Required fields are shown with yellow backgrounds and asterisks.

Page 1 of * 92

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

File No. * SR 2023 - * 07
Amendment No. (req. for Amendments *)

Filing by Nasdaq PHLX LLC

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

Initial * ☑ Amendment * ☐ Withdrawal ☐

Section 19(b)(2) * ☑ Section 19(b)(3)(A) * ☐ Section 19(b)(3)(B) * ☐

Pilot ☑

Extension of Time Period for Commission Action * ☐

Date Expires *

Rule

☐ 19b-4(f)(1) ☐ 19b-4(f)(4)
☐ 19b-4(f)(2) ☐ 19b-4(f)(5)
☐ 19b-4(f)(3) ☐ 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 *).

Make Permanent Certain P.M. Settled Pilots

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 * Angela Last Name * Dunn

Title * Principal Associate General Counsel

E-mail * angela.dunn@nasdaq.com

Telephone * (215) 496-5692 Fax

Signature

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

Date 02/23/2023

By John Zecca
(Name *)

(Title *) EVP and Chief Legal Officer

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.

John A. Zecca Date: 2023.02.23 12:59:48 -05'00'

Required fields are shown with yellow backgrounds and astericks.

SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

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

Form 19b-4 Information *

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SR-Phlx-2023-07 19b-4.doc

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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SR-Phlx-2023-07 Exhibit 1.doc

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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SR-Phlx-2023-07 Exhibit 3.doc

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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SR-Phlx-2023-07 Exhibit 5.doc

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.

1. Text of the Proposed Rule Change

(a) Nasdaq PHLX LLC ("Phlx" or "Exchange"), pursuant to Section 19(b)(1) of the Securities Exchange Act of 1934 ("Act")[1] and Rule 19b-4 thereunder,[2] is filing with the Securities and Exchange Commission ("SEC" or "Commission") a proposal to make permanent the pilot to permit the listing and trading of options based on 1/100 the value of the Nasdaq-100 Index ("Nasdaq-100" or "NDX") and the Exchange's nonstandard expirations pilot program which are both currently set to expire on May 4, 2023.

A notice of the proposed rule change for publication in the Federal Register is attached hereto as Exhibit 1. The text of the proposed rule change is attached as Exhibit 5.

(b) Not applicable.

(c) Not applicable.

2. Procedures of the Self-Regulatory Organization

The proposed rule change was approved by senior management of the Exchange pursuant to authority delegated by the Board of Directors (the "Board"). Exchange staff will advise the Board of any action taken pursuant to delegated authority. No other action is necessary for the filing of the rule change.

Questions and comments on the proposed rule change may be directed to:

Angela Saccomandi Dunn
Principal Associate General Counsel
Nasdaq, Inc.
215-496-5692

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1 15 U.S.C. 78s(b)(1).

2 17 CFR 240.19b-4.

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

a. Purpose

Phlx proposes to make permanent 2 pilots, which are both set to expire on May 4, 2023: (1) the Exchange's pilot to permit the listing and trading of options based on 1/100 the value of the Nasdaq-100 Index ("XND Pilot"), and (2) the Exchange's nonstandard expirations pilot program ("Nonstandard Pilot").

XND Pilot

Phlx filed a rule change to permit the listing and trading of index options on the Nasdaq 100 Micro Index Options ("XND") on a pilot basis.[3] XND options trade independently of and in addition to NDX options, and the XND options are subject to the same rules that presently govern the trading of index options based on the Nasdaq-100 Index, including sales practice rules, margin requirements, trading rules, and position and exercise limits. Similar to NDX, XND options are European-style and cash-settled, and have a contract multiplier of 100. The contract specifications for XND options mirror in all respects those of the NDX options contract already listed on the Exchange, except that XND options are based on 1/100th of the value of the Nasdaq-100 Index, and are p.m.-settled pursuant to Options 4A, Section 12(a)(5).

The Exchange proposes to amend Phlx Options 4A, Section 12(a)(6) to make permanent the current XND Pilot. The XND Pilot was extended various times with the last extension through May 4, 2023.[4] The Exchange continues to have sufficient capacity

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3 See Securities Exchange Act Release No. 91524 (April 9, 2021), 86 FR 19909 (April 15, 2021) (SR-Phlx-2021-07) (Approval Order).

4 See Securities Exchange Act Release No. 93447 (October 28, 2021), 86 FR 60719 (November 3, 2021) (SR-Phlx-2021-66); 94631 (April 7, 2022), 87 FR 21990

to handle additional quotations and message traffic associated with the listing and trading of XND options. In addition, index options are integrated into the Exchange's existing surveillance system architecture and are thus subject to the relevant surveillance processes. The Exchange also continues to have adequate surveillance procedures to monitor trading in XND options thereby aiding in the maintenance of a fair and orderly market. Additionally, there is continued investor interest in XND.

Nonstandard Pilot

Phlx filed a proposed rule change for the listing and trading on the Exchange, on a twelve month pilot basis, of p.m.-settled options on broad-based indexes with nonstandard expirations dates.[5] The Nonstandard Pilot permits both Weekly Expirations and End of Month ("EOM") expirations similar to those of the a.m.-settled broad-based index options, except that the exercise settlement value of the options subject to the pilot are based on the index value derived from the closing prices of component stocks. The Nonstandard Pilot was extended various times and is currently extended through May 4, 2023.[6]

(April 13, 2022) (SR-Phlx-2022-16); and 95993 (October 6, 2022), 87 FR 62161 (October 13, 2022) (SR-Phlx-2022-39).

5 See Securities Exchange Act Release No. 82612 (February 1, 2018), 83 FR 5470 (February 7, 2018) (approving SR-ISE-2017-111) (Order Approving a Proposed Rule Change To Establish a Nonstandard Expirations Pilot Program).

6 See Securities Exchange Act Release Nos. 84835 (December 17, 2018), 83 FR 65773 (December 21, 2018) (SR-Phlx-2018-80); 85669 (April 17, 2019), 84 FR 16913 (April 23, 2019) (SR-Phlx-2019-13); 87381 (October 22, 2019), 84 FR 57788 (October 28,2 019) (SR-Phlx-2019-43); 88684 (April 17, 2020), 85 FR 22781 (April 23, 2020) (SR-Phlx-2020-24); 90256 (October 22, 2020), 85 FR 68393 (October 28, 2020) (SR-Phlx-2020-48); 91484 (April 6, 2021), 86 FR 19050 (April 12, 2021) (SR-Phlx-2021-21); 93464 (October 29, 2021), 86 FR 60952 (November 4, 2021) (SR-Phlx-2021-65); 94631 (April 7, 2022), 87 FR

Phlx Options 4A, Section 12(b)(5)(A) provides that the Exchange may open for trading Weekly Expirations on any broad-based index eligible for standard options trading to expire on any Monday, Wednesday, or Friday (other than the third Friday-of-the-month or days that coincide with an EOM expiration). Weekly Expirations are subject to all provisions of Options 4A, Section 12 and are treated the same as options on the same underlying index that expire on the third Friday of the expiration month. Unlike the standard monthly options, however, Weekly Expirations are p.m.-settled.

Pursuant to Options 4A, Section 12(b)(5)(B) the Exchange may open for trading EOM expirations on any broad-based index eligible for standard options trading to expire on the last trading day of the month. EOM expirations are subject to all provisions of Options 4A, Section 12 and treated the same as options on the same underlying index that expire on the third Friday of the expiration month. However, the EOM expirations are p.m.-settled.

At this time, the Exchange proposes to make permanent the Nonstandard Pilot. The Exchange has sufficient systems capacity to handle p.m.-settled options on broad-based indexes with nonstandard expirations dates and has not encountered any issues or adverse market effects as a result of listing them. Additionally, there is continued investor interest in these products.

In support of the permanency of the XND Pilot and the Nonstandard Pilot, the Exchange empirically assessed the impact of p.m.-settled NDX options on options market

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21990 (April 13, 2022) (SR-Phlx-2022-16) and 95993 (October 6, 2022), 87 FR 62161 (October 13, 2022) (SR-Phlx-2022-39).

quality and examined market capacity around the market close.[7] Specifically, the Exchange analyzed trading volume, open interest, spreads, and closing auction volumes. In recent years, Phlx has implemented changes and introduced new types of index options tied to the Nasdaq-100 Index® (ticker symbol "NDX"). This report presents a set of empirical findings relating the impact of these changes, submitted in support of a request for permanency of the XND Pilot and the Nonstandard Pilot.

A general timeline of events since 2017 is as follows:

- In January 2017, the Exchange discontinued licensing agreements with competing options exchanges for the listing and trading of NDX options. This discontinuation led to a gradual reduction in the number of NDX expiries listed on these exchanges. By 2019 trading in NDX-related options therefore became exclusively done on three Nasdaq-affiliated exchanges: Phlx, Nasdaq ISE, LLC ("ISE") and Nasdaq GEMX, LLC ("GEMX").
- In January 2018, the expiration of NDX options on Fridays, other than the third Friday-of-the-month, was changed from a.m.-settled to p.m.-settled. Third-Friday expirations continued to be a.m.-settled as before. The p.m.-settled index options were given the new trading symbol "NDXP". These contracts were exclusively listed on Phlx and ISE.
- In June 2018, a new contract was introduced based on the Nasdaq-100 Index but with reduced notional value. The underlying index of the new contract, symbol

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[7] This includes p.m.-settled products trading on Phlx (XND Pilot and the Nonstandard Pilot) as well as p.m.-settled products trading on ISE (NQX Pilot and the Nonstandard Pilot). ISE filed a similar request for permanency of its p.m.-settled pilots. See SR-ISE-2023-07 (not yet noticed).

"NQX," was set at one-fifth the value of the NDX (with contract multiplier remaining at $100). This contract trades exclusively on ISE, and is p.m. settled on Fridays.

