

Required fields are shown with yellow backgrounds and asterisks.

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SECURITIES AND EXCHANGE COMMISSION  
WASHINGTON, D.C. 20549  
Form 19b-4

File No. \* SR 2023 - \* 018

Amendment No. (req. for Amendments \*)

Filing by Cboe Exchange, Inc.

Pursuant to Rule 19b-4 under the Securities Exchange Act of 1934

<b>Initial *</b> <input checked="" type="checkbox"/>	<b>Amendment *</b> <input type="checkbox"/>	<b>Withdrawal</b> <input type="checkbox"/>	<b>Section 19(b)(2) *</b> <input checked="" type="checkbox"/>	<b>Section 19(b)(3)(A) *</b> <input type="checkbox"/>	<b>Section 19(b)(3)(B) *</b> <input type="checkbox"/>
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<b>Pilot</b> <input type="checkbox"/>	<b>Extension of Time Period for Commission Action *</b> <input type="checkbox"/>	<b>Date Expires *</b> <input type="text"/>
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Rule

<input type="checkbox"/> 19b-4(f)(1)	<input type="checkbox"/> 19b-4(f)(4)
<input type="checkbox"/> 19b-4(f)(2)	<input type="checkbox"/> 19b-4(f)(5)
<input type="checkbox"/> 19b-4(f)(3)	<input type="checkbox"/> 19b-4(f)(6)

**Notice of proposed change pursuant to the Payment, Clearing, and Settlement Act of 2010**

**Section 806(e)(1) \***

**Section 806(e)(2) \***

**Security-Based Swap Submission pursuant to the Securities Exchange Act of 1934**

**Section 3C(b)(2) \***

**Exhibit 2 Sent As Paper Document**

**Exhibit 3 Sent As Paper Document**

**Description**

Provide a brief description of the action (limit 250 characters, required when Initial is checked \*).

The Exchange proposes to make the FLEX P.M.-settled index options pilot permanent.

**Contact Information**

Provide the name, telephone number, and e-mail address of the person on the staff of the self-regulatory organization prepared to respond to questions and comments on the action.

**First Name \*** Laura **Last Name \*** Dickman

**Title \*** VP, Associate General Counsel

**E-mail \*** ldickman@cboe.com

**Telephone \*** (312) 786-7572 **Fax**

**Signature**

Pursuant to the requirements of the Securities Exchange of 1934, Cboe Exchange, Inc. has duty caused this filing to be signed on its behalf by the undersigned thereunto duty authorized.

**Date** 04/10/2023 **(Title \*)**

**By** Laura G. Dickman **VP, Associate General Counsel**  
(Name \*)

NOTE: Clicking the signature block at right will initiate digitally signing the form. A digital signature is as legally binding as a physical signature, and once signed, this form cannot be changed.

*Laura Dickman* Date: 2023.04.10 15:01:30 -05'00'

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SECURITIES AND EXCHANGE COMMISSION  
WASHINGTON, D.C. 20549

For complete Form 19b-4 instructions please refer to the EDFS website.

**Form 19b-4 Information \***

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23-018 19b-4 (Permanent FLEX PM F

The self-regulatory organization must provide all required information, presented in a clear and comprehensible manner, to enable the public to provide meaningful comment on the proposal and for the Commission to determine whether the proposal is consistent with the Act and applicable rules and regulations under the Act.

**Exhibit 1 - Notice of Proposed Rule Change \***

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23-018 Exhibit 1 (Permanent FLEX PI

The Notice section of this Form 19b-4 must comply with the guidelines for publication in the Federal Register as well as any requirements for electronic filing as published by the Commission (if applicable). The Office of the Federal Register (OFR) offers guidance on Federal Register publication requirements in the Federal Register Document Drafting Handbook, October 1998 Revision. For example, all references to the federal securities laws must include the corresponding cite to the United States Code in a footnote. All references to SEC rules must include the corresponding cite to the Code of Federal Regulations in a footnote. All references to Securities Exchange Act Releases must include the release number, release date, Federal Register cite, Federal Register date, and corresponding file number (e.g., SR-[SRO]-xx-xx). A material failure to comply with these guidelines will result in the proposed rule change being deemed not properly filed. See also Rule 0-3 under the Act (17 CFR 240.0-3)

**Exhibit 1A - Notice of Proposed Rule Change, Security-Based Swap Submission, or Advanced Notice by Clearing Agencies \***

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The Notice section of this Form 19b-4 must comply with the guidelines for publication in the Federal Register as well as any requirements for electronic filing as published by the Commission (if applicable). The Office of the Federal Register (OFR) offers guidance on Federal Register publication requirements in the Federal Register Document Drafting Handbook, October 1998 Revision. For example, all references to the federal securities laws must include the corresponding cite to the United States Code in a footnote. All references to SEC rules must include the corresponding cite to the Code of Federal Regulations in a footnote. All references to Securities Exchange Act Releases must include the release number, release date, Federal Register cite, Federal Register date, and corresponding file number (e.g., SR-[SRO]-xx-xx). A material failure to comply with these guidelines will result in the proposed rule change being deemed not properly filed. See also Rule 0-3 under the Act (17 CFR 240.0-3)

**Exhibit 2- Notices, Written Comments, Transcripts, Other Communications**

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Copies of notices, written comments, transcripts, other communications. If such documents cannot be filed electronically in accordance with Instruction F, they shall be filed in accordance with Instruction G.

Exhibit Sent As Paper Document

**Exhibit 3 - Form, Report, or Questionnaire**

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23-018 Exhibit 3 (Final).docx

Copies of any form, report, or questionnaire that the self-regulatory organization proposes to use to help implement or operate the proposed rule change, or that is referred to by the proposed rule change.

Exhibit Sent As Paper Document

**Exhibit 4 - Marked Copies**

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The full text shall be marked, in any convenient manner, to indicate additions to and deletions from the immediately preceding filing. The purpose of Exhibit 4 is to permit the staff to identify immediately the changes made from the text of the rule with which it has been working.

**Exhibit 5 - Proposed Rule Text**

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The self-regulatory organization may choose to attach as Exhibit 5 proposed changes to rule text in place of providing it in Item I and which may otherwise be more easily readable if provided separately from Form 19b-4. Exhibit 5 shall be considered part of the proposed rule change

**Partial Amendment**

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If the self-regulatory organization is amending only part of the text of a lengthy proposed rule change, it may, with the Commission's permission, file only those portions of the text of the proposed rule change in which changes are being made if the filing (i.e. partial amendment) is clearly understandable on its face. Such partial amendment shall be clearly identified and marked to show deletions and additions.

**Item 1. Text of the Proposed Rule Change**

(a) Cboe Exchange, Inc. (the “Exchange” or “Cboe Options”) proposes to make permanent the operation of its Flexible Exchange Options (“FLEX Options”) pilot program (“Pilot Program”) regarding permissible exercise settlement values for FLEX Index Options. The text of the proposed rule change is provided below and in Exhibit 1.

\* \* \* \* \*

(additions are underlined; deletions are [bracketed])

\* \* \* \* \*

**Rules of Cboe Exchange, Inc.**

\* \* \* \* \*

**Rule 4.21. Series of FLEX Options**

(a) No change.

(b) *Terms.* When submitting a FLEX Order for a FLEX Option series to the System, the submitting FLEX Trader must include one of each of the following terms in the FLEX Order (all other terms of a FLEX Option series are the same as those that apply to non-FLEX Options), provided that a FLEX Index Option with an index multiplier of one may not be the same type (put or call) and may not have the same exercise style, expiration date, settlement type, and exercise price as a non-FLEX Index Option overlying the same index listed for trading (regardless of the index multiplier of the non-FLEX Index Option), which terms constitute the FLEX Option series:

(1) – (4) No change.

(5) settlement type:

(A) No change.

(B) *FLEX Index Options.* FLEX Index Options are settled in U.S. dollars, and may be:

(i) No change.

(ii) p.m.-settled (with exercise settlement value determined by reference to the reported level of the index derived from the reported closing prices of the component securities)[, except for a FLEX Index Option that expires on any business day that falls on or within two business days of a third Friday-of-the-month expiration day for

a non-FLEX Option (other than a QIX option) may only be a.m.-settled; however, for a pilot period ending the earlier of May 8, 2023 or the date on which the pilot program is approved on a permanent basis, a FLEX Index Option with an expiration date on the third-Friday of the month may be p.m.-settled];

\* \* \* \* \*

(b) Not applicable.

(c) Not applicable.

**Item 2. Procedures of the Self-Regulatory Organization**

(a) The Exchange's President (or designee) pursuant to delegated authority approved the proposed rule change on April 6, 2023.

(b) Please refer questions and comments on the proposed rule change to Patrick Sexton, Executive Vice President, General Counsel, and Corporate Secretary, (312) 786-7467, or Laura G. Dickman, (312) 786-7572, Cboe Exchange, Inc., 433 West Van Buren, Chicago, Illinois 60607.

**Item 3. Self-Regulatory Organization's Statement of the Purpose of, and Statutory Basis for, the Proposed Rule Change**

(a) Purpose

The Exchange proposes to make permanent its Pilot Program that permits the Exchange to list FLEX Options whose exercise settlement value is derived from closing prices on the last trading day prior to expiration that expire on or within two business days of a third Friday-of-the-month expiration day for a non-FLEX Option (other than QIX options) ("FLEX PM Third Friday"). The Securities and Exchange Commission (the "Commission") approved a Cboe Options rule change that, among other things, established a pilot program regarding permissible exercise settlement values for FLEX Index Options

on January 28, 2010.<sup>1</sup> The Exchange has extended the pilot period numerous times, which is currently set to expire on the earlier of May 8, 2023 or the date on which the pilot program is approved on a permanent basis.<sup>2</sup> The Exchange hereby requests that the Commission approve the FLEX PM Third Friday Pilot Program on a permanent basis.

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<sup>1</sup> Securities Exchange Act Release No. 61439 (January 28, 2010), 75 FR 5831 (February 4, 2010) (SR-CBOE-2009-087) (“Approval Order”). The initial pilot period was set to expire on March 28, 2011, which date was added to the rules in 2010. See Securities Exchange Act Release No. 61676 (March 9, 2010), 75 FR 13191 (March 18, 2010) (SR-CBOE-2010-026).

<sup>2</sup> See Securities Exchange Act Release Nos. 64110 (March 23, 2011), 76 FR 17463 (March 29, 2011) (SR-CBOE-2011-024); 66701 (March 30, 2012), 77 FR 20673 (April 5, 2012) (SR-CBOE-2012-027); 68145 (November 2, 2012), 77 FR 67044 (November 8, 2012) (SR-CBOE-2012-102); 70752 (October 24, 2013), 78 FR 65023 (October 30, 2013) (SR-CBOE-2013-099); 73460 (October 29, 2014), 79 FR 65464 (November 4, 2014) (SR-CBOE-2014-080); 77742 (April 29, 2016), 81 FR 26857 (May 4, 2016) (SR-CBOE-2016-032); 80443 (April 12, 2017), 82 FR 18331 (April 18, 2017) (SR-CBOE-2017-032); 83175 (May 4, 2018), 83 FR 21808 (May 10, 2018) (SR-CBOE-2018-037); 84537 (November 5, 2018), 83 FR 56113 (November 9, 2018) (SR-CBOE-2018-071); 85707 (April 23, 2019), 84 FR 18100 (April 29, 2019) (SR-CBOE-2019-021); 87515 (November 13, 2020), 84 FR 63945 (November 19, 2019) (SR-CBOE-2019-108); 88782 (April 30, 2020), 85 FR 27004 (May 6, 2020) (SR-CBOE-2020-039); 90279 (October 28, 2020), 85 FR 69667 (November 3, 2020) (SR-CBOE-2020-103); 91782 (May 5, 2021), 86 FR 25915 (May 11, 2021) (SR-CBOE-2021-031); 93500 (November 1, 2021), 86 FR 61340 (November 5, 2021) (SR-CBOE-2021-064); 94812 (April 28, 2022), 87 FR 26381 (May 4, 2022) (SR-CBOE-2022-020); and 96239 (November 4, 2022), 87 FR 67985 (November 10, 2022) (SR-CBOE-2022-053). At the same time the permissible exercise settlement values pilot was established for FLEX Index Options, the Exchange also established a pilot program eliminating the minimum value size requirements for all FLEX Options. See Approval Order, supra note 1. The pilot program eliminating the minimum value size requirements was extended twice pursuant to the same rule filings that extended the permissible exercise settlement values (for the same extended periods) and was approved on a permanent basis in a separate rule change filing. See id.; and Securities Exchange Act Release No. 67624 (August 8, 2012), 77 FR 48580 (August 14, 2012) (SR-CBOE-2012-040) (Order Granting Approval of Proposed Rule Change Related to Permanent Approval of Its Pilot on FLEX Minimum Value Sizes).

By way of background, when cash-settled<sup>3</sup> index options were first introduced in the 1980s, settlement was based on the closing value of the underlying index on the option's expiration date. The Commission later became concerned about the impact of P.M.-settled, cash-settled index options on the markets for the underlying stocks at the close on expiration Fridays. Specifically, certain episodes of price reversals around the close on quarterly expiration dates attracted the attention of regulators to the possibility that the simultaneous expiration of index futures, futures options, and options might be inducing abnormal volatility in the index value around the close.<sup>4</sup> Academic research at the time provided at least some evidence suggesting that futures and options expirations contributed to excess volatility and reversals around the close on those days.<sup>5</sup> In light of the concerns with P.M.-settlement and to help ameliorate the price effects associated with expirations of P.M.-settled, cash-settled index products, in 1987, the Commodity Futures Trading Commission ("CFTC") approved a rule change by the Chicago Mercantile Exchange

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<sup>3</sup> The seller of a "cash-settled" index option pays out the cash value of the applicable index on expiration or exercise. A "physically settled" option, like equity and ETF options, involves the transfer of the underlying asset rather than cash. See Characteristics and Risks of Standardized Options, available at: <https://www.theocc.com/Company-Information/Documents-and-Archives/Options-Disclosure-Document>.

<sup>4</sup> The close of trading on the quarterly expiration Friday (i.e., the third Friday of March, June, September and December), when options, index futures, and options on index futures all expire simultaneously, became known as the "triple witching hour."

<sup>5</sup> See Securities and Exchange Commission, Division of Economic Risk and Analysis, Memorandum, Cornerstone Analysis of PM Cash-Settled Index Option Pilots (February 2, 2021) ("DERA Staff PM Pilot Memo") at 5, available at: [https://www.sec.gov/files/Analysis\\_of\\_PM\\_Cash\\_Settled\\_Index\\_Option\\_Pilots.pdf](https://www.sec.gov/files/Analysis_of_PM_Cash_Settled_Index_Option_Pilots.pdf).

