

SECURITIES AND EXCHANGE COMMISSION
(Release No. 34-97263; File No. SR-NASDAQ-2022-079)

April 7, 2023

Self-Regulatory Organizations; The Nasdaq Stock Market LLC; Notice of Filing of Amendment No. 1 and Order Instituting Proceedings to Determine Whether to Approve or Disapprove a Proposed Rule Change, as Modified by Amendment No. 1, to Amend Rules 4702(b)(14) and (b)(15) Concerning Dynamic M-ELO Holding Periods

On December 21, 2022, The Nasdaq Stock Market LLC (“Nasdaq” or “Exchange”) filed with the Securities and Exchange Commission (“Commission”), pursuant to Section 19(b)(1) of the Securities Exchange Act of 1934 (“Act”)¹ and Rule 19b-4 thereunder,² a proposed rule change to replace the static holding period requirements for Midpoint Extended Life Orders and Midpoint Extended Life Orders Plus Continuous Book with dynamic holding periods. The proposed rule change was published for comment in the Federal Register on January 10, 2023.³ On February 22, 2023, pursuant to Section 19(b)(2) of the Act,⁴ the Commission designated a longer period within which to approve the proposed rule change, disapprove the proposed rule change, or institute proceedings to determine whether to disapprove the proposed rule change.⁵ On March 9, 2023, the Exchange filed Amendment No.1 to the proposed rule change, which amended and superseded the proposed rule change as originally filed.⁶ The Commission

¹ 15 U.S.C. 78s(b)(1).

² 17 CFR 240.19b-4.

³ See Securities Exchange Act Release No. 92844 (January 4, 2023), 88 FR 1438.

⁴ 15 U.S.C. 78s(b)(2).

⁵ See Securities Exchange Act Release No. 96963, 88 FR 12710 (February 28, 2023).

⁶ In Amendment No. 1, the Exchange (i) included additional information regarding the data used by its model, including a list of the 142 categories of data points; (ii) described its model retraining process; (iii) added information regarding the types of modifications for which it would request Commission approval; (iv) indicated it would regularly publish data regarding M-ELO and M-ELO+CB performance and holding period changes; and (v) stated its model would constitute an established, non-discriminatory method and

received two comments on the proposal, and the Exchange submitted a response to comments when it filed Amendment No. 1.⁷ The Commission is publishing this notice and order to solicit comments on the proposed rule change, as modified by Amendment No. 1, from interested persons and to institute proceedings pursuant to Section 19(b)(2)(B) of the Act⁸ to determine whether to approve or disapprove the proposed rule change, as modified by Amendment No. 1.

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

The Exchange proposes to amend Rules 4702(b)(14) and (b)(15) of the Exchange's Rulebook to replace the static holding period requirements for Midpoint Extended Life Orders and Midpoint Extended Life Orders Plus Continuous Book with dynamic holding periods. Amendment No. 1 supersedes the original filing in its entirety.

The text of the proposed rule change is available on the Exchange's Website at <https://listingcenter.nasdaq.com/rulebook/nasdaq/rules>, at the principal office of the Exchange, and at the Commission's Public Reference Room.

II. Self-Regulatory Organization's Statement of 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

would operate according to pre-disclosed rules and objectives without the exercise of discretion. When it submitted Amendment No. 1, the Exchange also submitted it as a comment letter to the filing, available at: <https://www.sec.gov/comments/sr-nasdaq-2022-079/srnasdaq2022079-20159016-327215.pdf>.

⁷ Comments and the Exchange's response to comments are available at: <https://www.sec.gov/comments/sr-nasdaq-2022-079/srnasdaq2022079.htm>

⁸ 15 U.S.C. 78s(b)(2)(B).

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 amend Rules 4702(b)(14) and (15) of the Exchange’s Rulebook to replace the static 10 millisecond holding period requirements for its Midpoint Extended Life Order (“M-ELO”) and Midpoint Extended Life Order Plus Continuous Book (“M-ELO+CB”) Order Types with dynamic holding periods (“Dynamic M-ELO and M-ELO+CB” or collectively, “Dynamic M-ELO”).

Background

In 2018, the Exchange introduced the M-ELO, which is a Non-Displayed Order priced at the Midpoint between the National Best Bid and Offer (“NBBO”) and which is eligible for execution only against other eligible M-ELOs and only after a minimum of one-half second passes from the time that the System accepts the order (the “Holding Period”).⁹ In 2019, the Exchange introduced the M-ELO+CB, which closely resembles the M-ELO, except that a M-ELO+CB may execute at the midpoint of the NBBO, not only against other eligible M-ELOs (and M-ELO+CBs), but also against Non-Displayed Orders with Midpoint Pegging and Midpoint Peg Post-Only Orders (“Midpoint Orders”) that rest on the Continuous Book for at least one-half second and have Trade Now enabled.¹⁰

⁹ See Securities Exchange Act Release No. 34-82825 (March 7, 2018), 83 FR 10937 (March 13, 2018) (SR-NASDAQ-2017-074) (“M-ELO Approval Order”).

¹⁰ See Securities Exchange Act Release No. 34-86938 (September 11, 2019), 84 FR 48978 (September 17, 2019) (SR-NASDAQ-2019-048) (“M-ELO+CB Approval Order”).

When the Exchange designed M-ELO, it originally set the length of the Holding Period at one-half second because it determined that this time period would be sufficient to ensure that likeminded investors would interact only with each other, and with minimal market impacts. The Exchange believed that the longer length of the M-ELO Holding Period and its simplicity in design would provide greater protection for participants than they could achieve through competing delay mechanisms.

In 2020, however, the Exchange shortened the length of the Holding Period to 10 milliseconds.¹¹ The Exchange did so after studying two years of actual use and performance of M-ELOs, as well as customer feedback. That is, the Exchange came to understand that, while users of M-ELO and M-ELO+CB are less concerned with achieving rapid executions of their Orders than are other participants, they are not indifferent about the length of time in which their M-ELOs and M-ELO+CBs must wait before they are eligible for execution. Indeed, participants informed the Exchange that in certain circumstances, such as when they sought to trade symbols that on average had a lower time-to-execution than a half-second, they were reticent to enter M-ELOs or M-ELO+CBs. They indicated that the associated Holding Periods for these Order Types were longer than necessary to achieve the desired protections and that, during the residual portion of the Holding Periods, they risked losing out on favorable execution opportunities that would otherwise be available to them had they placed a non-MELO order.