- In September 2018, a p.m.-settled index option, "NDXP," was introduced that expired on Wednesdays of each week. It was listed exclusively on Phlx and ISE.
- In February 2020, a p.m.-settled NDXP index option was introduced that expired on Mondays of each week. It was listed exclusively on Phlx and ISE.
- In April 2021, a second reduced value contract was introduced. The underlying index, "XND", is set at one-hundredth (1%) of the NDX (with contract multiplier remaining at $100). The notional value is therefore equal to the level of the Nasdaq-100 Index. This contract trades on Phlx and is p.m.-settled.
- On July 29, 2022, ISE received approval to list and trade p.m.-settled NDX index options that expire on Tuesday or Thursday under its Nonstandard Expirations Pilot Program.[8]
- On October 3, 2022, ISE commenced listing p.m.-settled quarterly option on the Nasdaq-100 Index.

Following terminological convention, the Exchange refers to the traditional third Friday expiration series as "monthly" contracts, while the other series are referred to as "weekly" contracts. In this report, the new p.m.-settled index options will be written as NDXP-Fri, NDXP-Wed, and NDXP-Mon based on their expiration day. The NDX contracts that formerly expired on Fridays, other than the third Friday-of-the-month, will

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[8] The Exchange notes that Tuesday and Thursday weeklies on the Nasdaq-100 Index have been trading for less than one month. See http://www.nasdaqtrader.com/MicroNews.aspx?id=OTA2022-26.

be referred to as NDX-Weekly, indicating their status as weekly contracts. The monthly third Friday NDX contract will be denoted NDX-Monthly. NQX and XND are considered weekly contracts. It may be noted that when Friday is a market holiday, the expiration moves to the prior Thursday.[9] When Wednesday is a holiday, expiration of Wednesday contracts moves forward to Tuesday. When Monday is a holiday, Monday expirations move back to Tuesday.[10]

The purpose of this report is to empirically assess the impact of these changes on NDX options markets, with a special focus on the market quality of the incumbent a.m.-settled NDX index options and market capacity around the market close. The Exchange provides a comprehensive analysis in this report on the impact of p.m.-settled index options on a.m.-settled NDX index options, including option trading volume, option open interests and option liquidity.[11] In assessing the impact of the innovations on market quality, the Exchange uses options on the Invesco QQQ Trust Series 1 ("QQQ")[12] as a control group. While activity in QQQ options would capture trading interest in the Nasdaq-100 Index generally and may reflect market conditions, it would be largely unaffected by the innovations considered in this report. QQQ options include monthly third Friday expirations, weekly non-third Friday expirations, and contracts expiring the end of the quarter.[13]

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9 See Phlx Options 4A, Section 12(b)(5)(A).

10 Id.

11 Today, NDX options are a.m.-settled and p.m.-settled.

12 Invesco QQQ™ is an exchange-traded fund based on the Nasdaq-100 Index.

13 For the purpose of spread analysis we match on option price, moneyness category, time to maturity and option's expiration month.

Historically there have been concerns that p.m.-settled index options could result in increased market and price volatility in the underlying component stocks, due to the unwinding of hedge-related positions at the close on expiration. A study conducted on behalf of the Securities and Exchange Commission's Division of Economic and Risk Analysis[14] shows that the market share for p.m.-settled options on S&P 500® Index has grown substantially since 2007. As the expiration date for p.m.-settled index options is more scattered compared to that for a.m.-settled options, only a smaller percentage of open interest expires on each date. As a result, p.m.-settled index option expirations are unlikely to cause any disruptive effect on the market. The DERA Staff PM Pilot Memo also shows that expiring open interest of a.m.-settled options may have had an economically small impact on the volatility of the Nasdaq-100 index around the open.[15] The DERA Staff PM Pilot Memo further shows that, although p.m.-settled index option trading volume may have a statistically significant relationship with the volatility of the underlying index around the market close, the economic significance was generally small. In its report, the Exchange provides additional analysis on market capacity around the market close. As the closing auction price is the most widely used reference price for mutual funds and for many exchange-traded products, closing auction volume has grown

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14 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"), available at: https://www.sec.gov/dera/staff-papers/studies-and-reports/analysis-of-pm-cash-settled-index-option-pilots.

15 Table 20 of the DERA Staff PM Pilot Memo suggests that a $10 billion increase in option settlement quantity is associated with an increase in absolute return of 0.025% near the open. The report also shows that expiring open interest of a.m.-settled options had no significant impact on the volatility of the underlying index near the open for the S&P 500 Index.

substantially in recent years. In this report, the Exchange shows that the closing auction volume on the equity market have become much larger than the opening auction, which may indicate that there is sufficient liquidity in closing auctions to absorb liquidity demand associated with p.m.-settlement of NDX and XND index options.

In addition to analysis on closing auctions, the report presents findings on three market characteristics: trading volume, open interest, and spreads. The Exchange finds that the trading volume and the notional open interests for options that had NDX and XND as the underlying increased during our sample period. In conclusion, there is no evidence that NDX and XND options contracts, which are p.m.-settled, would result in reduced trading activity or degradation in market quality of the a.m.-settled index options.

Analysis of Volume

The introduction of p.m.-settled index options and its impact on the trading activity of a.m.-settled options is likely the single most important factor under consideration. Volume is the primary indicator of trading interest and it drives market quality to a large extent. Consolidated volume information is available from The Options Price Reporting Authority ("OPRA"), the source of information used in this section. The sample period used for this report is 2017 through April 2022.

Consolidation of Trading on Nasdaq Affiliated Exchanges

As noted above, trading in NDX options began to consolidate exclusively onto Nasdaq-owned affiliated exchanges starting in 2017; the impact on volume was not immediate. Since January 2017, non-Nasdaq exchanges ceased listing new NDX options series, but continued with previously listed NDX options. The following table shows the

percentage of NDX options contract volume traded on non-Nasdaq exchanges, which at the time included Cboe Exchange, Inc. ("Cboe"), NYSE American LLC, and NYSE Arca, Inc. Of these three markets, Cboe was the largest in volume. The Nasdaq affiliated exchanges trading NDX options were Phlx, ISE and GEMX.

Table 1. NDX Volume on Non-Nasdaq Exchanges

Year	Quarter	Non-Nasdaq Share
2017	1	22.2%
	2	16.4%
	3	2.2%
	4	5.5%
2018	1	0.3%
	2	0.7%
	3	0.1%
	4	4.2%

By 2018 volume on the non-Nasdaq exchanges had largely disappeared. The surge in volume during the final quarter of 2018 was likely due to the end-of-year final closing of positions—note the similar bump in 2017. There was no NDX options volume from non-Nasdaq exchanges after 2018.

Contract Volume and Notional Volume

Contract volume in the regular-sized Nasdaq-100 Index contracts may be broken down into five time series: (1) the incumbent NDX-Monthly;[16] (2) the NDX-Weekly contract transitioning to NDXP-Fri;[17] and (3) the introduction of NDXP-Wed and NDXP-Mon.[18] The following graph shows monthly totals for each of these five groups.[19]

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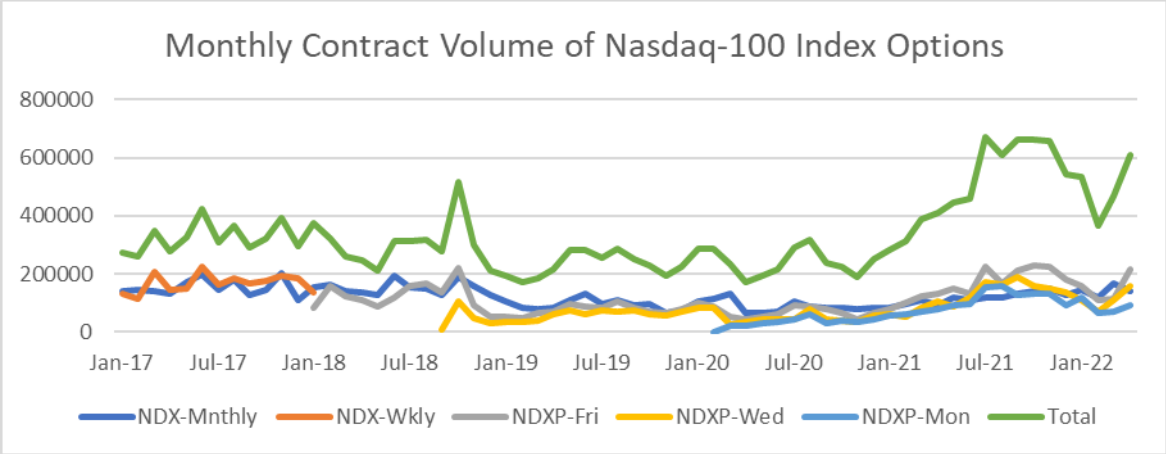
16 As noted herein, this refers to the monthly third Friday a.m.-settled NDX contract.

17 As noted above, this refers to the p.m.-settled NDX contracts that formerly expired on Fridays, other than the third Friday-of-the-month.

18 NDXP-Wed and NDXP-Mon are the p.m.-settled NDX contracts expiring on Wednesday and Monday, respectively.

Figure 1. Monthly Contract Volume of Nasdaq-100 Index Options



A number of observations can be drawn from the graph.

- The overall total contract volume remained almost flat until the pandemic market recovery started in the Spring of 2020. From Fall 2020 forward there has been substantial growth in volume. It appears that most of the recent growth has come from the NDX-Weekly contracts.
- The volumes of NDX-Monthly and NDX-Weekly were roughly equivalent during 2017. This is noteworthy for the fact that for any given month there would usually be at least three, and sometimes four times, the number of front-month expiries for the weekly contract. The Exchange can infer, then, that the monthly contracts tend to have substantially higher volume per series than the weekly contracts.
- When NDX-Weekly transitioned to NDXP-Fri, the volume relationship with NDX-Monthly remained roughly the same.