(“CME”) to provide for A.M. settlement<sup>6</sup> for index futures, including futures on the S&P 500.<sup>7</sup> The Commission subsequently approved a rule change by Cboe Options to list and trade A.M.-settled SPX options.<sup>8</sup> In 1992, the Commission approved Cboe Options’ proposal to transition all of its European-style cash-settled options on the S&P 500 Index to A.M.-settlement<sup>9</sup>; however, in 1993, the Commission approved a rule allowing Cboe Options to list P.M.-settled options on certain broad-based indices, including the S&P 500, expiring at the end of each calendar quarter (“Quarterly Index Expirations”) (since adopted as permanent).<sup>10</sup> Starting in 2006, the Commission approved numerous rule changes, on a pilot basis, permitting the Cboe Options to introduce other index options, including SPX options, with P.M.-settlement. These include P.M.-settled index options expiring weekly (other than the third Friday) and at the end of each month (“EOM”),<sup>11</sup> P.M.-settled options

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<sup>6</sup> The exercise settlement value for an A.M.-settled index option is determined by reference to the reported level of the index as derived from the opening prices of the component securities on the business day before expiration.

<sup>7</sup> See Securities Exchange Act Release No. 24367 (April 17, 1987), 52 FR 13890 (April 27, 1987) (SR-CBOE-87-11) (noting that CME moved S&P 500 futures contract’s settlement value to opening prices on the delivery date).

<sup>8</sup> See id.

<sup>9</sup> See Securities Exchange Act Release No. 30944 (July 21, 1992), 57 FR 33376 (July 28, 1992) (SR-CBOE-92-09). Thereafter, the Commission approved proposals by the options markets to transfer most of their cash-settled index products to A.M. settlement.

<sup>10</sup> See Securities Exchange Act Release No. 31800 (February 1, 1993), 58 FR 7274 (February 5, 1993) (SR-CBOE-92-13); and see Rule 4.13(a)(2)(B); see also Securities Exchange Act Release Nos. 54123 (July 11, 2006), 71 FR 40558 (July 17, 2006) (SR-CBOE-2006-65); and 60164 (June 23, 2009), 74 FR 31333 (June 30, 2009) (SR-CBOE-2009-029).

<sup>11</sup> See Securities Exchange Act Release Nos. 62911 (September 14, 2010), 75 FR 57539 (September 21, 2010) (SR-CBOE-2009-075); 76529 (November 30, 2015), 80 FR 75695 (December 3, 2015) (SR-CBOE-2015-106); 78132 (June 22, 2016),

on the S&P 500 Index that expire on the third Friday-of-the-month (“SPXPM”),<sup>12</sup> as well as P.M.-settled Mini-SPX Index (“XSP”) options and Mini-Russell 2000 Index (“MRUT”) options expiring on the third Friday.<sup>13</sup>

As stated above, since its inception in 2010, the Exchange has continuously extended the FLEX PM Third Friday Pilot Program period and, during the course of the FLEX PM Third Friday Pilot Program and in support of the extensions of the FLEX PM Third Friday Pilot Program, the Exchange has submitted reports to the Commission regarding the Pilot Program that detail the Exchange’s experience with the Pilot Program, pursuant to the FLEX PM Third Friday Pilot Program.<sup>14</sup> Specifically, the Exchange provided the Commission with annual reports analyzing volume and open interest for each broad-based FLEX Index Options class overlying a third Friday-of-the-month expiration day, p.m.-settled FLEX Index Options series. The annual reports also contained certain pilot period and pre-pilot period analyses of volume and open interest for third Friday-of-the-month expiration days, a.m.-settled FLEX Index series and third Friday-of-the-month expiration day Non-FLEX Index series overlying

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81 FR 42018 (June 28, 2016) (SR-CBOE-2016-046); and 78531 (August 10, 2016), 81 FR 54643 (August 16, 2016) (SR-CBOE-2016-046).

<sup>12</sup> See Securities Exchange Act Release No. 68888 (February 8, 2013), 78 FR 10668 (February 14, 2013) (SR-CBOE-2012-120) (the “SPXPM Approval Order”). Pursuant to Securities Exchange Act Release No. 80060 (February 17, 2017), 82 FR 11673 (February 24, 2017) (SR-CBOE-2016-091), the Exchange moved third-Friday P.M.-settled options into the S&P 500 Index options class, and as a result, the trading symbol for P.M.-settled S&P 500 Index options that have standard third Friday-of-the-month expirations changed from “SPXPM” to “SPXW.” This change went into effect on May 1, 2017, pursuant to Cboe Options Regulatory Circular RG17-054.

<sup>13</sup> See Securities Exchange Act Release Nos. 70087 (July 31, 2013), 78 FR 47809 (August 6, 2013) (SR-CBOE-2013-055); and 91067 (February 5, 2021) 86 FR 9108 (February 11, 2021) (SR-CBOE-2020-116).

<sup>14</sup> See supra note 1.

the same index as a third Friday-of-the-month expiration day, p.m.-settled FLEX Index option. The annual reports also contained information and analysis of FLEX Index Options trading patterns, and index price volatility and underlying share trading activity for each broad-based index class overlying an Expiration Friday, p.m.-settled FLEX Index Option that exceeds certain minimum open interest parameters. The Exchange also provided the Commission, on a periodic basis, interim reports of volume and open interest.

Also, during the course of the FLEX PM Third Friday Pilot Program, the Exchange provided the Commission with any additional data or analyses the Commission requested if it deemed such data or analyses necessary to determine whether the Pilot Program was consistent with the Exchange Act. The Exchange has made public on its website all data and analyses previously submitted to the Commission under the FLEX PM Third Friday,<sup>15</sup> and will continue to make public any data and analyses it submits to the Commission while the FLEX PM Third Friday is still in effect.

The Exchange has concluded that the FLEX PM Third Friday does not negatively impact market quality or raise any unique or prohibitive regulatory concerns. The Exchange has not identified any evidence from the pilot data indicating that the trading of P.M.-settled FLEX options has any adverse impact on fair and orderly markets on Expiration Fridays for broad-based indexes or the underlying securities comprising those indexes, nor have there been any observations of abnormal market movements attributable to P.M.-settled FLEX options from any market participants that have come to the attention of the Exchange.

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<sup>15</sup> Available at <https://www.cboe.com/aboutcboe/legal-regulatory/national-market-system-plans/pm-settlement-spxpm-data>.

Based on a study conducted by the Commission's Division of Economic and Risk Analysis ("DERA") staff on the pilot data from 2006 through 2018,<sup>16</sup> and the Exchange's review of the pilot data from 2019 through 2021, the size of the market for P.M.-settled SPX options (including quarterly, weekly, EOM and third Friday expirations) since 2007 has grown from a trivial portion of the overall market to a substantial share (from around 0.1% of open interest in 2007 to 30% in 2021).<sup>17</sup> Notional value of open interest in P.M.-settled SPX options increased from approximately a median of \$1.5 billion in 2007 to \$1.9 trillion in 2021, approximately 1260 times its value in 2007. Notional open interest in A.M.-settled SPX options was already hovering around a median of \$1.4 trillion in 2007, and it has since increased to approximately \$4.4 trillion in 2021. It is also important to note that open interest on expiring P.M.-settled SPX options, as compared to A.M.-settled options, is spread out across a greater number of expiration dates, which results in a smaller percentage of open interest expiring on any one date, thus mitigating concerns that SPXPM option expiration may have a disruptive effect on the market.<sup>18</sup> Daily trading volume in P.M.-settled SPX options

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<sup>16</sup> See DERA Staff PM Pilot Memo, at 13 ("Option settlement quantity data for A.M.- and P.M.-settled options were obtained from the Cboe, including the number of contracts that settled in-the-money for each exchange-traded option series on the S&P 500 index...on expiration days from January 20, 2006 through December 31, 2018. Daily open interest and volume data for [SPX] option series were also obtained from Cboe, including open interest data from January 3, 2006 through December 31, 2018 and trading volume data from January 3, 2006 through December 31, 2018.")

<sup>17</sup> The DERA staff study reviewed and provided statistics for market share, median notional value of open interest and median volume in 2007 and in 2018. The Exchange provides updated statistics for market share, median notional value of open interest and median volume in 2021, replacing the 2018 statistics provided in the Commission staff study.

<sup>18</sup> See DERA Staff PM Pilot Memo, at 2.

has increased from a median of about 700 contracts in 2007 to nearly 1.9 million contracts in 2021,<sup>19</sup> and now exceeds trading volume in A.M.-settled SPX options.

Moreover, the DERA staff study of the P.M.-settled SPX options pilot data (2006 through 2018) did not identify any significant economic impact on S&P 500 futures,<sup>20</sup> the S&P 500, or the underlying component securities of the S&P 500 surrounding the close. For purposes of the study, volatility was by and large measured by using the standard deviation<sup>21</sup> of one-minute returns of S&P 500 futures values and the index value during regular hours on each day reviewed (excluding the first and last 15 minutes of trading) and then compared with the standard deviation of one-minute returns (for S&P 500 futures, the S&P 500, and the underlying component securities of the S&P 500) over the last 15 minutes of a trading day.<sup>22</sup>

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<sup>19</sup> The Exchange notes that the DERA staff study used two-sided volume data for the median volume in 2007 and in 2018; therefore, the Exchange provides two-sided volume data for the median volume in 2021.

<sup>20</sup> Futures on the S&P 500 experience high volume and liquidity both before and after the close of the underlying market. Therefore, futures are a useful measure of abnormal volatility surrounding the close and the open. See DERA Staff PM Pilot Memo, at 14. The Exchange agrees with this approach.

<sup>21</sup> Standard deviation applied to a rate of return (in this case, one-minute) of an instrument can indicate that instrument's historical volatility. The greater the standard deviation, the greater the variance between price and the mean, which indicates a larger price range, i.e., higher volatility.

<sup>22</sup> For example, if on a particular day the standard deviation of one-minute returns between 3:45 p.m. ET and 4:00 p.m. ET is 0.004 and the standard deviation of returns from 9:45 a.m. ET to 3:45 p.m. ET is 0.002, this metric would take on a value of 2 for that day, indicating that volatility during the last 15 minutes of the trading day was twice as high as it was during the rest of the trading day. See DERA Staff PM Pilot Memo, at 15; see also DERA Staff PM Pilot Memo, at Section V, which discusses in detail the metrics used to measure, for the purposes of the study, the extent to which the market may experience abnormal volatility surrounding SPXPM option settlement.

Using this as a general measure,<sup>23</sup> the DERA staff study then reviewed whether, and to what extent, the settlement quantity of SPXPM options and the levels of open interest in SPXPM options on expiration days (as compared to non-expiration days) may be associated with general price volatility and price reversals for S&P 500 futures, the S&P 500, and the underlying component securities of the S&P 500 near the close. From its review of the study, the Exchange agrees that, although volatility before the market close is generally higher than during the rest of the trading day, there is no evidence of any significant adverse economic impact to the futures, index, or underlying index component securities markets as a result of the quantity of P.M.-settled SPX options that settle at the close or the amount of expiring open interest in P.M.-settled SPX options. For example, the largest settlement event that occurred during the time period of the study (a settlement of \$100.4 billion of notional on December 29, 2017) had an estimated impact on the futures price of only approximately 0.02% (a predicted impact of \$0.54 relative to a closing futures price of \$2,677).

In particular, the DERA staff study found that an additional P.M.-settled SPX options settlement quantity equal to \$10 billion in notional value is associated with a marginal impact on futures prices during the last 15 minutes of the trading day of only about \$0.06 (where the hypothetical index level is 2,500), additional expiring open interest in P.M.-settled SPX options equal to \$10 billion in notional value is associated with a marginal impact on futures prices during the last 15 minutes of the trading day of only about \$0.05 (assumed index level is 2,500). Also, an additional increase in settlement quantity or in expiring open interest, each

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<sup>23</sup> See DERA Staff PM Pilot Memo, at Section V, which discusses in detail the metrics used to measure, for the purposes of the study, the extent to which the market may experience abnormal volatility surrounding SPXPM option settlement.

equal to \$20 million in notional value, did not result in any meaningful futures price reversals near the close (neither was found to cause a price reversal of over one standard deviation<sup>24</sup>).

Likewise, the study identified that an additional total P.M.-settled SPX options settlement quantity equal to \$10 billion in notional value corresponds to price movement in the S&P 500 of only about \$0.08 (assuming an index level of 2,500) during the last 15 minutes of the trading day, and that additional expiring open interest equal to \$10 billion in notional value corresponds to a price movement in the S&P 500 of only about \$0.06 (assuming an index level of 2,500) during the last 15 minutes of the trading day. The study also identified that it would take an increase of \$34 billion in notional value of total settlement quantity and of expiring open interest for one additional S&P 500 price reversal of greater than two standard deviations to occur in the last 15 minutes before the market close. Also, regarding potential impact to S&P 500 component securities, it would take an increase in total P.M.-settled SPX options settlement quantity equal to \$20 billion to effect a price movement of only approximately \$0.03 for a \$200 stock, an increase in expiring open interest in P.M.-settled SPX options equal to \$10 billion to effect a price movement less than half a standard deviation, and an increase in total P.M.-settled SPX settlement quantity equal to \$7 billion to achieve a price reversal greater two standard deviations.

The study employed the same metrics to determine whether there is greater price volatility for S&P 500 futures, the S&P 500, and the component securities of the S&P 500 related to SPXPM option settlements during an environment of high market volatility (i.e., on days in which the VIX Index was in the top 10% of closing index values) and did not identify indicators of any significant economic impact on these markets near the close as a result of

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<sup>24</sup> See supra note 20.

the P.M.-settled SPX options settlement.<sup>25</sup> In addition to this, the DERA staff study, applying the same metrics and analysis as for P.M.-settled SPX options to A.M.-settled SPX options, did not identify any evidence of a statistically significant relationship between settlement quantity or expiring open interest of A.M.-settled options and volatility near the open.

