to solicit comments from interested persons on the Amendment No. 5.⁴

(February 24, 2010) (adding BATS Exchange, Inc. as a Plan Sponsor); 63162 (October 22, 2010), 75 FR 66401 (October 28, 2010) (adding C2 Options Exchange Incorporated as a Plan Sponsor); 66952 (May 9, 2012), 77 FR 28641 (May 15, 2012) (adding BOX Options Exchange LLC as a Plan Sponsor); 67327 (June 29, 2012), 77 FR 40125 (July 6, 2012) (adding Nasdaq OMX BX, Inc. as a Plan Sponsor); 70765 (October 28, 2013), 78 FR 65739 (November 1, 2013) (adding Topaz Exchange, LLC as a Plan Sponsor); 70764 (October 28, 2013), 78 FR 65733 (November 1, 2013) (adding Miami International Securities Exchange, LLC as a Plan Sponsor); 76822 (January 1, 2016), 81 FR 1251 (January 11, 2016) (adding EDGX Exchange, Inc. as a Plan Sponsor); 77323 (March 8, 2016), 81 FR 13433 (March 14, 2016) (adding ISE Mercury, LLC as a Plan Sponsor); 79897 (January 30, 2017), 82 FR 9263 (February 3, 2017) (adding MIAX PEARL, LLC as a Plan Sponsor); and 85228 (March 1, 2019), 84 FR 8355 (March 7, 2019) (adding MIAX Emerald, LLC as a Plan Sponsor).

⁴ 17 CFR 242.608. All capitalized and undefined terms used in this letter have the same meanings assigned to them in the OLPP.

II. Description of the Plan

Set forth in this Section I is the statement of the purpose and summary of Amendment No. 5, along with the information required by Rule 608(a)(4) and (5) under the Exchange Act,⁵ prepared and submitted by the Plan Sponsors to the Commission.⁶

A. Statement of Purpose and Summary of the Plan Amendment

The Plan Sponsors have agreed to amend the OLPP to govern the listing of option classes that quote in one-cent increments and five-cent increments under a Penny Interval Program (“Penny Program”).⁷ In particular, the Amendment proposes to adopt a new Section 3.1 that includes provisions to (i) establish an annual review process to add to and/or remove option classes from the Penny Program; (ii) allow an option class to be added to the Penny Program if it is a newly listed option class and it meets certain criteria; (iii) allow an option class with significant growth in activity to be added to the Penny Program if it meets certain criteria; (iv) provide that if a corporate action involves one or more option classes in the Penny Program, all adjusted and unadjusted series of the option class shall be included in the Penny Program; (v)

⁵ See 17 CFR 242.608(a)(4) and (a)(5).

⁶ See Transmittal Letter, supra note 3.

⁷ This Amendment No. 5 also seeks to make administrative changes in Section 4 of the OLPP to replace references to the adjustment panel with OCC. On November 9, 2018, the Commission approved a Supplement to the Options Disclosure Document. The Supplement provided for the implementation of modifications to the OCC By-Laws that transferred the authority to make contract adjustment determinations from adjustment panels, consisting of representatives from option exchanges, to OCC. The proposed modification to Section 4 of the OLPP coincides with these changes to the OCC By-Laws to reflect that contract adjustment determinations are now made by OCC. See Securities Exchange Act Release No. 84565 (November 9, 2018), 83 FR 57778 (November 16, 2018) (SR-ODD-2018-01). See also Securities Exchange Act Release No. 69977 (July 11, 2013), 78 FR 42815 (July 17, 2013) (SR-OCC-2013-05). This Amendment further seeks to make non-substantive ministerial changes to update the names and addresses of certain Plan Sponsors, as set forth in Section 9 of the OLPP.

provide that any series in an option class participating in the Penny Program in which the underlying security has been delisted, or are identified by OCC as ineligible for opening customer transactions, will continue to quote pursuant to the rules of the Penny Program until all such options have expired; and (vi) establish an amendment process for the Penny Program.

The Plan Sponsors propose to establish the Penny Program as a permanent replacement to the current Penny Pilot Program (“Penny Pilot”).⁸ The Penny Program will provide for such designated option classes to be quoted in \$0.01 increments (for all series in such option classes with a price of less than \$3.00) and \$0.05 increments (for all series in such option classes with a price of \$3.00 or higher). All option series in QQQ (PowerShares QQQ TrustSM, Series 1), SPY (SPDR S&P 500 ETF) and IWM (iShares Russell 2000 Index Fund) will continue to quote in \$0.01 increments, regardless of price.

⁸ On January 26, 2007, the six options exchanges commenced the Penny Pilot to quote and trade options on 13 stocks and ETFs in penny increments after Chairman Cox of the Commission encouraged the options exchanges in a letter dated June 6, 2006 to begin quoting a limited number of options in pennies. See Securities Exchange Act Release Nos. 55153 (January 23, 2007), 72 FR 4553 (January 31, 2007) (SR-Phlx-2006-74); 55154 (January 23, 2007), 72 FR 4743 (February 1, 2007) (SR-CBOE-2006-92); 55162 (January 24, 2007), 72 FR 4738 (February 1, 2007) (SR-Amex-2006-106); 55161 (January 24, 2007), 72 FR 4754 (January 24, 2007) (SR-ISE-2006-62); 55156 (January 23, 2007), 72 FR 4759 (February 1, 2007) (SR-NYSEArca-2006-73); and 55155 (January 23, 2007), 72 FR 4741 (February 1, 2007) (SR-BSE-2006-49). The Penny Pilot was subsequently expanded to include additional option classes. Most notably, the Penny Pilot was expanded by 22 option classes on September 28, 2007 and 28 option classes on March 28, 2008. The Penny Pilot was last expanded in 2009 to include the next 300 most actively traded, multiply-listed option classes that were not yet included in the Penny Pilot, excluding options with high premiums. See Securities Exchange Act Release Nos. 60711 (September 23, 2009), 74 FR 49419 (September 28, 2009) (SR-NYSEArca-2009-44); 60865 (October 22, 2009), 74 FR 55880 (October 29, 2009) (SR-ISE-2009-82); 60864 (October 22, 2009), 74 FR 55876 (October 29, 2009) (SR-CBOE-2009-076); 60874 (October 23, 2009), 74 FR 56682 (November 2, 2009) (SR-NASDAQ-2009-091); 60873 (October 23, 2009), 74 FR 56675 (November 2, 2009) (SR-Phlx-2009-91); 60886 (October 27, 2009), 74 FR 56897 (November 3, 2009) (SR-BX-2009-067); and 61106 (December 3, 2009), 74 FR 65193 (December 9, 2009) (SR-NYSEAmex-2009-74). Through these expansions, the Penny Pilot now consists of 363 option classes.

Initial Selection of Penny Program Classes

The Penny Program will initially apply only to the 363⁹ most actively traded multiply listed option classes, based on OCC's National Cleared Volume¹⁰ in the six full calendar months ending in the month of approval,¹¹ that (i) currently quote in penny increments (i.e., are already in the Penny Pilot) or, (ii) if not in the Penny Pilot, overlie securities priced below \$200, or any index at an index level below \$200.¹² Eligibility for inclusion in the Penny Program will be determined at the close of trading on the monthly expiration Friday of the second full month following Commission approval of the proposed Amendment. The changes made pursuant to this initial selection process will become effective on the first trading day of the third full calendar month following Commission approval of the proposed Amendment.¹³ Option classes that are in the Penny Pilot but are not selected for inclusion in the Penny Program following the

⁹ This figure is taken from the current number of option classes in the Penny Pilot. See supra note 8.

¹⁰ Under the current parameters of the Penny Pilot, whether for expansion of the Penny Pilot from 2007 to 2010, or for semi-annual replacements, new issues were selected based on total national contract volume cleared at OCC (i.e., "National Cleared Volume") over a six month period. In discussions amongst the Plan Sponsors in creating a permanent Penny Program with an annual review, it was agreed to continue to rank issues based on National Cleared Volume. National Cleared Volume includes FLEX transactions and all listed series transactions, regardless of clearing account type.

¹¹ For example, if the proposal is approved on November 6, the volume test for the initial selection into the Penny Program will include six months of National Cleared Volume beginning in June up to and including the month of November.

¹² Certain option classes that currently quote in penny increments pursuant to the Penny Pilot that are not among the 363 most actively traded multiply listed option classes at the time of the initial selection will not be eligible to quote in penny increments under the Penny Program.

¹³ For example, if the proposal is approved on November 6, the price determinant for inclusion into the Penny Program will be the expiration Friday in January (the second full month following approval). The changes from the initial selection process will become effective on the first trading day in February.

initial selection will be subject to the minimum trading increment as described in the rules of the Exchanges, effective on the first trading day of the third full calendar month following the Amendment's approval date. Once an option class is in the Penny Program, it will remain in the Penny Program until it is no longer among the 425 most actively traded multiply listed option classes at the time of annual review. Option classes will be replaced pursuant to the annual review process described below.

Annual Review

The Plan Sponsors agree on an annual review process by which eligible option classes may be added to the Penny Program, or ineligible option classes may be removed from the Penny Program based on objective criteria. Specifically, on an annual basis commencing in December 2020 and each December thereafter, OCC will rank all multiply listed option classes based on National Cleared Volume for the six full calendar months from June 1 through November 30 for determination of the most actively traded option classes. Any option class not yet in the Penny Program that is among the 300 most actively traded multiply listed option classes overlying securities priced below \$200, or an index at an index level below \$200, will be added to the Penny Program. Following the annual review, option classes to be added to the Penny Program will begin quoting in \$0.01 increments (for all series in such option classes with a price of less than \$3.00) and \$0.05 increments (for all series in such option classes with a price of \$3.00 or higher) on the first trading day of January.

In addition, following the annual review, any option class in the Penny Program that falls outside the 425 most actively traded multiply listed option classes will be removed from the Penny Program.¹⁴ Option classes that are removed from the Penny Program following an annual

¹⁴ The Plan Sponsors actively discussed the parameters of the annual review process, and determined that consideration of the top 425 issues struck the appropriate balance

review will be subject to the minimum trading increment as described in the rules of the Exchanges, effective the first trading day of April. Each Exchange will announce via bulletin if orders in their respective order books in option classes being removed from the Penny Program will be cancelled or if they will be converted to another order type.¹⁵ The Plan Sponsors believe that these time periods would give investors and traders sufficient time to prepare for the change in quoting increments. Further, the Plan Sponsors believe that the proposed annual review process provides an objective framework to add and remove option classes from the Penny Program in a manner that is designed to promote just and equitable principles of trade, to remove impediments to and perfect the mechanism of a free and open market and a national market system, and, in general, to protect investors and the public interest. As noted above, the proposed parameters of the annual review process are designed to ensure that the most active eligible issues (i.e., top 300) are included while preventing high turnovers for issues that are removed from the Penny Program (i.e., issues that fall outside the top 425). The Plan Sponsors

between guaranteeing inclusion of the most active issues (i.e., top 300) in the Penny Program while maintaining a buffer (of additional eligible issues) to ensure the least disruptive means for the annual rebalancing for those issues that were included in the Penny Program (which included the top 363 issues) that fall below the top 300. It was noted that the relative rankings of issues may increase or decrease by 20 to 30 spots from year to year, and that automatically including the top 300 (rather than 363), would allow the Penny Program to always include the most active issues, while maintaining the eligibility of an issue that is still active, although not as relatively active because of normal fluctuations in investor interest. Provided the issue was not less active than the next 62 most active (i.e., not among the top 425) such issues would remain in the Program. If the activity level declines to where it is not in the top 425, however, it should be phased out of the Penny Program. The proposed framework is therefore designed to allow for consistency and prevent high turnovers for issues that are removed from the Penny Program.

¹⁵ Each Exchange will disseminate a memorandum which will detail how open orders will be handled on its trading platform for all series on an option class removed from the Penny Program, since all the Exchanges do not employ the same process for cancellation of such orders.

believe that the proposed framework would thus promote consistency in the implementation of the Penny Program, thereby aiding in the maintenance of a fair and orderly options market system. Following Commission approval of the proposed Amendment, the Exchanges will continue to monitor the 300, 363 and 425 option class thresholds going forward to determine if they are set at appropriate levels.

Newly Listed Option Classes

In addition to the annual review described above, the Plan Sponsors agree to allow option classes to be added to the Penny Program if they are a newly listed option class that meets certain criteria. Specifically, the Exchanges may add a newly listed option class to the Penny Program, provided that (i) it is among the 300 most actively traded multiply listed option classes, as ranked by National Cleared Volume at OCC, in its first full calendar month of trading, and (ii) the underlying security is priced below \$200 or the underlying index is at an index level below \$200. Any option class added under this provision will be added on the first trading day of the month after it qualifies.¹⁶ Any option class so added shall remain in the Penny Program for one full calendar year, after which it will be subject to the annual review. The Plan Sponsors believe that the proposed trading volume threshold and initial price test, as described herein, provide objective criteria by which the Exchanges can add new option classes to the Penny Program in issues with the most demonstrated trading interest from market participants and investors on an expedited basis prior to the annual review, in a manner that will benefit market participants and

¹⁶ For example, a new issue that began trading on the 20th of October will have its volume for the month of November evaluated and ranked. If that issue is among the 300 most actively traded multiply listed option classes for November, and the underlying security is priced below \$200 or the underlying index is at an index level below \$200, it will be added to the Penny Program on the first trading day of December.

investors by allowing them to trade these new option classes that quote and trade in a finer trading increment.

Option Classes with Significant Growth in Activity

In addition to the annual review described above, the Plan Sponsors agree to allow an option class to be added to the Penny Program if it is an option class that has a significant growth in activity. Specifically, the Exchanges may add any option class to the Penny Program, provided that (i) it is among the 75 most actively traded multiply listed option classes, as ranked by National Cleared Volume at OCC, for six full calendar months of trading, and (ii) the underlying security is priced below \$200 or the underlying index is at an index level below \$200. Any option class added under this provision will be added on the first trading day of the second full month after it qualifies.¹⁷ The option class will then remain in the Penny Program for the rest of the calendar year, after which it will be subject to the annual review.¹⁸

The Plan Sponsors believe that a provision to allow for option classes to be added to the Penny Program outside of the annual review process is beneficial to market participants because of the rare instances when an option class that has been listed for some time becomes very active

¹⁷ For example, if an issue is among the 75 most actively traded multiply listed option classes for six months ending February 28 (for the period September 1 to February 28), and the underlying security is priced below \$200 or the underlying index is at an index level below \$200, it will be added to the Penny Program on the first trading day of April.

¹⁸ Thus, for example, if an issue was added to the Penny Program under this provision in October 2020, it would be subject to the next annual review in December 2020. In contrast, if a new issue was added to the Penny Program in October 2020 under the process described above for newly listed options, it would be up for annual review in December 2021 (i.e., it would remain in the Penny Program for one full calendar year, after which it would be subject to the annual review). As discussed below, the Plan Sponsors believe that it is appropriate for issues added under this provision to have a shorter lookback period as any issue that was already listed and was active enough to qualify under the more stringent requirements in this provision should be active enough to continue to qualify for the Penny Program.

for an extended period of time, such as after the development of a new product. While some issues may become active for a month or two, the six month activity requirement and the higher qualification level (among the 75 most active) ensures that only those option classes with widespread investor interest are added to the Penny Program outside of the regular process.

The Plan Sponsors also believe that option classes added outside of the regular process should be subject to the next annual review, as any option class that was active enough to qualify outside of the regular process under this provision should be active enough to continue to qualify for the Penny Program. The Plan Sponsors believe that the proposed trading volume threshold and initial price test, as described herein, provide objective criteria by which the Exchanges can add an option class to the Penny Program in issues with the most demonstrated trading interest from market participants and investors on an expedited basis prior to the annual review, in a manner that will benefit market participants and investors by allowing them to trade these new option classes that quote and trade in a finer trading increment.

Corporate Actions

The Plan Sponsors agree to provide that if a corporate action involves one or more option classes in the Penny Program, all adjusted and unadjusted series of the option class shall be included in the Penny Program.¹⁹ No trading volume threshold shall apply and the initial price test shall not apply to the option class added to the Penny Program as a result of the corporate action. The newly added adjusted and unadjusted series of the option class shall remain in the Penny Program for one full calendar year. After such time, the option class will be subject to the

¹⁹ For example, if Company A acquires Company B and Company A is not in the Penny Program but Company B is in the Penny Program, once the merger is consummated and an options contract adjustment is effective, then Company A will be added to the Penny Program and remain unchanged for one calendar year.

annual review. The Plan Sponsors believe that the proposal to allow such new option classes to be included in the Penny Program will ensure the continuity of liquidity in the option classes post-corporate action to the benefit of market participants and investors in a manner that it is designed to promote just and equitable principles of trade, to remove impediments to and perfect the mechanism of a free and open market and a national market system, and, in general, to protect investors and the public interest.

Delisted or Ineligible Option Classes

The Plan Sponsors agree to provide that any series in an option class participating in the Penny Program in which the underlying has been delisted, or is identified by OCC as ineligible for opening customer transactions, will continue to quote pursuant to the terms of the Penny Program until all options series have expired. The Plan Sponsors believe that the proposal to allow delisted or ineligible option classes to stay in the Penny Program until they expire will encourage market participants to continue to provide liquidity in these issues in a manner that is designed to promote just and equitable principles of trade, to remove impediments to and perfect the mechanism of a free and open market and a national market system, and, in general, to protect investors and the public interest.

Multiply Listed Option Classes; Penny Program Amendments

The Plan Sponsors agree that references to multiply listed option classes in proposed Section 3.1 of the OLPP will apply only to option classes in the Penny Program, and to no other sections of the OLPP.