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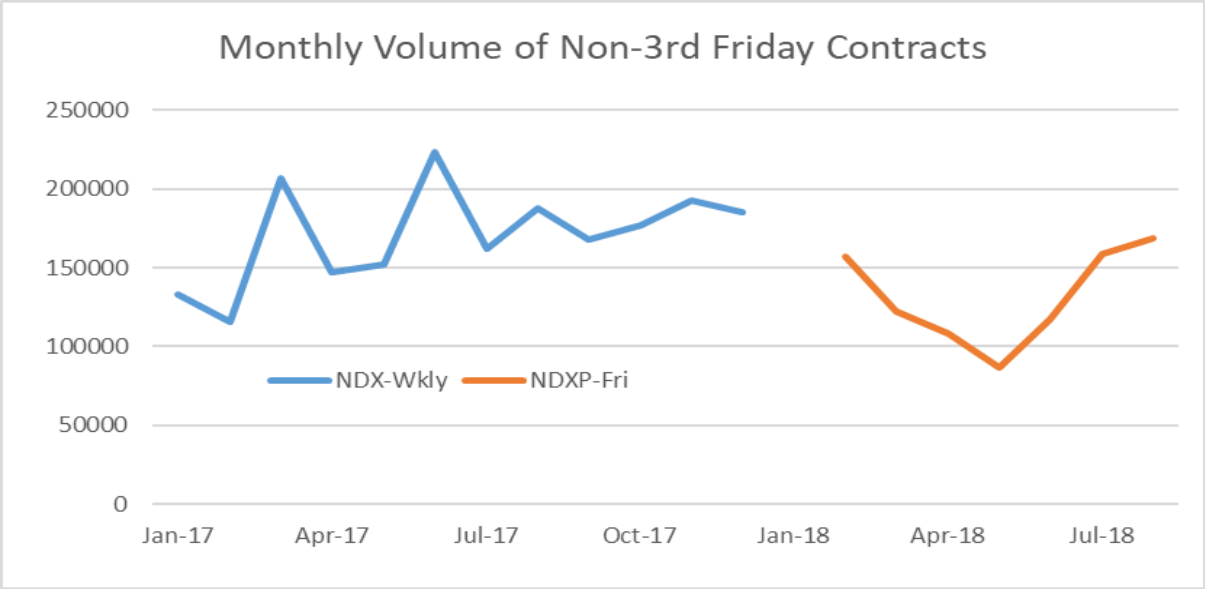
19 The full data supporting the graph is shown in the appendix.

- Soon after launch, the NDXP-Wed contracts achieved volume levels not much lower than the NDXP-Fri contracts, and, in turn, not much lower than the monthly contracts.
- Soon after launch, the NDXP-Monday contracts achieved volume levels not much lower than the NDXP-Fri contracts, and, in turn, not much lower than the monthly contracts.
- By the end of the sample period, each of the four remaining contract types had roughly the same value (again recognizing the differing number of expiries). Each of the current contract types garner substantial trading volume.

Regarding the NDX-Weekly/NDXP-Fri transition, Figure 2, which ends in August 2018, takes a closer look at the timeframe immediately prior to the launch of NDXP-Wed. The transition month of January 2018 is not shown (both contract types had volume during January).

Figure 2. Monthly Volume of Non-3rd Friday Contracts

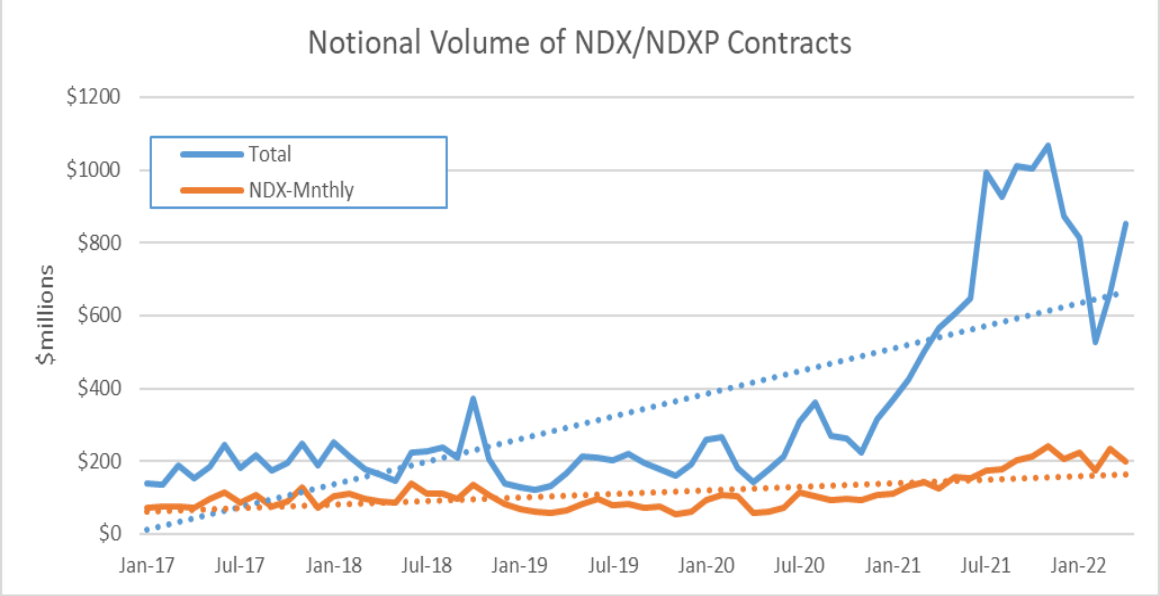


Though NDXP-Fri volume was relatively low in May 2018, there is no sign of a substantial sustained drop in volume accompanying the transition.

During the timeframe under consideration in this report there has been a remarkable increase in the level of the Nasdaq-100 Index, a rough tripling of the index from early 2017 to April 2022. The notional value of a regular-sized contract is $100 times the level of the index, and so it has tripled during the sample period, and is currently roughly $1.3 million. In light of these changes, it is useful to consider volume from the perspective of notional value traded rather than contracts.

Figure 3 shows the sum of monthly notional value traded for NDX-Monthly and for the total of all five of the contract types. The notional value traded was computed as the sum of contracts traded times the monthly average value of the Nasdaq-100 Index times $100. The graph also shows linear trend lines for each time series.

Figure 3. Notional Volume of NDX/NDXP Contracts



It appears that while the notional volume of the incumbent monthly contract has been flat, the total volume of all contract types exhibit a positive trend, with remarkable

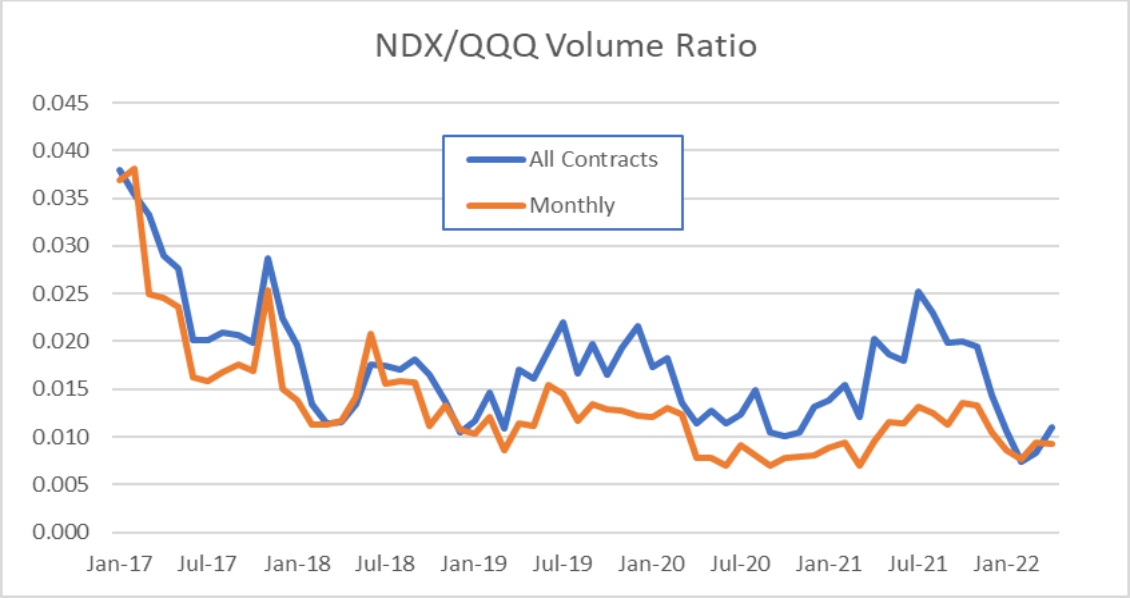
growth since the Fall of 2020. It appears, therefore, that the introduction of p.m.-settlement is associated with an increase in NDX options trading.

Comparison with QQQ Volume

The positive volume trend may be due to the remarkable performance of the Nasdaq-100 Index during this timeframe. To rule out this alternative explanation, the exchange compare the volume in NDX/NDXP index options to QQQ ETF options. It is worth noting that the notional volume of a QQQ option contract has been much lower than that of an index option. During the sample period, the average notional value of an index option contract was about $936,000, while a single QQQ contract had notional value of about $23,000.

Figure 4 presents a time series of the ratio of the sum of monthly contract volume in the indicated index option contracts to the sum of contract volume in QQQ options. For NDX-Monthly index options, only QQQ volume from third Friday expiring contracts was used. Since both the index and ETF options have the same underlying index, the observed trend is similar if notional volumes were used instead.