Based upon this feedback, the Exchange studied the potential effects of reducing the length of the Holding Periods for both M-ELOs and M-ELO+CBs (as well as for Midpoint Orders that would execute against M-ELO+CBs). Ultimately, the Exchange determined that it

¹¹ See Securities Exchange Act Release No. 34-88743 (April 24, 2020), 85 FR 24068 (April 30, 2020) (SR-NASDAQ-2020-011) (“M-ELO Timer Approval Order”).

could reduce the Holding Periods to 10 milliseconds without compromising the protective power that M-ELO and M-ELO+CB are intended to provide to participants and investors.¹² Thus, the Exchange determined that shortening the Holding Periods to 10 milliseconds for M-ELOs and M-ELO+CBs would increase the efficacy of the mechanism while not undermining the power of those Order Types to fulfill their underlying purpose of minimizing market impacts. At the same time, the Exchange determined that a reduction in the Holding Periods to 10 milliseconds would dramatically add to the circumstances in which M-ELOs and M-ELO+CBs would be useful to participants. In its M-ELO Timer Approval Order, the Commission agreed with the Exchange:

The Commission notes that, with the proposed ten-millisecond Holding Period and Resting Period, M-ELOs and M-ELO+CBs would continue to be optional order types that are available to investors with longer investment time horizons, including institutional investors. The Commission also believes that the proposal could make M-ELOs and M-ELO+CBs more attractive for securities that on average have a time-to-execution of less than one-half second and, for investors who currently do not use M-ELOs and M-ELO+CBs for these securities, provide optional order types that could enhance their ability to participate effectively on the

¹² The Exchange examined each of its historical M-ELO executions to determine at what Midpoints of the NBBO the M-ELOs would have executed if their Holding Periods had been shorter than one-half second (500 milliseconds). After examining the historical effects of shorter Holding Periods of between 10 milliseconds and 400 milliseconds, the Exchange determined that a reduction of the M-ELO Holding Period to as short as 10 milliseconds would have caused an average impact on mark-outs of only 0.10 basis points (across all symbols). In other words, compared to the execution price of an average M-ELO with a one-half second Holding Period, the Exchange found that a M-ELO with a 10 millisecond Holding Period would have had an average post-execution impact that was only a tenth of a basis point per share – a difference in protective effect that is immaterial. See Nasdaq, “The Midpoint Extended Life Order (M-ELO); M-ELO Holding Period,” available at <https://www.nasdaq.com/articles/the-midpoint-extended-life-order-m-elo%3A-m-elo-holding-period-2020-02-13> (analyzing effects of shortened Holding Periods on M-ELO performance).

Exchange. The Commission notes that, if market participants determine that the proposal would make M-ELOs and M-ELO+CBs less attractive for their particular investment objectives, such market participants may elect to reduce or eliminate their use of these optional order types. Moreover, as noted above, the Exchange will continue to conduct real-time surveillance to monitor the use of M-ELOs and M-ELO+CBs to ensure that such usage remains appropriately tied to the intent of the order types. If, as a result of such surveillance, the Exchange determines that the shortened Holding Period does not serve its intended purpose or adversely impacts market quality, the Exchange would seek to make further recalibrations.¹³

For similar reasons and with even better potential results for participants, the Exchange now proposes to further refine the length of the Holding Periods for M-ELOs and M-ELO+CBs, this time through the application of innovative and patent pending machine learning technology.

Dynamic M-ELO

After receiving feedback from participants that even 10 millisecond Holding Periods for M-ELO and M-ELO+CB may, at times, exceed what is necessary to accomplish the underlying intent of these Order Types, the Exchange began to experiment with making further refinements to the duration of the Holding Periods. Ultimately, the Exchange concluded that shorter Holding Periods could achieve the same, if not better results for participants in terms of mark-outs, but not in all circumstances. That is, where prices of the underlying securities are stable, and not subject to imminent unfavorable changes, M-ELOs and M-ELO+CBs face lower risks of confronting spread-crossing orders, such that shorter Holding Periods could suffice to protect M-ELOs and M-ELO+CB from such orders. In periods of heightened price volatility, however, M-ELOs and M-ELO+CBs also face heightened risks, such that longer Holding Periods would

¹³ M-ELO Timer Approval Order, supra, at 85 FR 24069.

continue to be beneficial in protecting M-ELOs and M-ELO+CBs from such risks. Thus, the Exchange determined that another across-the-board reduction of the static 10 millisecond Holding Periods would be sub-optimal because it could impact the performance of the M-ELO and M-ELO+CB Order Types during periods of heightened volatility.

In light of these observations, the Exchange tasked its artificial intelligence and machine learning laboratory (the “AI Core Development Group”) to explore whether it could employ these innovative technologies to optimize the length of M-ELO and M-ELO+CB Holding Periods during various states of price volatility, and then to vary the lengths of the Holding Periods dynamically during the lifecycles of M-ELOs and M-ELO+CBs, with the objectives of improving the performance of these Order Types while also further reducing opportunity costs.

As the Exchange explains in greater depth in the attached [sic] white paper,¹⁴ the AI Core Development Group proceeded to develop an artificial intelligence-based timer control system that will achieve these objectives.¹⁵ The AI Core Development Group did so by using reinforcement learning techniques – machine learning paradigms which develop optimal solutions to problems over time by taking actions to solve them, generating feedback on the

¹⁴ See Diana Kafkes et al., “Applying Artificial Intelligence & Reinforcement Learning Methods Towards Improving Execution Outcomes,” SSRN, October 19, 2022, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4243985 (attached hereto [sic] as Exhibit 3(a)) (the “White Paper”).

¹⁵ Although the AI Core Development Group acknowledges that an optimal Holding Period would update with every incoming order, it determined that training a reinforcement learning model on every order would be too difficult to program and too difficult to implement given the nanosecond latency requirements of the Exchange. The Group then investigated more feasible update cadences and determined the point at which optimal outcomes were best balanced with the level of programming and implementation difficulty to be between 15 and 30 second updates. Ultimately, the Group chose a 30 second update cadence to give the model the greatest opportunity to learn between potential actions.

results of such actions, applying that feedback to direct and improve the next round of solutions, and then repeating the feedback loop until the paradigm achieves optimized solutions.