The Plan Sponsors further agree to an amendment process that would only apply to changes to the Penny Program provisions set forth in proposed Section 3.1 of the OLPP. Currently, any amendments to the OLPP other than to add new Plan Sponsors must be approved

unanimously by the Plan Sponsors.²⁰ As proposed, the Plan Sponsors agree to a separate amendment process to govern any changes to Section 3.1. Specifically, not sooner than 60 months following Commission approval of the proposed Amendment, a super-majority (2/3) of the Plan Sponsors may vote to make changes to the Penny Program. At any time before 60 months have passed since the adoption of the Penny Program, any changes must be unanimously approved by the Plan Sponsors. Any changes to the Penny Program will be subject to SEC review pursuant to Section 11A(a)(3) of the Securities Exchange Act of 1934 and Rule 608 thereunder.

Summary of Penny Pilot Reports

The Plan Sponsors agree to adopt the Penny Program based on results of the numerous previously published studies regarding the Penny Pilot, and the most recent data presented in the Report on Activity in Option Classes Added to the Penny Pilot summarized below. Plan Sponsors note that the various markets and market participants have previously studied the Penny Pilot, in 2009 and 2010, when the Penny Pilot was expanded. The Exchanges have also studied the Penny Pilot throughout the duration of the program, and consistently found that as an overall program, the Penny Pilot was of significant benefit to investors and other market participants and had a minimal negative impact on the industry.²¹ Through these studies, the

²⁰ Section 7 of the OLPP sets forth a discrete process to effect amendments adding new Plan Sponsors, including requirements that the Eligible Exchange, as defined therein, execute a copy of the OLPP and provide each then-current Plan Sponsor with a copy of such executed Plan.

²¹ For example, the Exchanges' earlier Penny Pilot reports have generally found the National Best Bid and Offer ("NBBO") spread width has narrowed, size available at the NBBO has declined, quote traffic has increased, and industry volumes have increased. See e.g., Chicago Board Options Exchange, Penny Pilot Report dated March 4, 2008; International Securities Exchange Penny Pilot Analysis Phase 2, dated November 27, 2007; Philadelphia Stock Exchange Options Penny Pricing Pilot Report, dated February 29, 2007; American Stock Exchange Penny Pilot Report, dated November 2, 2007; New

options industry gained, and shared with the Commission, an understanding of the benefits to investors and other market participants of the Penny Pilot and the burdens on quote traffic and capacity caused by this program. Over the duration of the Penny Pilot, the Exchanges have studied quote traffic with an expectation that quote traffic would increase because of more quoting price points. However, this would be offset by benefits to the investing public due to narrowed spreads and more price points, along with the expectation that the increased quote traffic would provide increased trading activity. Overall, the Plan Sponsors agree these benefits remain true and that the Penny Pilot, as a whole, has largely met these expectations.

In addition, the Commission's Division of Economic and Risk Analysis ("DERA") recently contracted with Cornerstone Research ("Cornerstone") to conduct an independent analysis of the impact of the Penny Pilot on market quality, using quoted and effective spreads as measures of market quality ("Cornerstone Analysis").²² The Cornerstone Analysis is based on data on options added to the Penny Pilot between January 26, 2007 and January 5, 2016, and thus covers a time period from the inception of the Penny Pilot. Overall, the Cornerstone Analysis finds that relative to the control sample of options that were not included in the Penny Pilot, there is a statistically significant decrease in effective and quoted spreads for the most liquid option classes included in the Penny Pilot.²³ However, for less liquid Penny Pilot option classes,

York Stock Exchange Arca Options: Understanding Economic and Capacity Impact of the Options Penny Pilot, dated November 14, 2007. The Exchanges' Penny Pilot reports are also available at: <https://www.cboe.org/general-info/hybrid-reg-penny-pilot-program>; <https://boxoptions.com/regulatory/governing-documents-related-information-nms-plans/pilot-reports/penny/>; and <https://www.nyse.com/markets/american-options/reports>.

²² DERA Memorandum on Cornerstone Analysis, December 18, 2017, https://www.sec.gov/files/DERA_Memo_on_a_Cornerstone_Penny_Pilot_Analysis.pdf.

²³ Id. at 1.

especially in the later years (the period 2012 - 2015), the results do not indicate that inclusion in the Penny Pilot has a significant effect on market quality.²⁴

*Report on Activity in Option Classes Added to the Penny Pilot*²⁵

Most recently, on behalf of the U.S. options exchanges participating in the Penny Pilot, NYSE Group, together with its subsidiary markets, NYSE American Options and NYSE Arca Options, studied option quote and trade activity in the eight option classes listed in the table below (the “Study Group”). The study examined trading activity for this Study Group during two time periods: the Third and Fourth Quarters of 2014 (i.e., before the selected issues were added to the Penny Pilot (the “pre- Pilot period”)) and the Third and Fourth Quarters of 2015 (i.e., after the selected issues were added to the Penny Pilot (the “Pilot period”)).²⁶

| <u>Option Classes in the Study Group</u> | | |
|---|--|----------------------------|
| Symbol | Underlying Security | Date added to Pilot |
| BABA | Alibaba Group Holding Ltd | Jan. 5, 2015 |
| CBS | CBS Corp | Jan. 5, 2015 |
| FEYE | FireEye Inc | July 6, 2015 |
| GPRO | GoPro Inc | July 6, 2015 |
| HYG | iShares iBoxx \$ High Yield Corporate Bond ETF | July 6, 2015 |

²⁴ Id. at 2.

²⁵ The report setting forth the data for these studies, entitled “Report on Activity in Options Classes Added to the Penny Pilot” (“Report”), is submitted as Exhibit A as part of this Amendment No. 5.

²⁶ For avoidance of doubt, the phrase, “Pilot period” as used herein refers to solely the limited time period studied for purposes of the Report and does not include trading activity that is occurring in the ongoing Penny Pilot.

| | | |
|-----|--------------------------------|--------------|
| OIH | Market Vectors Oil Service ETF | July 6, 2015 |
| RAD | Rite Aid Corp | July 6, 2015 |
| RSX | Market Vectors Russia ETF | July 6, 2015 |

The data for the Study Group was compiled based on trading activity that occurred on each Wednesday during the pre-Pilot, and Pilot period (n=27), in an effort to minimize disruption from options expirations, which occur on Fridays, and/or the additions of new series, which often occur on Mondays.

The quote data was compiled across all series and expirations for options on each of the eight underlying securities in the Study Group. To focus on the effect of quoting in \$0.01 increments, the quotes in the Study Group were segregated by those with an offer value less than or equal to \$3.00, and those with an offer greater than \$3.00.²⁷ Option classes that are not in the Penny Pilot quote in \$0.05 increments below \$3.00 and \$0.10 increments at or above \$3.00, whereas option classes in the Penny Pilot quote in \$0.01 increments below \$3.00, and \$0.05 increments at or above \$3.00.

1. Spread Width

Spread width is a measure of the benefit to investors, as the costs of entering and exiting the market are reduced by a narrower spread.²⁸

²⁷ Generally, rules on Trading Differentials refer to “trading at less than \$3.00” or “trading at \$3.00 or above.” To accurately evaluate the effect of quotations in one cent increments, both the bid and the offer (ask) must be in one cent increments, which requires offers to be at or below \$3.00. Markets in Pilot Issues with an offer above \$3.00 are at least \$0.05 wide by rule.

²⁸ Spread width for this study was calculated by subtracting the National Best Bid from the National Best Offer.

As shown in Figures 1 and 3 of the Report, the study found that the average spread width for issues in the Study Group was reduced during the Pilot period as compared to the pre-Pilot period. The results indicated a more consistent reduction in spread width in the lower-priced options (i.e., that typically quote and trade below \$3.00) than in the higher-priced options (i.e., that typically quote and trade at or above \$3.00).

The study also examined the median width of all of the quotes on issues in the Study Group to determine whether the average spread width was distorted by higher-priced options in the Study Group. As Figures 4-5 show, the results indicated a reduced median spread width for lower-priced options during the Pilot period, while the results did not indicate as consistent a reduction in the median spread width for higher-priced options during the same period. The Exchanges still believe that the findings support making the Penny Pilot a permanent program because of the reduction in quoted spreads, especially for lower-priced options, which is beneficial to the investing public by lowering the costs of entering and exiting the market and thus consistent with the Act.

2. Liquidity; Trades by Quote Width

The study also examined the number of contracts in the Study Group offered at the National Best Offer. While most markets submitted to options exchanges are symmetrical in the number of contracts bid for, and the number of contracts offered, the common presence of quotes without a bid in out-of-the-money option series would distort the average bid size for a given option. With that in mind, the study focused solely on offer sizes.

Since the beginning of the Penny Pilot in 2007, there was a focus on whether the benefit of a reduced spread would be offset by a decrease in liquidity available at the National Best Bid/Offer (“NBBO”). As shown in Figure 6 and Table 2 of the Report, the study found that

while there was a reduction in the number of contracts offered at the NBBO for the Study Group during the Pilot period, the available size at the NBBO for the Study Group was, on average, greater than 99% of all options trades during this same time period.

As Table 3 shows, an examination of the Study Group trades during the pre-Pilot and Pilot period also indicated a sizeable percentage of transactions occurred between the NBBO (i.e., between 36.1% and 44.0%), a result seen more frequently during the pre-Pilot period than during the Pilot period.²⁹ While the Exchanges recognize that the foregoing results show that there has been a reduction in displayed size available at the NBBO in the Study Group issues, the Exchanges believe the study still supports making the pilot permanent, especially since the results also show (in Table 2) that the available size at the NBBO for the Study Group was, on average, greater than 99% of all options trades during the Pilot period.

As shown in Figures 7-14 in the Report, further examination of the Study Group data also demonstrated that having price points available under \$0.10 resulted in trading that was concentrated on narrower spreads even if this trend did not result in a significant narrowing of spreads across the universe of series in an underlying class. The data also indicated that after being added to the Penny Pilot, all but two classes in the Study Group experienced more than 50% of trading occurred when the spread width was \$0.05 or less. The other two classes (e.g., HYG and RSX) still experienced a noticeable increase in trading in that spread width bucket.

3. Quote Traffic Data

²⁹ For purposes of this study, all reported trades were included, regardless of trade condition, including Complex Trades. Complex Trades are priced at a total or net debit or credit, with the possibility of each component of the Complex Trade being priced between the National Best Bid and the National Best Offer. The observed variation in the percentage of transactions that occurred between the NBBO in the pre-Pilot and Pilot period could have been, in part, driven by the variation in the proportion of Complex Trades over the two periods.

One portion of the quote traffic analysis also observed the same Study Group and covered time pre-Pilot and Pilot periods of 2014 and 2015, respectively. As Figure 15 of the Report shows, nearly all of the issues showed an increase in number of quotes once it was included with the Penny Pilot.³⁰ On average, the quote traffic increase between the two time periods was 121%.³¹

Additionally, further analysis was conducted on a second study group to evaluate quote traffic for Penny Pilot issues that were added to the Penny Pilot in July 2017 (see option classes below, “July 2017 Study Group”).

| <u>Option Classes in July 2017 Study Group</u> | | |
|---|---|----------------------------|
| Symbol | Underlying Security | Date added to Pilot |
| FEZ | SPDR EURO STOXX 50 ETF | Jul 5, 2017 |
| HPE | Hewlett Packard Enterprise Co. | Jul 5, 2017 |
| ILG | ILG Inc. | Jul 5, 2017 |
| JNUG | Direxion Daily Jr. Gold Miners Index Bull 3X Shares | Jul 5, 2017 |
| MBLY | Mobileye N.V. | Jul 5, 2017 |

³⁰ Alibaba Group Holding (BABA) shows an extreme traffic increase of 403%, which significantly overshadows the amount of quote traffic increase of the other additions. This is, in large part, due to its IPO in September 2014; when it was the largest IPO in history at that time. Over the two periods, historically, there were days of higher quote traffic around earnings announcements. Further, over each of the last two months of 2015, BABA quote traffic exceeded 2 billion quotes, which was nearly as much as it experienced, in total, over its first three months of trading.

³¹ Due to the considerable influence of the BABA traffic increase, if the percentage increase in quote traffic was calculated without BABA’s quote data, then the value would fall to 81%.

| | | |
|------|-------------------------------------|-------------|
| MPC | Marathon Petroleum Corp | Jul 5, 2017 |
| PANW | Palo Alto Networks Inc. | Jul 5, 2017 |
| SDRL | Seadrill Ltd. | Jul 5, 2017 |
| SNAP | Snap Inc. | Jul 5, 2017 |
| UCO | ProShares Ultra Bloomberg Crude Oil | Jul 5, 2017 |
| YELP | Yelp Inc. | Jul 5, 2017 |

Figure 16 in the Report compares two time periods (January-June 2017 and January-June 2018) for the July 2017 Study Group, which represents the time before and after their inclusion into the Penny Pilot. As shown in Figure 16, of the July 2017 Study Group issues, only two (2) experienced a decrease in quote traffic (e.g., MBLY and SDRL), and such issues are the only issues that have eventually been delisted from a National Market System.³² On average, the July 2017 Study Group issues have experienced an increase in quote traffic of over 140% between the two time periods.

The Report also compares the effect on quote traffic for the potential removals and additions to the Penny Pilot for the time period between January 2018 and June 2018, as shown in Figure 17. Over the six months of 2018, the issues which would be additions to the Penny Pilot generated nearly 103 billion quotes, and issues which would be removed generated about

³² Symbol MBLY was voluntarily delisted from NYSE on September 6, 2017, in connection with a tender offer from Intel (INTC) and subsequently listed on the OTC market. Symbol SDRL filed for Chapter 11 Bankruptcy on September 12, 2017. Subsequent to the bankruptcy filing, SDRL was delisted from NYSE and listed on an OTC market. When a security moves to the OTC market, many options exchanges seek to delist the security as it is not in compliance with continued listings standards for options. Due to its removal from nearly all options exchanges, quoting in this security is drastically reduced and are typically present only when (or if) a customer looks to close out an open options position.

77 billion quotes over the same time period. Thus by comparison, the additions generated approximately 26 billion more quotes than the removals during January to June timeframe (or an average of over 4 billion quotes each month). While the foregoing findings demonstrate that the increase in quote traffic has been appreciable, the capacities of the Exchanges' systems and Options Price Reporting Authority ("OPRA") have been sufficiently adequate in handling the quote traffic increase resulting from the Penny Pilot. In addition, the Exchanges believe that their respective and OPRA's systems have sufficient quote capacity going forward to accommodate the projected increase in quote traffic that will result from the initial selection and annual review process proposed above.

B. Governing or Constitutional Documents

Not applicable.

C. Description of Amendment Implementation

The OLPP, as amended, will become effective upon Commission approval. The Plan Sponsors will implement the OLPP, as amended, pursuant to the terms of this Amendment No. 5 upon Commission approval.

D. Development and Implementation Phases

Not applicable.

E. Analysis of Impact on Competition

The proposed OLPP, as amended, does not impose any burden on competition that is not necessary or appropriate in furtherance of the purposes of the Act. The Plan Sponsors do not believe that this Amendment No. 5 introduces terms that are unreasonably discriminatory for the purposes of Section 11A(c)(1)(D) of the Act.³³ The Plan Sponsors believe that making the

³³ 15 U.S.C. 78k-1(c)(1)(D).

Penny Pilot a permanent program will allow for continued competition between market participants trading similar products as their counterparts across the options exchanges, while at the same time allowing options exchanges to continue to compete for order flow in option classes trading as part of the Penny Program.

F. Written Understandings or Agreements Relating to Interpretation of, or Participation in, the OLPP

Not applicable.

G. Approval by Plan Sponsors

This Amendment No. 5 has been approved by the Plan Sponsors in accordance with the OLPP. The Plan Sponsors have each executed a signed copy of the Amendment.

H. Terms and Conditions of Access

Not applicable.

I. Method of Determination and Imposition, and Amount of, Fees and Charges

Not applicable.

J. Method and Frequency of Processor Evaluation

Not applicable.

K. Dispute Resolution

Not applicable.

III. Solicitation of Comments

Interested persons are invited to submit written data, views, and arguments concerning the foregoing, including whether the amendment 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. Please include File Number 4-443 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 4-443. 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 plan amendment that are filed with the Commission, and all written communications relating to the amendment 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 am and 3:00 pm. Copies of such filing also will be available for inspection and copying at the Participants' offices. 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 4-443 and should be submitted on or before [insert date 21 days from publication in the Federal Register].

By the Commission.

Jill M. Peterson
Assistant Secretary

Report on Activity in Option Classes Added to the Penny Pilot

March 8, 2019

Executive Summary

On behalf of the U.S. options exchanges participating in the Penny Pilot program (the “Penny Pilot” or “Pilot”), NYSE Group, together with its subsidiary markets, NYSE American Options and NYSE Arca Options, studied option quote and trade activity in the eight option classes listed in the table below (the “Study Group”). The study examined trading activity for this Study Group during two time periods: the Third and Fourth Quarters of 2014 (i.e., before the selected issues were added to the Pilot (the “pre- Pilot period”) and the Third and Fourth Quarters of 2015 (i.e., after the selected issues were added to the Pilot (the “Pilot period”).¹ The changes in market conditions could affect quote activity and market quality measures such as spread width and trading activity examined in this report. This report utilizes the level and changes in market volatility measured by Cboe Volatility index (“VIX”) to gauge market condition during the pre-Pilot period and the Pilot period. In general, an increase in market volatility could lead to an increase in quote activity, wider spread widths, and higher trading volume for options.