Figure 4. NDX/QQQ Volume Ratio

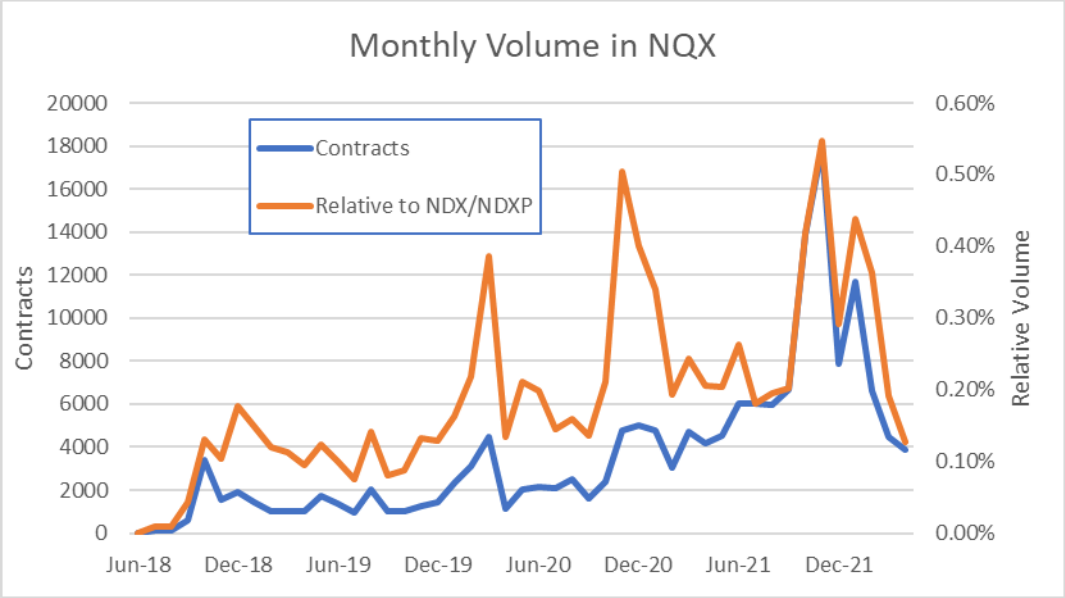


The graph shows a substantial decline in the relative level of the index option volume during 2017. This decline is too large to be explained by the reduction in the share of options trading on non-Nasdaq exchanges. The decline stabilized at the start of 2018.

NQX Volume

In spite of the very high notional volume of NDX/NDXP options, volume in the reduced-value NQX options has never been higher than NDXP trading volume (perhaps due to the availability of QQQ options). Figure 5 shows monthly volume for all NQX contracts. Shown are both the volume in terms of contracts traded, as well as NQX volume relative to the total volume of NDX/NDXP contracts. For the latter calculation, the NQX contract volume was divided by 5 to reflect its reduced notional value.

Figure 5. Monthly Volume in NQX



Since launch, NQX volume has grown, both in absolute terms and relative to NDX/NDXP volume. The period of extreme market volatility surrounding the pandemic crisis in the Spring of 2020 led to a volume spike, as did the market recovery of the Fall of 2020. Even so, the relative level of NQX volume was very low relative to that of the regular-valued indexes. Due to the low level of NQX volume, it seems unlikely that its introduction had a significant impact on the market quality of the full-sized NDX contracts. Therefore, no further analysis was attempted on NQX options.

XND Volume

Trading in XND options contracts is relatively new.[20] The following table shows XND monthly contract volume for the first year of trading.

[20] As noted herein, XND began trading in April 2021.

Table 2. XND Trading Volume

Apr 2021	292
May 2021	1,128
Jun 2021	4,334
Jul 2021	6,452
Aug 2021	3,222
Sep 2021	5,319
Oct 2021	3,860
Nov 2021	2,700
Dec 2021	2,492
Jan 2022	4,941
Feb 2022	3,634
Mar 2022	6,593
Apr 2022	12,990

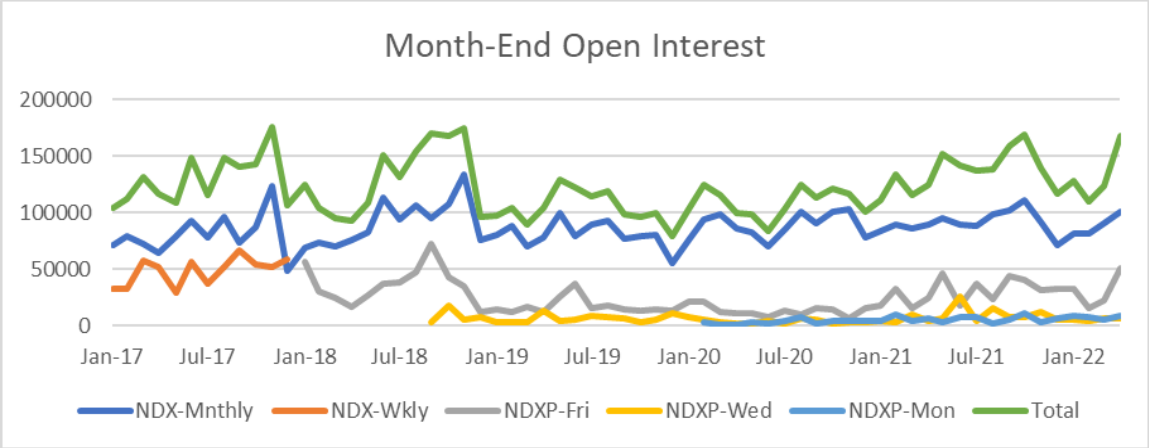
The low level of XND options volume suggests that the introduction of XND did not have a noticeable impact on the trading of the incumbent NDX/NDXP contracts.

Analysis of Open Interest

The Exchange next considered trends in open interest for the Nasdaq-100 Index options. The Options Clearing Corporation ("OCC") data was utilized as source data for this analysis. Open interest measures positions held overnight; positions that are established and closed during the day are not captured.

Figure 6 shows the open interest, in contracts, as of the last trading day of the indicated month.

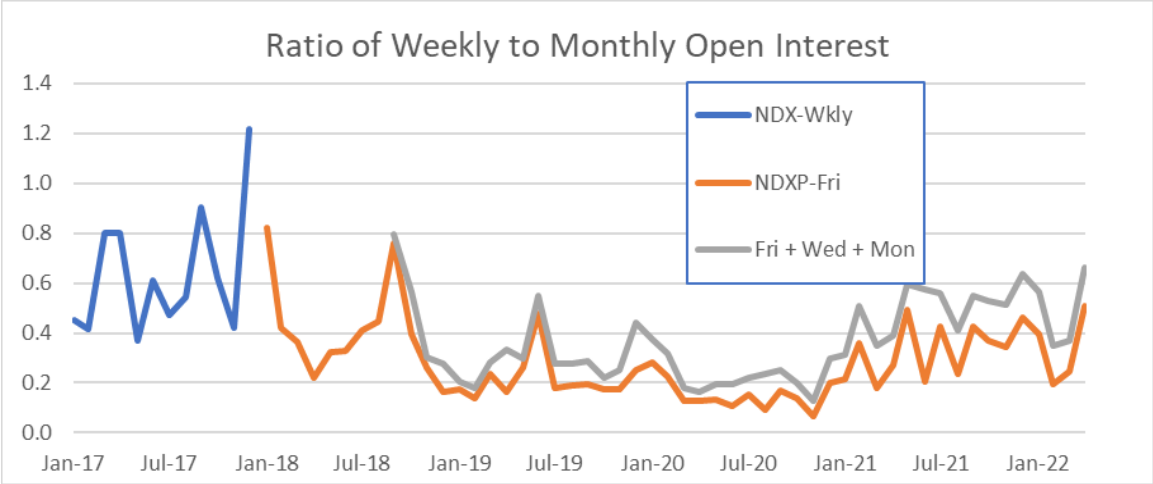
Figure 6. Month-End Open Interest



The open interest in NDX-Monthly is remarkably stable during this timeframe, and is substantially higher than that of the weekly contracts. After transitioning to p.m.-settlement, the open interest in NDXP-Fri contract started to decline while it increased in the second half of 2022. The open interest in the Wednesday and Monday contracts has always been relatively low.

Further insight is shown in the following graph, which shows the ratio of open interest in weekly contracts to that of the monthly contract (that is, the open interest sum of NDX-Weekly, NDXP-Fri, -Wed, and Mon divided by the open interest in NDX-Monthly).