In this instance, the AI Core Development Group applied reinforcement learning techniques to a simulation of the M-ELO Book that it constructed using a representative data set from the first quarter of 2022 (the “Training Period”). The Training Period data consisted of 380 out of the 6,257 symbols on the M-ELO Book (accounting for approximately 67 percent of M-ELO volume). The symbols chosen reflect both actively-traded and thinly-traded securities, and both low-priced and high-priced securities.

The AI Core Development Group then developed a machine learning model and applied it to the Training Period data. The Group programmed the model to value the achievement of higher fill rates or lower mark-outs than that which occurred in a historical simulation of M-ELOs and M-ELO+CBs involving the Training Period data.¹⁶ The Group then programmed the model to seek to achieve its goals by taking one of five possible actions with respect to the duration of the Holding Periods at 30 second intervals¹⁷ for each symbol during each trading day of the Training Period. That is, at each 30 second interval, the model evaluated market conditions for each symbol over the prior 30 second period and either kept the Holding Periods the same, increased/decreased them by 0.25 milliseconds, or increased/decreased them by 0.50 milliseconds.¹⁸ After each decision-making round, the model utilized the results to inform its actions at the next 30 second increment.

¹⁶ As the White Paper explains, the Group developed a model to simulate activity on the Exchange involving M-ELOs and M-ELO+CBs during the Training Period. See White Paper, supra, at 10.

¹⁷ See id.

¹⁸ The AI Core Development Group experimented with a range of permissible Holding Period durations. Ultimately, it concluded that it could produce better outcomes for M-

In making its decisions, the model (again, drawing upon a combination of historical SIP and M-ELO-specific data) considered 142 categories of data points.¹⁹ A confluence of data points that correlated with an increase in volatility tended to cause the model to increase the durations of Holding Periods, including increases in the standard deviation of NBBO prices, the number of unique participants placing sell orders on M-ELO and M-ELO+CB, and the volume-weighted average of the NBBO spread. Conversely, a confluence of data points that correlated with greater price stability tended to cause the model to decrease the durations of Holding periods, such as an increase in the median and max number of shares per trade and the number of resting bids left in the M-ELO and M-ELO+CB Book.

The AI Core Development Team produced variations of its model that prioritized achievement of the lowest mark-outs, the highest fill rates, and a blend of these two objectives.²⁰ Through a process of learning and experimentation involving a combination of historical and simulated data, the AI Core Development Group settled on a Dynamic M-ELO model that

ELO and M-ELO+CB participants than the existing approach using Holding Periods as low as 0.25 milliseconds and as high as 2.5 milliseconds, under normal market conditions.

¹⁹ Nasdaq attaches [sic] a full list of these data elements (attached hereto [sic] as “Exhibit 3(b)”), along with an observation of the strength of the correlations that currently exist between changes to those data values and decisions the system makes to set the duration of Holding Periods at any given time. See also White Paper, supra, at 31, for a description of these features.

²⁰ The AI Core Development Group also applied to the model a paradigm called “retraining” to combat the degradation of model performance that can otherwise occur as the reference data it uses for initial comparison becomes stale. Finally, the AI Core Development group added a stability protection mechanism to the model to provide maximum production to participants in the event that the model observes extraordinary levels of instability in the National Best Bid and Offer during the prior three seconds as compared to reference data. When the model detects such instability, it is programmed to increase the length of the Holding Period to 12 milliseconds for a period of 750 milliseconds.

achieved substantial simulated performance improvements for users of M-ELO and M-ELO+CB – both in terms of mark-outs and fill rates – as compared to the static 10 millisecond Holding Periods. As the White Paper explains in greater detail, Dynamic M-ELO yielded an average combined volume-weighted (simulated) improvement of 31.7 percent, including a 20.3 percent increase in fill rates and a 11.4 percent reduction in mark-outs.²¹ The White Paper provides a more fulsome explanation of these improvements.²²

Based upon these exciting results, the Exchange now proposes to amend Rule 4702(b)(14) and (15) to replace the static 10 millisecond timers applicable to M-ELO and M-ELO+CB with Dynamic M-ELO Holding Periods. Using the Exchange’s proprietary and patent pending technology, the Dynamic M-ELO system will evaluate and, as it deems necessary, adjust the length of the Holding Periods for each symbol comprising M-ELOs and M-ELO+CBs (and Midpoint Orders on the Continuous Book that opt to interact with M-ELO+CBs after resting on the Book) every 30 seconds throughout the Market Hours (each such 30 second interval, a “Change Event”). In so doing, Dynamic M-ELO will help participants to achieve a more optimized blend of the underlying purposes of the M-ELO and M-ELO+CB Order Types: protection against adverse selection (low mark-outs) without sacrificing opportunities to achieve high-quality executions (high fill rates).

A proposed M-ELO or M-ELO+CB with a Dynamic Holding Period will operate as follows. At the outset of Market Hours (approximately 9:30:00 AM), the Exchange will impose initial Holding Periods of 1.25 milliseconds for M-ELOs and M-ELO+CBs in all symbols. Thereafter, Holding Periods for a given symbol will become eligible to change dynamically from

²¹ See White Paper, supra, at 22.

²² See id.

the initial duration beginning at 9:30:30AM and then at 30 second intervals thereafter during Market Hours. The Exchange will then apply to the M-ELO or M-ELO+CB Order a Holding Period that is of the duration that prevailed at the time of entry. For example, if participant A enters a M-ELO for symbol XYZ at 9:30:25 AM, then Holding Period for that M-ELO will be 1.25 milliseconds. If at 9:30:30:00 AM, the System decides to lower the duration of the Holding Period by 0.50 milliseconds, and then participant B enters a M-ELO for symbol XYZ at 9:30:45 AM, then the System will assign a 0.75 millisecond Holding Period to participant B's M-ELO. To be clear, the System will determine Dynamic M-ELO Holding Periods independently for M-ELOs and M-ELO+CBs in each symbol.