Table 1. Option Classes in the Study Group

| Symbol | Underlying Security | Date added to Pilot |
|---------------|--|----------------------------|
| BABA | Alibaba Group Holding Ltd | Jan. 5, 2015 |
| CBS | CBS Corp | Jan. 5, 2015 |
| FEYE | FireEye Inc | July 6, 2015 |
| GPRO | GoPro Inc | July 6, 2015 |
| HYG | iShares iBoxx \$ High Yield Corporate Bond ETF | July 6, 2015 |

¹ For avoidance of doubt, the phrase, “Pilot period” as used herein refers to solely the limited time period studied for purposes of this report and does not include trading activity that is occurring in the ongoing Pilot.

| | | |
|-----|--------------------------------|--------------|
| OIH | Market Vectors Oil Service ETF | July 6, 2015 |
| RAD | Rite Aid Corp | July 6, 2015 |
| RSX | Market Vectors Russia ETF | July 6, 2015 |

The data for the Study Group was compiled based on trading activity that occurred on each Wednesday during the pre-Pilot, and Pilot period (n=27), in an effort to minimize disruption from options expirations, which occur on Fridays, and/or the addition of new series, which often occur on Mondays.

The quote data was compiled across all series and expirations for options on each of the eight underlying securities in the Study Group. To focus on the effect of quoting in \$0.01 increments, the quotes in the Study Group were segregated by those with an offer value less than or equal to \$3.00, and those with an offer greater than \$3.00.² Option classes that are not in the Pilot quote in \$0.05 increments below \$3 and \$0.10 increments at or above \$3.00, whereas option classes in the Pilot quote in \$0.01 increments below \$3.00, and \$0.05 increments at or above \$3.00. Spread width is a measure of benefit to investors, as the costs of entering and exiting the market are reduced by a narrower spread.³

The study found that the average spread width for issues in the Study Group was reduced during the Pilot period as compared to the pre-Pilot period. The results indicated a more consistent reduction in spread width in the lower-priced options (i.e., that typically quote and traded below \$3) than in the higher-priced options (i.e., that typically quote and traded at or above \$3.00). The study also examined the median width of all of the quotes on issues in the Study Group to determine whether the average spread width was distorted by higher-priced options in the Study Group. The results indicated a reduced median spread width for lower-priced options during the Pilot period, while the results did not indicate as consistent a reduction in the median spread width for higher-priced options during the same period.

The study also examined the number of contracts in the Study Group offered at the National Best Offer. While most markets submitted to options exchanges are symmetrical in the number of contracts bid for, and the number of contracts offered, the common presence of quotes without a bid in out-of-the-money option series would distort the average bid size for a given option. With that in mind, the study focused solely on offer sizes.

Since the beginning of the Pilot in 2007, there was a focus on whether the benefit of a reduced spread would be offset by a decrease in liquidity available at the National Best Bid/Offer (“NBBO”). The study found that while there was a reduction in the number of contracts offered

² Generally, rules on Trading Differentials refer to “trading at less than \$3” or “trading at \$3 or above.” To accurately evaluate the effect of quotations in one cent increments, both the bid and the offer (ask) must be in one cent increments, which requires offers to be at or below \$3. Markets in Pilot Issues with an offer above \$3 are at least \$0.05 wide by rule.

³ Spread width for this study was calculated by subtracting the National Best Bid from the National Best Offer.

at the NBBO for the Study Group during the Pilot period, the size traded at the NBBO for the Study Group still vastly exceeded the available size at the NBBO during this same time period. An examination of the Study Group trades during the pre-Pilot and Pilot period also indicated a sizeable percentage of transactions occurred between the NBBO (i.e., between 36.1% and 44.0%), a result seen more frequently during the pre-Pilot period than during the Pilot period. This finding of a reduced effective spread demonstrates that exchanges have used alternative mechanisms such as price improvement auctions to offset the artificial spread width caused by the lower minimum quote increments.⁴

Further examination of the Study Group data also demonstrated that having price points available under \$0.10 resulted in trading that was concentrated on narrower spreads even if this trend did not result in a significant narrowing of spreads across the universe of series in an underlying class. The data also indicated that after being added to the Pilot, all but two classes experienced more than 50% of trading occurred when the spread width was \$0.05 or less. The other two classes (e.g. HYG and RSX) still showed a noticeable increase in trading in that spread width bucket.

The Participants feel the Report demonstrates the benefit to the investing public of pricing active options classes in \$0.01 increments below \$3.00, and \$0.05 increments above \$3.00. The Report is consistent with findings from earlier Penny Pilot Reports from 2007 to 2012: the NBBO spread has narrowed, size available at the NBBO has declined, quote traffic has increased and industry volumes have increased.

These findings are also consistent with those of Cornerstone Research,⁵ that inclusion in the Pilot is associated with a decrease in quoted spreads.

⁴ For purposes of this study, all reported trades were included, regardless of trade condition, including Complex Trades. Complex Trades are priced at a total or net debit or credit, with the possibility of each component of the Complex Trade being priced between the National Best Bid and the National Best Offer. The observed variation in the percentage of transactions that occurred between the NBBO in the pre-Pilot and Pilot period could have been, in part, driven by the variation in the proportion of complex trades over the two periods.

⁵ Division of Economic and Risk Analysis (“DERA”) of the U.S. Securities and Exchange Commission contracted with Cornerstone Research (“Cornerstone”), an economic and financial consulting firm, to conduct analyses related to investigating the effects on market quality of the continuing Pilot that allows certain exchange-traded options to be quoted in reduced price increments. See DERA Memorandum on Cornerstone Analysis, December 18, 2017, https://www.sec.gov/files/DERA_Memo_on_a_Cornerstone_Penny_Pilot_Analysis.pdf

Spread Width⁶

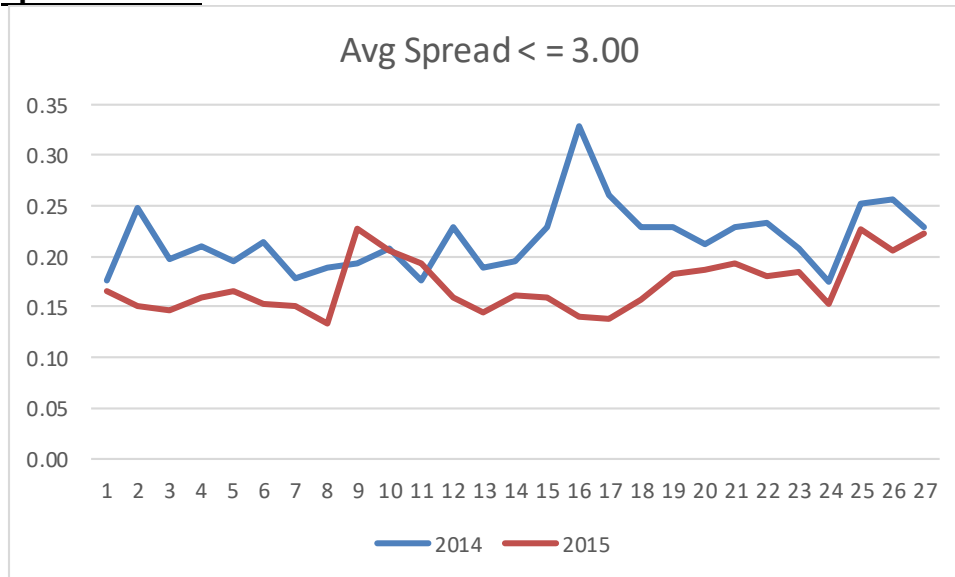


Figure 1. Average Spread Width When Offer Is Equal To or Less Than \$3.00

Except for a two week period where the Pilot period spread was higher than or equal to the Pre-Pilot period spread, the Pilot led to narrower markets across the Study Group in option series quoted in penny increments. As observed in Figure 2, the levels of market volatility measured by VIX are similar during the pre-Pilot and Pilot period. We observed narrower spreads during the Pilot period compared to those during the pre-Pilot period. The two week period where the Pilot period spread was higher than or equal to the pre-Pilot period spread is associated with higher and increasing market volatility.

⁶ Spread width for this study was calculated by subtracting the National Best Bid from the National Best Offer. No weighting was applied. Figure 1 represents the arithmetic average of all National Best Bid/Offer (“NBBO”) quotes in the Study Group with an offer equal to or less than \$3, while Figure 3 represents the arithmetic average of all NBBO quotes in the Study Group with an offer greater than \$3.

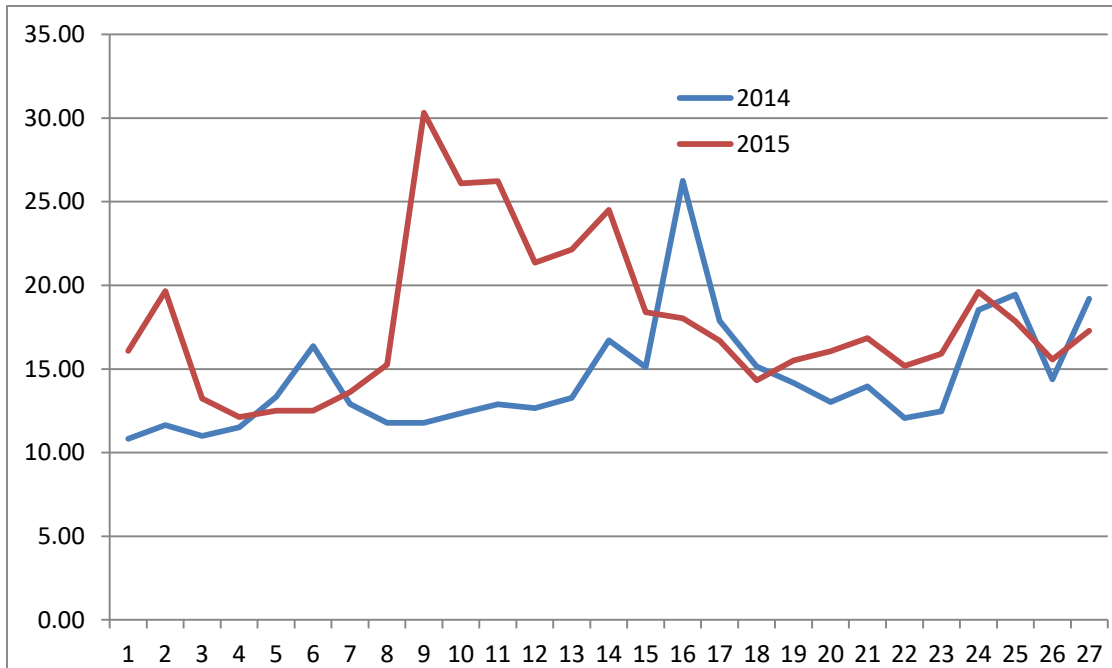


Figure 2. Closing Value of Cboe Volatility Index

The periods where VIX increased correlated to increased spread widths.

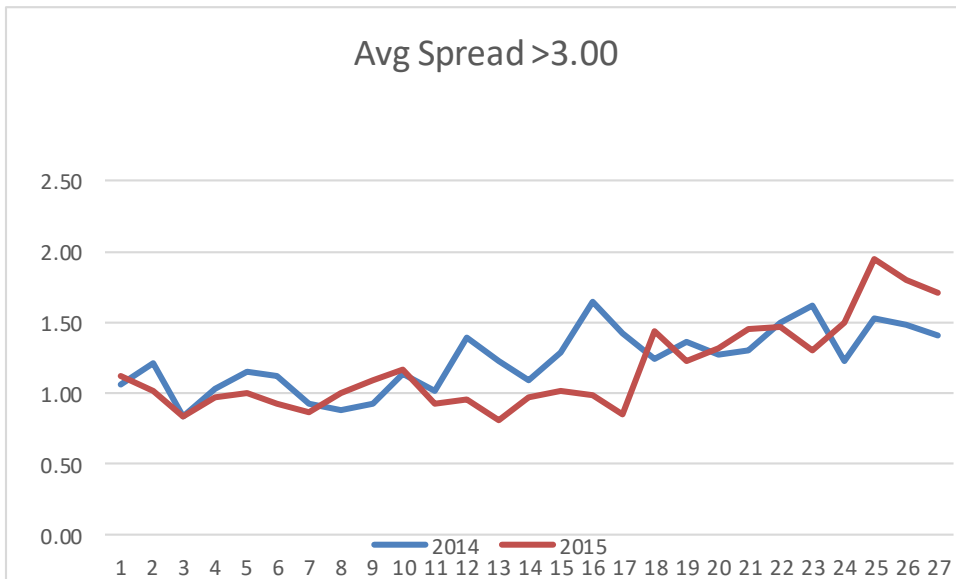


Figure 3. Average Spread Width When Offer Is Greater Than \$3.00

The study did not demonstrate a consistently narrower market for higher-priced options.

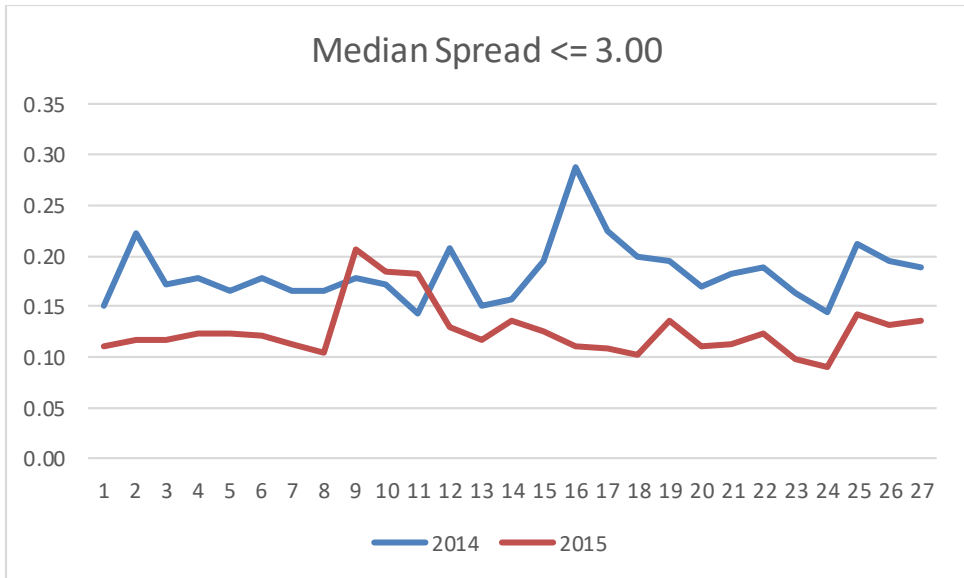


Figure 4. Median Spread Width When Offer Is Equal To or Less Than \$3.00

An examination of the median of all the spreads of lower-priced options in the Study Group during the Pilot demonstrated a consistent reduction in the average spread width.

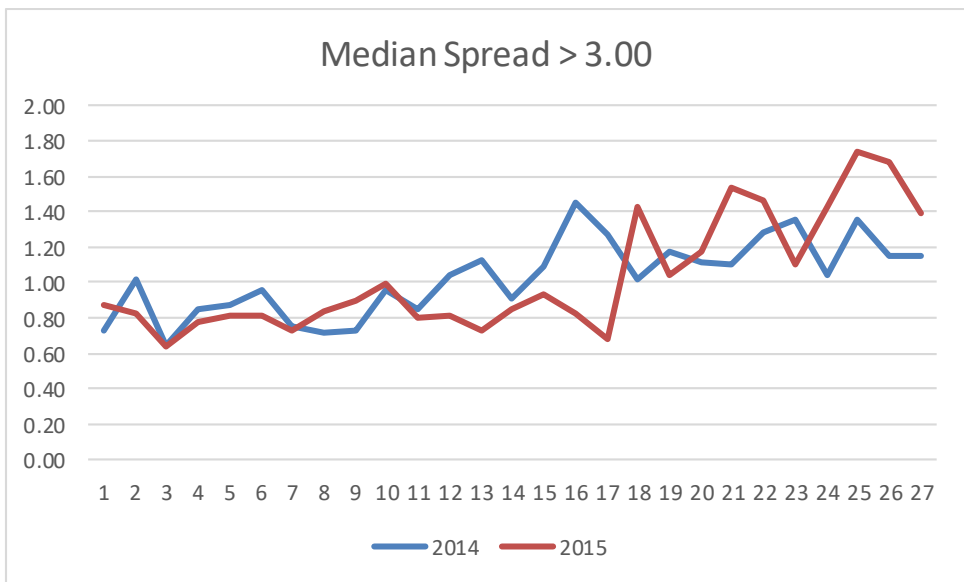


Figure 5. Median Spread Width When Offer Is Greater Than \$3.00

An examination of the median of all spread widths of higher-priced options in the Study Group did not demonstrate as consistent a reduction in spread width.