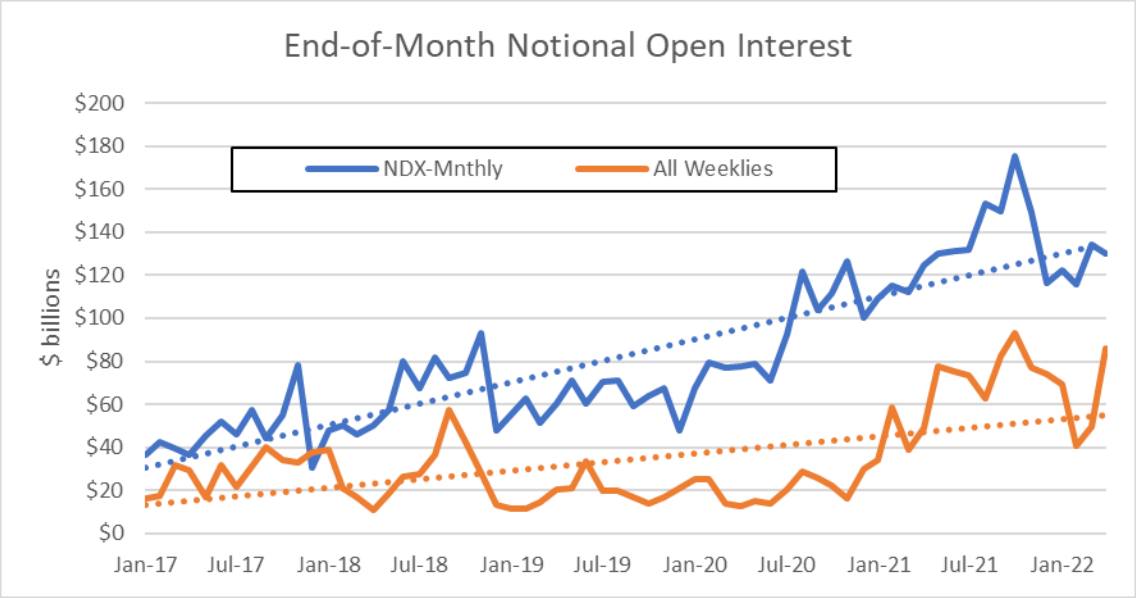
Figure 7. Ratio of Weekly to Monthly Open Interest



The graph shows a clear decline in the ratio of weekly to monthly open interest, starting at the beginning of 2018, but the declining trend stabilized at the end of Q1 2018. When considered with the volume information shown above, this may be because options traders with longer holding horizons may be more likely to trade the monthly contract, while those with shorter intra-day positions are more likely to use the weekly contracts. This tendency is reflected in the listing of expiries. At any given time, expirations out to a year or more are available for the monthlies, while expirations only out a month or so are available for the weeklies.

As noted above, the notional value of Nasdaq-100 Index options has roughly tripled during this timeframe. It is therefore useful to consider the trends in open interest from a notional perspective, as shown in the following graph.

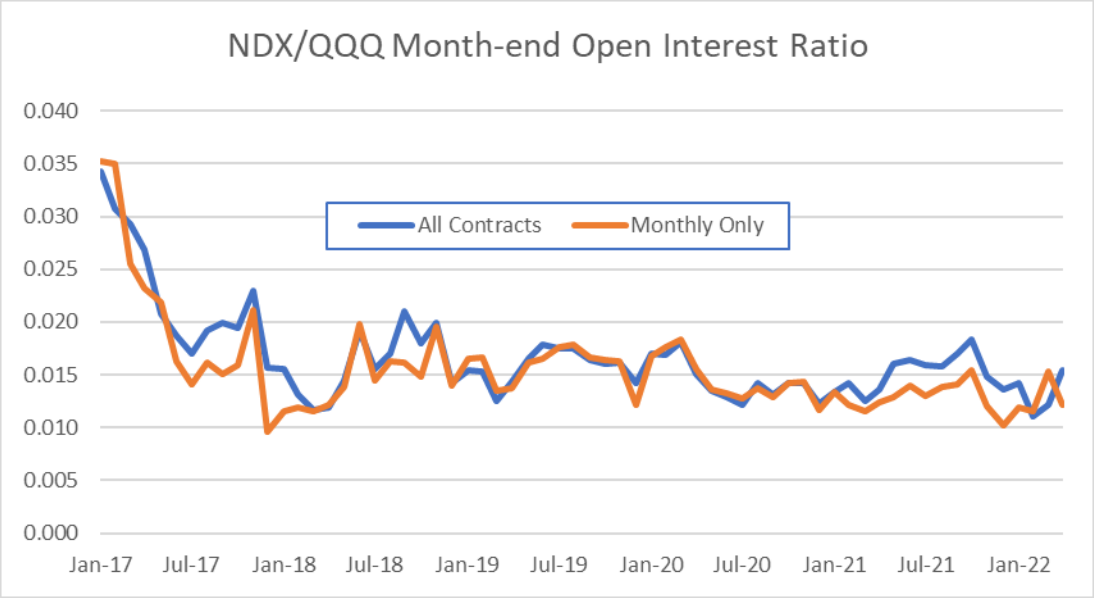
Figure 8. End of Month Notional Open Interest



A clear positive trend is evident for the monthly contract in terms of notional value. The weeklies showed a flat trend that has increased since the Fall of 2020.

As discussed above, we designate QQQ options as a control group for our analysis. Figure 9 shows the ratio (in contracts) of Nasdaq-100 Index options to QQQ options. As noted herein, the trend is unaffected when measuring open interest in contracts or notional value. The graph shows the ratio for monthly contracts for NDX and QQQ, as well as for NDX/NDXP and QQQ.

Figure 9. NDX/QQQ Month-End Open Interest Ratio



This graph closely mirrors the volume graph shown above in Figure 9. There was a distinct decline during 2017 in month-end open interest, but the trend stabilized at the start of 2018 and has remained flat since then.

Analysis of Spreads

An important dimension of market quality is the cost of trading. Following Holden and Jacobsen (2014)[21], the Exchange used duration weighted relative quoted spread as a measure of the cost of trading. In this section, the Exchange examines whether there is any deterioration of spreads to a.m.-settled Nasdaq-100 Index options by introducing p.m.-settled index options. A particular challenge for measuring quoted spreads is created by the large number of options series tied to a particular underlying. In addition to the range of expiries, a given expiration will have many available strike

21 See Holden, C. and Jacobsen, S., 2014, Liquidity Measurement Problems in Fast, Competitive Markets: Expensive and Cheap Solutions. Journal of Finance. 69, 1747-17852 (https://onlinelibrary.wiley.com/doi/abs/10.1111/jofi.12127)

prices. This set of combinations then is doubled by considering calls and puts. Many listed options series will be very infrequently traded. For example, at the start of the sample period on January 3, 2017, there were 3,720 individual options series that had NDX as the underlying, made up from 14 expiration dates and 382 strike prices. Of these listed options series, only 458 had traded volume on that date, with 233 options series with volume of at least 10 contracts. Nearer to the end of the sample period, on April 29, 2022, there were 16,624 listed options series with NDX or NDXP as the underlying, consisting of 33 expiration dates and 675 strikes. Of the listed options series, 2,192 had some volume and 538 had volume of at least 10 contracts.

To assess the trend in the relative NBBO quoted spread, the Exchange limited the number of options series under consideration by reviewing spreads in the front-month contracts (contract nearest expiration) on the first trading day of each month.[22] The Exchange considered an NBBO quotation to be "live" and used in the computation when the National Best Offer (NBO) was non-zero.

In the following section, the Exchanges shows the impact of the introduction of p.m.- settled index options on the liquidity of NDX contracts by showing the average monthly NDX spread over time (in Figure 10) as well as comparing the trend of relative quoted spread of NDX contracts with that of QQQ contracts (Figures 11 and 12). Figure 10 shows the average monthly relative quoted spread for all options with NDX as the underlying. To better reflect the trend of the relative quoted spread, the Exchange plotted

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[22] Although the Exchange believes that sampling the first trading day of each month between date January 2017 and April 2022 would reflect the trend of market quality, the Exchange acknowledges that in some cases there may some information loss given a particular trading day. For example, a volatile trading day may not be representative of the market for that trading month.

the average relative quoted spread benchmarked against (subtracted by) the average spread of 2017 as the dotted line in Figure 10. The dotted vertical line highlights the time when p.m.-settled index options were introduced. Specifically, the time series in the dotted line was computed using the following steps. First, the Exchange calculated the duration weighted average relative quoted spread for each contract on each day. Second, the Exchange took the average of the above daily spread across all contracts with NDX as the underlying for each day. Third, the Exchange calculated the average relative quoted spread for all months in 2017. Finally, the 2017 average was subtracted from the monthly average to create a time series dataset. As can be seen from the plot, a consistent decrease in the relative quoted spread is prevalent from 2017 to 2022 and most importantly, there is no obvious change in the trend following the introduction of p.m.-settled index options.

Although the above method is intuitive, it is well known that the option premia are correlated with option characteristics such as expiry, strike price, and whether the contract is a put or a call option. Also, option premia tend to increase when the expected volatility of the underlying asset increases, and premia increase may in turn cause the spread to increase. Inspired by Kaul, Nimalendran and Zhang (2004)[23] and Albuquerque, Song and Chen (2020)[24], the Exchange also employed the following regression model to

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23 See Kaul, G., Nimalendran, m., and Zhang D., 2004, Informed Trading and Option Spreads Working Paper (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=547462).

24 See Albuquerque, R., Song, S., and Yao, C., 2020, The Price Effects of Liquidity Shocks: A Study of SEC's Tick-Size Experiment. Journal of Financial Economics. 138, 700-724 (https://www.sciencedirect.com/science/article/pii/S0304405X20301884).

control for factors related to option characteristics unrelated to the XND Pilot and the Nonstandard Pilot:[25]

Spread = α + $InverseofPrice$ + Call/Put Dummy + Expiry +Moneyness Categories + Month Fixed Effect + ε (1)

In the above model, *Spread* is the relative quoted spread. *InverseofPrice* is the inverse of the option price. *Call/Put Dummy* is a dummy variable that equals 1 for call options and 0 otherwise. *Expiry* is the number of the days to the expiration date. *Moneyness* is a dummy variable for moneyness category of each option. Specifically, all option contracts were classified into 5 moneyness categories. The moneyness for call options was calculated as:

$$\frac{S-X}{X} * 100\%$$

and

$$\frac{X-S}{X} * 100\%,$$

for put options, where "S" is the stock price and "X" is the exercise price. The cut-offs for the five moneyness groups were: -30%; -10%; 10%; and 30%. Month Fixed Effect is a dummy variable for each month.