During normal market conditions, the range of potential Holding Period durations for M-ELOs and M-ELO+CBs will be between 0.25 – 2.50 milliseconds, with the Holding Period duration being eligible to change by increments of either 0.25 or 0.50 milliseconds at each Change Event. Thus, if the Holding Period for a M-ELO in symbol XYZ is set at 0.75 milliseconds at 2:22:11 PM, and at 2:22:41 PM, the System determines to increase the duration of the Holding Period, it may do so only by 0.25 or 0.50 milliseconds during that event.

When a Change Event occurs, and the System determines to adjust the duration of a Holding Period for a symbol, that adjustment will apply, not only to all M-ELOs and M-ELO+CBs for that symbol entered within the 30 second period after the Change Event occurs, but also to M-ELOs and M-ELO+CBs entered prior to the Change Event with unexpired Holding Periods (with applicability retroactive to the time of Order acceptance). Thus, if a participant enters a M-ELO in symbol XYZ at 1:14:299 PM, and the prevailing Holding Period applicable to that M-ELO is 2 milliseconds, and at 1:14:30 PM, the System modifies the Holding Period to be 1.5 milliseconds, then the M-ELO will become eligible to execute at 1:14:3005 P.M. This is the

case because the M-ELO will have already expended 1 millisecond of its Holding Period as of the time of the Change Event; thereafter, the M-ELO will need to rest only another 0.5 milliseconds to become eligible to execute under the new 1.5 millisecond Holding Period (as measured from 1:14:299 PM). This last feature ensures that the M-ELO Book maintains time priority among M-ELOs and M-ELO+CBs in a dynamic environment. That is, it ensures that no M-ELO or M-ELO+CB with an unexpired Holding Period at the time of a Change Event will end up becoming eligible to execute later than a M-ELO entered after the Change Event which has a shorter Holding Period applicable to it.

If at any time, the System detects extraordinary instability in a symbol, then the System will activate a “stability protection mechanism” to provide an extra layer of protection to M-ELO and M-ELO users from the heightened risks of adverse selection that exists during such periods of instability.²³ The stability protection mechanism will override the prevailing Holding Periods for M-ELOs and M-ELO+CBs in a symbol experiencing extraordinary instability and immediately increase the duration of those Holding Periods to 12 milliseconds for a period of 750 milliseconds. The System may activate the stability protection mechanism even between Change Events. The System will evaluate, at each NBBO update, whether market conditions remain extraordinarily unstable and, if so, it will restart the 750 millisecond Stability Protected

²³ For purposes of this Rule, the System determines that “extraordinary instability” for a symbol exists through observations it makes following every change in the NBBO for that symbol that occurs during the trading day. When the NBBO changes, the System looks back at the prior three seconds of trading and measures the difference between the highest and the lowest NBBO midpoint values that occurred during that period, and then it compares that measurement to a threshold value for the symbol. The System concludes that extraordinary instability exists for a symbol if the measurement exceeds the threshold value. The threshold value for a symbol, in turn, is the difference between the highest and the lowest NBBO midpoint values for the symbol that, if applied to its trading activity during the prior trading day, would have caused the System to deem trading in the symbol to be extraordinarily unstable for as close to one percent of that day as possible.

Period and maintain the 12 millisecond Holding Period until conditions stabilize. Once the System determines that market conditions have stabilized (i.e., all measurements for the symbol are at or below the threshold value throughout the duration of the prevailing Stability Protected Period), the System will revert the duration of the Holding Periods to that which prevailed as of the Change Event that occurred immediately prior to the activation of the stability protection mechanism or, if the stability protection mechanism was active when a Change Event occurred, to the duration selected at the immediately preceding Change Event. The System will then proceed to reevaluate the duration of the Holding Periods as per the regular schedule of Change Events.

The following is an illustration of the operation of the stability protection mechanism. At 11:10:04 AM, the prevailing Holding Period for M-ELOs in symbol XYZ is 1.5 milliseconds. At the same time, the NBBO for symbol XYZ updates. The System looks back at the prior three seconds of trading in symbol XYZ and finds that during that period, the highest observed NBBO midpoint was \$10.05, and the lowest was \$10.00, such that the difference between these two values is a range of \$0.05. The System then looks back at trading behavior for symbol XYZ during the immediately preceding trading day. In doing so, the System calculates the value of the threshold that would have caused the symbol to be deemed extraordinarily unstable for one percent of the trading day; the System determines that this threshold value is a range of \$0.03. The System then compares the \$0.03 threshold to its measurement of the prior three seconds of NBBO changes (\$0.05), and concludes that over these past three seconds, the symbol is extraordinarily unstable. Accordingly, the System activates the stability protection mechanism and the Holding Period for M-ELOs in symbol XYZ immediately increases to 12 milliseconds for a period of 750 milliseconds. However, 5 milliseconds after the Stability Protection Period

commences, the NBBO updates again, thus prompting the System to repeat its assessment of the stability of the symbol in light of the update. This reassessment reveals that the symbol remains unstable, such that a new Stability Protection Period of 750 milliseconds begins at that time (overriding the pre-existing Period). Over the course of this new Stability Protection Period, the NBBO shifts two more times, but each of the ensuing reassessments indicate that the NBBO ranges for the symbol have fallen below the \$0.03 threshold. The Stability Protection Period elapses 750 milliseconds after it began with the symbol remaining stable. Thus, the Holding Period reverts to 1.5 milliseconds.

If the Exchange halts trading in a symbol, then upon resumption of trading, any new M-ELO or M-ELO+CB in that symbol and any pending M-ELO or M-ELO+CB in that symbol with an unexpired Holding Period will be subject to a new 12 milliseconds Holding Period (running from the time when trading resumes) until the next scheduled Change Event, at which point the System may determine to adjust that Holding Period to a duration within the range applicable under normal market conditions.²⁴ If, however, the System determines that extraordinary instability in the symbol exists, it will instead determine to activate the stability protection mechanism and maintain the duration of the Holding Period at 12 milliseconds for another 750 milliseconds. This design will help to ensure that M-ELOs and M-ELO+CBs receive added protection coming out of halt conditions.²⁵

²⁴ Prior to commencement of a new 12 millisecond Holding Period for a new or pending M-ELO or M-ELO+CB following a Halt, the System will first determine whether the M-ELO or M-ELO+CB is or remains eligible for execution. That is, the Holding Period will commence only if, upon commencement of trading following the Halt, the midpoint price for the Order is within the limit set by the participant. If not, the System will hold the Order until the midpoint falls within the limit set by the participant, at which time the 12 millisecond Holding Period will commence.