Liquidity⁷

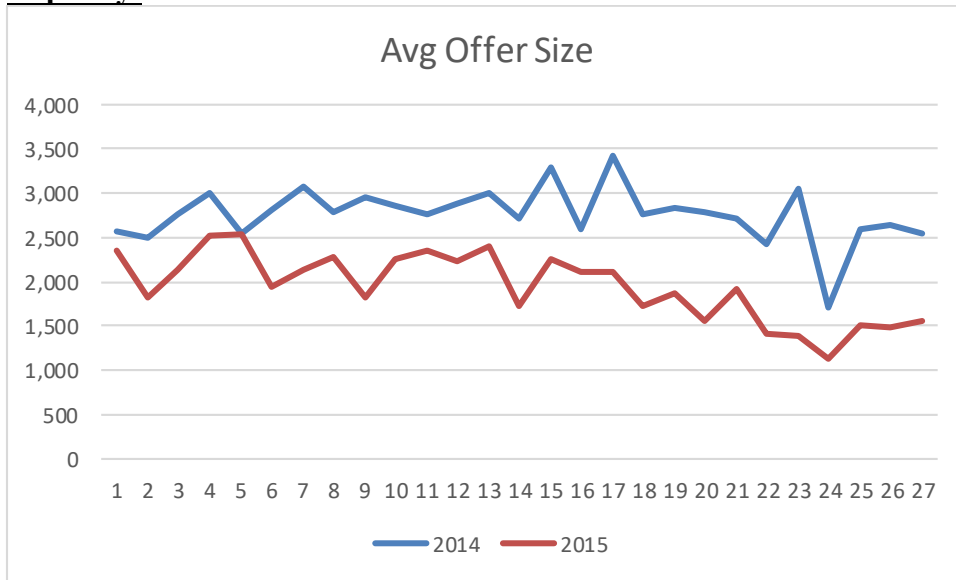


Figure 6. Average Offer Size, All Series

| Trade Size | Q3 -2014 | Q4-2014 | Q3-2015 | Q4-2015 |
|--------------|----------|---------|---------|---------|
| 0 - 10 | 64935 | 276275 | 158229 | 216690 |
| 11 to 50 | 13298 | 47541 | 31656 | 36690 |
| 51 to 100 | 1688 | 5950 | 4277 | 4486 |
| 101 to 500 | 1094 | 2587 | 1880 | 1994 |
| 501 to 1,000 | 254 | 204 | 144 | 143 |
| > 1,000 | 308 | 197 | 136 | 193 |
| | 81,577 | 332,754 | 196,322 | 260,196 |

Table 2. Transactions Grouped by Trade Size (“Trade Buckets”)

While the data indicated a reduction in available liquidity at the NBBO for options traded in the Study Group during the Pilot period, the quoted size at the NBBO for the Study Group issues was, on average, greater than 99% of all options trades during the Pilot period. Only the trade bucket for the very largest trades (>1,000 Contracts) were in excess of the average offer size.

| | Total Trades | At Bid | At Ask | Between |
|----------|--------------|--------|--------|---------|
| Q3- 2014 | 81,577 | 18,378 | 21,881 | 35,917 |
| | | 22.5% | 26.8% | 44.0% |

⁷ As noted above, the study focused solely on offer sizes because most markets submitted to options exchanges are symmetrical (i.e., number of contracts bid for generally equals the number of contracts offered), and the common presence of quotes without a bid in out-of-the-money option series would distort the average bid size for a given option. Figure 6 represents an arithmetic average of all NBBO offer sizes in the Study Group.

| | | | | |
|----------|---------|--------|--------|---------|
| Q4 -2014 | 332,754 | 69,451 | 76,552 | 152,661 |
| | | 20.9% | 23.0% | 45.9% |
| Q3- 2015 | 196,322 | 54,692 | 57,840 | 75,908 |
| | | 27.9% | 29.5% | 38.7% |
| Q4- 2015 | 260,196 | 78,171 | 79,544 | 93,862 |
| | | 30.0% | 30.6% | 36.1% |

Table 3. Breakdown of Trades Executed On Bid, Offer, Or Between Bid and Offer

Trades by Quote Width⁸

Transactions in the Study Group for the pre-Pilot and Pilot periods were analyzed by segregating such transactions into the following “buckets” of quote widths:

\$0.00 - \$0.05
 \$0.06 - \$0.10
 \$0.11 - \$0.20
 \$0.21 - \$0.40
 > \$0.40

A review of the data indicates that significantly higher percentage of Study Group transactions occurred in the bucket with the narrowest quote width (i.e., \$0.00 to \$0.05) following an issue being added to the Pilot.

⁸ Quote width for this study was calculated by subtracting the National Best Bid from the National Best Offer. The quote used for each trade is the NBBO at the time of trade reporting.