Upon review of the results of the DERA staff study, the Exchange agrees that each of the above-described marginal price movements in S&P 500 futures, the S&P 500, and the S&P 500 component securities affected by increases in P.M.-settled SPX options settlement quantity and expiring open interest appear to be de minimis pricing changes from those that occur over regular trading hours (outside of the last 15 minutes of the trading day). Further, the Exchange has not observed any significant economic impact or other adverse effects on the market from similar reviews of its pilot reports and data submitted after 2018.<sup>26</sup> In its review of a sample of the pilot data from 2019 through 2021, the Exchange similarly measured volatility over the final fifteen minutes of each trading day by taking the standard deviation of rolling one-minute returns of the S&P 500 level (excluding the first and last fifteen minutes of trading) and comparing such with the standard deviation of one-minute returns<sup>27</sup> of the S&P 500 level, over the last 15 minutes of a trading day. The Exchange identified an average standard deviation ratio of 1.42 for the S&P 500 on non-expiration days and an average standard deviation ratio of 1.54 for the S&P 500 on expiration days (a ratio between expiration days and non-expiration days of 1.09). The Exchange also notes that, using the same

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<sup>25</sup> The Exchange also notes that the study did not identify any evidence that less liquid S&P 500 constituent securities experienced any greater impact from the settlement of P.M.-settled SPX options.

<sup>26</sup> Total SPX open interest volumes were examined for expiration dates over a roughly two-year period between October 2019 and November 2021.

<sup>27</sup> Calculated at every tick for the prior minute.

methodology, it observed that, from 2015 through 2019,<sup>28</sup> the average standard deviation ratio for the S&P 500 on non-expiration days was 1.11 and the average standard deviation ratio for the S&P 500 on expiration days was 1.22 (a ratio between expiration days and non-expiration days of 1.10). While the average standard deviation ratio on both expiration and non-expiration days was higher in 2019 through 2021 due to overall market volatility, the ratios between the standard deviation ratios on expiration days and non-expirations days remained nearly identical between the 2015 through 2019 timeframe and the 2019 through 2021. This shows that, in cases where overall market volatility may increase, the normalized impact on expiration days to non-expiration days generally remains consistent.

In addition to this, the Exchange notes that the S&P 500 is rebalanced quarterly. The changes resulting from each rebalancing coincide with the third-Friday of the quarterly rebalancing month (i.e., March, June, September, October and December)<sup>29</sup> and generally drive an increase in trading activity from investors that seek to track the S&P 500. As such, the Exchange measured volatility on quarterly rebalancing dates and found that the average standard deviation ratio was 1.62, which suggests more closing volatility on quarterly rebalance dates compared to non-quarterly expiration dates (for which the average standard deviation ratio was 1.22), thus indicating that the impact rebalancing may have on the S&P 500 is greater than any impact that P.M.-settled SPX options may have on the S&P 500.

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<sup>28</sup> November 2015 through November 2021.

<sup>29</sup> See S&P Dow Jones Indices, Equity Indices Policies & Practices, Methodology (August 2021), at 15, available at <https://www.spglobal.com/spdji/en/documents/methodologies/methodology-sp-equity-indices-policies-practices.pdf>.

The Exchange additionally focused its study of the post-2018 sample pilot data on reviewing for potential correlation between excess market volatility and price reversals and the hedging activity of liquidity providers. As explained in the DERA staff study, potential impact of P.M.-settled SPX options on the correlated equity markets is thought to stem from the hedging activity of liquidity providers in such options.<sup>30</sup> To determine any such potential correlation, the Exchange studied the expected action of liquidity providers that are the primary source of the hedging on settlement days. These liquidity providers generally delta-hedge their S&P 500 index exposure via S&P 500 futures and on settlement day unwind their futures positions that correspond with the delta of their in-the-money (ITM) expiring P.M.-settled SPX options. Assuming such behavior, the Exchange estimated the Market-On-Close (“MOC”)<sup>31</sup> volume for the shares of the S&P 500 component securities (i.e., “MOC share volume”) that could ultimately result from the unwinding of the liquidity providers’ futures positions by equating the notional value of the futures positions that correspond to expiring ITM open interest to the number S&P 500 component security contracts (based on the weight of each S&P 500 component security). That is, the Exchange calculated (an estimate) of the amount of MOC volume in the S&P 500 component markets attributable hedging activity as a result of expiring ITM P.M.-settled SPX options (i.e., “hedging MOC”). The Exchange then: (1) compared the hedging MOC share volume to all MOC share volume on expiration days and non-expiration trading days; and (2) compared the notional value of the hedging futures positions (i.e., that correspond to expiring ITM P.M.-settled SPX options open

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<sup>30</sup> See DERA Staff PM Pilot Memo, at 10-12.

<sup>31</sup> MOC orders allow a market participant to trade at the closing price. Market participants generally utilize MOC orders to ensure they exit positions at the end of the trading day.

interest) to the notional value of expiring ITM P.M.-settled SPX options open interest, the notional value of all expiring P.M.-settled SPX options open interest and the notional value of all P.M.-settled SPX options open interest.

The Exchange observed that, on average, there were approximately 25% more MOC shares executed on expiration days (332 expiration days) than non-expiration days (209 non-expiration days). While, at first glance, the volume of MOC shares executed on expiration days seems much greater than the volume executed on non-expiration days, the Exchange notes that much of this difference is attributable to just eight expiration days — the quarterly index rebalancing dates captured within the scope of the post-2018 sample pilot data. The average MOC share volume on the eight quarterly rebalancing dates was approximately 4.8 times the average MOC share volume on the non-quarterly rebalancing expiration dates; again, indicating that the impact rebalancing may have on the S&P 500 Index is greater than any impact that P.M.-settled SPX options may have on the S&P 500 Index. That is, the Exchange observed that the majority of closing volume on quarterly rebalance dates is driven by rebalancing of shares in the S&P 500, and not by P.M.-settled SPX options expiration-related hedging activity. Notwithstanding the MOC share volume on quarterly rebalancing dates, the volume of MOC shares executed on expiration days (324 expiration days) was only approximately 13% more than that on non-expiration days, substantially less than the increase in volume over non-expiration days wherein the eight index rebalancing dates are included in expiration day volume. In addition to this, the Exchange observed that the hedging MOC share volume (i.e., the expected MOC share volume resulting from hedging activity in connection with expiring ITM P.M.-settled SPX options) was, on average, less than the MOC share volume on non-expiration days, and was only approximately 20% of the total MOC share

volume on expiration days, indicating that other sources of MOC share volume generally exceed the volume resulting from hedging activity of expiring ITM P.M.-settled SPX options and would more likely be a source of any potential market volatility.

The Exchange also observed that, across all third-Friday expirations, the notional value of the hedging futures positions was approximately 25% of the notional value of expiring ITM P.M.-settled SPX options, approximately 3.8% of the notional value of all expiring P.M.-settled SPX options, and approximately only 0.5% of the notional value of all P.M.-settled SPX options. As such, the estimated hedging activity from liquidity providers on expiration days is a fraction of the expiring open interest in P.M.-settled SPX options, which, the Exchange notes, is only 14% of the total open interest in P.M.-settled SPX options; thus, indicating negligible capacity for hedging activity to increase volatility in the underlying markets.

While unrelated to the initial concerns of P.M.-settlement as described above, at the request of the Commission, the Exchange recently completed an analysis intended to evaluate whether the introduction of P.M.-settled options impacted the quality of the A.M.-settled option market. Specifically, the Exchange compared values of key market quality indicators (specifically, the bid-ask spread<sup>32</sup> and effective spread<sup>33</sup>) in SPXW options both before and

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<sup>32</sup> The Exchange calculated for each of SPXW options (with Monday, Wednesday, and Friday expirations) and SPY Weekly options (with Monday, Wednesday, and Friday expirations) the daily time-weighted bid-ask spread on the Exchange during its regular trading hours session, adjusted for the difference in size between SPXW options and SPY options (SPXW options are approximately ten times the value of SPY options).

<sup>33</sup> The Exchange calculated the volume-weighted average daily effective spread for simple trades for each of SPXW options (with Monday, Wednesday, and Friday expirations) and SPY Weekly options (with Monday, Wednesday, and Friday expirations) as twice the amount of the absolute value of the difference between an order execution price and the midpoint of the national best bid and offer at the time

after the introduction of Tuesday expirations and Thursday expirations for SPXW options on April 18 and May 11, 2022, respectively.<sup>34</sup> Options on the Standard & Poor's Depository Receipts S&P 500 ETF ("SPY") were used as a control group to account for any market factors that might influence key market quality indicators. The Exchange used data from January 3, 2022 through March 4, 2022 (the two-month period prior to the introduction of SPXW options with Tuesday expirations) and data from May 11, 2022 to July 10, 2022 (the two-month period following the introduction of SPXW options with Thursday expirations).<sup>35</sup>

Given the time that has passed since the introduction of FLEX P.M.-settled options, the Exchange is unable to analyze whether the introduction of those options significantly impacted the market quality of FLEX P.M.-settled options. Additionally, the Exchange is unable to analyze whether the introduction of the FLEX P.M.-settled options significantly impacted the market quality of A.M.-settled FLEX options, as there is no book for FLEX options, as FLEX options are listed only if and when market participants create them for trading. However, the Exchange believes analyzing whether the introduction of new SPXW P.M.-settled expirations (i.e., SPXW options with Tuesday and Thursday expirations) impacted the market quality of then-existing SPXW P.M.-settled expirations (i.e., SPXW options with Monday, Wednesday, and Friday expirations) provides a reasonable substitute to evaluate whether the introduction of P.M.-settled index options impacted the market quality

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of execution, adjusted for the difference in size between SPXW options and SPY options.

<sup>34</sup> For purposes of comparison, the Exchange paired SPXW options and SPY options with the same moneyness and same days to expiration.

<sup>35</sup> The Exchange observed comparable market volatility levels during the pre-intervention and post-intervention time ranges.

of the underlying cash markets when the pilot began. The full analysis is included in Exhibit 3 of this rule filing.

As a result of this analysis, the Exchange believes the introduction of SPX options with Tuesday and Thursday options had no significant impact on the market quality of SPXW options with Monday, Wednesday, and Friday expirations. With respect to the majority of series analyzed, the Exchange observed no statistically significant difference in the bid-ask spread or the effective spread of the series in the period prior to introduction of the Tuesday and Thursday expirations and the period following the introduction of the Tuesday and Thursday expirations. While statistically insignificant, the Exchange notes that in many series, particularly as they were closer to expiration, the Exchange observed that the values of these spreads decreased during the period following the introduction of the Tuesday and Thursday expirations.<sup>36</sup>

To further note, given the significant changes in the closing procedures of the primary markets in recent decades, including considerable advances in trading systems and technology, the Exchange believes that the risks of any potential impact of P.M.-, cash-settled FLEX options on the underlying cash markets are also de minimis.

The Exchange proposes to make the FLEX PM Third Friday Program permanent as P.M.-settled index products have become an integral part of the Exchange's product offerings, providing investors with greater trading opportunities and flexibility. As indicated by the significant growth in the size of the market for P.M.-settled options, such options have been, and continue to be, well-received and widely used by market participants. Therefore, the

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<sup>36</sup> In any series in which the Exchange observed an increase in the market quality indicators, the Exchange notes any such increase was also statistically insignificant.

Exchange wishes to be able to continue to provide investors with the ability to trade FLEX PM options on a permanent basis. The Exchange believes that the permanent continuation of the FLEX PM Third Friday Pilot Program will serve to maintain the status quo by continuing to offer a product to which investors have become accustomed and have incorporated into their business models and day-to-day trading methodologies for nearly ten years. As such, the Exchange also believes that ceasing to offer FLEX PM options may result in significant market disruption and investor confusion. The Exchange has not identified any significant impact on market quality nor any unique or prohibitive regulatory concerns as a result of the FLEX PM Third Friday Pilot Program, and, as such, the Exchange believes that the continuation of the FLEX PM Third Friday Pilot Program as a pilot, including the use of time and resources to compile and analyze quarterly and annual pilot reports and pilot data, is no longer necessary and that making the FLEX PM Third Friday Pilot Program permanent will allow the Exchange to otherwise allocate time and resources to other industry initiatives.

(b) Statutory Basis

The Exchange believes the proposed rule change is consistent with the Securities Exchange Act of 1934 (the “Act”) and the rules and regulations thereunder applicable to the Exchange and, in particular, the requirements of Section 6(b) of the Act.<sup>37</sup> Specifically, the Exchange believes the proposed rule change is consistent with the Section 6(b)(5)<sup>38</sup> requirements that the rules of an exchange be designed to prevent fraudulent and manipulative acts and practices, to promote just and equitable principles of trade, to foster cooperation and coordination with persons engaged in regulating, clearing, settling,

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<sup>37</sup> 15 U.S.C. 78f(b).

<sup>38</sup> 15 U.S.C. 78f(b)(5).

processing information with respect to, and facilitating transactions in securities, 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.

In particular, the Exchange believes that the making the FLEX PM Third Friday Pilot Program permanent will allow the Exchange to be able to continue to offer FLEX PM options on a continuous and permanent basis. These products have been, and continue to be, well-received and widely used by market participants, providing investors with greater trading opportunities and flexibility. The Exchange believes that the permanent continuation of the FLEX PM Third Friday Pilot Program will remove impediments to and perfect the mechanism of a free and open market and a national market system, and, in general, protect investors and the public interest by continuing to offer a product to which investors have become accustomed and have incorporated into their business models and day-to-day trading strategies for approximately 13 years. The Exchange believes ceasing to offer the FLEX PM Third Friday Pilot Program may result in significant market disruption and investor confusion, as P.M.-settled index products, particularly SPX options, have become an integral part of the Exchange's product offerings, providing investors with greater trading opportunities and flexibility.

The Exchange further believes that making the FLEX PM Third Friday Pilot Program permanent will remove impediments to and perfect the mechanism of a free and open market and a national market system and protect investors, while maintaining a fair and orderly market, as the Exchange believes that previous concerns (arising in the 1980s) regarding options expirations potentially contributing to excess volatility and reversals around the close have been adequately diminished. As described in detail above, the Exchange has observed

no significant adverse market impact or identified any meaningful regulatory concerns during the approximately 13-year operation of the FLEX PM Third Friday Program as a pilot nor during the 15 years since P.M.-settled index options (SPX) were reintroduced to the marketplace.<sup>39</sup> Notably, the Exchange did not identify any significant economic impact (including on pricing or volatility or in connection with reversals) on related futures, the underlying indexes, or the underlying component securities of the underlying indexes surrounding the close as a result of the quantity of P.M.-settled FLEX options that settle at the close or the amount of expiring open interest in P.M.-settled FLEX options, nor any demonstrated capacity for options hedging activity to impact volatility in the underlying markets. While the DERA staff study and corresponding Exchange study described above specifically evaluated SPX options, P.M.-settled FLEX options overlay broad-based indexes (including the S&P 500), the Exchange believes it is appropriate to extrapolate the data to apply the FLEX PM options. This is particularly true given that the reports submitted by the Exchange during the pilot period have similarly demonstrated no significant economic impact on the respective underlying indexes or other products.