In constructing the plot, the coefficients for those month fixed effects were adjusted. The raw coefficients for each month were collected from the regression output. The first month in the sample, January 2017, implicitly had a coefficient of zero. The

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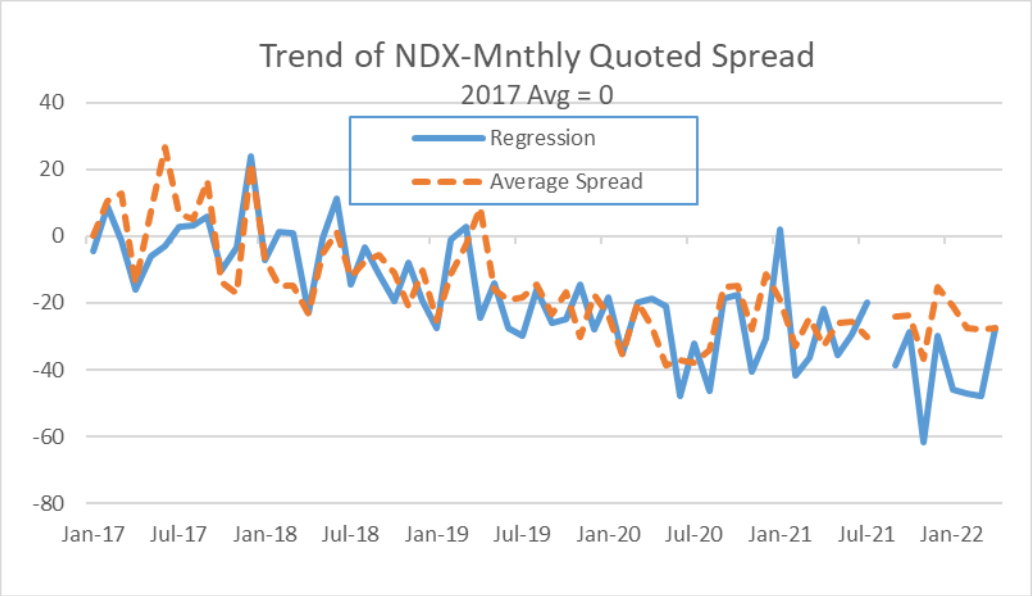
[25] The calculation was inspired by Kaul, G., Nimalendran, m., and Zhang D., and Albuquerque, R., Song, S., and Yao, C. See notes 21 and 22 above. The Exchange includes control variables used in Albuquerque, R., Song, S., and Yao, C. (2020) liquidity analysis and constructs *Moneyness Categories* following Kaul, Nimalendran and Zhang (2004).

average coefficient for the 12 months in 2017 was then calculated. Finally, the average coefficients across all 12 months in 2017 were subtracted from the raw coefficients to create a time series dataset, which is depicted as the unbroken line in Figure 10.

As can be seen from the plot, there is a steady decrease in the relative quoted spread for NDX option contracts. The average relative quoted spread for NDX contracts decreased by about 30% - 40% from the beginning of 2017 until the end of the sample period. Since the regression model controls for factors that affect the spread, the unbroken line based on the regression model tends to be less volatile. However, there is no large difference in the results between the average spread and results based on the regression models, but there is some divergence at certain points in time. The Exchange conjectures that the divergence is due to higher option premia caused by the elevated levels of volatility. In summary, based on both methods, a consistent decrease in relative quoted spread is observed from 2017 to 2022.

Figure 10. Trend of NDX-Monthly Quoted Spread[26]



The Exchange then compared the spread trend of NDX monthly contracts to that of QQQ monthly contracts. The average monthly spread for QQQ contracts was constructed the same way as that for the NDX monthly contracts (as described in detail above). Figure 11, below, displays the patterns of relative quoted spread for NDX and QQQ, which are remarkably similar and decreased during the sample period. Figure 12, below, highlights the difference in Figure 11 as between NDX and QQQ. Relative to a QQQ control, there is therefore no evidence of a deterioration of NDX monthly spreads during the sample period. In summary, the results suggest that there is gradual decrease in both the NDX monthly contracts spread and the QQQ contracts spread during the sample period.

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[26] NBBO data was unavailable between August 1, 2021 and August 11, 2021, and, therefore, August 2021 was excluded from the plot. Also, with respect to Figure 10, Regression plots the coefficients of dummies for each month (i.e., fixed effects). Average Spread plots the average monthly relative quoted spread subtracted by the 2017 average relative quoted spread.

As the introduction of p.m.-settled index options may affect the transaction cost for NDX monthly contracts, it is unlikely to affect the spread of QQQ options. Therefore, the Exchange uses the following regression to formally test whether the spread of NDX contract changed after the introduction of p.m.-settled index options. NDX and QQQ options are included in the sample for the period between January 2017 and December 2018. This regression looks at a sample period starting from one year before and ending one year after the introduction of p.m.-settled index options.

Spread = α + NDX + Post + NDX * Post + $InverseofPrice$ + Call/Put Dummy + Expiry +Moneyness Categories + Month Fixed Effect + ε (2)

Similar to regression model (1), *Spread* is the relative quoted spread. *InverseofPrice* is the inverse of the option price. *Call/Put Dummy* is a dummy variable that equals 1 for call options and 0 otherwise. *Expiry* is the number of the days to the expiration date.[27] *Moneyness* is a dummy variable for moneyness category of each option. *NDX* is a dummy variable that equals one if the underlying asset of the option is NDX index and zero otherwise. *Post* is a dummy variable that equals to one for days after January 2018 and zero otherwise. The Exchange also includes the interaction terms of the post dummy and the NDX dummy (NDX * Post).

Table 3 shows that the coefficient of the interaction term is negative but it is statistically insignificant. Therefore, the Exchange concludes that the introduction of p.m.-settled index options did not negatively affect the liquidity of a.m.-settled NDX options.

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[27] The Exchange notes that there was no transformation.

Figure 11. Trend of NDX-Monthly and QQQ Quoted Spread[28]

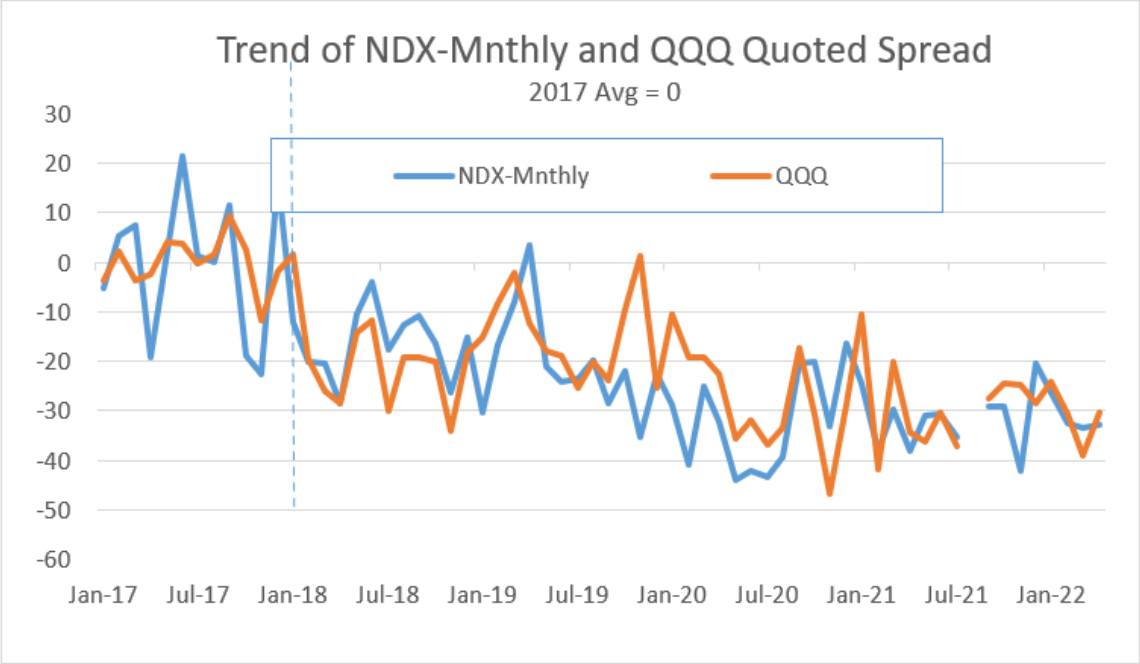
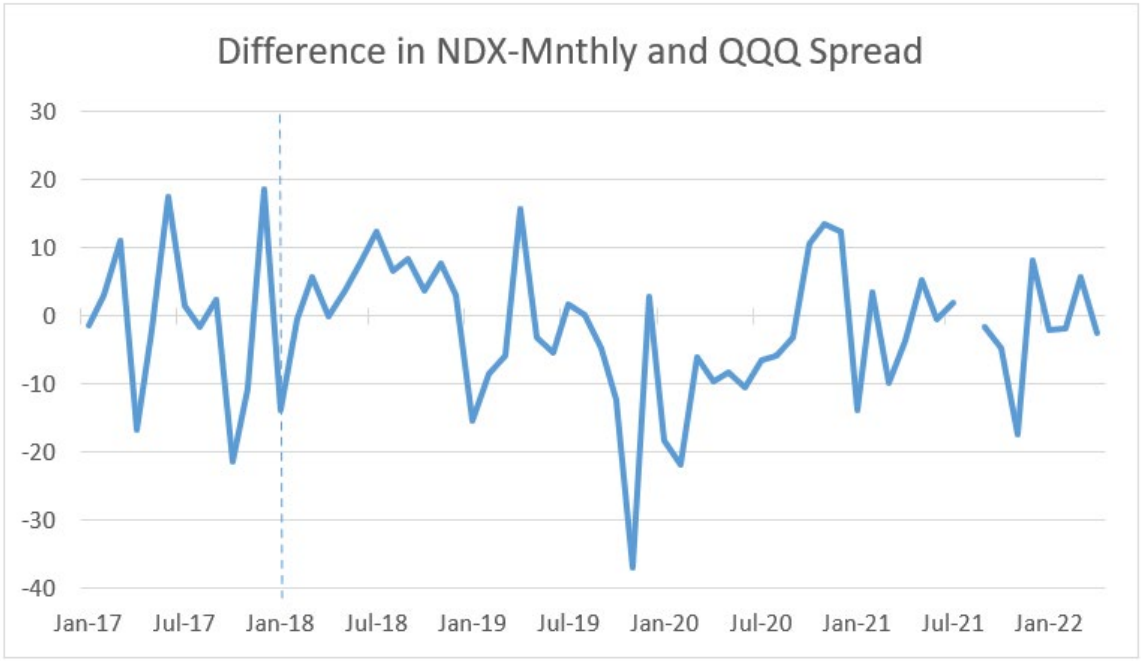