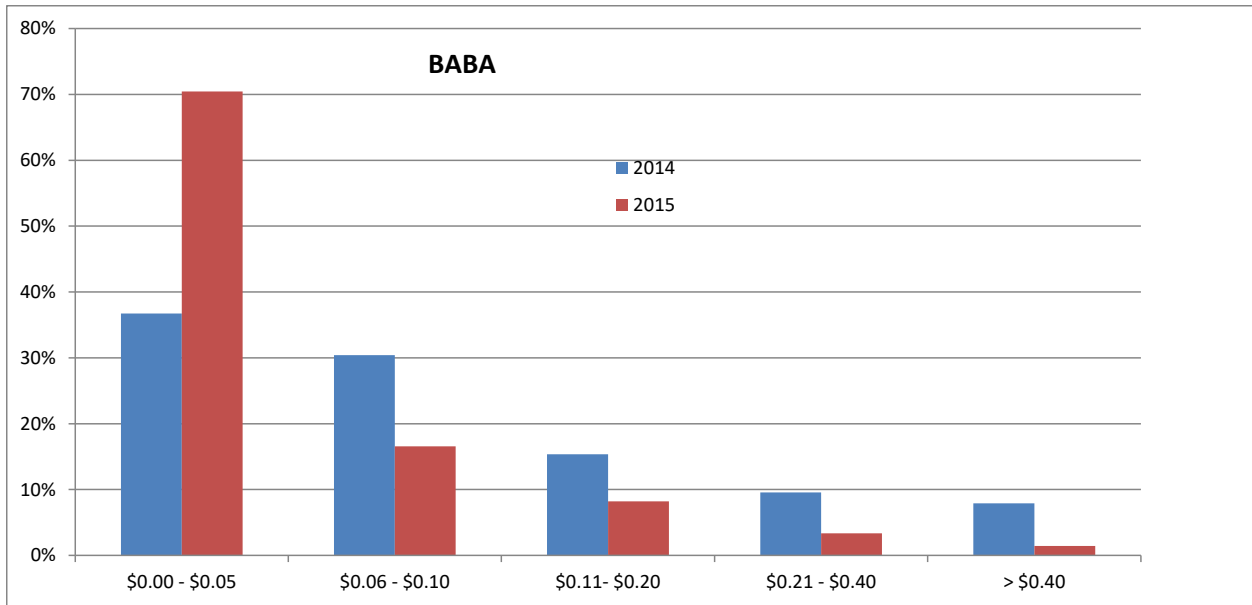


Figure 7. Trades in BABA by Quote Width

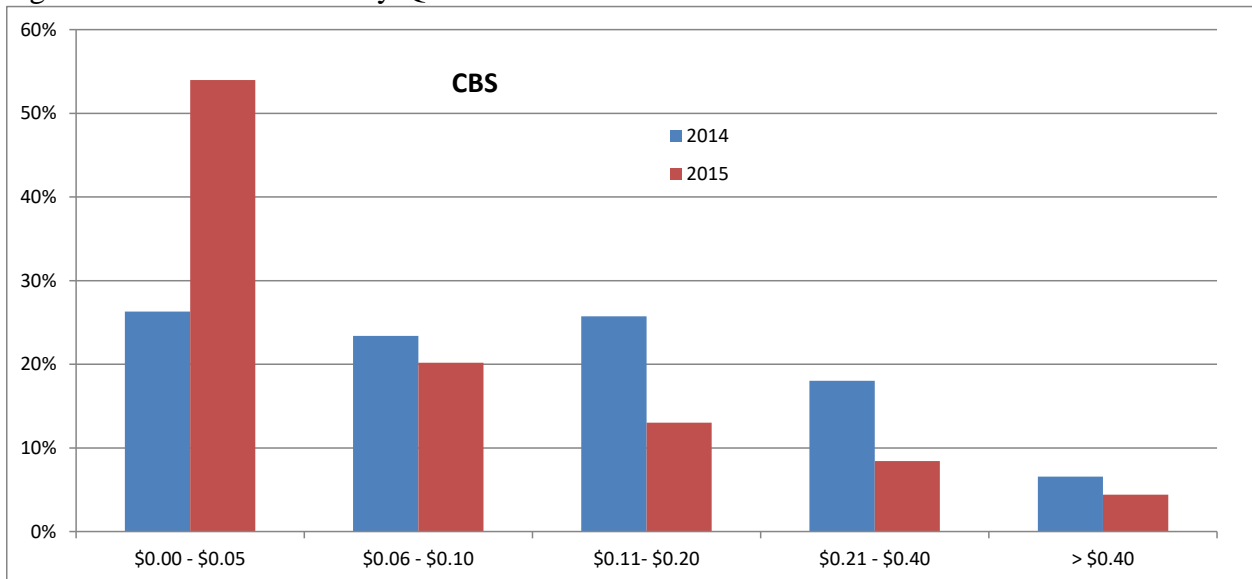


Figure 8. Trades in CBS by Quote Width

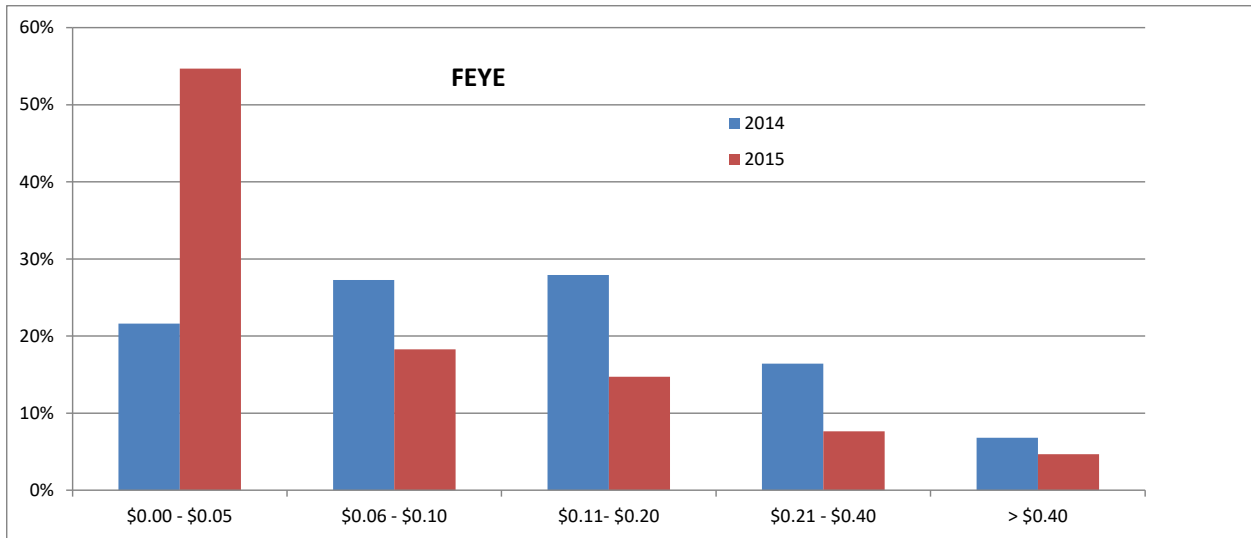


Figure 9. Trades in FEYE by Quote Width

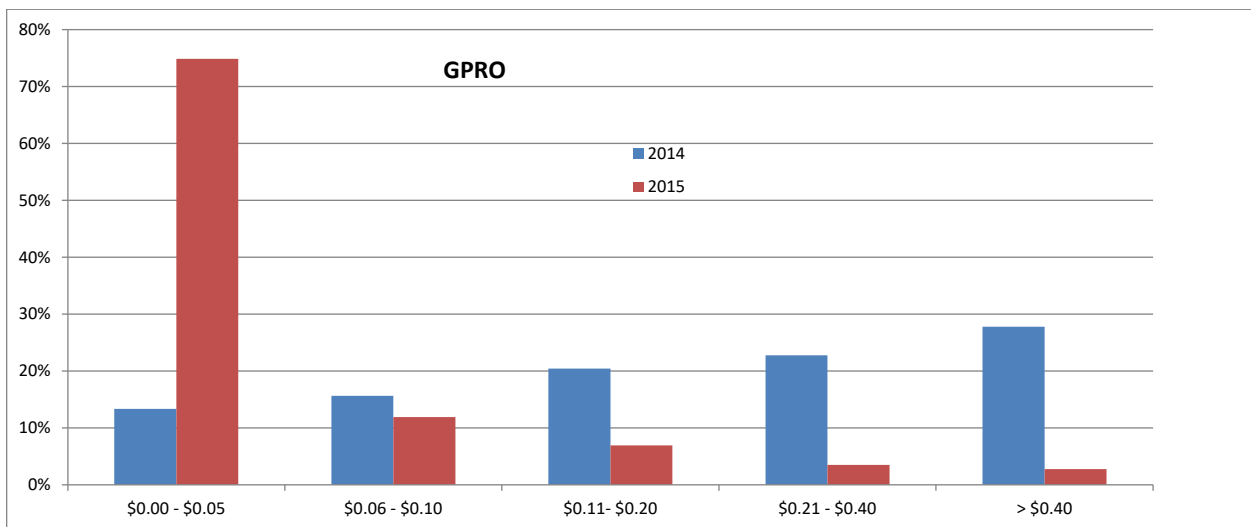


Figure 10. Trades in GPRO by Quote Width

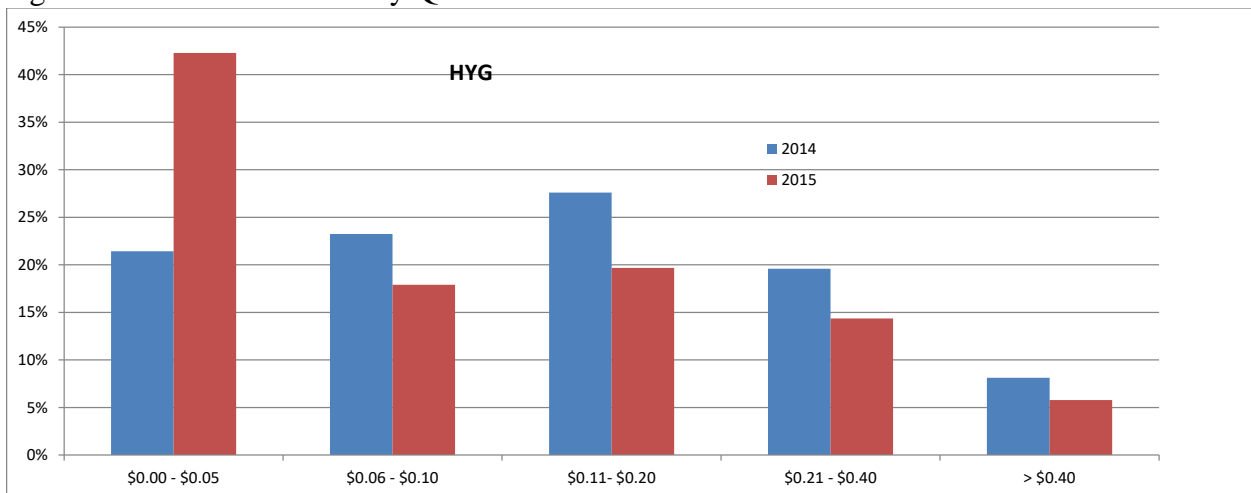


Figure 11. Trades in HYG by Quote Width

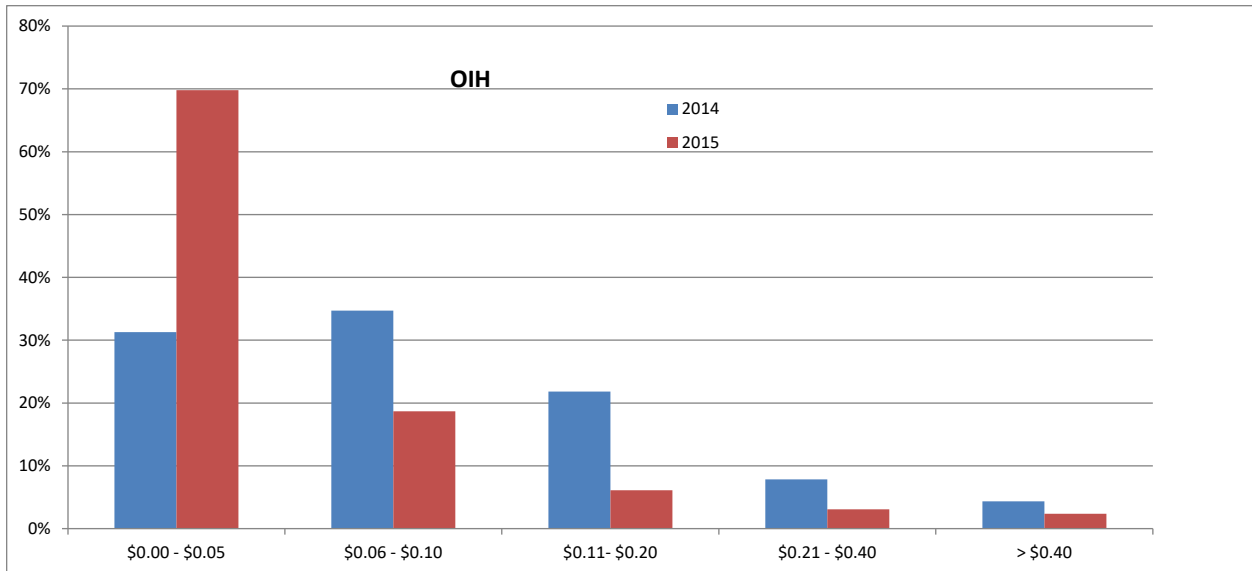


Figure 12. Trades in OIH by Quote Width

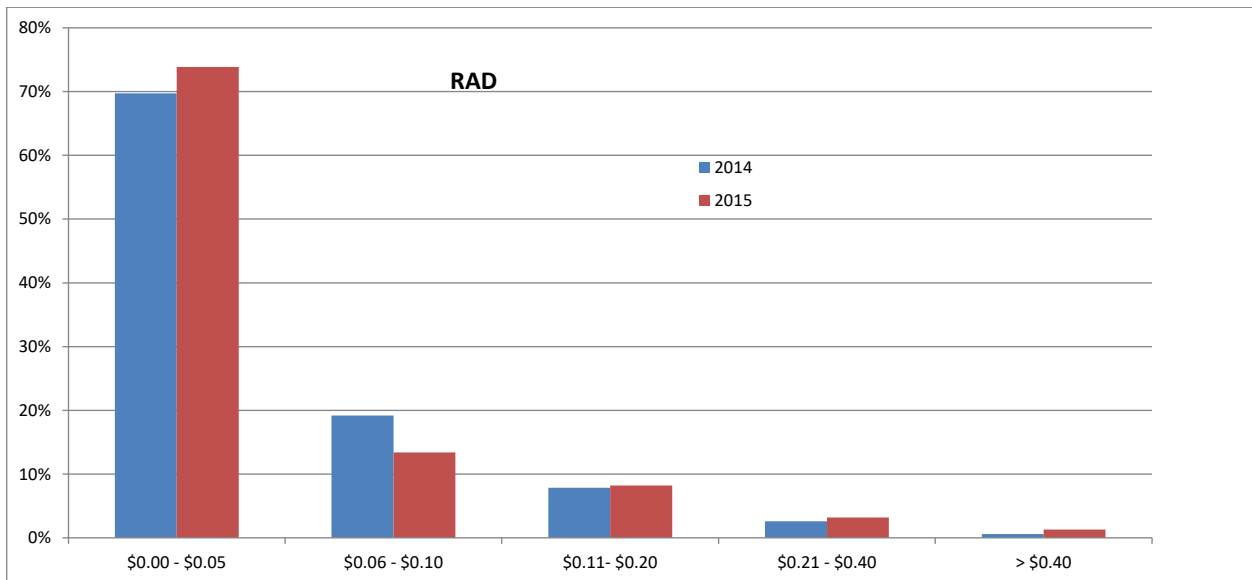


Figure 13. Trades in RAD by Quote Width

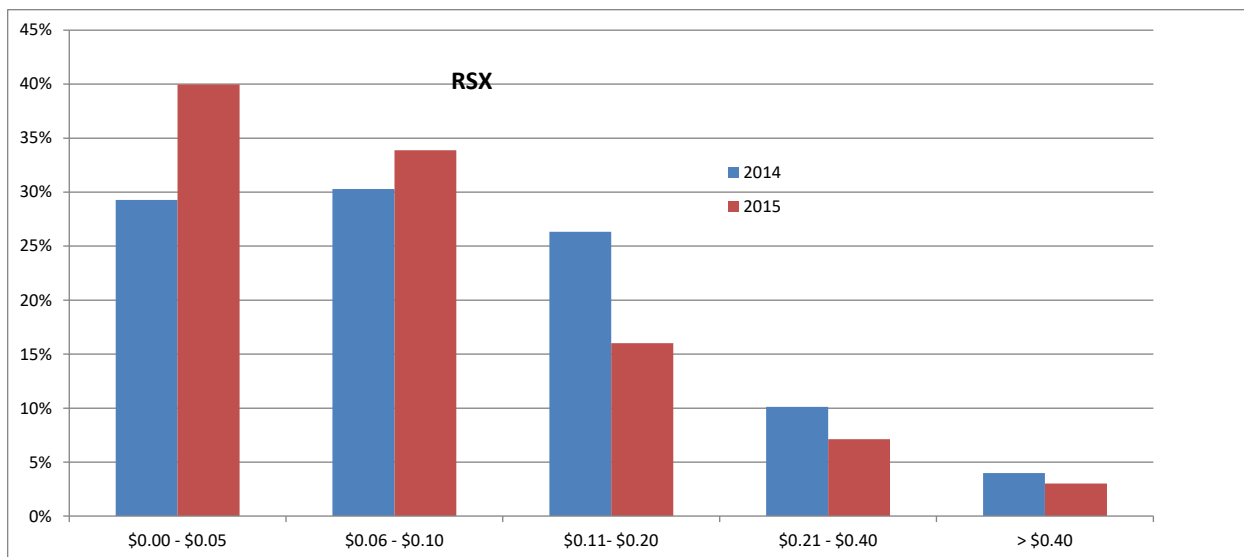


Figure 14. Trades in RSX by Quote Width

This data demonstrates that having price points available under \$0.10 resulted in trading that was concentrated on narrower spreads even if this trend did not result in a significant narrowing of spreads across the universe of series in an underlying class. The data also indicated that after being added to the Pilot, all but two classes experienced more than 50% of trading occurred when the spread width was \$0.05 or less. The other two classes (e.g. HYG and RSX) still showed a noticeable increase in trading in that spread width bucket.

Quote Traffic Analysis and Projection⁹

As the Plan Sponsors look to amend the Pilot, one of the modifications to the program will be the inauguration of an annual review. This review will be conducted every December to allow eligible issues to be added to the program, while ineligible issues will be removed from the program. Currently, there are 363 issues in the Pilot. However, it is assumed that the current issues are not the top 363 issues in the industry based upon volume. The exchanges performed a test to assess what the impact would be if the annual review would be conducted present day versus waiting until December to do so. This would examine not only the issues added/removed, but also how OPRA quote traffic would be impacted with all changes to the program.

For this projection, the analysis looked at options volume from January through July 2018 to set the industry's top 363 issues. There were 107 current Penny Pilot issues which did not rank within the top 363 industry issues. Conversely, there were 96 issues that are currently not in the Pilot, however, that rank in the top 363 industry issues. There are 11 issues that are within the

⁹ The changes in quote traffic could have been due to factors unrelated to penny increment pricing. Changes in quote traffic could have been, in part, driven by differences in market conditions and/or corporate actions during the pre-Pilot and Pilot period. For example, when markets are more volatile we would expect market participants to update or revise quotes more frequently resulting in higher levels of quote traffic.

top 363 issues, but would not qualify for the Pilot due to the underlying price being greater than \$200.

The analysis looked at the basket of recent additions to the Penny Pilot (basket of 8 stocks from earlier analysis) from the years 2014-2015. As evidenced by the chart below, nearly all of the issues showed an increase in number of quotes once it was included with the Pilot.¹⁰ On average, the quote traffic increase during the time periods was 121%.¹¹

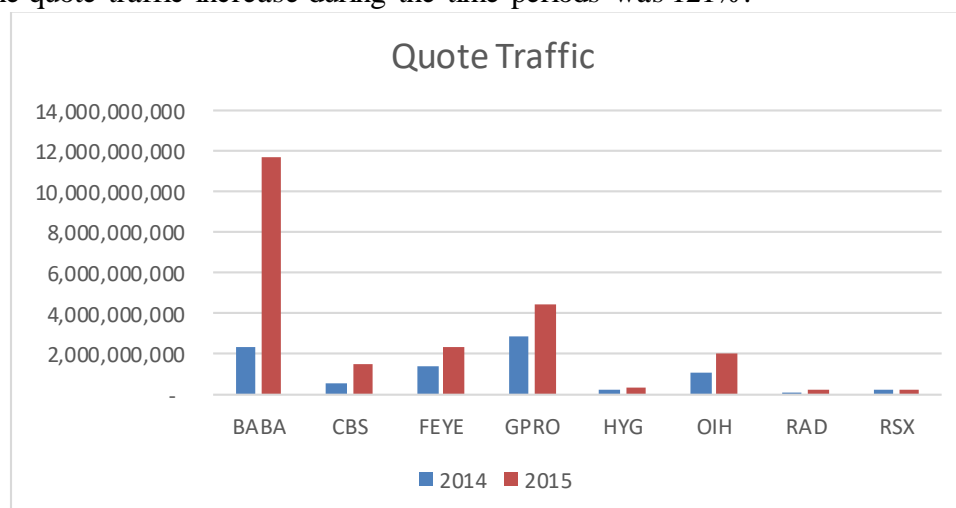


Figure 15. Quote Traffic Before and After Inclusion in Pilot

Using a different sample set, the analysis examined the quote traffic for the eleven (11) issues that were added to the Pilot in July 2017 (“July 2017 Study Group”). The below chart depicts the change in quote traffic based on quote totals from January to June 2017 vs January to June 2018. There were only two issues which did not experience an increase in quote traffic for the comparative time periods.¹² On average, these issues show that once added to the Penny pilot, there was an increase of 143% in quotes to the market.

¹⁰ Alibaba Group Holding (BABA) shows an extreme traffic increase of 403%, which significantly overshadows the amount of quote traffic increase of the other additions. This is, in large part, due to its IPO in September 2014; when it was the largest IPO in history at that time. Over the two periods, historically, there were days of higher quote traffic around earnings announcements. Further, over each of the last two months of 2015, BABA quote traffic exceeded 2 billion quotes, which was nearly as much as it experienced, in total, over its first three months of trading.

¹¹ Due to the considerable influence of the BABA traffic increase, if the percentage increase in quote traffic was calculated without BABA’s quote data, then the value would fall to 81%.

¹² Symbol MBLY was voluntarily delisted from NYSE on September 6, 2017, in connection with a tender offer from Intel (INTC) and subsequently listed on the OTC market. Symbol SDRL filed for Chapter 11 Bankruptcy on September 12, 2017. Subsequent to the bankruptcy filing, SDRL was delisted from NYSE and listed on an OTC market. When a security moves to the OTC market, many options exchanges seek to delist the security as it is not in compliance with continued listings standards for

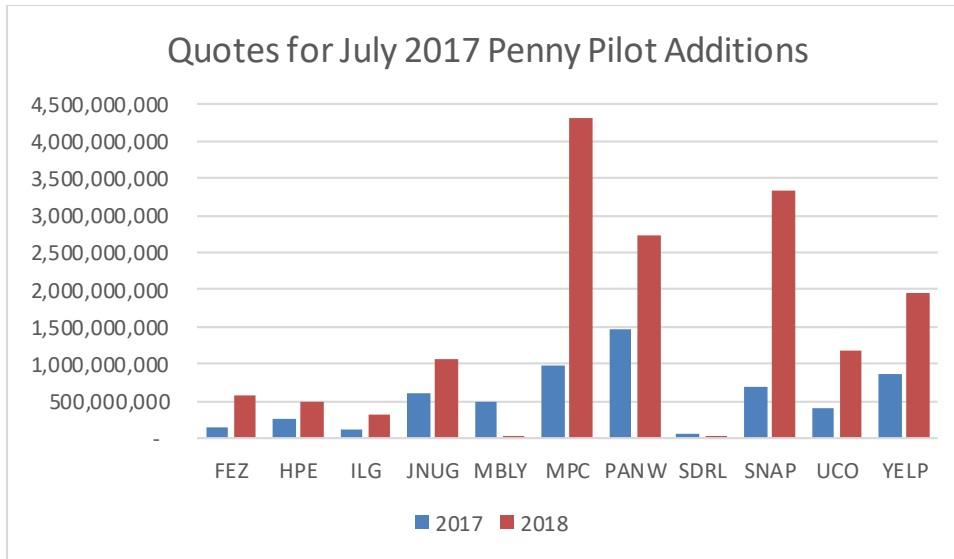


Figure 16. Quote Traffic Before and After Inclusion in Pilot – July 2017 Study Group

When analyzing the two study groups above, each of them showed a quote traffic increase over comparative time periods. The average increase between the samples is 132%.¹³ In looking at the quote traffic data from the first six months of 2018, there were 107 issues which fell outside of the top 363 issues, and had a total of nearly 77.5 billion quotes (or an average of approximately 13 billion quotes per month over a six month period). On the other hand, there are 96 securities that are currently not on the Penny Pilot but are within the top 363 issues. These 96 issues totaled close to 103 billion quotes (or an average of about 17 billion quotes per month over a six month period). The chart below details the month to month activity of the issues which would be removed and added as a result of a review.

options. Due to its removal from nearly all options exchanges, quoting in this security is drastically reduced and are typically present only when (or if) a customer looks to close out an open options position.

¹³ If BABA's large effect of the total quote traffic was not used, it would drop the average increase between the samples to 111%.

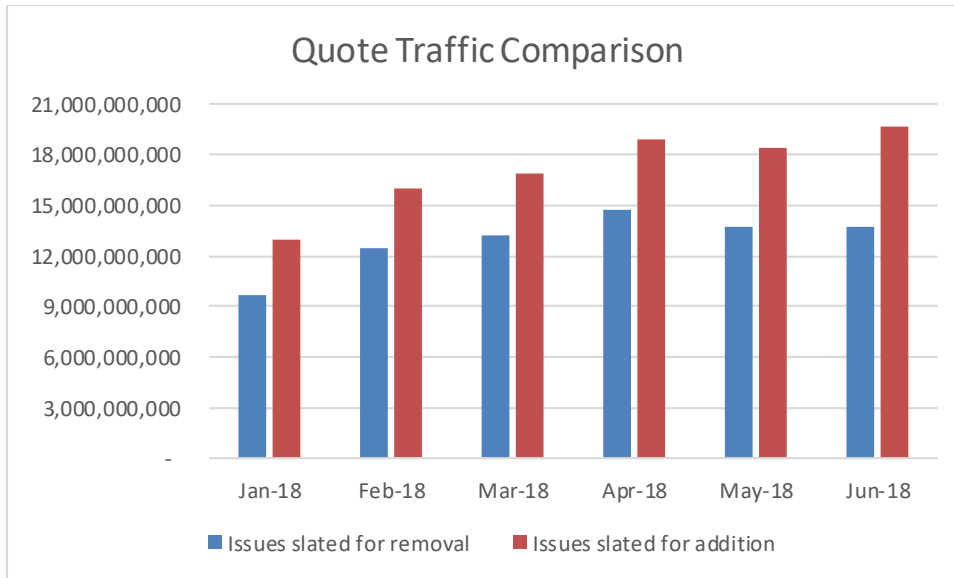


Figure 17. Effect on Quote Traffic from Rebalancing

When comparing the January to June 2018 quote traffic for the potential removals and potential additions to the Penny Pilot, there is an increase in traffic for each of the six months. It ranges from a 28% increase in March to a 44% increase in June. The monthly traffic increase over the six month period averages out to nearly 33%.¹⁴ Over the six months of 2018, the issues which would be additions to the Penny Pilot generated nearly 103 billion quotes. Conversely, the issues which would be removed generated about 77 billion quotes over the same time period. Therefore, by comparison, the additions generated approximately 26 billion more quotes than the removals in the January to June timeframe (or an average of slightly over 4 billion quotes each month)¹⁵. Hence, if the 96 new issues were added to the program, it can be reasonably concluded that the Penny Pilot would see an increase in total quote traffic; even while removing the other 107 issues which would no longer qualify for the program.

¹⁴ This figure does not represent a constant growth rate of quote traffic into perpetuity. Historically, there have been issues in the Penny Pilot program which suffer a decrease in quote traffic over the years, with some even getting delisted at some point in the future. For example, issues such as GPRO and RAD have seen their quote numbers decrease by 83% and 53%, respectively, since their inclusion in the Penny Pilot from 2014.

¹⁵ When comparing on a month to month basis for January to June 2018, the quote traffic differences between the added and removed issues are as follows: January 2018 – 3,261,431,336; February 2018 – 3,617,834,797; March 2018 – 3,685,135,946; April 2018 – 4,144,730,113, May 2018 – 4,688,087,205, June 2018 – 5,990,971,122. The total quote traffic difference is 25,388,190,519 more quotes generated by the potential 96 issues.