The Exchange also believes the introduction of FLEX PM options had no significant impact on the market quality of corresponding A.M.-settled options or other options. The Exchange believes this as a result of its analysis conducted after the introduction of SPXW options with Tuesday and Thursday expirations, which demonstrated no statistically significant impact on the bid-ask or effective spreads of SPXW options with Monday, Wednesday, and Friday expirations after trading in the SPXW options with Tuesday and Thursday expirations began. FLEX options are nearly identical to non-FLEX options and

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<sup>39</sup> See supra notes 16-29.

overlay the same indexes. Therefore, the Exchange believes analyzing the impact of new SPXW options on then-existing SPXW options permit the Exchange to extrapolate from this data that it is unlikely the introduction of P.M.-settled FLEX options significantly impacted the market quality of A.M.-settled options when the pilot began.

Additionally, the significant changes in the closing procedures of the primary markets in recent decades, including considerable advances in trading systems and technology, has significantly minimized risks of any potential impact of P.M.-, cash-settled FLEX options on the underlying cash markets. As such, the Exchange believes that a permanent FLEX PM Third Friday Pilot Program does not raise any unique or prohibitive regulatory concerns and that such trading has not, and will not, adversely impact fair and orderly markets on Expiration Fridays for the underlying indexes or their component securities. Further, as the Exchange has not identified any significant impact on market quality or any unique or prohibitive regulatory concerns as a result of offering FLEX PM options, the Exchange believes that the continuation of the FLEX PM Third Friday Pilot Program as a pilot, including the gathering, submission and review of the pilot reports and data, is no longer necessary and that making the FLEX PM Third Friday Pilot Program permanent will allow the Exchange to otherwise allocate time and resources to other industry initiatives.

**Item 4. Self-Regulatory Organization's Statement on Burden on Competition**

Cboe Options does not believe that the proposed rule change will impose any burden on competition that is not necessary or appropriate in furtherance of the purposes of the Act. The Exchange does not believe that making the FLEX PM Third Friday Pilot Program permanent will impose any unnecessary or inappropriate burden on intramarket competition because FLEX PM options will continue to be available to all market

participants who wish to participate in the FLEX PM options market. The Exchange believes that the growth that the P.M.-settled options market, including FLEX PM options, has experienced since their reintroduction through pilot programs indicates strong, continued investor interest and demand, warranting a permanent FLEX PM Third Friday Pilot Program. The Exchange believes that, for the period that P.M.-settled FLEX options have been in operation as pilot programs, they have provided investors with a desirable product with which to trade and wishes to permanently offer this product to investors. Furthermore, during the pilot period, the Exchange has not observed any significant adverse market effects nor identified any regulatory concerns as a result of the FLEX PM Third Friday Pilot Program, and, as such, the continuation of the FLEX PM Third Friday Pilot Program as a pilot, including the gathering, submission and review of the pilot reports and data, is no longer necessary — a permanent FLEX PM Third Friday Pilot Program will allow the Exchange to otherwise allocate time and resources to other industry initiatives.

The Exchange further does not believe that making the FLEX PM Third Friday Pilot Program permanent will impose any burden on intermarket competition that is not necessary or appropriate in furtherance of the purposes of the Act because it applies to a class of options listed only for trading on Cboe Options. The Exchange notes that other exchanges are free to and do offer competing products. To the extent that the permanent offering and continued trading of FLEX PM options may make Cboe Options a more attractive marketplace to market participants at other exchanges, such market participants may elect to become Cboe Options market participants.

**Item 5. Self-Regulatory Organization’s Statement on Comments on the Proposed Rule Change Received from Members, Participants, or Others**

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

**Item 6. Extension of Time Period for Commission Action**

Not applicable.

**Item 7. Basis for Summary Effectiveness Pursuant to Section 19(b)(3) or for Accelerated Effectiveness Pursuant to Section 19(b)(2) or Section 19(b)(7)(D)**

Not applicable.

**Item 8. Proposed Rule Change Based on Rules of Another Self-Regulatory Organization or of the Commission**

The proposed rule change is not based on a rule either of another self-regulatory organization or of the Commission.

**Item 9. Security-Based Swap Submissions Filed Pursuant to Section 3C of the Act**

Not applicable.

**Item 10. Advance Notices Filed Pursuant to Section 806(e) of the Payment, Clearing and Settlement Supervision Act**

Not applicable.

**Item 11. Exhibits**

Exhibit 1. Completed Notice of Proposed Rule Change for publication in the Federal Register.

Exhibit 3. Analysis of Market Quality Impact of P.M.-Settled Index Options

EXHIBIT 1**SECURITIES AND EXCHANGE COMMISSION**

[Release No. 34- ; File No. SR-CBOE-2023-018]

[Insert date]

Self-Regulatory Organizations; Cboe Exchange, Inc.; Notice of Filing of a Proposed Rule Change to Make Permanent the Operation of its Flexible Exchange Options (“FLEX Options”) Pilot Program (“Pilot Program”) Regarding Permissible Exercise Settlement Values for FLEX Index Options

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

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

Cboe Exchange, Inc. (the “Exchange” or “Cboe Options”) proposes to make permanent the operation of its Flexible Exchange Options (“FLEX Options”) pilot program (“Pilot Program”) regarding permissible exercise settlement values for FLEX Index Options. The text of the proposed rule change is provided below.

(additions are underlined; deletions are [bracketed])

\* \* \* \* \*

Rules of Cboe Exchange, Inc.

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

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

**Rule 4.21. Series of FLEX Options**

(a) No change.

(b) *Terms*. When submitting a FLEX Order for a FLEX Option series to the System, the submitting FLEX Trader must include one of each of the following terms in the FLEX Order (all other terms of a FLEX Option series are the same as those that apply to non-FLEX Options), provided that a FLEX Index Option with an index multiplier of one may not be the same type (put or call) and may not have the same exercise style, expiration date, settlement type, and exercise price as a non-FLEX Index Option overlying the same index listed for trading (regardless of the index multiplier of the non-FLEX Index Option), which terms constitute the FLEX Option series:

(1) – (4) No change.

(5) settlement type:

(A) No change.

(B) *FLEX Index Options*. FLEX Index Options are settled in U.S. dollars, and may be:

(i) No change.

(ii) p.m.-settled (with exercise settlement value determined by reference to the reported level of the index derived from the reported closing prices of the component securities)[, except for a FLEX Index Option that expires on any business day that falls on or within two business days of a third Friday-of-the-month expiration day for a non-FLEX Option (other than a QIX option) may only be a.m.-settled; however, for a pilot period ending the earlier of May 8, 2023 or the date on which the pilot program is approved on a permanent basis, a FLEX Index Option with an expiration date on the third-Friday of the month may be p.m.-settled];

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The text of the proposed rule change is also available on the Exchange's website (<http://www.cboe.com/AboutCBOE/CBOELegalRegulatoryHome.aspx>), at the Exchange's Office of the Secretary, and at the Commission's Public Reference Room.

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

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

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

#### **1. Purpose**

The Exchange proposes to make permanent its Pilot Program that permits the Exchange to list FLEX Options whose exercise settlement value is derived from closing prices on the last trading day prior to expiration that expire on or within two business days of a third Friday-of-the-month expiration day for a non-FLEX Option (other than QIX options) (“FLEX PM Third Friday”). The Securities and Exchange Commission (the “Commission”) approved a Cboe Options rule change that, among other things, established a pilot program regarding permissible exercise settlement values for FLEX Index Options on January 28, 2010.<sup>3</sup> The Exchange has extended the pilot period numerous times, which is currently set to expire on the earlier of May 8, 2023 or the date on which the pilot

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<sup>3</sup> Securities Exchange Act Release No. 61439 (January 28, 2010), 75 FR 5831 (February 4, 2010) (SR-CBOE-2009-087) (“Approval Order”). The initial pilot period was set to expire on March 28, 2011, which date was added to the rules in 2010. See Securities Exchange Act Release No. 61676 (March 9, 2010), 75 FR 13191 (March 18, 2010) (SR-CBOE-2010-026).

program is approved on a permanent basis.<sup>4</sup> The Exchange hereby requests that the Commission approve the FLEX PM Third Friday Pilot Program on a permanent basis.

By way of background, when cash-settled<sup>5</sup> index options were first introduced in the 1980s, settlement was based on the closing value of the underlying index on the option's expiration date. The Commission later became concerned about the impact of P.M.-settled,

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<sup>4</sup> See Securities Exchange Act Release Nos. 64110 (March 23, 2011), 76 FR 17463 (March 29, 2011) (SR-CBOE-2011-024); 66701 (March 30, 2012), 77 FR 20673 (April 5, 2012) (SR-CBOE-2012-027); 68145 (November 2, 2012), 77 FR 67044 (November 8, 2012) (SR-CBOE-2012-102); 70752 (October 24, 2013), 78 FR 65023 (October 30, 2013) (SR-CBOE-2013-099); 73460 (October 29, 2014), 79 FR 65464 (November 4, 2014) (SR-CBOE-2014-080); 77742 (April 29, 2016), 81 FR 26857 (May 4, 2016) (SR-CBOE-2016-032); 80443 (April 12, 2017), 82 FR 18331 (April 18, 2017) (SR-CBOE-2017-032); 83175 (May 4, 2018), 83 FR 21808 (May 10, 2018) (SR-CBOE-2018-037); 84537 (November 5, 2018), 83 FR 56113 (November 9, 2018) (SR-CBOE-2018-071); 85707 (April 23, 2019), 84 FR 18100 (April 29, 2019) (SR-CBOE-2019-021); 87515 (November 13, 2020), 84 FR 63945 (November 19, 2019) (SR-CBOE-2019-108); 88782 (April 30, 2020), 85 FR 27004 (May 6, 2020) (SR-CBOE-2020-039); 90279 (October 28, 2020), 85 FR 69667 (November 3, 2020) (SR-CBOE-2020-103); 91782 (May 5, 2021), 86 FR 25915 (May 11, 2021) (SR-CBOE-2021-031); 93500 (November 1, 2021), 86 FR 61340 (November 5, 2021) (SR-CBOE-2021-064); 94812 (April 28, 2022), 87 FR 26381 (May 4, 2022) (SR-CBOE-2022-020); and 96239 (November 4, 2022), 87 FR 67985 (November 10, 2022) (SR-CBOE-2022-053). At the same time the permissible exercise settlement values pilot was established for FLEX Index Options, the Exchange also established a pilot program eliminating the minimum value size requirements for all FLEX Options. See Approval Order, *supra* note 3. The pilot program eliminating the minimum value size requirements was extended twice pursuant to the same rule filings that extended the permissible exercise settlement values (for the same extended periods) and was approved on a permanent basis in a separate rule change filing. See *id.*; and Securities Exchange Act Release No. 67624 (August 8, 2012), 77 FR 48580 (August 14, 2012) (SR-CBOE-2012-040) (Order Granting Approval of Proposed Rule Change Related to Permanent Approval of Its Pilot on FLEX Minimum Value Sizes).

<sup>5</sup> The seller of a “cash-settled” index option pays out the cash value of the applicable index on expiration or exercise. A “physically settled” option, like equity and ETF options, involves the transfer of the underlying asset rather than cash. See Characteristics and Risks of Standardized Options, available at: <https://www.theocc.com/Company-Information/Documents-and-Archives/Options-Disclosure-Documents>.

cash-settled index options on the markets for the underlying stocks at the close on expiration Fridays. Specifically, certain episodes of price reversals around the close on quarterly expiration dates attracted the attention of regulators to the possibility that the simultaneous expiration of index futures, futures options, and options might be inducing abnormal volatility in the index value around the close.<sup>6</sup> Academic research at the time provided at least some evidence suggesting that futures and options expirations contributed to excess volatility and reversals around the close on those days.<sup>7</sup> In light of the concerns with P.M.-settlement and to help ameliorate the price effects associated with expirations of P.M.-settled, cash-settled index products, in 1987, the Commodity Futures Trading Commission (“CFTC”) approved a rule change by the Chicago Mercantile Exchange (“CME”) to provide for A.M. settlement<sup>8</sup> for index futures, including futures on the S&P 500.<sup>9</sup> The Commission subsequently approved a rule change by Cboe Options to list and trade A.M.-settled SPX options.<sup>10</sup> In 1992, the Commission approved Cboe Options’

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<sup>6</sup> The close of trading on the quarterly expiration Friday (i.e., the third Friday of March, June, September and December), when options, index futures, and options on index futures all expire simultaneously, became known as the “triple witching hour.”

<sup>7</sup> See Securities and Exchange Commission, Division of Economic Risk and Analysis, Memorandum, Cornerstone Analysis of PM Cash-Settled Index Option Pilots (February 2, 2021) (“DERA Staff PM Pilot Memo”) at 5, available at: [https://www.sec.gov/files/Analysis\\_of\\_PM\\_Cash\\_Settled\\_Index\\_Option\\_Pilots.pdf](https://www.sec.gov/files/Analysis_of_PM_Cash_Settled_Index_Option_Pilots.pdf).

<sup>8</sup> The exercise settlement value for an A.M.-settled index option is determined by reference to the reported level of the index as derived from the opening prices of the component securities on the business day before expiration.

<sup>9</sup> See Securities Exchange Act Release No. 24367 (April 17, 1987), 52 FR 13890 (April 27, 1987) (SR-CBOE-87-11) (noting that CME moved S&P 500 futures contract’s settlement value to opening prices on the delivery date).

<sup>10</sup> See *id.*

proposal to transition all of its European-style cash-settled options on the S&P 500 Index to A.M.-settlement<sup>11</sup>; however, in 1993, the Commission approved a rule allowing Cboe Options to list P.M.-settled options on certain broad-based indices, including the S&P 500, expiring at the end of each calendar quarter (“Quarterly Index Expirations”) (since adopted as permanent).<sup>12</sup> Starting in 2006, the Commission approved numerous rule changes, on a pilot basis, permitting the Cboe Options to introduce other index options, including SPX options, with P.M.-settlement. These include P.M.-settled index options expiring weekly (other than the third Friday) and at the end of each month (“EOM”),<sup>13</sup> P.M.-settled options on the S&P 500 Index that expire on the third Friday-of-the-month (“SPXPM”),<sup>14</sup> as well

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<sup>11</sup> See Securities Exchange Act Release No. 30944 (July 21, 1992), 57 FR 33376 (July 28, 1992) (SR-CBOE-92-09). Thereafter, the Commission approved proposals by the options markets to transfer most of their cash-settled index products to A.M. settlement.

<sup>12</sup> See Securities Exchange Act Release No. 31800 (February 1, 1993), 58 FR 7274 (February 5, 1993) (SR-CBOE-92-13); and see Rule 4.13(a)(2)(B); see also Securities Exchange Act Release Nos. 54123 (July 11, 2006), 71 FR 40558 (July 17, 2006) (SR-CBOE-2006-65); and 60164 (June 23, 2009), 74 FR 31333 (June 30, 2009) (SR-CBOE-2009-029).