Figure 12. Difference in NDX-Monthly and QQQ Spread[29]



28 Id.

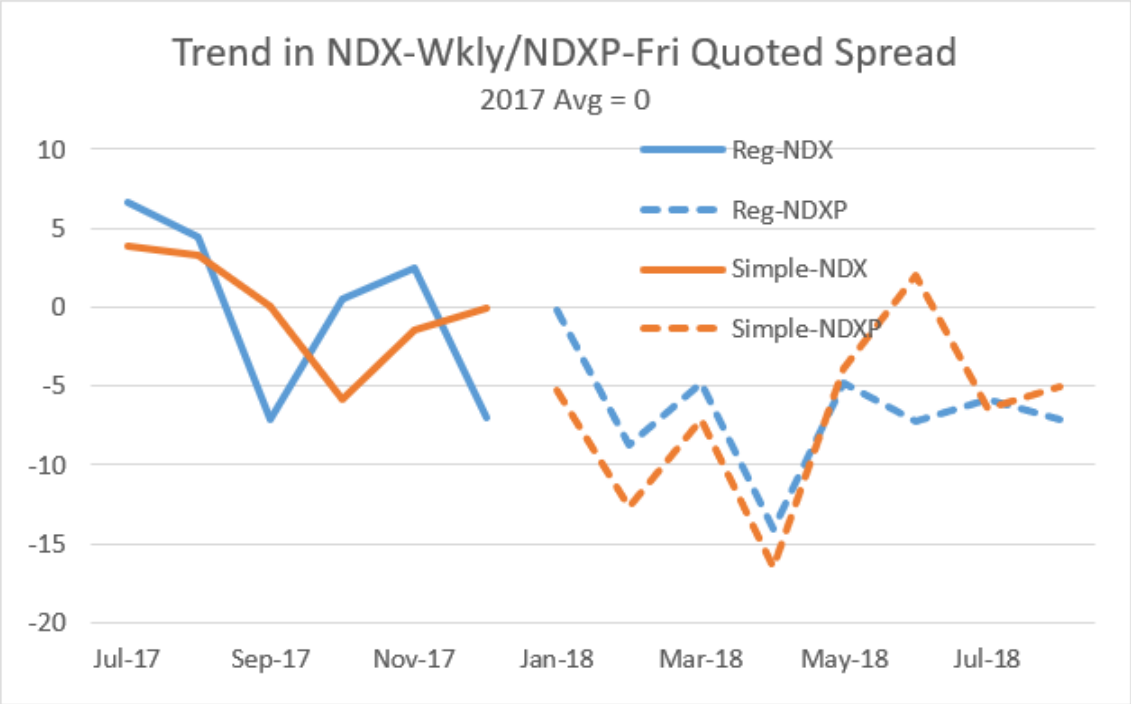
29 Id.

Table 3. Regression Results

	coef	std	t
Constant	0.26***	0.01	37.50
NDX	0.28***	0.01	28.62
Post	-0.01	0.02	-0.80
NDX*Post	-0.02*	0.01	-1.73
InverseofPrice	0.00***	0.00	48.65
Call/Put Dummy	0.26***	0.01	37.77
Expiry	0.00***	0.00	46.29
Moneyness Categories Fixed Effect	Yes		
Month Fixed Effect	Yes		

The report considered one additional question regarding quoted spreads — whether the move from a.m.-settlement to p.m.-settlement for Friday weeklies (NDX-Weekly to NDXP-Fri) led to changes in spreads for those contracts. This sample timeframe was from July 2017 through August 2018, prior to the launch of NDXP-Wed contracts. As before, the Exchange presented both the simple average monthly relative quoted spread as well as the average spread calculated using the regression model.

Figure 13. Trend in NDX-Wkly/NDXP-Fri Quoted Spread[30]



The relative quoted spread went down at the first part of 2018 and up in May and June 2018; it remained comparable to the 2017 average.

Overall, the Exchange sees no evidence of deterioration of spreads associated with the introduction of p.m.-settled NDX options.

Market Capacity Around the Market Close

The Exchange next analyzed the impact that p.m.-settled index options may have on the closing process of the equity markets.[31] The DERA Staff PM Pilot Memo

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30 With respect to Figure 13, Reg-NDX plots the coefficients of dummies for each month for NDX contracts. Reg-NDXP plots the coefficients of dummies for each month for NDXP contracts. Simple-NDX plots the average monthly relative quoted spread subtracted by the 2017 average relative quoted spread for NDX contracts. Simple-NDXP plots the average monthly relative quoted spread subtracted by the 2017 average relative quoted spread for NDXP contracts.

31 This analysis considers the DERA Staff PM Pilot Memo.

concluded that while p.m.-settled index options activity may have had a statistically detectable impact on volatility, the economic significance was generally small. The DERA Staff PM Pilot Memo provided,

> However, the report suggests that the magnitude of the effect of expiring p.m. cash-settled index options open interest on the measure of volatility and price reversals for index futures, the underlying cash index, and index component securities is economically very small.[32]

The following provides an illustration using some of the regression results from the DERA Staff PM Pilot Memo. Among the volatility variables analyzed by the DERA Staff PM Pilot Memo was the "Magnitude of Maximum Reversal Overlapping Close" of index futures prices. The DERA Staff PM Pilot Memo found that this metric was higher when the options settlement volume was higher, for both the S&P 500 and the Nasdaq-100 Index options. Using data provided in the DERA Staff PM Pilot Memo, the Exchange can estimate the impact of a very large increase in settlement volume: an increase from its 25th percentile to its 75th percentile. The following table shows the steps of the calculation.

Table 4[33]

	Settlement Volume			Regression Coefficient	Impact	Median of Variable	Rel. Impact
	25th	75th	Diff.				
S&P500	0.40	1.66	1.26	0.317	0.40	1.96	20.4%
Nq-100	0.07	0.17	0.10	2.39	0.24	1.58	15.4%

The percentiles of settlement volume (in units of $10 billion notional) are shown in Table 25 of the DERA Staff PM Pilot Memo, which indicated that the volume of S&P 500 contracts was much higher than that of Nasdaq-100 contracts. The regression

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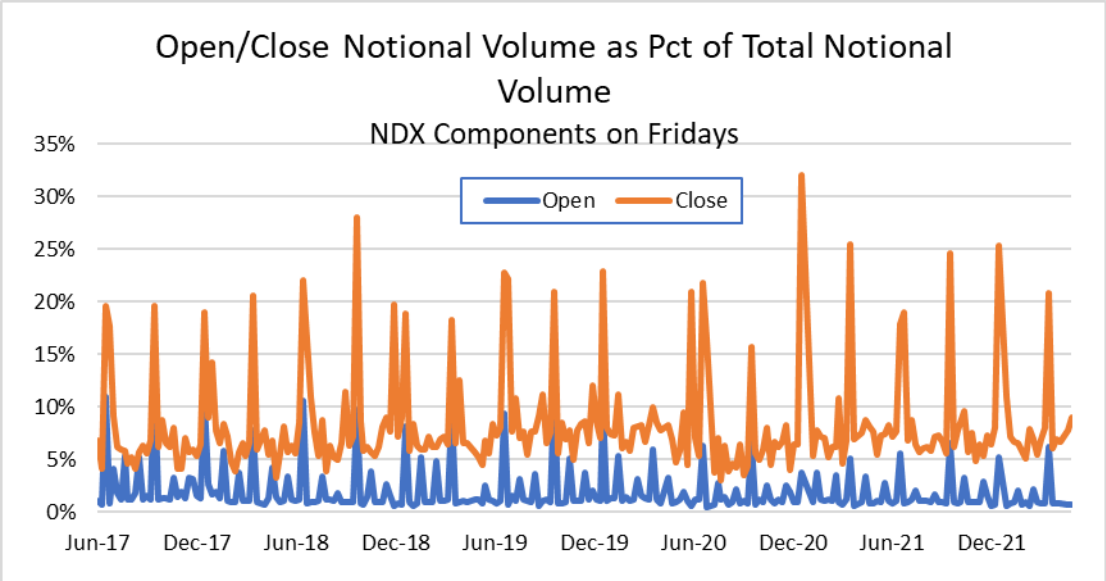
32 See DERA Staff PM Pilot Memo at page 1.

33 See DERA Staff PM Pilot Memo

coefficients are from Table 5 (S&P 500) and Table 19 (Nasdaq-100) of the DERA Staff PM Pilot Memo. The estimated impact is the product of the volume difference times the coefficient. Table 5 of the DERA Staff PM Pilot Memo provided the median of the volatility metric during the sample period. The relative impact is the estimated impact divided by the sample median, i.e., the estimated change in the volatility metric, relative to its median value, due to an increase in settlement volume. As shown, the relative impact was small for both indexes, about 20% for the S&P 500 and 15% for the Nasdaq-100.

The Exchange provides some additional analysis on market capacity around the market close. Specifically, the Exchange believes it is important to recognize that in recent years the closing auctions on the equity markets have steadily grown to a point where they are much larger than the opening auctions. To illustrate this point, the following chart shows the percentage of dollar volume of Nasdaq-100 Index components executed in the opening and closing auctions on Fridays.