²⁵ Also as a safeguard, the System will apply a default Holding Period of 12 milliseconds to a M-ELO or M-ELO+CB if ever it fails to receive a signal during a Change Event as to

The Exchange notes that same dynamic process described above will also apply to and govern the time periods during which Midpoint Orders on the Continuous Book must rest before they will become eligible to interact with M-ELO+CBs (provided that participants have opted for their Midpoint Orders to interact with M-ELO+CBs). Thus, the same Holding Period duration that the System sets for a M-ELO+CB in a symbol during Regular Market Hours will also be the length of time that a Midpoint Order must rest on the Continuous Book must rest before it may interact with a M-ELO+CB.

Apart from these impacts of Dynamic Holding Periods, M-ELOs and M-ELO+CBs will continue to behave as they do now in all respects, and as set forth in Rules 4702(b)(14) and (15).

It is important to note that within the parameters discussed herein and in the White Paper, the Exchange will continue to re-train Dynamic M-ELO and M-ELO+CB on a weekly basis (outside of market hours) so that the model will continue to learn from and act upon the basis of more recent SIP and M-ELO book data sets, and further improve its performance over time. The retraining process should not result in dramatic or unpredictable changes to the behavior of Dynamic M-ELO. The retraining process will not retrain the model from scratch each week; rather, it will retain the model's existing data inputs, knowledge base, and objectives – all without alteration. Retraining will result in new behaviors only as needed to address new scenarios that the model did not confront previously, and even then, only in a manner designed to further optimize outcomes, i.e., reduce mark-outs or increase fill rates. If the System assesses that a retrained model would be worse than the existing model in achieving its objectives, then

whether the System should adjust or maintain the duration of the prevailing Holding Period. The System will continue to apply the default 12 millisecond Holding Period until the next Change Event where the signal is restored and the System is able to act dynamically again.

the System will continue to use the existing model and discard the retrained model. This retraining process is a standard and accepted practice for use of deep learning models; it helps to ensure that deep learning models not only work well, but that they continue to work well in dynamic circumstances.²⁶

The Exchange will not modify the underlying structure of Dynamic M-ELO and M-ELO+CB without first obtaining the Commission’s approval to do so, including modifications to the data elements the model considers in making decisions about Holding Period durations, the conditions under which the model may adjust the duration of Holding Periods, the frequency with which the model may adjust the Holding Periods, the range of Holding Period durations available to M-ELOs and M-ELO+CBs, the increments by which Holding Periods may change at any given Change Event, and the procedures for triggering, maintaining, and ending 12 millisecond Holding Periods during times of extraordinary instability.²⁷ Although the Exchange will seek Commission approval prior to changing any of the data elements that the model considers, the Exchange will not seek Commission approval prior to retraining the model to adjust the weighting it applies to those data elements.

²⁶ During periods where the model is not undergoing retraining, the System will behave predictably from day to day, such that its decisions when presented with given set of facts and circumstances in a given security on day 1 should be the same as they would be on day 2.

²⁷ In addition to the proposed changes described above, the Exchange proposes to delete an extraneous reference in Rule 4702(b)(15) to M-ELO+CB being eligible to execute against a Midpoint Order on the Continuous Book if the Continuous Book order has the “Midpoint” Trade Now Attribute enabled. In a prior filing, the Exchange folded the concept of “Midpoint Trade Now” into the general “Trade Now” Attribute. See Securities Exchange Act Release No. 34-92180 (June 15, 2021), 86 FR 33420 (June 24, 2021)(SR-NASDAQ-2021-044).

To aid investors in understanding and evaluating Dynamic M-ELO, Nasdaq will continue to publish weekly and monthly transparency statistics on Nasdaqtrader.com, as it does now, about the performance of its M-ELOs and M-ELO+CBs, including statistics listing the weekly numbers of shares and trades in M-ELOs by symbol, weekly aggregated M-ELO share and trade data, and monthly aggregated block data.²⁸ Nasdaq also will continue to disclose monthly data on Nasdaq.com, as it does now (the M-ELO Monthly Report), about M-ELO and M-ELO+CB mark-outs (quote stability by time horizon) and fill rates.²⁹ Moreover, Nasdaq will add statistics to the M-ELO Monthly Report about how frequently, on average, the System changes Holding Period durations for the top decile, median, and bottom decile of symbols, as measured by monthly M-ELO and M-ELO+CB trading volumes. Nasdaq will retain copies of each historical iteration of its models as part of its books and records, and make them available to the Commission upon request, should it wish to examine them to understand how the model changes over time. Furthermore, Nasdaq will publish an equity trader alert in advance of deploying a retrained version of Dynamic M-ELO whenever Nasdaq has reason to anticipate that the retrained version will produce results that differ materially from the prior version, i.e., a projected change in mark-outs or fill-rates of 10% or more in either direction.

²⁸ See <http://www.nasdaqtrader.com/Trader.aspx?id=MELOSymbolData>.

²⁹ See, e.g., <https://www.nasdaq.com/docs/M-ELO-Monthly-Report>. Nasdaq understands that current users of M-ELO and M-ELO independently monitor the performance of these Order Types. Nasdaq often receives feedback from such users about M-ELO and M-ELO+CB performance, which Nasdaq then factors into decisions about improvements and enhancements. Nasdaq expects that this feedback loop will continue after implementation of Dynamic M-ELO.

Implementation

The Exchange intends to make the proposed change effective for M-ELOs and M-ELO+CBs in the Second or Third Quarter of 2023, but that time frame is subject to change. The Exchange will publish a Trader Alert in advance of making the proposed change effective.

2. Statutory Basis

The Exchange believes that its proposal is consistent with Section 6(b) of the Act,³⁰ in general, and furthers the objectives of Section 6(b)(5) of the Act,³¹ in particular, in that it is designed to promote just and equitable principles of trade, to remove impediments to and perfect the mechanism of a free and open market and a national market system, and, in general to protect investors and the public interest, by allowing for more widespread use of M-ELOs and M-ELO+CBs.