<sup>13</sup> See Securities Exchange Act Release Nos. 62911 (September 14, 2010), 75 FR 57539 (September 21, 2010) (SR-CBOE-2009-075); 76529 (November 30, 2015), 80 FR 75695 (December 3, 2015) (SR-CBOE-2015-106); 78132 (June 22, 2016), 81 FR 42018 (June 28, 2016) (SR-CBOE-2016-046); and 78531 (August 10, 2016), 81 FR 54643 (August 16, 2016) (SR-CBOE-2016-046).

<sup>14</sup> See Securities Exchange Act Release No. 68888 (February 8, 2013), 78 FR 10668 (February 14, 2013) (SR-CBOE-2012-120) (the “SPXPM Approval Order”). Pursuant to Securities Exchange Act Release No. 80060 (February 17, 2017), 82 FR 11673 (February 24, 2017) (SR-CBOE-2016-091), the Exchange moved third-Friday P.M.-settled options into the S&P 500 Index options class, and as a result, the trading symbol for P.M.-settled S&P 500 Index options that have standard third Friday-of-the-month expirations changed from “SPXPM” to “SPXW.” This change went into effect on May 1, 2017, pursuant to Cboe Options Regulatory Circular RG17-054.

as P.M.-settled Mini-SPX Index (“XSP”) options and Mini-Russell 2000 Index (“MRUT”) options expiring on the third Friday.<sup>15</sup>

As stated above, since its inception in 2010, the Exchange has continuously extended the FLEX PM Third Friday Pilot Program period and, during the course of the FLEX PM Third Friday Pilot Program and in support of the extensions of the FLEX PM Third Friday Pilot Program, the Exchange has submitted reports to the Commission regarding the Pilot Program that detail the Exchange’s experience with the Pilot Program, pursuant to the FLEX PM Third Friday Pilot Program.<sup>16</sup> Specifically, the Exchange provided the Commission with annual reports analyzing volume and open interest for each broad-based FLEX Index Options class overlying a third Friday-of-the-month expiration day, p.m.-settled FLEX Index Options series. The annual reports also contained certain pilot period and pre-pilot period analyses of volume and open interest for third Friday-of-the-month expiration days, a.m.-settled FLEX Index series and third Friday-of-the-month expiration day Non-FLEX Index series overlying the same index as a third Friday-of-the-month expiration day, p.m.-settled FLEX Index option. The annual reports also contained information and analysis of FLEX Index Options trading patterns, and index price volatility and underlying share trading activity for each broad-based index class overlying an Expiration Friday, p.m.-settled FLEX Index Option that exceeds certain minimum open interest parameters. The Exchange also provided the Commission, on a periodic basis, interim reports of volume and open interest.

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<sup>15</sup> See Securities Exchange Act Release Nos. 70087 (July 31, 2013), 78 FR 47809 (August 6, 2013) (SR-CBOE-2013-055); and 91067 (February 5, 2021) 86 FR 9108 (February 11, 2021) (SR-CBOE-2020-116).

<sup>16</sup> See supra note 3.

Also, during the course of the FLEX PM Third Friday Pilot Program, the Exchange provided the Commission with any additional data or analyses the Commission requested if it deemed such data or analyses necessary to determine whether the Pilot Program was consistent with the Exchange Act. The Exchange has made public on its website all data and analyses previously submitted to the Commission under the FLEX PM Third Friday,<sup>17</sup> and will continue to make public any data and analyses it submits to the Commission while the FLEX PM Third Friday is still in effect.

The Exchange has concluded that the FLEX PM Third Friday does not negatively impact market quality or raise any unique or prohibitive regulatory concerns. The Exchange has not identified any evidence from the pilot data indicating that the trading of P.M.-settled FLEX options has any adverse impact on fair and orderly markets on Expiration Fridays for broad-based indexes or the underlying securities comprising those indexes, nor have there been any observations of abnormal market movements attributable to P.M.-settled FLEX options from any market participants that have come to the attention of the Exchange.

Based on a study conducted by the Commission's Division of Economic and Risk Analysis ("DERA") staff on the pilot data from 2006 through 2018,<sup>18</sup> and the Exchange's review of the pilot data from 2019 through 2021, the size of the market for P.M.-settled SPX

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<sup>17</sup> Available at <https://www.cboe.com/aboutcboe/legal-regulatory/national-market-system-plans/pm-settlement-spxpm-data>.

<sup>18</sup> See DERA Staff PM Pilot Memo, at 13 ("Option settlement quantity data for A.M.- and P.M.-settled options were obtained from the Cboe, including the number of contracts that settled in-the-money for each exchange-traded option series on the S&P 500 index...on expiration days from January 20, 2006 through December 31, 2018. Daily open interest and volume data for [SPX] option series were also obtained from Cboe, including open interest data from January 3, 2006 through December 31, 2018 and trading volume data from January 3, 2006 through December 31, 2018.")

options (including quarterly, weekly, EOM and third Friday expirations) since 2007 has grown from a trivial portion of the overall market to a substantial share (from around 0.1% of open interest in 2007 to 30% in 2021).<sup>19</sup> Notional value of open interest in P.M.-settled SPX options increased from approximately a median of \$1.5 billion in 2007 to \$1.9 trillion in 2021, approximately 1260 times its value in 2007. Notional open interest in A.M.-settled SPX options was already hovering around a median of \$1.4 trillion in 2007, and it has since increased to approximately \$4.4 trillion in 2021. It is also important to note that open interest on expiring P.M.-settled SPX options, as compared to A.M.-settled options, is spread out across a greater number of expiration dates, which results in a smaller percentage of open interest expiring on any one date, thus mitigating concerns that SPXPM option expiration may have a disruptive effect on the market.<sup>20</sup> Daily trading volume in P.M.-settled SPX options has increased from a median of about 700 contracts in 2007 to nearly 1.9 million contracts in 2021,<sup>21</sup> and now exceeds trading volume in A.M.-settled SPX options.

Moreover, the DERA staff study of the P.M.-settled SPX options pilot data (2006 through 2018) did not identify any significant economic impact on S&P 500 futures,<sup>22</sup> the

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<sup>19</sup> The DERA staff study reviewed and provided statistics for market share, median notional value of open interest and median volume in 2007 and in 2018. The Exchange provides updated statistics for market share, median notional value of open interest and median volume in 2021, replacing the 2018 statistics provided in the Commission staff study.

<sup>20</sup> See DERA Staff PM Pilot Memo, at 2.

<sup>21</sup> The Exchange notes that the DERA staff study used two-sided volume data for the median volume in 2007 and in 2018; therefore, the Exchange provides two-sided volume data for the median volume in 2021.

<sup>22</sup> Futures on the S&P 500 experience high volume and liquidity both before and after the close of the underlying market. Therefore, futures are a useful measure of abnormal volatility surrounding the close and the open. See DERA Staff PM Pilot Memo, at 14. The Exchange agrees with this approach.

S&P 500, or the underlying component securities of the S&P 500 surrounding the close. For purposes of the study, volatility was by and large measured by using the standard deviation<sup>23</sup> of one-minute returns of S&P 500 futures values and the index value during regular hours on each day reviewed (excluding the first and last 15 minutes of trading) and then compared with the standard deviation of one-minute returns (for S&P 500 futures, the S&P 500, and the underlying component securities of the S&P 500) over the last 15 minutes of a trading day.<sup>24</sup> Using this as a general measure,<sup>25</sup> the DERA staff study then reviewed whether, and to what extent, the settlement quantity of SPXPM options and the levels of open interest in SPXPM options on expiration days (as compared to non-expiration days) may be associated with general price volatility and price reversals for S&P 500 futures, the S&P 500, and the underlying component securities of the S&P 500 near the close. From its review of the study, the Exchange agrees that, although volatility before the market close is generally higher than during the rest of the trading day, there is no evidence of any significant adverse economic impact to the futures, index, or underlying index component securities markets as a result of

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<sup>23</sup> Standard deviation applied to a rate of return (in this case, one-minute) of an instrument can indicate that instrument's historical volatility. The greater the standard deviation, the greater the variance between price and the mean, which indicates a larger price range, i.e., higher volatility.

<sup>24</sup> For example, if on a particular day the standard deviation of one-minute returns between 3:45 p.m. ET and 4:00 p.m. ET is 0.004 and the standard deviation of returns from 9:45 a.m. ET to 3:45 p.m. ET is 0.002, this metric would take on a value of 2 for that day, indicating that volatility during the last 15 minutes of the trading day was twice as high as it was during the rest of the trading day. See DERA Staff PM Pilot Memo, at 15; see also DERA Staff PM Pilot Memo, at Section V, which discusses in detail the metrics used to measure, for the purposes of the study, the extent to which the market may experience abnormal volatility surrounding SPXPM option settlement.

<sup>25</sup> See DERA Staff PM Pilot Memo, at Section V, which discusses in detail the metrics used to measure, for the purposes of the study, the extent to which the market may experience abnormal volatility surrounding SPXPM option settlement.

the quantity of P.M.-settled SPX options that settle at the close or the amount of expiring open interest in P.M.-settled SPX options. For example, the largest settlement event that occurred during the time period of the study (a settlement of \$100.4 billion of notional on December 29, 2017) had an estimated impact on the futures price of only approximately 0.02% (a predicted impact of \$0.54 relative to a closing futures price of \$2,677).

In particular, the DERA staff study found that an additional P.M.-settled SPX options settlement quantity equal to \$10 billion in notional value is associated with a marginal impact on futures prices during the last 15 minutes of the trading day of only about \$0.06 (where the hypothetical index level is 2,500), additional expiring open interest in P.M.-settled SPX options equal to \$10 billion in notional value is associated with a marginal impact on futures prices during the last 15 minutes of the trading day of only about \$0.05 (assumed index level is 2,500). Also, an additional increase in settlement quantity or in expiring open interest, each equal to \$20 million in notional value, did not result in any meaningful futures price reversals near the close (neither was found to cause a price reversal of over one standard deviation<sup>26</sup>).

Likewise, the study identified that an additional total P.M.-settled SPX options settlement quantity equal to \$10 billion in notional value corresponds to price movement in the S&P 500 of only about \$0.08 (assuming an index level of 2,500) during the last 15 minutes of the trading day, and that additional expiring open interest equal to \$10 billion in notional value corresponds to a price movement in the S&P 500 of only about \$0.06 (assuming an index level of 2,500) during the last 15 minutes of the trading day. The study also identified that it would take an increase of \$34 billion in notional value of total settlement quantity and of expiring open interest for one additional S&P 500 price reversal of greater than two

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<sup>26</sup> See supra note 22.

standard deviations to occur in the last 15 minutes before the market close. Also, regarding potential impact to S&P 500 component securities, it would take an increase in total P.M.-settled SPX options settlement quantity equal to \$20 billion to effect a price movement of only approximately \$0.03 for a \$200 stock, an increase in expiring open interest in P.M.-settled SPX options equal to \$10 billion to effect a price movement less than half a standard deviation, and an increase in total P.M.-settled SPX settlement quantity equal to \$7 billion to achieve a price reversal greater two standard deviations.

The study employed the same metrics to determine whether there is greater price volatility for S&P 500 futures, the S&P 500, and the component securities of the S&P 500 related to SPXPM option settlements during an environment of high market volatility (i.e., on days in which the VIX Index was in the top 10% of closing index values) and did not identify indicators of any significant economic impact on these markets near the close as a result of the P.M.-settled SPX options settlement.<sup>27</sup> In addition to this, the DERA staff study, applying the same metrics and analysis as for P.M.-settled SPX options to A.M.-settled SPX options, did not identify any evidence of a statistically significant relationship between settlement quantity or expiring open interest of A.M.-settled options and volatility near the open.

Upon review of the results of the DERA staff study, the Exchange agrees that each of the above-described marginal price movements in S&P 500 futures, the S&P 500, and the S&P 500 component securities affected by increases in P.M.-settled SPX options settlement quantity and expiring open interest appear to be de minimis pricing changes from those that occur over regular trading hours (outside of the last 15 minutes of the trading day). Further,

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<sup>27</sup> The Exchange also notes that the study did not identify any evidence that less liquid S&P 500 constituent securities experienced any greater impact from the settlement of P.M.-settled SPX options.

the Exchange has not observed any significant economic impact or other adverse effects on the market from similar reviews of its pilot reports and data submitted after 2018.<sup>28</sup> In its review of a sample of the pilot data from 2019 through 2021, the Exchange similarly measured volatility over the final fifteen minutes of each trading day by taking the standard deviation of rolling one-minute returns of the S&P 500 level (excluding the first and last fifteen minutes of trading) and comparing such with the standard deviation of one-minute returns<sup>29</sup> of the S&P 500 level, over the last 15 minutes of a trading day. The Exchange identified an average standard deviation ratio of 1.42 for the S&P 500 on non-expiration days and an average standard deviation ratio of 1.54 for the S&P 500 on expiration days (a ratio between expiration days and non-expiration days of 1.09). The Exchange also notes that, using the same methodology, it observed that, from 2015 through 2019,<sup>30</sup> the average standard deviation ratio for the S&P 500 on non-expiration days was 1.11 and the average standard deviation ratio for the S&P 500 on expiration days was 1.22 (a ratio between expiration days and non-expiration days of 1.10). While the average standard deviation ratio on both expiration and non-expiration days was higher in 2019 through 2021 due to overall market volatility, the ratios between the standard deviation ratios on expiration days and non-expirations days remained nearly identical between the 2015 through 2019 timeframe and the 2019 through 2021. This shows that, in cases where overall market volatility may increase, the normalized impact on expiration days to non-expiration days generally remains consistent.

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<sup>28</sup> Total SPX open interest volumes were examined for expiration dates over a roughly two-year period between October 2019 and November 2021.

<sup>29</sup> Calculated at every tick for the prior minute.

<sup>30</sup> November 2015 through November 2021.

In addition to this, the Exchange notes that the S&P 500 is rebalanced quarterly. The changes resulting from each rebalancing coincide with the third-Friday of the quarterly rebalancing month (i.e., March, June, September, October and December)<sup>31</sup> and generally drive an increase in trading activity from investors that seek to track the S&P 500. As such, the Exchange measured volatility on quarterly rebalancing dates and found that the average standard deviation ratio was 1.62, which suggests more closing volatility on quarterly rebalance dates compared to non-quarterly expiration dates (for which the average standard deviation ratio was 1.22), thus indicating that the impact rebalancing may have on the S&P 500 is greater than any impact that P.M.-settled SPX options may have on the S&P 500.