Table 4. Reference Data Table

| Summary Quote Data for Pre-Pilot period (i.e., Third and Fourth Quarter 2014) | | | | | | |
|---|-------------------|-------------------------|------------------------|---------------------------------|--------------------------------|--------------|
| quote date | underlying symbol | spread avg: ask <= 3.00 | spread avg: ask > 3.00 | appx median spread: ask <= 3.00 | appx median spread: ask > 3.00 | avg ask size |
| 7/2/2014 | CBS | 0.34 | 1.15 | 0.30 | 1.10 | 1091 |
| 7/2/2014 | FEYE | 0.25 | 1.36 | 0.25 | 1.10 | 2364 |
| 7/2/2014 | HYG | 0.16 | 1.81 | 0.10 | 0.80 | 1519 |
| 7/2/2014 | OIH | 0.10 | 0.84 | 0.05 | 0.60 | 1949 |
| 7/2/2014 | RAD | 0.11 | 0.37 | 0.10 | 0.30 | 6617 |
| 7/2/2014 | RSX | 0.10 | 0.79 | 0.10 | 0.50 | 1837 |
| 7/9/2014 | CBS | 0.71 | 2.04 | 0.60 | 1.90 | 591 |
| 7/9/2014 | FEYE | 0.27 | 1.18 | 0.25 | 1.00 | 2270 |
| 7/9/2014 | GPRO | 0.12 | 0.66 | 0.10 | 0.40 | 523 |
| 7/9/2014 | HYG | 0.27 | 2.31 | 0.25 | 2.20 | 2228 |
| 7/9/2014 | OIH | 0.11 | 1.18 | 0.10 | 0.70 | 2011 |
| 7/9/2014 | RAD | 0.15 | 0.38 | 0.15 | 0.40 | 7739 |
| 7/9/2014 | RSX | 0.11 | 0.75 | 0.10 | 0.50 | 2174 |
| 7/16/2014 | CBS | 0.17 | 0.71 | 0.15 | 0.50 | 1755 |
| 7/16/2014 | FEYE | 0.25 | 1.01 | 0.25 | 1.00 | 2840 |
| 7/16/2014 | GPRO | 0.38 | 1.51 | 0.30 | 1.40 | 1647 |
| 7/16/2014 | HYG | 0.23 | 1.23 | 0.20 | 0.50 | 1652 |
| 7/16/2014 | OIH | 0.14 | 0.56 | 0.10 | 0.50 | 2654 |
| 7/16/2014 | RAD | 0.10 | 0.27 | 0.10 | 0.20 | 6388 |
| 7/16/2014 | RSX | 0.11 | 0.55 | 0.10 | 0.40 | 2330 |
| 7/23/2014 | CBS | 0.31 | 1.17 | 0.25 | 1.00 | 2879 |
| 7/23/2014 | FEYE | 0.19 | 0.88 | 0.15 | 0.80 | 2629 |
| 7/23/2014 | GPRO | 0.35 | 1.45 | 0.30 | 1.20 | 1679 |
| 7/23/2014 | HYG | 0.26 | 1.61 | 0.25 | 1.30 | 2232 |
| 7/23/2014 | OIH | 0.12 | 1.27 | 0.10 | 0.80 | 1864 |
| 7/23/2014 | RAD | 0.12 | 0.30 | 0.10 | 0.30 | 7091 |
| 7/23/2014 | RSX | 0.12 | 0.54 | 0.10 | 0.50 | 2637 |
| 7/30/2014 | CBS | 0.26 | 1.22 | 0.25 | 0.80 | 1989 |
| 7/30/2014 | FEYE | 0.21 | 0.71 | 0.20 | 0.70 | 2212 |
| 7/30/2014 | GPRO | 0.33 | 1.47 | 0.25 | 1.30 | 1557 |
| 7/30/2014 | HYG | 0.23 | 2.02 | 0.15 | 1.30 | 1456 |
| 7/30/2014 | OIH | 0.11 | 1.31 | 0.10 | 1.10 | 2325 |
| 7/30/2014 | RAD | 0.11 | 0.39 | 0.10 | 0.30 | 5949 |
| 7/30/2014 | RSX | 0.11 | 0.93 | 0.10 | 0.60 | 2339 |
| 8/6/2014 | CBS | 0.31 | 1.35 | 0.25 | 1.10 | 1842 |

| | | | | | | |
|-----------|------|------|------|------|------|------|
| 8/6/2014 | FEYE | 0.28 | 1.46 | 0.20 | 1.40 | 2344 |
| 8/6/2014 | GPRO | 0.32 | 1.43 | 0.30 | 1.20 | 1787 |
| 8/6/2014 | HYG | 0.24 | 0.95 | 0.20 | 0.70 | 2257 |
| 8/6/2014 | OIH | 0.11 | 1.57 | 0.10 | 1.40 | 2069 |
| 8/6/2014 | RAD | 0.14 | 0.38 | 0.10 | 0.40 | 6918 |
| 8/6/2014 | RSX | 0.10 | 0.74 | 0.10 | 0.50 | 2425 |
| 8/13/2014 | CBS | 0.25 | 1.13 | 0.25 | 0.90 | 1648 |
| 8/13/2014 | FEYE | 0.18 | 0.85 | 0.15 | 0.80 | 2338 |
| 8/13/2014 | GPRO | 0.28 | 1.63 | 0.25 | 1.40 | 2005 |
| 8/13/2014 | HYG | 0.20 | 1.06 | 0.15 | 0.80 | 1387 |
| 8/13/2014 | OIH | 0.11 | 0.94 | 0.10 | 0.60 | 2768 |
| 8/13/2014 | RAD | 0.13 | 0.29 | 0.15 | 0.30 | 7232 |
| 8/13/2014 | RSX | 0.10 | 0.60 | 0.10 | 0.50 | 4179 |
| 8/20/2014 | CBS | 0.27 | 1.16 | 0.25 | 0.70 | 1109 |
| 8/20/2014 | FEYE | 0.18 | 0.86 | 0.15 | 0.80 | 2662 |
| 8/20/2014 | GPRO | 0.32 | 1.70 | 0.25 | 1.60 | 2368 |
| 8/20/2014 | HYG | 0.20 | 0.81 | 0.20 | 0.60 | 2054 |
| 8/20/2014 | OIH | 0.12 | 0.76 | 0.10 | 0.60 | 1831 |
| 8/20/2014 | RAD | 0.12 | 0.32 | 0.10 | 0.30 | 6414 |
| 8/20/2014 | RSX | 0.11 | 0.50 | 0.10 | 0.40 | 3075 |
| 8/27/2014 | CBS | 0.24 | 0.80 | 0.25 | 0.70 | 1500 |
| 8/27/2014 | FEYE | 0.18 | 0.91 | 0.15 | 0.90 | 2764 |
| 8/27/2014 | GPRO | 0.31 | 1.53 | 0.25 | 1.20 | 1749 |
| 8/27/2014 | HYG | 0.25 | 0.89 | 0.25 | 0.60 | 1881 |
| 8/27/2014 | OIH | 0.12 | 1.26 | 0.10 | 0.90 | 2560 |
| 8/27/2014 | RAD | 0.14 | 0.32 | 0.15 | 0.30 | 7080 |
| 8/27/2014 | RSX | 0.11 | 0.71 | 0.10 | 0.50 | 3080 |
| 9/3/2014 | CBS | 0.25 | 1.24 | 0.25 | 1.10 | 1649 |
| 9/3/2014 | FEYE | 0.22 | 1.39 | 0.20 | 1.00 | 3400 |
| 9/3/2014 | GPRO | 0.41 | 2.00 | 0.25 | 2.10 | 1479 |
| 9/3/2014 | HYG | 0.22 | 0.96 | 0.20 | 0.80 | 1466 |
| 9/3/2014 | OIH | 0.11 | 0.85 | 0.10 | 0.70 | 2525 |
| 9/3/2014 | RAD | 0.14 | 0.61 | 0.10 | 0.40 | 6192 |
| 9/3/2014 | RSX | 0.11 | 0.87 | 0.10 | 0.60 | 3305 |
| 9/10/2014 | CBS | 0.25 | 1.13 | 0.25 | 0.90 | 1756 |
| 9/10/2014 | FEYE | 0.19 | 0.98 | 0.15 | 0.70 | 2826 |
| 9/10/2014 | GPRO | 0.41 | 2.07 | 0.30 | 2.30 | 1616 |
| 9/10/2014 | HYG | 0.00 | 0.00 | 0.00 | 0.00 | 0 |
| 9/10/2014 | OIH | 0.11 | 1.31 | 0.10 | 0.90 | 2841 |
| 9/10/2014 | RAD | 0.15 | 0.49 | 0.10 | 0.40 | 6710 |
| 9/10/2014 | RSX | 0.13 | 1.13 | 0.10 | 0.70 | 3641 |
| 9/17/2014 | CBS | 0.27 | 1.43 | 0.25 | 0.80 | 1487 |
| 9/17/2014 | FEYE | 0.21 | 1.22 | 0.20 | 0.80 | 2946 |

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|------------|------|------|------|------|------|------|
| 9/17/2014 | GPRO | 0.39 | 2.10 | 0.35 | 2.20 | 1709 |
| 9/17/2014 | HYG | 0.31 | 1.47 | 0.30 | 1.20 | 1762 |
| 9/17/2014 | OIH | 0.13 | 1.10 | 0.10 | 0.80 | 3021 |
| 9/17/2014 | RAD | 0.18 | 1.01 | 0.15 | 0.70 | 5996 |
| 9/17/2014 | RSX | 0.12 | 1.38 | 0.10 | 0.80 | 3334 |
| 9/24/2014 | CBS | 0.25 | 1.25 | 0.25 | 1.10 | 2128 |
| 9/24/2014 | FEYE | 0.19 | 0.82 | 0.15 | 0.80 | 3146 |
| 9/24/2014 | GPRO | 0.26 | 2.24 | 0.15 | 2.60 | 858 |
| 9/24/2014 | HYG | 0.26 | 1.14 | 0.25 | 0.90 | 2415 |
| 9/24/2014 | OIH | 0.12 | 1.31 | 0.10 | 1.10 | 2939 |
| 9/24/2014 | RAD | 0.13 | 0.57 | 0.05 | 0.60 | 7259 |
| 9/24/2014 | RSX | 0.12 | 1.22 | 0.10 | 0.80 | 2334 |
| 10/1/2014 | BABA | 0.11 | 0.77 | 0.10 | 0.60 | 1753 |
| 10/1/2014 | CBS | 0.26 | 1.02 | 0.25 | 0.80 | 1984 |
| 10/1/2014 | FEYE | 0.18 | 0.69 | 0.15 | 0.70 | 2465 |
| 10/1/2014 | GPRO | 0.45 | 2.24 | 0.30 | 2.40 | 1101 |
| 10/1/2014 | HYG | 0.21 | 0.97 | 0.20 | 0.70 | 2127 |
| 10/1/2014 | OIH | 0.13 | 1.31 | 0.10 | 1.00 | 2452 |
| 10/1/2014 | RAD | 0.11 | 0.31 | 0.10 | 0.30 | 7347 |
| 10/1/2014 | RSX | 0.11 | 1.44 | 0.05 | 0.80 | 2577 |
| 10/8/2014 | BABA | 0.18 | 1.19 | 0.15 | 0.90 | 2771 |
| 10/8/2014 | CBS | 0.30 | 1.10 | 0.25 | 0.80 | 1649 |
| 10/8/2014 | FEYE | 0.20 | 0.72 | 0.20 | 0.70 | 4029 |
| 10/8/2014 | GPRO | 0.52 | 2.35 | 0.40 | 2.50 | 2891 |
| 10/8/2014 | HYG | 0.25 | 1.21 | 0.25 | 1.00 | 2284 |
| 10/8/2014 | OIH | 0.13 | 1.59 | 0.10 | 1.40 | 2900 |
| 10/8/2014 | RAD | 0.13 | 0.31 | 0.10 | 0.30 | 6762 |
| 10/8/2014 | RSX | 0.13 | 1.85 | 0.10 | 1.10 | 3012 |
| 10/15/2014 | BABA | 0.30 | 1.56 | 0.25 | 1.50 | 2117 |
| 10/15/2014 | CBS | 0.56 | 2.23 | 0.50 | 2.00 | 1613 |
| 10/15/2014 | FEYE | 0.33 | 1.53 | 0.30 | 1.50 | 3365 |
| 10/15/2014 | GPRO | 0.63 | 2.52 | 0.50 | 2.50 | 1916 |
| 10/15/2014 | HYG | 0.34 | 1.32 | 0.35 | 1.00 | 1224 |
| 10/15/2014 | OIH | 0.17 | 1.87 | 0.15 | 1.90 | 1819 |
| 10/15/2014 | RAD | 0.15 | 0.49 | 0.15 | 0.40 | 6211 |
| 10/15/2014 | RSX | 0.15 | 1.63 | 0.10 | 0.80 | 2443 |
| 10/22/2014 | BABA | 0.26 | 1.30 | 0.25 | 1.10 | 2818 |
| 10/22/2014 | CBS | 0.32 | 1.54 | 0.25 | 1.35 | 2337 |
| 10/22/2014 | FEYE | 0.23 | 1.06 | 0.25 | 1.00 | 3753 |
| 10/22/2014 | GPRO | 0.51 | 2.44 | 0.45 | 2.50 | 1731 |
| 10/22/2014 | HYG | 0.27 | 1.45 | 0.25 | 1.20 | 2756 |
| 10/22/2014 | OIH | 0.16 | 1.37 | 0.15 | 1.20 | 3444 |
| 10/22/2014 | RAD | 0.17 | 0.88 | 0.10 | 0.90 | 6843 |

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|------------|------|------|------|------|------|------|
| 10/22/2014 | RSX | 0.17 | 1.35 | 0.10 | 0.90 | 3707 |
| 10/29/2014 | BABA | 0.17 | 1.11 | 0.10 | 0.80 | 1401 |
| 10/29/2014 | CBS | 0.26 | 1.33 | 0.25 | 1.00 | 2687 |
| 10/29/2014 | FEYE | 0.24 | 0.84 | 0.25 | 0.70 | 2233 |
| 10/29/2014 | GPRO | 0.51 | 2.08 | 0.50 | 2.10 | 1526 |
| 10/29/2014 | HYG | 0.27 | 1.37 | 0.20 | 1.20 | 2203 |
| 10/29/2014 | OIH | 0.12 | 1.46 | 0.10 | 1.00 | 2809 |
| 10/29/2014 | RAD | 0.13 | 0.37 | 0.10 | 0.30 | 6067 |
| 10/29/2014 | RSX | 0.14 | 1.42 | 0.10 | 1.00 | 3127 |
| 11/5/2014 | BABA | 0.14 | 1.31 | 0.10 | 0.90 | 1786 |
| 11/5/2014 | CBS | 0.27 | 1.44 | 0.25 | 1.10 | 1514 |
| 11/5/2014 | FEYE | 0.18 | 1.55 | 0.15 | 1.50 | 1980 |
| 11/5/2014 | GPRO | 0.57 | 2.26 | 0.50 | 2.30 | 1459 |
| 11/5/2014 | HYG | 0.26 | 1.36 | 0.25 | 1.20 | 2608 |
| 11/5/2014 | OIH | 0.12 | 1.33 | 0.10 | 1.10 | 3771 |
| 11/5/2014 | RAD | 0.16 | 0.57 | 0.10 | 0.40 | 6033 |
| 11/5/2014 | RSX | 0.13 | 1.10 | 0.10 | 0.90 | 3516 |
| 11/12/2014 | BABA | 0.14 | 1.39 | 0.10 | 1.10 | 1731 |
| 11/12/2014 | CBS | 0.24 | 1.31 | 0.20 | 0.90 | 1500 |
| 11/12/2014 | FEYE | 0.17 | 0.96 | 0.15 | 0.90 | 2465 |
| 11/12/2014 | GPRO | 0.45 | 2.37 | 0.30 | 2.50 | 1525 |
| 11/12/2014 | HYG | 0.28 | 1.56 | 0.25 | 1.40 | 3310 |
| 11/12/2014 | OIH | 0.12 | 1.14 | 0.10 | 1.10 | 3105 |
| 11/12/2014 | RAD | 0.16 | 0.47 | 0.15 | 0.35 | 5507 |
| 11/12/2014 | RSX | 0.13 | 0.98 | 0.10 | 0.70 | 3146 |
| 11/19/2014 | BABA | 0.16 | 1.42 | 0.10 | 1.20 | 2153 |
| 11/19/2014 | CBS | 0.24 | 1.30 | 0.20 | 1.00 | 1466 |
| 11/19/2014 | FEYE | 0.18 | 0.77 | 0.15 | 0.70 | 2602 |
| 11/19/2014 | GPRO | 0.57 | 2.39 | 0.40 | 2.40 | 901 |
| 11/19/2014 | HYG | 0.26 | 1.73 | 0.25 | 1.30 | 2980 |
| 11/19/2014 | OIH | 0.14 | 1.25 | 0.10 | 1.10 | 3119 |
| 11/19/2014 | RAD | 0.16 | 0.43 | 0.15 | 0.40 | 5212 |
| 11/19/2014 | RSX | 0.13 | 1.17 | 0.10 | 0.70 | 3207 |
| 11/26/2014 | BABA | 0.17 | 1.56 | 0.10 | 1.40 | 2320 |
| 11/26/2014 | CBS | 0.29 | 1.80 | 0.25 | 1.20 | 1301 |
| 11/26/2014 | FEYE | 0.24 | 1.12 | 0.20 | 1.10 | 2484 |
| 11/26/2014 | GPRO | 0.43 | 2.26 | 0.30 | 2.50 | 1281 |
| 11/26/2014 | HYG | 0.29 | 1.76 | 0.30 | 1.50 | 2461 |
| 11/26/2014 | OIH | 0.12 | 1.36 | 0.10 | 1.10 | 2115 |
| 11/26/2014 | RAD | 0.20 | 0.55 | 0.15 | 0.40 | 5462 |
| 11/26/2014 | RSX | 0.13 | 1.56 | 0.10 | 1.10 | 1951 |
| 12/3/2014 | BABA | 0.15 | 1.55 | 0.10 | 1.70 | 2562 |
| 12/3/2014 | CBS | 0.25 | 1.85 | 0.20 | 1.60 | 1525 |

| | | | | | | |
|------------|------|------|------|------|------|------|
| 12/3/2014 | FEYE | 0.19 | 1.51 | 0.15 | 1.20 | 3131 |
| 12/3/2014 | GPRO | 0.40 | 1.89 | 0.30 | 1.90 | 1996 |
| 12/3/2014 | HYG | 0.29 | 2.01 | 0.30 | 1.40 | 3119 |
| 12/3/2014 | OIH | 0.13 | 1.92 | 0.10 | 1.50 | 3492 |
| 12/3/2014 | RAD | 0.14 | 0.72 | 0.10 | 0.60 | 5398 |
| 12/3/2014 | RSX | 0.12 | 1.49 | 0.05 | 0.90 | 3247 |
| 12/10/2014 | BABA | 0.15 | 0.74 | 0.10 | 0.60 | 2362 |
| 12/10/2014 | CBS | 0.32 | 1.75 | 0.30 | 1.30 | 1772 |
| 12/10/2014 | FEYE | 0.25 | 1.12 | 0.20 | 0.80 | 2632 |
| 12/10/2014 | GPRO | 0.44 | 2.08 | 0.40 | 2.20 | 1758 |
| 12/10/2014 | HYG | 0.00 | 0.00 | 0.00 | 0.00 | 0 |
| 12/10/2014 | OIH | 0.12 | 2.19 | 0.10 | 1.60 | 2313 |
| 12/10/2014 | RAD | 0.00 | 0.00 | 0.00 | 0.00 | 0 |
| 12/10/2014 | RSX | 0.12 | 1.96 | 0.05 | 1.80 | 2837 |
| 12/17/2014 | BABA | 0.17 | 0.81 | 0.15 | 0.60 | 2198 |
| 12/17/2014 | CBS | 0.34 | 1.69 | 0.25 | 1.50 | 1669 |
| 12/17/2014 | FEYE | 0.24 | 0.98 | 0.20 | 0.70 | 2255 |
| 12/17/2014 | GPRO | 0.46 | 2.18 | 0.45 | 2.20 | 1822 |
| 12/17/2014 | HYG | 0.30 | 1.70 | 0.25 | 1.10 | 2157 |
| 12/17/2014 | OIH | 0.17 | 2.39 | 0.15 | 2.60 | 2886 |
| 12/17/2014 | RAD | 0.13 | 0.45 | 0.10 | 0.30 | 5761 |
| 12/17/2014 | RSX | 0.20 | 2.01 | 0.15 | 1.80 | 2026 |
| 12/24/2014 | BABA | 0.19 | 1.16 | 0.10 | 0.80 | 2087 |
| 12/24/2014 | CBS | 0.30 | 1.36 | 0.25 | 1.00 | 1898 |
| 12/24/2014 | FEYE | 0.27 | 1.62 | 0.20 | 1.20 | 1894 |
| 12/24/2014 | GPRO | 0.37 | 1.84 | 0.20 | 1.90 | 1692 |
| 12/24/2014 | HYG | 0.31 | 1.79 | 0.30 | 1.20 | 2894 |
| 12/24/2014 | OIH | 0.20 | 1.95 | 0.15 | 1.60 | 2714 |
| 12/24/2014 | RAD | 0.20 | 0.75 | 0.15 | 0.60 | 5108 |
| 12/24/2014 | RSX | 0.21 | 1.32 | 0.20 | 0.90 | 2816 |
| 12/31/2014 | BABA | 0.22 | 1.63 | 0.15 | 1.60 | 2261 |
| 12/31/2014 | CBS | 0.21 | 1.09 | 0.20 | 0.80 | 1131 |
| 12/31/2014 | FEYE | 0.23 | 1.38 | 0.15 | 1.00 | 2594 |
| 12/31/2014 | GPRO | 0.36 | 1.78 | 0.25 | 1.70 | 1770 |
| 12/31/2014 | HYG | 0.29 | 1.72 | 0.25 | 1.20 | 3374 |
| 12/31/2014 | OIH | 0.18 | 1.82 | 0.15 | 1.50 | 2526 |
| 12/31/2014 | RAD | 0.15 | 0.62 | 0.15 | 0.40 | 4285 |
| 12/31/2014 | RSX | 0.20 | 1.26 | 0.20 | 1.00 | 2440 |