When the Commission approved the M-ELO and the M-ELO+CB, it determined that these Order Types are consistent with the Act because they “could create additional and more efficient trading opportunities on the Exchange for investors with longer investment time horizons, including institutional investors, and could provide these investors with an ability to limit the information leakage and the market impact that could result from their orders.”³² Nothing about the Exchange’s proposal should cause the Commission to revisit or rethink this determination. Indeed, the proposal will not alter the fundamental design of these Order Types, the manner in which they operate, or their effects.

³⁰ 15 U.S.C. 78f(b).

³¹ 15 U.S.C. 78f(b)(5).

³² M-ELO Approval Order, supra 83 FR at 10938–39; M-ELO+CB Approval Order, supra, 84 FR at 48980.

Even with Dynamic M-ELO Holding Periods, M-ELOs and M-ELO+CBs will continue to provide their users with protection against information leakage and adverse selection – and they will do so at levels which are substantially undiminished from that which they provide now.³³

At the same time, however, the proposal will benefit market participants and investors by reducing the opportunity costs of utilizing M-ELOs and M-ELO+CBs. The proposal, in other words, will re-calibrate the lengths of the Holding Periods so that M-ELOs and M-ELO+CBs will operate in the “Goldilocks” zone – their Holding Periods will not be so short as to render them unable to provide meaningful protections against information leakage and adverse selection, but the Holding Periods also will not be too long so as to cause participants and investors to miss out on favorable execution opportunities. Nasdaq believes the proposal will render M-ELOs and M-ELO+CBs more useful and attractive to market participants and investors, and this increased utility and attractiveness, in turn, will spur an increase in M-ELO and M-ELO+CB use cases on the Exchange, both from new and existing users of M-ELOs and M-ELO+CBs. Ultimately, the proposal should enhance market quality by increasing opportunities for midpoint executions on the Exchange.

As Nasdaq explained above, the proposal will operate within strict, well-defined, and transparent parameters. Although it will undergo weekly retraining (outside of market hours), such retraining will aim to improve the performance of the model in achieving its twin objectives; retraining will not alter the inputs, objectives, or basic design parameters of Dynamic M-ELO without prior Commission approval.³⁴ Moreover, the Exchange will not deploy a

³³ See note 12, *supra*.

³⁴ As discussed above, Nasdaq will not seek Commission approval prior to allowing the model, as part of its re-training process, to vary the weighting of the data elements it

retrained model if it fails to achieve performance improvements. To aid investors in evaluating Dynamic M-ELO, the Exchange will publish statistics about its performance, including as to mark-outs and fill rates, as well as statistics about how frequently the System changes Holding Period durations. To further facilitate accountability, the Exchange will retain each historical iteration of its model as part of its books and records, and make such information available to the Commission, upon request. The Exchange will also publish equity trader alerts whenever retraining will result in a performance change of 10% or more.

Nasdaq notes that the twin objectives it prescribes for the model involve the absolute values of mark-outs and fill rates; they are not designed to further the performance of any participant or any category of participant. Thus, Nasdaq believes the model is objective and designed to avoid bias and discrimination.

The Exchange notes that use of Dynamic M-ELOs and M-ELO+CBs remains voluntary for all market participants. Accordingly, if any market participant feels that the dynamic Holding Periods are still too long or too short or because competing venues offer more attractive delay mechanisms, then the participants are free to pursue other trading strategies or utilize other trading venues. They need not utilize Dynamic M-ELOs or M-ELO+CBs.

ingests. Nasdaq believes this is appropriate because such variance will only occur to the extent that it will improve the model's performance with respect to pre-defined objectives. Nasdaq will alert traders if the retraining process would result in substantial performance changes, and it will also publish statistics to help participants to assess performance themselves. Moreover, Nasdaq will retain historical iterations of its models for the Commission's review, should it wish to examine how these models have changed over time.

Furthermore, the design of Dynamic-MELO would constitute an “established, non-discretionary” method that is consistent with the definition of an exchange, as set forth in SEC Rule 3b-16.³⁵ The Commission stated as follows when it adopted Rule 3b-16:

A system uses established non-discretionary methods either by providing a trading facility or by setting rules governing trading among subscribers. The Commission intends for "established, non-discretionary methods" to include any methods that dictate the terms of trading among the multiple buyers and sellers entering orders into the system. Such methods include those that set procedures or priorities under which open terms of a trade may be determined. For example, traditional exchanges' rules of priority, parity, and precedence are "established non-discretionary methods," as are the trading algorithms of electronic systems. Similarly, systems that determine the trading price at some designated future date on the basis of pre-established criteria (such as the weighted average trading price for the security on the specified date in a specified market or markets) are using established, non-discretionary methods.³⁶

Nothing in the Reg. ATS Adopting Release or in any of its illustrative examples suggests that Dynamic M-ELO would constitute an exercise of discretionary behavior. Dynamic M-ELO will handle and execute Orders according to published, pre-determined rules that are disclosed to the public and which provide reasonable notice of how the Order Type will behave.³⁷ To the extent that the design of the System permits variation in the Holding Periods for such Orders, it does so

³⁵ See 17 CFR 240.3b-16(a)(2) (“(a) An organization, association, or group of persons shall be considered to constitute, maintain, or provide ‘a market place or facilities for bringing together purchasers and sellers of securities or for otherwise performing with respect to securities the functions commonly performed by a stock exchange,’ as those terms are used in section 3(a)(1) of the Act, (15 U.S.C. 78c(a)(1)), if such organization, association, or group of persons: (1) Brings together the orders for securities of multiple buyers and sellers; and (2) Uses established, non-discretionary methods (whether by providing a trading facility or by setting rules) under which such orders interact with each other, and the buyers and sellers entering such orders agree to the terms of a trade.”).

³⁶ See Securities Exchange Act Release No. 40760 (December 8, 1998), 63 FR 70844, 70850 (December 22, 1998).