The Exchange additionally focused its study of the post-2018 sample pilot data on reviewing for potential correlation between excess market volatility and price reversals and the hedging activity of liquidity providers. As explained in the DERA staff study, potential impact of P.M.-settled SPX options on the correlated equity markets is thought to stem from the hedging activity of liquidity providers in such options.<sup>32</sup> To determine any such potential correlation, the Exchange studied the expected action of liquidity providers that are the primary source of the hedging on settlement days. These liquidity providers generally delta-hedge their S&P 500 index exposure via S&P 500 futures and on settlement day unwind their futures positions that correspond with the delta of their in-the-money (ITM) expiring P.M.-settled SPX options. Assuming such behavior, the Exchange estimated the Market-On-Close

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<sup>31</sup> See S&P Dow Jones Indices, Equity Indices Policies & Practices, Methodology (August 2021), at 15, available at <https://www.spglobal.com/spdji/en/documents/methodologies/methodology-sp-equity-indices-policies-practices.pdf>.

<sup>32</sup> See DERA Staff PM Pilot Memo, at 10-12.

(“MOC”)<sup>33</sup> volume for the shares of the S&P 500 component securities (i.e., “MOC share volume”) that could ultimately result from the unwinding of the liquidity providers’ futures positions by equating the notional value of the futures positions that correspond to expiring ITM open interest to the number S&P 500 component security contracts (based on the weight of each S&P 500 component security). That is, the Exchange calculated (an estimate) of the amount of MOC volume in the S&P 500 component markets attributable hedging activity as a result of expiring ITM P.M.-settled SPX options (i.e., “hedging MOC”). The Exchange then: (1) compared the hedging MOC share volume to all MOC share volume on expiration days and non-expiration trading days; and (2) compared the notional value of the hedging futures positions (i.e., that correspond to expiring ITM P.M.-settled SPX options open interest) to the notional value of expiring ITM P.M.-settled SPX options open interest, the notional value of all expiring P.M.-settled SPX options open interest and the notional value of all P.M.-settled SPX options open interest.

The Exchange observed that, on average, there were approximately 25% more MOC shares executed on expiration days (332 expiration days) than non-expiration days (209 non-expiration days). While, at first glance, the volume of MOC shares executed on expiration days seems much greater than the volume executed on non-expiration days, the Exchange notes that much of this difference is attributable to just eight expiration days — the quarterly index rebalancing dates captured within the scope of the post-2018 sample pilot data. The average MOC share volume on the eight quarterly rebalancing dates was approximately 4.8 times the average MOC share volume on the non-quarterly rebalancing expiration dates;

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<sup>33</sup> MOC orders allow a market participant to trade at the closing price. Market participants generally utilize MOC orders to ensure they exit positions at the end of the trading day.

again, indicating that the impact rebalancing may have on the S&P 500 Index is greater than any impact that P.M.-settled SPX options may have on the S&P 500 Index. That is, the Exchange observed that the majority of closing volume on quarterly rebalance dates is driven by rebalancing of shares in the S&P 500, and not by P.M.-settled SPX options expiration-related hedging activity. Notwithstanding the MOC share volume on quarterly rebalancing dates, the volume of MOC shares executed on expiration days (324 expiration days) was only approximately 13% more than that on non-expiration days, substantially less than the increase in volume over non-expiration days wherein the eight index rebalancing dates are included in expiration day volume. In addition to this, the Exchange observed that the hedging MOC share volume (i.e., the expected MOC share volume resulting from hedging activity in connection with expiring ITM P.M.-settled SPX options) was, on average, less than the MOC share volume on non-expiration days, and was only approximately 20% of the total MOC share volume on expiration days, indicating that other sources of MOC share volume generally exceed the volume resulting from hedging activity of expiring ITM P.M.-settled SPX options and would more likely be a source of any potential market volatility.

The Exchange also observed that, across all third-Friday expirations, the notional value of the hedging futures positions was approximately 25% of the notional value of expiring ITM P.M.-settled SPX options, approximately 3.8% of the notional value of all expiring P.M.-settled SPX options, and approximately only 0.5% of the notional value of all P.M.-settled SPX options. As such, the estimated hedging activity from liquidity providers on expiration days is a fraction of the expiring open interest in P.M.-settled SPX options, which, the Exchange notes, is only 14% of the total open interest in P.M.-settled SPX options;

thus, indicating negligible capacity for hedging activity to increase volatility in the underlying markets.

While unrelated to the initial concerns of P.M.-settlement as described above, at the request of the Commission, the Exchange recently completed an analysis intended to evaluate whether the introduction of P.M.-settled options impacted the quality of the A.M.-settled option market. Specifically, the Exchange compared values of key market quality indicators (specifically, the bid-ask spread<sup>34</sup> and effective spread<sup>35</sup>) in SPXW options both before and after the introduction of Tuesday expirations and Thursday expirations for SPXW options on April 18 and May 11, 2022, respectively.<sup>36</sup> Options on the Standard & Poor's Depository Receipts S&P 500 ETF ("SPY") were used as a control group to account for any market factors that might influence key market quality indicators. The Exchange used data from January 3, 2022 through March 4, 2022 (the two-month period prior to the introduction of SPXW options with Tuesday expirations) and data from May 11, 2022 to July 10, 2022 (the two-month period following the introduction of SPXW options with Thursday expirations).<sup>37</sup>

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<sup>34</sup> The Exchange calculated for each of SPXW options (with Monday, Wednesday, and Friday expirations) and SPY Weekly options (with Monday, Wednesday, and Friday expirations) the daily time-weighted bid-ask spread on the Exchange during its regular trading hours session, adjusted for the difference in size between SPXW options and SPY options (SPXW options are approximately ten times the value of SPY options).

<sup>35</sup> The Exchange calculated the volume-weighted average daily effective spread for simple trades for each of SPXW options (with Monday, Wednesday, and Friday expirations) and SPY Weekly options (with Monday, Wednesday, and Friday expirations) as twice the amount of the absolute value of the difference between an order execution price and the midpoint of the national best bid and offer at the time of execution, adjusted for the difference in size between SPXW options and SPY options.

<sup>36</sup> For purposes of comparison, the Exchange paired SPXW options and SPY options with the same moneyness and same days to expiration.

<sup>37</sup> The Exchange observed comparable market volatility levels during the pre-

Given the time that has passed since the introduction of FLEX P.M.-settled options, the Exchange is unable to analyze whether the introduction of those options significantly impacted the market quality of FLEX P.M.-settled options. Additionally, the Exchange is unable to analyze whether the introduction of the FLEX P.M.-settled options significantly impacted the market quality of A.M.-settled FLEX options, as there is no book for FLEX options, as FLEX options are listed only if and when market participants create them for trading. However, the Exchange believes analyzing whether the introduction of new SPXW P.M.-settled expirations (i.e., SPXW options with Tuesday and Thursday expirations) impacted the market quality of then-existing SPXW P.M.-settled expirations (i.e., SPXW options with Monday, Wednesday, and Friday expirations) provides a reasonable substitute to evaluate whether the introduction of P.M.-settled index options impacted the market quality of the underlying cash markets when the pilot began. The full analysis is included in Exhibit 3 of this rule filing.

As a result of this analysis, the Exchange believes the introduction of SPX options with Tuesday and Thursday options had no significant impact on the market quality of SPXW options with Monday, Wednesday, and Friday expirations. With respect to the majority of series analyzed, the Exchange observed no statistically significant difference in the bid-ask spread or the effective spread of the series in the period prior to introduction of the Tuesday and Thursday expirations and the period following the introduction of the Tuesday and Thursday expirations. While statistically insignificant, the Exchange notes that in many series, particularly as they were closer to expiration, the Exchange observed that the values of

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intervention and post-intervention time ranges.

these spreads decreased during the period following the introduction of the Tuesday and Thursday expirations.<sup>38</sup>

To further note, given the significant changes in the closing procedures of the primary markets in recent decades, including considerable advances in trading systems and technology, the Exchange believes that the risks of any potential impact of P.M.-, cash-settled FLEX options on the underlying cash markets are also de minimis.

The Exchange proposes to make the FLEX PM Third Friday Program permanent as P.M.-settled index products have become an integral part of the Exchange's product offerings, providing investors with greater trading opportunities and flexibility. As indicated by the significant growth in the size of the market for P.M.-settled options, such options have been, and continue to be, well-received and widely used by market participants. Therefore, the Exchange wishes to be able to continue to provide investors with the ability to trade FLEX PM options on a permanent basis. The Exchange believes that the permanent continuation of the FLEX PM Third Friday Pilot Program will serve to maintain the status quo by continuing to offer a product to which investors have become accustomed and have incorporated into their business models and day-to-day trading methodologies for nearly ten years. As such, the Exchange also believes that ceasing to offer FLEX PM options may result in significant market disruption and investor confusion. The Exchange has not identified any significant impact on market quality nor any unique or prohibitive regulatory concerns as a result of the FLEX PM Third Friday Pilot Program, and, as such, the Exchange believes that the continuation of the FLEX PM Third Friday

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<sup>38</sup> In any series in which the Exchange observed an increase in the market quality indicators, the Exchange notes any such increase was also statistically insignificant.

Pilot Program as a pilot, including the use of time and resources to compile and analyze quarterly and annual pilot reports and pilot data, is no longer necessary and that making the FLEX PM Third Friday Pilot Program permanent will allow the Exchange to otherwise allocate time and resources to other industry initiatives.

## 2. Statutory Basis

The Exchange believes the proposed rule change is consistent with the Securities Exchange Act of 1934 (the “Act”) and the rules and regulations thereunder applicable to the Exchange and, in particular, the requirements of Section 6(b) of the Act.<sup>39</sup> Specifically, the Exchange believes the proposed rule change is consistent with the Section 6(b)(5)<sup>40</sup> requirements that the rules of an exchange be designed to prevent fraudulent and manipulative acts and practices, to promote just and equitable principles of trade, to foster cooperation and coordination with persons engaged in regulating, clearing, settling, processing information with respect to, and facilitating transactions in securities, 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.

In particular, the Exchange believes that the making the FLEX PM Third Friday Pilot Program permanent will allow the Exchange to be able to continue to offer FLEX PM options on a continuous and permanent basis. These products have been, and continue to be, well-received and widely used by market participants, providing investors with greater trading opportunities and flexibility. The Exchange believes that the permanent continuation of the FLEX PM Third Friday Pilot Program will remove impediments to and perfect the mechanism

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<sup>39</sup> 15 U.S.C. 78f(b).

<sup>40</sup> 15 U.S.C. 78f(b)(5).

of a free and open market and a national market system, and, in general, protect investors and the public interest by continuing to offer a product to which investors have become accustomed and have incorporated into their business models and day-to-day trading strategies for approximately 13 years. The Exchange believes ceasing to offer the FLEX PM Third Friday Pilot Program may result in significant market disruption and investor confusion, as P.M.-settled index products, particularly SPX options, have become an integral part of the Exchange's product offerings, providing investors with greater trading opportunities and flexibility.

The Exchange further believes that making the FLEX PM Third Friday Pilot Program permanent will remove impediments to and perfect the mechanism of a free and open market and a national market system and protect investors, while maintaining a fair and orderly market, as the Exchange believes that previous concerns (arising in the 1980s) regarding options expirations potentially contributing to excess volatility and reversals around the close have been adequately diminished. As described in detail above, the Exchange has observed no significant adverse market impact or identified any meaningful regulatory concerns during the approximately 13-year operation of the FLEX PM Third Friday Program as a pilot nor during the 15 years since P.M.-settled index options (SPX) were reintroduced to the marketplace.<sup>41</sup> Notably, the Exchange did not identify any significant economic impact (including on pricing or volatility or in connection with reversals) on related futures, the underlying indexes, or the underlying component securities of the underlying indexes surrounding the close as a result of the quantity of P.M.-settled FLEX options that settle at the close or the amount of expiring open interest in P.M.-settled FLEX options, nor any

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<sup>41</sup> See supra notes 18-31.

demonstrated capacity for options hedging activity to impact volatility in the underlying markets. While the DERA staff study and corresponding Exchange study described above specifically evaluated SPX options, P.M.-settled FLEX options overlay broad-based indexes (including the S&P 500), the Exchange believes it is appropriate to extrapolate the data to apply the FLEX PM options. This is particularly true given that the reports submitted by the Exchange during the pilot period have similarly demonstrated no significant economic impact on the respective underlying indexes or other products.

The Exchange also believes the introduction of FLEX PM options had no significant impact on the market quality of corresponding A.M.-settled options or other options. The Exchange believes this as a result of its analysis conducted after the introduction of SPXW options with Tuesday and Thursday expirations, which demonstrated no statistically significant impact on the bid-ask or effective spreads of SPXW options with Monday, Wednesday, and Friday expirations after trading in the SPXW options with Tuesday and Thursday expirations began. FLEX options are nearly identical to non-FLEX options and overlay the same indexes. Therefore, the Exchange believes analyzing the impact of new SPXW options on then-existing SPXW options permit the Exchange to extrapolate from this data that it is unlikely the introduction of P.M.-settled FLEX options significantly impacted the market quality of A.M.-settled options when the pilot began.

Additionally, the significant changes in the closing procedures of the primary markets in recent decades, including considerable advances in trading systems and technology, has significantly minimized risks of any potential impact of P.M.-, cash-settled FLEX options on the underlying cash markets. As such, the Exchange believes that a permanent FLEX PM Third Friday Pilot Program does not raise any unique or prohibitive

regulatory concerns and that such trading has not, and will not, adversely impact fair and orderly markets on Expiration Fridays for the underlying indexes or their component securities. Further, as the Exchange has not identified any significant impact on market quality or any unique or prohibitive regulatory concerns as a result of offering FLEX PM options, the Exchange believes that the continuation of the FLEX PM Third Friday Pilot Program as a pilot, including the gathering, submission and review of the pilot reports and data, is no longer necessary and that making the FLEX PM Third Friday Pilot Program permanent will allow the Exchange to otherwise allocate time and resources to other industry initiatives.