Table 5. Summary Quote Data for Pilot period (i.e., Third and Fourth Quarter 2015)

| quote date | underlying symbol | spread avg: ask <= 3.00 | spread avg: ask > 3.00 | appx median spread: ask <= 3.00 | appx median spread: ask > 3.00 | avg ask size |
|------------|-------------------|-------------------------|------------------------|---------------------------------|--------------------------------|--------------|
| 7/1/2015 | BABA | 0.05 | 0.33 | 0.04 | 0.35 | 1358 |
| 7/1/2015 | CBS | 0.23 | 1.29 | 0.20 | 0.85 | 2000 |
| 7/1/2015 | FEYE | 0.24 | 1.11 | 0.20 | 0.90 | 2180 |
| 7/1/2015 | GPRO | 0.27 | 1.64 | 0.20 | 1.40 | 2164 |
| 7/1/2015 | HYG | 0.17 | 1.63 | 0.10 | 1.30 | 2789 |
| 7/1/2015 | OIH | 0.12 | 1.56 | 0.05 | 1.30 | 3174 |
| 7/1/2015 | RAD | 0.11 | 0.45 | 0.05 | 0.40 | 3252 |
| 7/1/2015 | RSX | 0.13 | 0.94 | 0.05 | 0.50 | 1986 |
| 7/8/2015 | BABA | 0.09 | 0.60 | 0.08 | 0.55 | 1273 |
| 7/8/2015 | CBS | 0.24 | 1.44 | 0.21 | 1.15 | 1795 |
| 7/8/2015 | FEYE | 0.29 | 1.38 | 0.27 | 1.20 | 2244 |
| 7/8/2015 | GPRO | 0.26 | 1.27 | 0.19 | 1.00 | 2102 |
| 7/8/2015 | HYG | 0.14 | 1.49 | 0.10 | 1.25 | 1997 |
| 7/8/2015 | OIH | 0.09 | 1.54 | 0.04 | 1.10 | 1811 |
| 7/8/2015 | RAD | 0.09 | 0.37 | 0.05 | 0.35 | 3283 |
| 7/8/2015 | RSX | 0.00 | 0.00 | 0.00 | 0.00 | 0 |
| 7/15/2015 | BABA | 0.05 | 0.31 | 0.04 | 0.30 | 1546 |
| 7/15/2015 | CBS | 0.28 | 0.80 | 0.29 | 0.75 | 1765 |
| 7/15/2015 | FEYE | 0.17 | 0.88 | 0.14 | 0.65 | 1883 |
| 7/15/2015 | GPRO | 0.22 | 1.22 | 0.14 | 0.95 | 1914 |
| 7/15/2015 | HYG | 0.13 | 1.25 | 0.09 | 0.70 | 2535 |
| 7/15/2015 | OIH | 0.11 | 1.15 | 0.07 | 0.95 | 1980 |
| 7/15/2015 | RAD | 0.07 | 0.23 | 0.04 | 0.20 | 2839 |
| 7/15/2015 | RSX | 0.14 | 0.81 | 0.13 | 0.60 | 2637 |
| 7/22/2015 | BABA | 0.05 | 0.32 | 0.04 | 0.30 | 1840 |
| 7/22/2015 | CBS | 0.22 | 0.76 | 0.19 | 0.65 | 1870 |
| 7/22/2015 | FEYE | 0.20 | 0.97 | 0.17 | 0.65 | 2680 |
| 7/22/2015 | GPRO | 0.22 | 1.56 | 0.11 | 1.50 | 1615 |
| 7/22/2015 | HYG | 0.16 | 1.72 | 0.10 | 1.15 | 2165 |
| 7/22/2015 | OIH | 0.13 | 1.65 | 0.12 | 1.30 | 3805 |
| 7/22/2015 | RAD | 0.10 | 0.31 | 0.08 | 0.30 | 3866 |
| 7/22/2015 | RSX | 0.20 | 0.46 | 0.17 | 0.40 | 2302 |
| 7/29/2015 | BABA | 0.06 | 0.31 | 0.05 | 0.25 | 1395 |
| 7/29/2015 | CBS | 0.20 | 0.97 | 0.17 | 0.75 | 1780 |
| 7/29/2015 | FEYE | 0.28 | 0.98 | 0.21 | 0.60 | 1912 |
| 7/29/2015 | GPRO | 0.24 | 1.33 | 0.21 | 1.25 | 2692 |
| 7/29/2015 | HYG | 0.18 | 1.60 | 0.12 | 1.15 | 2245 |

| | | | | | | |
|-----------|------|------|------|------|------|------|
| 7/29/2015 | OIH | 0.10 | 1.38 | 0.06 | 1.15 | 3903 |
| 7/29/2015 | RAD | 0.10 | 0.64 | 0.05 | 0.60 | 3883 |
| 7/29/2015 | RSX | 0.16 | 0.83 | 0.12 | 0.70 | 2483 |
| 8/5/2015 | BABA | 0.05 | 0.35 | 0.04 | 0.30 | 1102 |
| 8/5/2015 | CBS | 0.29 | 0.97 | 0.22 | 0.80 | 1881 |
| 8/5/2015 | FEYE | 0.24 | 1.50 | 0.21 | 1.47 | 1362 |
| 8/5/2015 | GPRO | 0.18 | 1.24 | 0.16 | 1.20 | 1859 |
| 8/5/2015 | HYG | 0.15 | 1.44 | 0.11 | 1.10 | 2338 |
| 8/5/2015 | OIH | 0.08 | 1.00 | 0.05 | 0.75 | 2818 |
| 8/5/2015 | RAD | 0.09 | 0.32 | 0.07 | 0.30 | 1658 |
| 8/5/2015 | RSX | 0.14 | 0.63 | 0.10 | 0.55 | 2495 |
| 8/12/2015 | BABA | 0.08 | 0.79 | 0.06 | 0.70 | 1456 |
| 8/12/2015 | CBS | 0.22 | 0.72 | 0.19 | 0.60 | 2031 |
| 8/12/2015 | FEYE | 0.21 | 0.96 | 0.18 | 0.80 | 2505 |
| 8/12/2015 | GPRO | 0.26 | 1.43 | 0.16 | 1.30 | 1643 |
| 8/12/2015 | HYG | 0.13 | 1.28 | 0.10 | 1.00 | 2494 |
| 8/12/2015 | OIH | 0.10 | 0.99 | 0.07 | 0.90 | 2903 |
| 8/12/2015 | RAD | 0.08 | 0.24 | 0.05 | 0.20 | 2066 |
| 8/12/2015 | RSX | 0.13 | 0.52 | 0.09 | 0.35 | 2073 |
| 8/19/2015 | BABA | 0.05 | 0.47 | 0.05 | 0.50 | 2267 |
| 8/19/2015 | CBS | 0.25 | 0.84 | 0.25 | 0.70 | 1880 |
| 8/19/2015 | FEYE | 0.17 | 0.93 | 0.15 | 0.80 | 2167 |
| 8/19/2015 | GPRO | 0.19 | 1.30 | 0.15 | 1.25 | 2705 |
| 8/19/2015 | HYG | 0.13 | 2.14 | 0.09 | 1.40 | 1807 |
| 8/19/2015 | OIH | 0.09 | 1.18 | 0.05 | 1.00 | 2485 |
| 8/19/2015 | RAD | 0.08 | 0.25 | 0.04 | 0.25 | 2747 |
| 8/19/2015 | RSX | 0.11 | 0.89 | 0.05 | 0.75 | 2205 |
| 8/26/2015 | BABA | 0.16 | 1.23 | 0.14 | 1.00 | 1757 |
| 8/26/2015 | CBS | 0.30 | 1.01 | 0.31 | 0.90 | 1675 |
| 8/26/2015 | FEYE | 0.27 | 1.29 | 0.25 | 1.15 | 1751 |
| 8/26/2015 | GPRO | 0.28 | 1.54 | 0.20 | 1.50 | 2395 |
| 8/26/2015 | HYG | 0.30 | 1.57 | 0.28 | 1.15 | 1577 |
| 8/26/2015 | OIH | 0.18 | 0.91 | 0.16 | 0.70 | 2142 |
| 8/26/2015 | RAD | 0.12 | 0.30 | 0.13 | 0.30 | 1743 |
| 8/26/2015 | RSX | 0.21 | 0.84 | 0.18 | 0.50 | 1558 |
| 9/2/2015 | BABA | 0.12 | 1.01 | 0.13 | 0.80 | 2357 |
| 9/2/2015 | CBS | 0.23 | 1.29 | 0.16 | 1.05 | 1693 |
| 9/2/2015 | FEYE | 0.24 | 1.33 | 0.24 | 1.20 | 2281 |
| 9/2/2015 | GPRO | 0.22 | 1.62 | 0.15 | 1.70 | 1852 |
| 9/2/2015 | HYG | 0.28 | 1.56 | 0.29 | 1.10 | 2242 |
| 9/2/2015 | RAD | 0.11 | 0.26 | 0.12 | 0.25 | 3314 |
| 9/2/2015 | RSX | 0.22 | 1.19 | 0.17 | 0.95 | 2573 |
| 9/9/2015 | BABA | 0.16 | 1.03 | 0.17 | 0.85 | 2237 |

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|------------|------|------|------|------|------|------|
| 9/9/2015 | CBS | 0.26 | 0.82 | 0.25 | 0.70 | 1897 |
| 9/9/2015 | FEYE | 0.20 | 0.98 | 0.19 | 0.90 | 2109 |
| 9/9/2015 | GPRO | 0.18 | 1.27 | 0.18 | 1.15 | 2249 |
| 9/9/2015 | HYG | 0.27 | 1.28 | 0.26 | 1.05 | 1676 |
| 9/9/2015 | RAD | 0.10 | 0.29 | 0.12 | 0.30 | 3610 |
| 9/9/2015 | RSX | 0.17 | 0.54 | 0.11 | 0.50 | 2838 |
| 9/16/2015 | BABA | 0.10 | 1.01 | 0.09 | 0.90 | 1686 |
| 9/16/2015 | CBS | 0.16 | 0.92 | 0.12 | 0.75 | 1679 |
| 9/16/2015 | FEYE | 0.19 | 0.82 | 0.16 | 0.60 | 1998 |
| 9/16/2015 | GPRO | 0.19 | 1.34 | 0.17 | 1.35 | 1932 |
| 9/16/2015 | HYG | 0.21 | 1.80 | 0.17 | 1.30 | 2610 |
| 9/16/2015 | RAD | 0.10 | 0.29 | 0.08 | 0.25 | 3333 |
| 9/16/2015 | RSX | 0.13 | 0.59 | 0.07 | 0.55 | 2245 |
| 9/23/2015 | BABA | 0.08 | 0.67 | 0.06 | 0.60 | 1937 |
| 9/23/2015 | CBS | 0.19 | 0.83 | 0.16 | 0.70 | 1590 |
| 9/23/2015 | FEYE | 0.15 | 0.89 | 0.13 | 0.80 | 2004 |
| 9/23/2015 | GPRO | 0.22 | 1.27 | 0.19 | 1.30 | 2352 |
| 9/23/2015 | HYG | 0.19 | 1.27 | 0.13 | 1.00 | 2401 |
| 9/23/2015 | OIH | 0.11 | 0.77 | 0.07 | 0.68 | 3167 |
| 9/23/2015 | RAD | 0.10 | 0.31 | 0.12 | 0.30 | 3277 |
| 9/23/2015 | RSX | 0.12 | 0.45 | 0.07 | 0.40 | 2450 |
| 9/30/2015 | BABA | 0.10 | 0.92 | 0.09 | 0.85 | 1560 |
| 9/30/2015 | CBS | 0.18 | 0.77 | 0.16 | 0.65 | 1697 |
| 9/30/2015 | FEYE | 0.20 | 0.96 | 0.19 | 0.95 | 1693 |
| 9/30/2015 | GPRO | 0.24 | 1.50 | 0.21 | 1.50 | 2074 |
| 9/30/2015 | HYG | 0.25 | 2.23 | 0.23 | 1.65 | 1560 |
| 9/30/2015 | OIH | 0.10 | 0.70 | 0.05 | 0.60 | 1489 |
| 9/30/2015 | RAD | 0.09 | 0.22 | 0.06 | 0.20 | 1953 |
| 9/30/2015 | RSX | 0.13 | 0.41 | 0.09 | 0.35 | 1770 |
| 10/7/2015 | BABA | 0.10 | 0.50 | 0.06 | 0.40 | 1069 |
| 10/7/2015 | CBS | 0.18 | 0.80 | 0.17 | 0.80 | 1555 |
| 10/7/2015 | FEYE | 0.22 | 1.05 | 0.22 | 1.05 | 1997 |
| 10/7/2015 | GPRO | 0.17 | 1.38 | 0.13 | 1.35 | 2167 |
| 10/7/2015 | HYG | 0.22 | 2.21 | 0.18 | 2.00 | 1855 |
| 10/7/2015 | OIH | 0.12 | 1.24 | 0.06 | 1.05 | 2360 |
| 10/7/2015 | RAD | 0.12 | 0.37 | 0.11 | 0.30 | 4144 |
| 10/7/2015 | RSX | 0.14 | 0.51 | 0.08 | 0.50 | 2917 |
| 10/14/2015 | BABA | 0.08 | 0.55 | 0.06 | 0.40 | 1191 |
| 10/14/2015 | CBS | 0.16 | 0.85 | 0.14 | 0.75 | 1588 |
| 10/14/2015 | FEYE | 0.18 | 1.24 | 0.17 | 0.95 | 1792 |
| 10/14/2015 | GPRO | 0.15 | 1.08 | 0.12 | 1.00 | 2034 |
| 10/14/2015 | HYG | 0.19 | 2.15 | 0.15 | 1.85 | 1963 |
| 10/14/2015 | OIH | 0.10 | 1.02 | 0.06 | 0.80 | 2157 |