³⁷ See *id.* at 70900 (“an essential indication of the non-discretionary status of rules and procedures is that those rules and procedures are communicated to the systems users” and “[t]hus, participants have an expectation regarding the manner of execution—that is, if an order is entered, it will be executed in accordance with those procedures and not at the discretion of a counterparty or intermediary.”).

by design. The range of potential variations, the objectives that such variations are intended to achieve, and the factors that determine when such variations may occur are also predetermined and set forth in the Exchange's Rules or otherwise disclosed to the public. The mere fact that the System may apply different weights over time to the factors it uses to determine whether and by how much to vary a Holding Period does not mean that the System will act with discretion in the same sense that a human being could be said to exercise independent judgment when deciding whether and how to handle an order.³⁸ Even when the System makes decisions about changing the Holding Periods, the System will operate pursuant to a mathematical algorithm from which it cannot deviate – an algorithm that is programmed to achieve pre-defined and pre-disclosed objectives.³⁹

³⁸ Cf. id. at 70851 (explaining that a traditional block trading desk is an example of a system that does not use established, non-discretionary methods because the operators of such desks do not act according to fixed procedures known to their customers, but instead shop orders around for potential counterparties and make their own determinations as to whether and how to execute block orders, including by sometimes deciding to take a proprietary position in part of the block order).

³⁹ See id. at 80755 (describing an example of a system that would be non-discretionary in nature: “System I permits participants to enter a range of ranked contingent buy and sell orders at which they are willing to trade securities. These orders are matched based on a mathematical algorithm whose priorities are designed to achieve the participants’ objectives. System I does not display orders to any participants. System I is included under Rule 3b-16.”); see also Securities Exchange Act Release No. 34-89686 (August 20, 2020), 85 FR 54438, at 54445, n.92 (September 1, 2020) (Order approving SR-IEX-2019-15) (rejecting argument that IEX’s D-Limit order time is an exercise of discretion because “D-Limit orders will not allow IEX to exercise any discretion on any particular order by deviating from the CQI and D-Limit functionality, which is hardcoded in the IEX rulebook.”); Securities Exchange Act Release No. 34-78101 (June 17, 2016), 81 FR 41141, at 41153 (June 17, 2016) (Order approving IEX Form 1 and D-Peg Order Type) (“the Commission does not believe that the hardcoded conditionality of the IEX proposed “discretionary” peg order type provides IEX with actual discretion or the ability to exercise individualized judgment when executing an order. Rather, if IEX’s fixed formula determines the quote to be stable, the discretionary peg order can execute up to the midpoint; if it does not deem the quote to be stable, then it will hold the order to its pegged price. As such, IEX would not exercise discretion over the routing and execution of a resting order”). Nasdaq does not believe that it is necessary to codify its

Finally, the Exchange notes that it will continue to conduct real-time surveillance to monitor the use of M-ELOs and M-ELO+CBs to ensure that such usage remains appropriately tied to the intent of the Order Types. If, as a result of such surveillance, the Exchange determines that the Dynamic M-ELO Holding Periods do not serve their intended purposes, or adversely impact market quality, then the Exchange will seek to make further re-calibrations.

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

The Exchange does not believe that the proposed rule change will impose any burden on competition not necessary or appropriate in furtherance of the purposes of the Act. To the contrary, the Exchange believes that this proposal will promote the competitiveness of the Exchange by rendering its M-ELO and M-ELO+CB Order Types more attractive to participants.

The Exchange adopted the M-ELO and M-ELO+CB as pro-competitive measures intended to increase participation on the Exchange by allowing certain market participants that may currently be underserved on regulated exchanges to compete based on elements other than speed. The proposed change continues to achieve this purpose. With Dynamic M-ELO Holding Periods, both M-ELOs and M-ELO+CBs will afford their users with a level of protection from information leakage and adverse selection that is better from what is achievable at present.⁴⁰ At the same time, the Dynamic Holding Periods will increase opportunities to interact with other

mathematical formula for Dynamic M-ELO in its Rules because Nasdaq has disclosed sufficient information in its Rules and in its filing to inform the public as to the possible and expected behaviors associated with Dynamic M-ELO, as well as a means for the Commission and/or investors to verify whether Dynamic M-ELO is performing appropriately. Much as the Commission does not require an exchange to codify the source code it uses to effectuate other behaviors or actions that it explains in its Rules, including the behaviors of other complex Order Types, there is no basis to require codification of the Dynamic M-ELO formula in this instance.

⁴⁰ See White Paper, supra.

like-minded investors with longer time horizons while also lowering the opportunity costs for participants that utilize M-ELOs and M-ELO+CBs, particularly for securities that trade within the “Goldilocks” zone. In sum, the proposed changes will not burden competition, but instead may promote competition for liquidity in M-ELOs and M-ELO+CBs by broadening the circumstances in which market participants may find such Orders to be useful. With the proposed changes, market participants will be more likely to determine that the benefits of entering M-ELOs and M-ELO+CBs outweigh the risks of doing so.

The proposed change will not place a burden on competition among market venues, as any market may adopt an order type that operates similarly to a M-ELO or a M-ELO+CB with Dynamic M-ELO Holding Periods.

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

No written comments were either solicited or received.

III. Proceedings to Determine Whether to Approve or Disapprove SR-NASDAQ-2022-079, as Modified by Amendment No. 1, and Grounds for Disapproval Under Consideration

The Commission is instituting proceedings pursuant to Section 19(b)(2)(B) of the Act⁴¹ to determine whether the proposed rule change, as modified by Amendment No.1, should be approved or disapproved. Institution of proceedings is appropriate at this time in view of the legal and policy issues raised by the proposed rule change and the comments received thereon. Institution of proceedings does not indicate that the Commission has reached any conclusions with respect to any of the issues involved. Rather, the Commission seeks and encourages interested persons to provide additional comment on the proposed rule change to inform the Commission’s analysis of whether to approve or disapprove the proposed rule change.

⁴¹ 15 U.S.C. 78s(b)(2)(B).

Pursuant to Section 19(b)(2)(B) of the Act,⁴² the Commission is providing notice of the grounds for possible disapproval under consideration. As noted above, the Commission received two comments on the proposal and the Exchange simultaneously filed a response to comments along with Amendment No. 1.⁴³ Of note, both commenters assert that the Exchange must provide additional information about how it determines the Dynamic Holding Periods proposed herein.⁴⁴ One of these commenters states that “as a threshold question, how can the public ‘provide meaningful comment on the proposal’ without knowing what all the categories and parameters are.”⁴⁵ This commenter also states that it is unclear under what circumstances the Exchange believes it would need to file a proposed rule change should the machine learning model alter its methods or functionalities, specifically citing the proposed retraining of the artificial intelligence based timer control system.⁴⁶ This commenter also questions whether the proposed rule change provides sufficient information to determine whether (i) it is not unfairly discriminatory and (ii) will not place a burden on competition among market venues.⁴⁷

Nasdaq replied to these comments with its own comment letter and by filing Amendment No. 1. Nasdaq states, among other things, that it is not necessary to describe precisely how its

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Id.