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

Cboe Options does not believe that the proposed rule change will impose any burden on competition that is not necessary or appropriate in furtherance of the purposes of the Act. The Exchange does not believe that making the FLEX PM Third Friday Pilot Program permanent will impose any unnecessary or inappropriate burden on intramarket competition because FLEX PM options will continue to be available to all market participants who wish to participate in the FLEX PM options market. The Exchange believes that the growth that the P.M.-settled options market, including FLEX PM options, has experienced since their reintroduction through pilot programs indicates strong, continued investor interest and demand, warranting a permanent FLEX PM Third Friday Pilot Program. The Exchange believes that, for the period that P.M.-settled FLEX options have been in operation as pilot programs, they have provided investors with a desirable product with which to trade and wishes to permanently offer this product to investors. Furthermore, during the pilot period, the Exchange has not observed any significant adverse market effects nor identified any regulatory concerns as a result of the FLEX PM

Third Friday Pilot Program, and, as such, the continuation of the FLEX PM Third Friday Pilot Program as a pilot, including the gathering, submission and review of the pilot reports and data, is no longer necessary — a permanent FLEX PM Third Friday Pilot Program will allow the Exchange to otherwise allocate time and resources to other industry initiatives.

The Exchange further does not believe that making the FLEX PM Third Friday Pilot Program permanent will impose any burden on intermarket competition that is not necessary or appropriate in furtherance of the purposes of the Act because it applies to a class of options listed only for trading on Cboe Options. The Exchange notes that other exchanges are free to and do offer competing products. To the extent that the permanent offering and continued trading of FLEX PM options may make Cboe Options a more attractive marketplace to market participants at other exchanges, such market participants may elect to become Cboe Options market participants.

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

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

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

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

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

#### **IV. Solicitation of Comments**

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

##### Electronic comments:

- Use the Commission's Internet comment form (<http://www.sec.gov/rules/sro.shtml>); or
- Send an e-mail to [rule-comments@sec.gov](mailto:rule-comments@sec.gov). Please include File Number SR-CBOE-2023-018 on the subject line.

##### Paper comments:

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

All submissions should refer to File Number SR-CBOE-2023-018. This file number should be included on the subject line if e-mail is used. To help the Commission process and review your comments more efficiently, please use only one method. The Commission will post all comments on the Commission's Internet website (<http://www.sec.gov/rules/sro.shtml>). Copies of the submission, all subsequent amendments, all written statements with respect to the proposed rule change that are filed with the Commission, and all written communications relating to the proposed rule change between the Commission and any person, other than those that may be withheld from the public in accordance with the provisions of 5 U.S.C. 552, will be available for website viewing and printing in the Commission's Public Reference Room, 100 F Street, NE, Washington, D.C. 20549 on official business days between the hours of 10:00 a.m. and

3:00 p.m. Copies of the filing also will be available for inspection and copying at the principal office of the Exchange. All comments received will be posted without change; the Commission does not edit personal identifying information from submissions. You should submit only information that you wish to make available publicly. All submissions should refer to File Number SR-CBOE-2023-018 and should be submitted on or before [insert date 21 days from publication in the Federal Register].

For the Commission, by the Division of Trading and Markets, pursuant to delegated authority.<sup>42</sup>

Secretary

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<sup>42</sup> 17 CFR 200.30-3(a)(12).

### EXHIBIT 3

## ANALYSIS OF MARKET QUALITY IMPACT OF P.M.-SETTLED INDEX OPTIONS

### I. Background & Research Questions

The analysis aims to evaluate the impact on market quality in connection with Cboe Exchange, Inc.'s (the "Exchange" or "Cboe Options") and certain of its affiliates' listing of P.M.-settled broad-based index options.

### II. Methodology

The study followed the 'difference-in-difference' approach ("DnD") to compare the values of key market quality indicators before-and-after the introduction of Tuesday expirations and Thursday expirations for SPX Weekly ("SPXW") options, which were launched on April 18, 2022 and May 11, 2022 respectively. DnD is a commonly used quasi-experimental technique to estimate causal inference from a nonequivalence control group. It first involves identifying a 'treatment group' and a group of non-treated subjects as 'control group'. In this case, the existing product of SPX Weekly options with Monday/Wednesday/Friday ("M/W/F") expirations was the treatment group and SPY options with Monday/Wednesday/Friday expirations was the control group. Although the Exchange considered using the E-mini Weekly options as a control group as they are more similarly situated to SPXW options, CME also began listing Tuesday and Thursday expirations, therefore the Exchange does not believe that E-mini Weekly options can be used as a control group for this study. The Exchange notes that the use of SPY options presents certain limitations as a result of systematic differences between SPXW options and SPY options. For example: SPY options pay a dividend every quarter whereas SPX options do not; the minimum tick size requirements differ; and SPY options are American-style and physically settled, whereas SPXW options are European-style and cash-settled.

The study calculated the difference in market quality indicators before and after the ‘treatment’ (the introduction of SPXW Tuesday/Thursday expirations in this case) on each group. The impact could therefore be assessed by comparing the pre/post changes in the SPXW M/W/F expirations series with those from the SPY M/W/F expirations series. In addition, the parallel trend assumption should be met to ensure the internal validity of DnD model, which requires the difference between the treatment and control group to be constant over time before the intervention.

In addition, the Exchange does not believe that SPX AM options can be used as a treatment group with the SPY options as the control group. First, one of the essences of the DnD framework is to pair the treatment group with the comparable control group. Since there’s only one set of series available for SPY to match with SPX, including SPX in the model will introduce double-counting SPY. Second, SPY might not be a good comparison to SPX given their different settlement schedules. For the contract expiring on the same day, SPY options always have a longer day to expiration than SPX options. The Exchange also conducted a correlation test comparing SPX AM vs SPY, from which a weaker correlation in the key market quality indicators was observed. Therefore, adding SPX AM options to the analysis is not recommended due to the intrinsic differences between the products.

### **Key Market Quality Indicator of Interest**

The Bid-Ask Spread (“Spread”) was used as one of the key indicators of market quality in the analysis. Specifically, daily time-weighted Spread on the Exchange during Regular Trading Hours (“RTH”) was calculated for SPXW M/W/F series, and daily time-weighted Spread of the NBBO will be calculated for SPY M/W/F series. Since an SPX option is about 10

times the value of an SPY option, the Spread of SPY options was adjusted by x10 to scale it with the Spread of SPXW options.

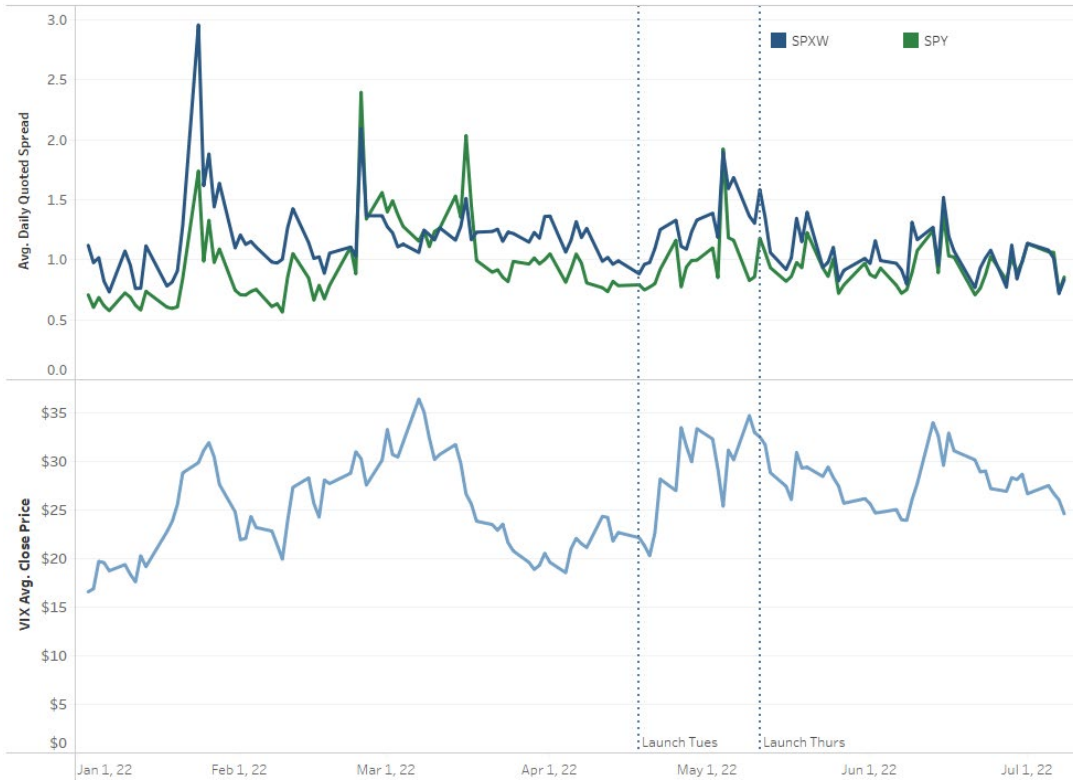
The Effective Spread for simple trades was used as another indicator of market quality, where the Effective Spread measures the twice of the amount for the absolute value of an order execution to the midpoint of the national best bid and national best offer at the time of execution. The volume-weight average daily Effective Spread for the order executions on the Cboe Exchanges was calculated for both SPXW M/W/F series and SPY M/W/F series. The Effective Spread of SPY options was adjusted by x10 to scale it with the Effective Spread of SPXW options for the same reason mentioned above. Below shows the formula for Effective Spread:

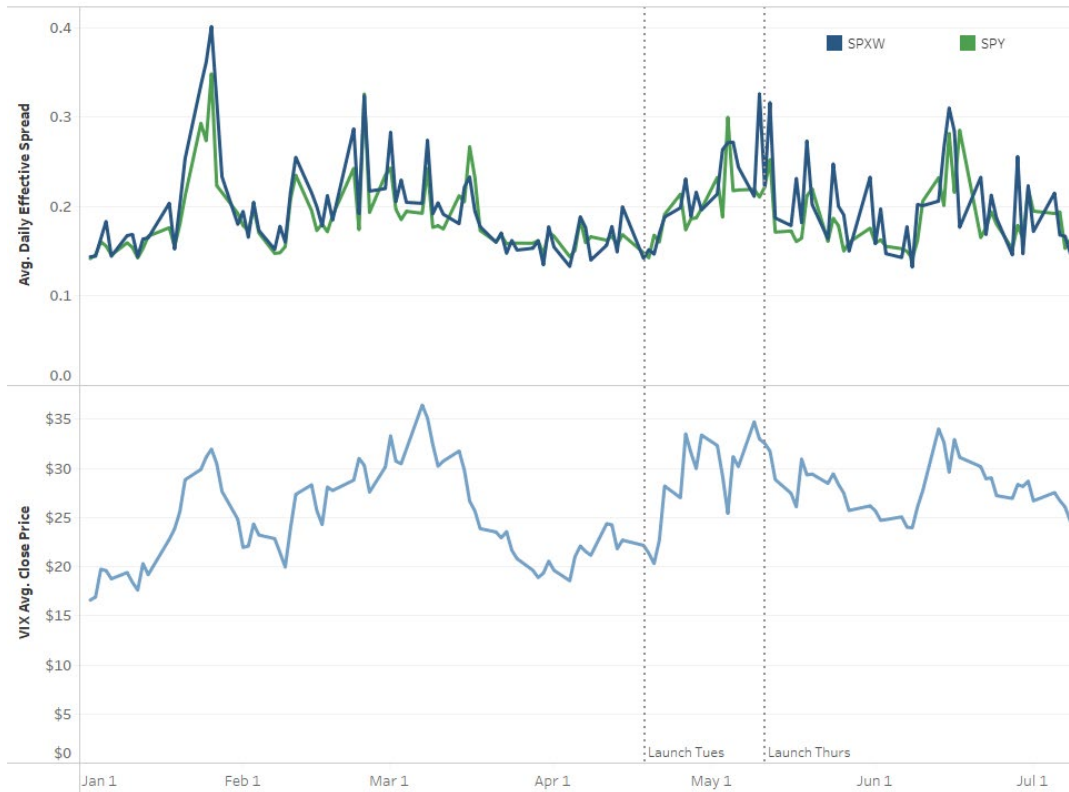
$$\text{Effective Spread} = \text{Abs} \left( \text{Order Execution Price} - \frac{(\text{National Best Bid} + \text{National Best Offer})}{2} \right) \times 2$$

### **Time Range**

Data was compared between the pre-intervention period and the post-intervention period. The post-intervention data was collected for the time range from May 11, 2022 to July 10, 2022 (two calendar months following the introduction of Thursdays expirations), and the pre-intervention time range from January 3, 2022 to March 4, 2022 (two calendar months). The Exchange believes the selection of pre-intervention time range has similar market conditions to the post-intervention period that the two time periods share comparable market volatility levels

**Table 1: SPXW & SPY Quoted Spread Trend**



**Table 2: SPXW & SPY Effective Spread Trend**

Note: Tables 1 and 2 only show paired SPXW & SPY series with the strike price +/- 3% to the spot price and DTE within 27 days.

### Grouping of Samples

In order to make fair comparisons between the symbols possessing similar characteristics, the analysis matched each SPXW and SPY pair by the same moneyness and days to expirations (“DTE”) group. For example, an in-the-money SPXW call option that expired on April 28, 2022 was compared to the matching SPY call option expiring on the same Expiration Day with the same (notionally adjusted) strike price as the SPXW option; the series of contracts having similar moneyness to the end of day index level of the underlying and the DTE of the trading day will be grouped together. Fixing moneyness and DTE ensures the pairs in each trade day have similar characteristics. The analysis included all SPXW and SPY paired contracts with the strike price

+/- 3% to the spot price and DTE within 27 days. Tables 3 through 6 provide the summary information of the matched pair data by DTE and moneyness group before and after the intervention.