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|------------|------|------|------|------|------|------|
| 10/14/2015 | RAD | 0.12 | 0.41 | 0.10 | 0.30 | 3669 |
| 10/14/2015 | RSX | 0.14 | 0.61 | 0.08 | 0.50 | 2486 |
| 10/21/2015 | BABA | 0.07 | 0.46 | 0.05 | 0.35 | 1020 |
| 10/21/2015 | CBS | 0.19 | 0.80 | 0.16 | 0.80 | 1215 |
| 10/21/2015 | FEYE | 0.17 | 1.05 | 0.16 | 0.85 | 1982 |
| 10/21/2015 | GPRO | 0.16 | 1.23 | 0.13 | 1.10 | 1636 |
| 10/21/2015 | HYG | 0.18 | 1.49 | 0.12 | 0.80 | 1748 |
| 10/21/2015 | OIH | 0.09 | 0.86 | 0.06 | 0.75 | 2753 |
| 10/21/2015 | RAD | 0.13 | 0.31 | 0.11 | 0.30 | 4003 |
| 10/21/2015 | RSX | 0.12 | 0.53 | 0.08 | 0.45 | 2522 |
| 10/28/2015 | BABA | 0.08 | 0.66 | 0.05 | 0.45 | 987 |
| 10/28/2015 | CBS | 0.20 | 0.99 | 0.18 | 0.70 | 1044 |
| 10/28/2015 | FEYE | 0.18 | 0.84 | 0.16 | 0.65 | 1479 |
| 10/28/2015 | GPRO | 0.15 | 0.97 | 0.09 | 0.80 | 1574 |
| 10/28/2015 | HYG | 0.17 | 2.47 | 0.10 | 2.70 | 1665 |
| 10/28/2015 | OIH | 0.13 | 1.30 | 0.08 | 1.10 | 3245 |
| 10/28/2015 | RAD | 0.18 | 3.56 | 0.04 | 4.33 | 1411 |
| 10/28/2015 | RSX | 0.17 | 0.72 | 0.12 | 0.70 | 2396 |
| 11/4/2015 | BABA | 0.06 | 0.50 | 0.04 | 0.35 | 784 |
| 11/4/2015 | CBS | 0.30 | 1.89 | 0.24 | 1.80 | 1260 |
| 11/4/2015 | FEYE | 0.17 | 0.89 | 0.16 | 0.65 | 2112 |
| 11/4/2015 | GPRO | 0.15 | 0.93 | 0.12 | 0.80 | 1899 |
| 11/4/2015 | HYG | 0.16 | 2.49 | 0.09 | 2.60 | 1485 |
| 11/4/2015 | OIH | 0.13 | 0.99 | 0.08 | 0.85 | 2960 |
| 11/4/2015 | RAD | 0.33 | 1.27 | 0.25 | 0.55 | 1996 |
| 11/4/2015 | RSX | 0.16 | 0.86 | 0.10 | 0.75 | 2401 |
| 11/11/2015 | BABA | 0.07 | 0.56 | 0.05 | 0.35 | 304 |
| 11/11/2015 | CBS | 0.20 | 1.27 | 0.16 | 0.95 | 1264 |
| 11/11/2015 | FEYE | 0.17 | 1.19 | 0.14 | 0.95 | 1705 |
| 11/11/2015 | GPRO | 0.15 | 0.87 | 0.13 | 0.75 | 1264 |
| 11/11/2015 | HYG | 0.18 | 2.13 | 0.08 | 1.60 | 1308 |
| 11/11/2015 | OIH | 0.12 | 1.04 | 0.08 | 0.90 | 2824 |
| 11/11/2015 | RAD | 0.47 | 2.88 | 0.16 | 3.35 | 1837 |
| 11/11/2015 | RSX | 0.14 | 0.60 | 0.09 | 0.55 | 1897 |
| 11/18/2015 | BABA | 0.05 | 0.44 | 0.03 | 0.30 | 861 |
| 11/18/2015 | CBS | 0.22 | 1.33 | 0.17 | 1.05 | 1467 |
| 11/18/2015 | FEYE | 0.18 | 0.99 | 0.16 | 0.95 | 2330 |
| 11/18/2015 | GPRO | 0.19 | 1.47 | 0.12 | 1.40 | 1893 |
| 11/18/2015 | HYG | 0.19 | 2.49 | 0.10 | 2.65 | 2772 |
| 11/18/2015 | OIH | 0.12 | 1.10 | 0.07 | 0.95 | 2420 |
| 11/18/2015 | RAD | 0.45 | 3.24 | 0.14 | 4.50 | 1960 |
| 11/18/2015 | RSX | 0.15 | 0.58 | 0.11 | 0.50 | 1631 |
| 11/25/2015 | BABA | 0.05 | 0.39 | 0.04 | 0.30 | 859 |

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|------------|------|------|------|------|------|------|
| 11/25/2015 | CBS | 0.25 | 1.39 | 0.22 | 0.90 | 1064 |
| 11/25/2015 | FEYE | 0.18 | 1.02 | 0.15 | 0.80 | 1691 |
| 11/25/2015 | GPRO | 0.20 | 1.08 | 0.14 | 0.95 | 1769 |
| 11/25/2015 | HYG | 0.21 | 2.71 | 0.13 | 2.70 | 1291 |
| 11/25/2015 | OIH | 0.09 | 1.15 | 0.06 | 1.00 | 1572 |
| 11/25/2015 | RAD | 0.34 | 3.27 | 0.16 | 4.45 | 1320 |
| 11/25/2015 | RSX | 0.13 | 0.72 | 0.08 | 0.55 | 1667 |
| 12/2/2015 | BABA | 0.06 | 0.51 | 0.04 | 0.30 | 567 |
| 12/2/2015 | CBS | 0.22 | 1.47 | 0.16 | 1.15 | 1201 |
| 12/2/2015 | FEYE | 0.12 | 1.01 | 0.08 | 0.70 | 1754 |
| 12/2/2015 | GPRO | 0.16 | 0.81 | 0.11 | 0.65 | 1298 |
| 12/2/2015 | HYG | 0.19 | 1.79 | 0.11 | 1.25 | 1484 |
| 12/2/2015 | OIH | 0.09 | 1.17 | 0.05 | 1.05 | 1497 |
| 12/2/2015 | RAD | 0.51 | 3.03 | 0.15 | 3.25 | 1293 |
| 12/2/2015 | RSX | 0.13 | 0.62 | 0.08 | 0.50 | 1940 |
| 12/9/2015 | BABA | 0.06 | 0.48 | 0.04 | 0.35 | 503 |
| 12/9/2015 | CBS | 0.23 | 1.25 | 0.19 | 1.10 | 973 |
| 12/9/2015 | FEYE | 0.12 | 1.02 | 0.06 | 0.90 | 1013 |
| 12/9/2015 | GPRO | 0.09 | 1.03 | 0.05 | 0.90 | 693 |
| 12/9/2015 | HYG | 0.17 | 2.18 | 0.10 | 1.70 | 989 |
| 12/9/2015 | OIH | 0.10 | 1.46 | 0.05 | 1.35 | 2167 |
| 12/9/2015 | RAD | 0.31 | 3.75 | 0.14 | 4.55 | 853 |
| 12/9/2015 | RSX | 0.14 | 0.80 | 0.09 | 0.60 | 1853 |
| 12/16/2015 | BABA | 0.12 | 0.77 | 0.06 | 0.50 | 705 |
| 12/16/2015 | CBS | 0.30 | 1.79 | 0.28 | 1.50 | 1250 |
| 12/16/2015 | FEYE | 0.21 | 1.24 | 0.15 | 0.90 | 1731 |
| 12/16/2015 | GPRO | 0.18 | 1.16 | 0.11 | 1.00 | 947 |
| 12/16/2015 | HYG | 0.22 | 2.68 | 0.19 | 3.15 | 1539 |
| 12/16/2015 | OIH | 0.15 | 1.64 | 0.07 | 1.20 | 2458 |
| 12/16/2015 | RAD | 0.43 | 4.41 | 0.18 | 4.65 | 974 |
| 12/16/2015 | RSX | 0.20 | 1.87 | 0.10 | 1.00 | 2407 |
| 12/23/2015 | BABA | 0.11 | 0.66 | 0.05 | 0.45 | 663 |
| 12/23/2015 | CBS | 0.28 | 1.71 | 0.24 | 1.15 | 568 |
| 12/23/2015 | FEYE | 0.20 | 1.30 | 0.17 | 1.15 | 949 |
| 12/23/2015 | GPRO | 0.22 | 0.97 | 0.13 | 0.80 | 1306 |
| 12/23/2015 | HYG | 0.21 | 3.14 | 0.16 | 3.70 | 2071 |
| 12/23/2015 | OIH | 0.11 | 1.30 | 0.05 | 0.90 | 3149 |
| 12/23/2015 | RAD | 0.35 | 4.08 | 0.17 | 4.50 | 1271 |
| 12/23/2015 | RSX | 0.16 | 1.24 | 0.08 | 0.80 | 1892 |
| 12/30/2015 | BABA | 0.16 | 0.62 | 0.06 | 0.45 | 787 |
| 12/30/2015 | CBS | 0.19 | 1.61 | 0.19 | 1.10 | 772 |
| 12/30/2015 | FEYE | 0.21 | 1.08 | 0.19 | 0.85 | 1059 |
| 12/30/2015 | GPRO | 0.22 | 0.98 | 0.16 | 0.80 | 1295 |

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|------------|-----|------|------|------|------|------|
| 12/30/2015 | HYG | 0.20 | 1.86 | 0.13 | 1.35 | 2193 |
| 12/30/2015 | OIH | 0.11 | 1.65 | 0.06 | 1.15 | 3080 |
| 12/30/2015 | RAD | 0.55 | 4.00 | 0.19 | 4.50 | 1132 |
| 12/30/2015 | RSX | 0.15 | 1.85 | 0.10 | 0.90 | 2120 |

Exhibit B to Amendment No. 5

AMENDMENT TO PLAN FOR THE PURPOSE OF DEVELOPING AND IMPLEMENTING PROCEDURES DESIGNED TO FACILITATE THE LISTING AND TRADING OF STANDARDIZED OPTIONS SUBMITTED PURSUANT TO SECTION 11A(a)(3)(B) OF THE SECURITIES EXCHANGE ACT OF 1934.

Underlined language indicates additions. [Bracketed] language indicates deletions.

PLAN FOR THE PURPOSE OF DEVELOPING AND IMPLEMENTING PROCEDURES DESIGNED TO FACILITATE THE LISTING AND TRADING OF STANDARDIZED OPTIONS SUBMITTED PURSUANT TO SECTION 11A(a)(3)(B) OF THE SECURITIES EXCHANGE ACT OF 1934

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3.1 Selecting Option Classes for the Penny Interval Program (“Penny Program”)

The registered options exchanges agree to list option classes for the Penny Program with the following minimum increment quoting requirements (“penny increments”):

(A) one cent (\$0.01) for all series in QQQ (PowerShares QQQ TrustSM, Series 1), SPY (SPDR S&P 500 ETF) and IWM (iShares Russell 2000 Index Fund), regardless of price;

(B) one cent (\$0.01) for all series in such option classes included in the Penny Program with a price of less than \$3.00;

(C) five cents (\$0.05) for all series in such option classes included in the Penny Program with a price of \$3.00 or higher.

(a) Initial Selection. On the first trading day of the third full calendar month after [insert date of approval], the Penny Program will apply only to the 363 most actively traded multiply listed option classes, based on OCC’s National Cleared Volume in the six full calendar months ending in the month of approval, that (i) currently quote in penny increments, or (ii) overlie securities priced below \$200, or any index at an index level below \$200. Eligibility for inclusion in the Penny Program will be determined at the close of trading on the monthly Expiration Friday of the second full month following [insert date of approval].

(b) Annual Review. Commencing in December 2020 and each December thereafter, OCC will rank all multiply listed option classes based on National Cleared Volume for the six full calendar months from June 1 through November 30 for determination of the most actively traded option classes.

(1) Addition to the Penny Program. Based on the Annual Review, any option class not in the Penny Program that is among the 300 most actively traded multiply listed option classes overlying securities priced below \$200, or an index at an index level below \$200, will be added to the Penny Program on the first trading day of January.

(2) Removal from the Penny Program. Except as provided in (c), (d), (e) and (f) below, based on the Annual Review, any option class in the Penny Program that falls outside the 425 most actively traded multiply listed option classes will be removed from the Penny Program on the first trading day of April.

(c) Newly Listed Option Classes. A registered options exchange may add a newly listed option class to the Penny Program, provided that (i) it is among the 300 most actively traded multiply listed option classes, as ranked by National Cleared Volume at OCC, in its first full calendar month of trading and (ii) the underlying security is priced below \$200 or the underlying index is at an index level below \$200. Any option class added under this provision will be added on the first trading day of the month after it qualifies and will remain in the Penny Program for one full calendar year, after which it will be subject to the Annual Review stated in section (b) above.

(d) Classes with Significant Growth in Activity. A registered options exchange may add any option class to the Penny Program, provided that (i) it is among the 75 most actively traded multiply listed option classes, as ranked by National Cleared Volume at OCC, in the past six full calendar months of trading and (ii) the underlying security is priced below \$200 or the underlying index is at an index level below \$200. Any option class added under this provision will be added on the first trading day of the second full month after it qualifies and will remain in the Penny Program for the rest of the calendar year, after which it will be subject to the Annual Review stated in section (b) above.

(e) Corporate Actions. If a corporate action involves one or more option classes in the Penny Program, all adjusted and unadjusted series of the option class will be included in the Penny Program. Any new option class added to the Penny Program under this provision will remain in the Penny Program for one full calendar year; after which it will be subject to the Annual Review stated in section (b) above.

(f) Delisted or Ineligible Option Classes. Any series in an option class participating in the Penny Program in which the underlying security has been delisted, or are identified by OCC as ineligible for opening customer transactions, will continue to quote pursuant to the terms of the Penny Program until all such options have expired.

(g) The registered options exchanges agree that references to multiply listed option classes in this section of the Plan only applies to option classes in the Penny Program, and to no other sections of the Plan.

(h) Not sooner than 60 months after approval of the Penny Program, a super-majority (2/3) of the Plan Sponsors may vote to make changes to the Penny Program. At any time before 60 months have passed since the adoption of the Penny Program, any changes must be unanimously approved by the Plan Sponsors. Any changes to the Penny Program are subject to SEC review pursuant to Section 11A(a)(3) of the Securities Exchange Act of 1934 and Rule 608 thereunder.

4. Adjustments Pursuant to OCC By-Laws — Article VI, Section 11 of the OCC By-Laws, as approved by the SEC, provides that [an adjustment panel of the Securities Committee, comprised of representatives from each registered options exchange trading options on the affected underlying security,]OCC shall determine whether to make adjustments to reflect particular events in respect of such underlying security, and the nature and extent of any such adjustment. In connection with such determinations, the options exchanges trading such options class are authorized to determine operational issues attendant to the adjustment made by [the adjustment panel]OCC.

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9. **List of Plan Sponsors** — The Sponsors of the Options Listing Procedures Plan are as follows:

- [American Stock Exchange LLC (“AMEX”)]NYSE American, LLC, registered as a national securities exchange under the Exchange Act and having its principal place of business at [86 Trinity Place, New York, New York 10006]11 Wall Street, New York, NY 10005.
- [BATS Exchange, Inc. (“BATS”)]Cboe BZX Exchange, Inc., registered as a national securities exchange under the Exchange Act and having its principal place of business at [8050 Marshall Dr., Suite 120, Lenexa, Kansas 66214]400 South LaSalle Street, Chicago, Illinois 60605.
- BOX [Options] Exchange LLC (“BOX”), registered as a national securities exchange under the Exchange Act and having its principal place of business at 101 Arch Street, St. 610, Boston, Massachusetts 02110.
- [Chicago Board Options Exchange, Incorporated. (“CBOE”)]Cboe Exchange, Inc., registered as a national securities exchange under the Exchange Act and having its principal place of business at 400 South LaSalle Street, Chicago, Illinois 60605.
- [C2 Options Exchange, Incorporated (“C2”)]Cboe C2 Exchange, Inc., registered as a national securities exchange under the Exchange Act and having its principal place of business at 400 South LaSalle Street, Chicago, Illinois 60605.
- [EDGX Exchange, Inc. (“EDGX”)]Cboe EDGX Exchange, Inc., registered as a national securities exchange under the Exchange Act and having its principal place of business at [8050 Marshall Dr., Suite 120, Lenexa, Kansas 66214]400 South LaSalle Street, Chicago, Illinois 60605.
- [International Securities Exchange LLC (“ISE”)]Nasdaq ISE, LLC, registered as a national securities exchange under the Exchange Act and having its principal place of business at [60 Broad Street, New York, New York 10004]One Liberty Plaza, 50th Floor, New York, New York 10006.
- [ISE Mercury, LLC (“ISE Mercury”)]Nasdaq MRX, LLC, registered as a national securities exchange under the Exchange Act and having its principal place of business at [60 Broad Street, New York, New York 10004]One Liberty Plaza, 50th Floor, New York, New York 10006.
- Miami International Securities Exchange, LLC (“MIAX”), registered as a national securities exchange under the Exchange Act and having its principal place of business at 7 Roszel Road, Fifth Floor, Princeton, New Jersey 08540.
- MIAX Emerald, LLC (“MIAX Emerald”), registered as a national securities exchange under the Exchange Act and having its principal place of business at 7 Roszel Road, Fifth Floor, Princeton, New Jersey 08540.

- MIAX PEARL, LLC ("MIAX PEARL"), registered as a national securities exchange under the Exchange Act and having its principal place of business at 7 Roszel Road, Fifth Floor, Princeton, New Jersey 08540.
- The [NASDAQ]Nasdaq Stock Market LLC, registered as a national securities exchange under the Exchange Act and having its principal place of business at One Liberty Plaza, 50th Floor, New York, New York 10006.
- [NASDAQ OMX BX, Inc., ("BX")]Nasdaq BX, Inc., registered as a national securities exchange under the Exchange Act and having its principal place of business at One Liberty Plaza, 50th Floor, New York, New York 10006.
- The Options Clearing Corporation ("OCC"), registered as a clearing agency under the Exchange Act and having its principal place of business at [440 South LaSalle Street, Chicago, Illinois 60605]125 South Franklin Street, Suite 1200, Chicago, Illinois 60606.
- [Pacific Exchange, Inc. ("PCX")]NYSE Arca, Inc., registered as a national securities exchange under the Exchange Act and having its principal place of business at [301 Pine Street, San Francisco, California 94104]11 Wall Street, New York, NY 10005.
- [Philadelphia Stock Exchange, Inc. ("PHLX")]Nasdaq PHLX LLC, registered as a national securities exchange under the Exchange Act and having its principal place of business at [1900 Market Street, Philadelphia, Pennsylvania 19103]FMC Tower, Level 8, 2929 Walnut Street, Philadelphia, Pennsylvania 19104.
- [Topaz Exchange, LLC ("Topaz")]Nasdaq GEMX, LLC, registered as a national securities exchange under the Exchange Act and having its principal place of business at [60 Broad Street, New York, New York 10004]One Liberty Plaza, 50th Floor, New York, New York 10006.

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