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See supra note 6.

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See Letters from Joseph Saluzzi, Partner, Themis Trading LLC, to Vanessa Countryman, Secretary, Commission, dated January 25, 2023, at 2 (“Nasdaq should be required to reveal all of the specifics behind their dynamic holding period formula so others can evaluate how it works and decide if they would like to have Nasdaq apply the logic to their orders.”); and R. T. Leuchtkafer to Vanessa Countryman, Secretary, Commission, dated January 31, 2023, at 1-2 (“Leuchtkafer Letter”).

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See Leuchtkafer Letter, at 1.

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See id., at 2 (stating that “it’s not at all clear under exactly what circumstances Nasdaq will seek approval for a change.”).

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See id., at 2-3.

system will react in each and every circumstance it will confront in the market as long as the choices that the system can make are bounded and its range of behaviors are understood and reasonably predictable, which it asserts is “indeed the case for Dynamic M-ELO.”⁴⁸ Nasdaq also submitted the full list of these data elements as both an Appendix A to its response to comments and new Exhibit 3B to the proposal in Amendment No. 1. Nasdaq also states that:

Nasdaq is clear that it will seek approval prior to altering the data inputs that the system ingests for decision-making purposes, but not for changes to the relative weighting that the system applies to these data elements. Nasdaq also will seek Commission approval prior to altering the twin objectives of Dynamic M-ELO or making changes to its fundamental operating parameters, such as changes to the permissible range of Holding Periods, to the permissible change increments for a Holding Period at any given Change Event, to the frequency with which Change Events may occur, to the procedures for triggering, maintaining, and ending 12 millisecond Holding Periods during times of extraordinary instability.⁴⁹

The Commission is instituting proceedings to allow for additional analysis of, and input from commenters with respect to, the consistency of the proposal, as modified by Amendment No. 1, with Sections 6(b)(5)⁵⁰ and 6(b)(8) of the Act.⁵¹ Section 6(b)(5) of the Act requires that the rules of a national securities exchange be designed, among other things, to promote just and equitable principles of trade, to remove impediments to and perfect the mechanism of a free and open market and a national market system and, in general, to protect investors and the public interest, and not be designed to permit unfair discrimination between customers, issuers, brokers, or dealers. Section 6(b)(8) of the Act requires that the rules of a national securities exchange not

⁴⁸ See Letter from Brett Kitt, Associate Vice President and Principal Associate General Counsel, Nasdaq, Inc., to Vanessa Countryman, Secretary, Commission, dated March 9, 2023, at 2 (“Nasdaq Letter”).

⁴⁹ See Nasdaq Letter at 3.

⁵⁰ 15 U.S.C. 78f(b)(5).

⁵¹ 15 U.S.C. 78f(b)(8).

impose any burden on competition that is not necessary or appropriate in furtherance of the purposes of the Act.

IV. Procedure: Request for Written Comments

The Commission requests that interested persons provide written submissions of their views, data, and arguments with respect to the issues identified above, as well as any other concerns they may have with the proposal, as modified by Amendment No. 1. In particular, the Commission invites the written views of interested persons concerning whether the proposal, as modified by Amendment No. 1, is consistent with Sections 6(b)(5) and 6(b)(8), or any other provision of the Act, or the rules and regulations thereunder. Although there do not appear to be any issues relevant to approval or disapproval that would be facilitated by an oral presentation of views, data, and arguments, the Commission will consider, pursuant to Rule 19b-4, any request for an opportunity to make an oral presentation.⁵²

Interested persons are invited to submit written data, views, and arguments regarding whether the proposal, as modified by Amendment No. 1, should be approved or disapproved by [insert date 21 days from publication in the Federal Register]. Any person who wishes to file a rebuttal to any other person's submission must file that rebuttal by [insert date 35 days from publication in the Federal Register].

Comments may be submitted by any of the following methods:

⁵² Section 19(b)(2) of the Act, as amended by the Securities Act Amendments of 1975, Pub. L. 94-29 (June 4, 1975), grants the Commission flexibility to determine what type of proceeding – either oral or notice and opportunity for written comments – is appropriate for consideration of a particular proposal by a self-regulatory organization. See Securities Act Amendments of 1975, Senate Comm. on Banking, Housing & Urban Affairs, S. Rep. No. 75, 94th Cong., 1st Sess. 30 (1975).

Electronic Comments:

- Use the Commission's Internet comment form (<http://www.sec.gov/rules/sro.shtml>); or
- Send an e-mail to rule-comments@sec.gov. Please include File Number SR-NASDAQ-2022-079 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 Numbers SR-NASDAQ-2022-079. This file number should be included on the subject line if e-mail is used. To help the Commission process and review your comments more efficiently, please use only one method. The Commission will post all comments on the Commission's Internet website (<http://www.sec.gov/rules/sro.shtml>). Copies of the submission, all subsequent amendments, all written statements with respect to the proposed rule change that are filed with the Commission, and all written communications relating to the proposed rule change between the Commission and any person, other than those that may be withheld from the public in accordance with the provisions of 5 U.S.C. 552, will be available for website viewing and printing in the Commission's Public Reference Room, 100 F Street, NE, Washington, DC 20549, on official business days between the hours of 10:00 a.m. and 3:00 p.m. Copies of these filings also will be available for inspection and copying at the principal office of the Exchange.

All comments received will be posted without change. Persons submitting comments are cautioned that we do not redact or edit personal identifying information from comment submissions. You should submit only information that you wish to make available publicly. All submissions should refer to File Number SR-NASDAQ-2022-079 and should be submitted on or before [insert date 21 days from publication in the Federal Register]. Rebuttal comments should be submitted by [insert date 35 days from date of publication in the Federal Register].

For the Commission, by the Division of Trading and Markets, pursuant to delegated authority.⁵³

Sherry R. Haywood

Assistant Secretary

⁵³ 17 CFR 200.30-3(a)(12), (57).