**Table 3: SPXW & SPY Series Quoted Spread Summary Stats (All ITM contracts)**

Dte (group)	Trade Dat..	ITM 1-3%				ITM 0-1%			
		Avg. Daily Bid-Ask Spread		Number of Paired Symbols		Avg. Daily Bid-Ask Spread		Number of Paired Symbols	
		SPXW	SPY	SPXW	SPY	SPXW	SPY	SPXW	SPY
0-3	Pre	1.904	1.152	1,209	1,209	0.798	0.480	559	559
	Post	1.804	0.940	1,280	1,280	0.641	0.450	617	617
4-7	Pre	2.421	0.743	1,073	1,073	0.753	0.361	528	528
	Post	1.894	0.772	1,123	1,123	0.536	0.363	559	559
8-11	Pre	1.802	0.769	1,056	1,056	0.638	0.428	516	516
	Post	1.411	0.885	1,096	1,096	0.510	0.425	550	550
12-15	Pre	1.564	0.751	1,141	1,141	0.670	0.453	560	560
	Post	1.204	0.919	1,143	1,143	0.535	0.454	606	606
16-19	Pre	1.376	0.725	1,018	1,018	0.674	0.460	505	505
	Post	0.968	1.018	974	974	0.533	0.438	512	512
20-23	Pre	1.412	0.896	1,145	1,145	0.753	0.535	575	575
	Post	0.890	1.150	1,172	1,172	0.577	0.504	620	620
24-27	Pre	1.659	1.185	873	873	0.868	0.672	454	454
	Post	0.875	1.242	955	955	0.660	0.623	526	526

Note: Showing normalized SPY quoted spread (multiplied by 10)

**Table 4: SPXW & SPY Series Quoted Spread Summary Stats (All OTM contracts)**

Dte (group)	Trade Dat..	OTM 0-1%				OTM 1-3%			
		Avg. Daily Bid-Ask Spread		Number of Paired Symbols		Avg. Daily Bid-Ask Spread		Number of Paired Symbols	
		SPXW	SPY	SPXW	SPY	SPXW	SPY	SPXW	SPY
0-3	Pre	0.325	0.168	525	525	0.190	0.111	1,020	1,020
	Post	0.209	0.131	578	578	0.122	0.101	968	968
4-7	Pre	0.461	0.215	522	522	0.338	0.150	1,067	1,067
	Post	0.320	0.153	557	557	0.209	0.111	1,112	1,112
8-11	Pre	0.479	0.303	518	518	0.392	0.225	1,053	1,053
	Post	0.352	0.199	550	550	0.265	0.129	1,094	1,094
12-15	Pre	0.537	0.349	560	560	0.451	0.274	1,141	1,141
	Post	0.393	0.244	606	606	0.319	0.157	1,143	1,143
16-19	Pre	0.558	0.373	505	505	0.464	0.298	1,018	1,018
	Post	0.409	0.260	512	512	0.340	0.171	974	974
20-23	Pre	0.610	0.423	575	575	0.506	0.345	1,144	1,144
	Post	0.457	0.305	620	620	0.388	0.205	1,172	1,172
24-27	Pre	0.704	0.531	454	454	0.582	0.430	874	874
	Post	0.530	0.400	526	526	0.439	0.271	955	955

Note: Showing normalized SPY quoted spread (multiplied by 10)

**Table 5: SPXW & SPY Series Effective Spread Summary Stats (All ITM contracts)**

Dte (group)	Trading Dt..	ITM 1-3%				ITM 0-1%			
		Avg. Daily Effective Spread		Number of Paired Symbols		Avg. Daily Effective Spread		Number of Paired Symbols	
		SPXW	SPY	SPXW	SPY	SPXW	SPY	SPXW	SPY
0-3	Pre	0.345	0.257	905	905	0.246	0.182	627	627
	Post	0.392	0.312	825	825	0.242	0.189	521	521
4-7	Pre	0.473	0.333	633	633	0.370	0.238	515	515
	Post	0.434	0.354	565	565	0.348	0.217	417	417
8-11	Pre	0.482	0.426	473	473	0.377	0.264	475	475
	Post	0.469	0.463	486	486	0.394	0.268	372	372
12-15	Pre	0.611	0.552	410	410	0.533	0.339	398	398
	Post	0.589	0.424	339	339	0.447	0.307	327	327
16-19	Pre	0.596	0.481	345	345	0.468	0.303	341	341
	Post	0.949	0.436	218	218	0.490	0.299	231	231
20-23	Pre	0.788	0.656	297	297	0.500	0.523	328	328
	Post	0.532	0.471	244	244	0.482	0.303	281	281
24-27	Pre	0.744	0.585	172	172	0.523	0.386	228	228
	Post	0.790	0.450	132	132	0.710	0.402	164	164

Note: Showing normalized SPY effective spread (multiplied by 10)

**Table 6: SPXW & SPY Series Effective Spread Summary Stats (All OTM contracts)**

Dte (group)	Trading Dt..	OTM 0-1%				OTM 1-3%			
		Avg. Daily Effective Spread		Number of Paired Symbols		Avg. Daily Effective Spread		Number of Paired Symbols	
		SPXW	SPY	SPXW	SPY	SPXW	SPY	SPXW	SPY
0-3	Pre	0.171	0.154	631	631	0.144	0.138	1,231	1,231
	Post	0.168	0.150	522	522	0.123	0.129	1,057	1,057
4-7	Pre	0.318	0.198	540	540	0.271	0.167	1,086	1,086
	Post	0.311	0.195	425	425	0.247	0.154	875	875
8-11	Pre	0.347	0.207	516	516	0.296	0.185	1,011	1,011
	Post	0.354	0.230	395	395	0.325	0.185	762	762
12-15	Pre	0.451	0.253	446	446	0.332	0.221	869	869
	Post	0.398	0.268	377	377	0.318	0.227	678	678
16-19	Pre	0.445	0.254	367	367	0.481	0.207	755	755
	Post	0.531	0.264	259	259	0.361	0.217	469	469
20-23	Pre	0.534	0.330	384	384	0.398	0.264	692	692
	Post	0.433	0.273	311	311	0.381	0.221	550	550
24-27	Pre	0.411	0.408	276	276	0.476	0.324	481	481
	Post	0.659	0.296	188	188	0.475	0.258	318	318

Note: Showing normalized SPY effective spread (multiplied by 10)

### The DnD Regression Model

A DnD regression model can be expressed as:

$$Y = \beta_0 + \beta_1 \text{ Intervention} + \beta_2 \text{ Time} + \beta_3 \text{ Intervention} \times \text{Time} + \varepsilon$$

This is a linear regression model.  $Y$  is the observed value of the targeting market quality indicator before and after treatment.  $\beta_0$  is the intercept of regression, which is the baseline average for the control group before treatment.

*Intervention* is a dummy variable (0 or 1) that refers to whether an observation is in the control group or treatment group. Its coefficient ( $\beta_1$ ) measures the differences between treatment and control group pre-intervention.

*Time* is a dummy variable (0 or 1) that specifies the time periods (pre or post treatment) for each observation. Its coefficient ( $\beta_2$ ) measures the time trend in control group.

*Intervention*  $\times$  *Time* is an interactive term that takes the multiplication of *Time* and *Intervention* variable for each observation in the regression model. Its coefficient ( $\beta_3$ ) will be the

difference in the changes for the treatment group over time due to the introduction of Tuesday/Thursday expirations of the market quality indicator of interest. For example, a positive and statistically significant coefficient for bid-ask spread will suggest a wider quoted spread, or a negative impact on market quality for SPXW options, and vice versa. Finally, the  $\varepsilon$  is the error term that represents the effects that the model was not able to capture.

### **III. Correlation Analysis**

The Exchange conducted two sets of correlation tests regarding bid-ask spread and effective spread between the paired SPXW and SPY series by their moneyness and DTE group during the pre-intervention period. A correlation test measures the strength and direction of association between the treatment and control group, and the values of correlation coefficient range between  $-1$  and  $+1$ . The relationship between the two variables is considered as a strong correlation when the coefficient equals or greater than  $0.75$ . Table 7 and Table 8 show the correlation coefficients for bid-ask spread and effective spread, respectively. For example, a coefficient of  $0.83$  in 0-3 DTE and ITM 1-3% call options group in bid-ask spread suggests a positive and strong correlation between the paired SPXW and SPY series in that group. In other words, these series tend to move in the same direction and in a similar fashion during the pre-intervention period.

In general, the Exchange observed strong positive correlations between the paired SPXW and SPY series in both market quality indicators during the pre-intervention period. Specifically, the correlations generally get stronger when the series have a shorter DTE and are closer to at-the-money. The results help support the parallel trend assumption under the DnD framework, that the treatment and control group move in similar trends before the intervention. Groups with

strong correlation (coefficient  $\geq 0.75$ ) will be selected to perform DnD regressions as those are the most comparable pairs for the DnD analysis.

**Table 7: Bid-Ask Spreads Correlation Results**

Moneyness/DTE		<b>0-3</b>	<b>4-7</b>	<b>8-11</b>	<b>12-15</b>	<b>16-19</b>	<b>20-23</b>	<b>24-27</b>
Call Options	<b>ITM 1-3%</b>	0.83	0.75	0.74	0.56	0.43	0.28	0.51
	<b>ITM 0-1%</b>	0.96	0.90	0.91	0.89	0.84	0.76	0.71
	<b>OTM 0-1%</b>	0.96	0.92	0.89	0.92	0.84	0.74	0.84
	<b>OTM 1-3%</b>	0.97	0.94	0.93	0.94	0.93	0.75	0.89
Put Options	<b>ITM 1-3%</b>	0.70	0.62	0.80	0.71	0.55	0.51	0.40
	<b>ITM 0-1%</b>	0.86	0.88	0.89	0.86	0.80	0.69	0.69
	<b>OTM 0-1%</b>	0.91	0.88	0.94	0.93	0.96	0.91	0.84
	<b>OTM 1-3%</b>	0.95	0.96	0.98	0.96	0.98	0.91	0.85

**Table 8: Effective Spreads Correlation Results**

Moneyness/DTE		<b>0-3</b>	<b>4-7</b>	<b>8-11</b>	<b>12-15</b>	<b>16-19</b>	<b>20-23</b>	<b>24-27</b>
Call Options	<b>ITM 1-3%</b>	0.56	0.67	0.43	(0.08)	0.46	0.77	0.19
	<b>ITM 0-1%</b>	0.93	0.66	0.83	0.29	0.64	0.56	0.66
	<b>OTM 0-1%</b>	0.85	0.90	0.72	0.77	0.61	0.39	0.31
	<b>OTM 1-3%</b>	0.89	0.85	0.76	0.77	0.77	0.55	0.09
Put Options	<b>ITM 1-3%</b>	0.63	0.57	0.68	0.57	0.46	0.12	0.35
	<b>ITM 0-1%</b>	0.78	0.88	0.79	0.28	0.50	0.55	(0.10)
	<b>OTM 0-1%</b>	0.76	0.77	0.80	0.60	0.60	0.78	0.06

	<b>OTM 1-3%</b>	0.85	0.84	0.90	0.60	0.87	0.65	0.54
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#### IV. Regression Results

Tables 9 and 10 show the estimated coefficients for the DnD regressions for the market quality indicators between the treatment and control group, together with the p-value in parentheses. The p-value can be used to measure the statistical significance of the coefficient—the confidence that the true value of the coefficient is different than zero. A p-value of 0.1 or lower is considered statistically significant under the regression model. As stated, the regression results only include the groups with strong correlations (with the coefficient  $\geq 0.75$ ) during pre-intervention period. As shown in Table 9 below, the regression results are accompanied by a set of asterisks indicating the associated level of significance: \* = 10%, \*\* = 5%, and \*\*\* = 1%.

**Table 9: Bid-Ask Spread Regression Results**

Moneyness/DTE		<b>0-3</b>	<b>4-7</b>	<b>8-11</b>	<b>12-15</b>	<b>16-19</b>	<b>20-23</b>	<b>24-27</b>
<b>Call Options</b>	<b>ITM 1-3%</b>	-						
		0.65***						
		(0.000)						
	<b>ITM 0-1%</b>	-0.17**	-0.10	0.01	0.08	0.02	0.18***	
	(0.020)	(0.153)	(0.856)	(0.155)	(0.681)	(0.001)		
	<b>OTM 0-1%</b>	-0.02	0.04	-0.02	-0.02	-0.04		0.12**
	(0.534)	(0.236)	(0.415)	(0.494)	(0.310)		(0.025)	
	<b>OTM 1-3%</b>	0.00	0.02**	0.00	-0.02	-0.04*		0.08***
	(0.665)	(0.032)	(0.875)	(0.310)	(0.090)		(0.008)	

	<b>ITM 1-3%</b>			-				
				0.94***				
				(0.000)				
<b>Put Options</b>	<b>ITM 0-1%</b>	-0.11	-0.10	-0.01	-	0.09		
		(0.178)	(0.160)	(0.832)	0.13**	(0.157)		
						(0.013)		
	<b>OTM 0-1%</b>	-0.02	0.03	0.05*	-0.01	0.00	0.07*	0.18***
		(0.562)	(0.206)	(0.087)	(0.804)	(0.976)	(0.088)	(0.000)
	<b>OTM 1-3%</b>	0.00	0.03**	0.01	-0.03	-	0.02	0.08***
		(0.671)	(0.011)	(0.611)	(0.192)	0.06**	(0.476)	(0.004)
						(0.043)		

Table 10: Effective Spread Regression Results

	Moneyiness/DTE	0-3	4-7	8-11	12-15	16-19	20-23	24-27
	<b>ITM 1-3%</b>		-				0.09	
			0.08***				(0.224)	
<b>Call</b>			(0.004)					
<b>Options</b>	<b>ITM 0-1%</b>	-	-0.02	-0.02				0.12
		0.05***	(0.208)	(0.206)				(0.238)
		(0.004)						

	<b>OTM 0-1%</b>	-0.00	-0.01	0.00	-	
		(0.932)	(0.518)	(0.735)	0.05***	
					(0.007)	
	<b>OTM 1-3%</b>	0.00	0.00	0.03***	-0.01	0.02
		(0.717)	(0.909)	(0.001)	(0.705)	(0.315)
	<b>ITM 1-3%</b>			0.01		
				(0.811)		
	<b>ITM 0-1%</b>	-0.03	-0.02	0.05*		
<b>Put</b>		(0.412)	(0.643)	(0.092)		
<b>Options</b>	<b>OTM 0-1%</b>	0.03**	0.00	0.00		0.08
		(0.026)	(0.824)	(0.948)		(0.341)
	<b>OTM 1-3%</b>	0.00	-0.01	-0.01		-0.03
		(0.727)	(0.252)	(0.267)		(0.230)

Series with a statistically insignificant p-value ( $> 0.1$ ) suggests that there is no difference in the spreads during the post-intervention period. In other words, no impact on the market quality can be observed due to the introduction of T/TH expirations. For example, a coefficient of -0.02 in 0-3 DTE and OTM 0-1% call options group in bid-ask spread suggests that, on average, the bid-ask spread for SPXW M/W/F expirations in that group decreased by \$0.02 post-intervention relative to the comparable SPY options. However, a p-value of 0.534 suggests that the decrease is statistically insignificant. In other words, we don't believe there is a change in bid-ask spread in this group between the pre- and post-intervention period.

Overall, the Exchange believes there is no market quality impact on the M/W/F expirations series due to the introduction of T/TH expirations. The majority of the series in the DnD regression results are statistically insignificant, which showed no impact on the spreads. While a slight increase in the bid-ask spread within the 24-27 DTE group has been observed, the Exchange believes it doesn't weaken the overall conclusion since these are the least active series with smaller volume.

While the Exchange's analysis does not prove that the observed improvements in the spreads could necessarily be attributed to the introduction of T/TH expirations instead of other market factors, the above regression results support the overall conclusion that the spreads in existing M/W/F series were not widening following the T/TH expirations.