Figure 14. Open/Close Dollar Volume as Pct of Total Dollar Volume NDX Components on Fridays



The percentage of volume executed in the close is uniformly higher than that of the open. The spikes in the closing percentages represent third Fridays, and in a few cases Fridays that corresponded to the end of a month. The opening percentage is slightly declining, the closing percentage slightly increasing during this timeframe. As another illustration, consider the opening and closing dollar volume percentages for Fridays, other than the third Friday-of-the-month, from the second half of 2017 compared with the first half of 2018. This timeframe corresponds to the introduction of NDXP options,[34] in which non-third Friday series moved to p.m.-settled. The following table present the average percentages.

Table 5. Dollar Volume for Nasdaq-100 Components on non-3rd Fridays

	Auction Vol. as Pct of Total Vol.	
	Opening	Closing
Jul – Dec 2017	1.48%	6.40%
Jan – Jun 2018	1.13%	6.76%
Difference	-0.35%	0.36%

As would be expected, the relative size of the opening auction declined, and the closing auction increased by roughly the same amount. The percentage of about 0.35% would be an estimate of the volume impact of NDX/NDXP options settlement on the equity market auctions. This percentage is small to begin with, but it is a much smaller proportion of the closing auction than the opening auction. Therefore, the Exchange believes that the liquidity available at or around the close would be able to mitigate any excess volatility created by the options settlement at the market close.

34 NDXP options are p.m.-settled index options on broad-based indexes with nonstandard expirations dates which are also the subject of a pilot program. NDXP are listed on ISE and Phlx.

As a third example, the Exchange considered the level of options settlement volume relative to the size of the closing and opening auctions.[35] To provide the most up-to-date view of the current situation, the Exchange examined activity from the start of 2021 through April 2022. The below table shows the notional settlement volume (in billions of dollars) along with the notional volume in the auctions for Nasdaq-100 Index components. Settlement volume is the average dollar volume settled at OCC, Closing Auction is the average dollar volume executed in the closing auction, Pct of Close is calculated as Settlement Volume divided by Closing Auction, Open Auction is the average notional volume executed in the open auction, and Pct of Open is calculated as Settlement Volume divided by Opening Auction.

Table 6. Settlement Volume for NDX/NDXP vs Auctions: Jan 2021– Apr 2022

Exp. Day	Settlement Volume	Closing Auction	Pct of Close	Opening Auction	Pct of Open
NDXP					
Monday	$2.4	$9.9	25.9%		
Wed	$2.7	$9.0	30.2%		
Non 3rd Fri.	$4.1	$9.6	44.7%		
NDX					
3rd Friday	$13.1	$23.0	78.0%	$6.6	230.4%

Table 6 shows that the settlement volume for NDXP settlements averages between 26% and 45% of the closing auction volume, the Friday NDXP settlements being the largest. NDX settlement volumes are larger, and relative to the opening auction—the relevant auction—they average more than twice the size of the auctions. By contrast, the relative size of the settlement volume would be about a third less if it were

35 Options settlement volume is the primary size metric used in the DERA Staff PM Pilot Memo. Options settlement volume is the notional volume settled in the closing auction.

compared to the closing auctions on the third Fridays. As documented in the DERA Staff PM Pilot Memo, p.m.-settled option activities only have a very small impact on the volatility of the underlying index. Additionally, the size of the option settlement value is relatively small compared with the size of the closing auction value. Therefore, the Exchange believes that it is difficult to manipulate the underlying Nasdaq-100 Index during the closing auction. The equity closing auctions have grown to be substantial liquidity events (for the period examined the closing auction volume is larger than the opening auction volume) and would therefore be suited for handling the excess liquidity demand created by index options settlement.

Technical Amendment to Rule Text

The Exchange proposes to amend Options 4A, Section 12(b)(5) to remove "C" and re-letter "D" as "C."

b. Statutory Basis

The Exchange believes that its proposal is consistent with Section 6(b) of the Act,[36] in general, and furthers the objectives of Section 6(b)(5) of the Act,[37] 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 proposing to make permanent the XND Pilot and the Nonstandard Pilot.

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36 15 U.S.C. 78f(b).

37 15 U.S.C. 78f(b)(5).

Previously, the Commission has raised concerns about expanding p.m. settlement.[38] Specifically, the Commission noted in the Cboe Pilot Order that it had concerns about the adverse effects and impact of p.m. settlement upon market volatility and the operation of fair and orderly markets on the underlying cash market at or near the close of trading.[39] The Commission noted in the Cboe Pilot Order that the information requested of Cboe would enable the Commission to evaluate whether allowing p.m. settlement for EOW and EOMs will result in increased market and price volatility in the underlying component stocks.[40] Further, the p.m. settlement Pilot information should help the Commission assess the impact on the markets and determine whether other changes are necessary.[41] Furthermore, the Exchange's ongoing analysis of the Pilot should help it monitor any potential risks from large p.m.-settled positions and take appropriate action if warranted.[42]

Similar to Cboe, Phlx has provided pilot data to the Commission with respect to its XND Pilot and Nonstandard Pilot. The Exchange's analysis presents data that the introduction of p.m.-settlement has led to an increase in options trading tied to the Nasdaq-100 Index. The Exchange notes within its analysis that it seems unlikely that the

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38 See Securities Exchange Act Release No. 62911 (September 14, 2010), 75 FR 57539 (September 21, 2010) (SR-CBOE-2009-075) (Order Approving Notice of Proposed Rule Change, as Modified by Amendment Nos. 1 and 2, To Establish a Pilot Program To List P.M.-Settled End of Week and End of Month Expirations for Options on Broad-Based Indexes) ("Cboe Pilot Order").

39 Id at 57540.

40 Id at 57540.

41 Id at 57540.

42 Id at 57540.

introduction of XND option contracts or NQX contracts[43] had a significant impact on the market quality of the full-sized Nasdaq-100 Index option contracts. The Exchange observed a consistent decrease in relative quoted spread is observed from 2017 to 2022 for NDX options. When the Exchange compared the spread trend of NDX monthly contracts to that of QQQ monthly contracts, the results suggest that there is gradual decrease in both the NDX monthly contracts spread and the QQQ contracts spread during the sample period.

The Exchange also considered whether the move from a.m.-settlement to p.m.-settlement for Friday weeklies (NDX-Weekly to NDXP-Fri) led to changes in spreads for those contracts. Overall, the Exchange sees no evidence of deterioration of spreads associated with the changes the Exchange has made to its Nasdaq-100 Index product offering by introducing p.m.-settled products.

Finally, in considering impact on the closing process in equity markets, the Exchange concluded that it is difficult to manipulate the underlying Nasdaq-100 Index. Specifically, the equity closing auctions have grown to be substantial liquidity events that are much larger than the opening auctions, and would therefore be better suited for handling the excess liquidity demand created by index options settlement. The Exchange believes the expiration of p.m.-settlement options would not adversely affect the options market or the underlying cash equities market.

Further, the Exchange has sufficient systems capacity to handle p.m.-settled options on broad-based indexes with nonstandard expirations dates and has not encountered any issues or adverse market effects as a result of listing them.

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43 See note 7 above.

Accordingly, the Exchange believes that weekly expirations and EOMs, including the XND expirations, in the p.m.-settled products should create greater trading and hedging opportunities and flexibility and provide customers with the ability to more closely tailor their investment objectives.

4. 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. Making permanent the XND Pilot and the Nonstandard Pilot will not impose an undue burden on competition, rather, it will continue to provide investors with greater trading and hedging opportunities and flexibility, as well as the ability to more closely tailor their investment objectives.

Additionally, the Exchange does not believe the proposal will impose any burden on intermarket competition as market participants are welcome to become members or member organizations and trade at Phlx if they determine that this proposed rule change has made Phlx more attractive or favorable. Finally, all options exchanges are free to compete by listing and trading their own broad-based index options with weekly or end of month expirations.

5. 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.

6. Extension of Time Period for Commission Action

The Exchange does not consent to an extension of the time period for Commission action.

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

Not applicable.

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

Not applicable.

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

Not applicable.

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

Not applicable.

11. Exhibits

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

3. Data Appendix.

5. Text of the proposed rule change.

EXHIBIT 1

SECURITIES AND EXCHANGE COMMISSION
(Release No. ; File No. SR-Phlx-2023-07)

February __, 2023

Self-Regulatory Organizations; Nasdaq PHLX LLC; Notice of Filing of Proposed Rule Change to Make Permanent Certain P.M.-Settled Pilots

Pursuant to Section 19(b)(1) of the Securities Exchange Act of 1934 ("Act")[1], and Rule 19b-4 thereunder,[2] notice is hereby given that on February 23, 2023, Nasdaq PHLX LLC ("Phlx" or "Exchange") filed with the Securities and Exchange Commission ("SEC" or "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

The Exchange proposes to make permanent the pilot to permit the listing and trading of options based on 1/100 the value of the Nasdaq-100 Index ("Nasdaq-100" or "NDX") and the Exchange's nonstandard expirations pilot program which are both currently set to expire on May 4, 2023.

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

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1 15 U.S.C. 78s(b)(1).

2 17 CFR 240.19b-4.

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

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

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

1. Purpose

Phlx proposes to make permanent 2 pilots, which are both set to expire on May 4, 2023: (1) the Exchange's pilot to permit the listing and trading of options based on 1/100 the value of the Nasdaq-100 Index ("XND Pilot"), and (2) the Exchange's nonstandard expirations pilot program ("Nonstandard Pilot").

XND Pilot

Phlx filed a rule change to permit the listing and trading of index options on the Nasdaq 100 Micro Index Options ("XND") on a pilot basis.[3] XND options trade independently of and in addition to NDX options, and the XND options are subject to the same rules that presently govern the trading of index options based on the Nasdaq-100 Index, including sales practice rules, margin requirements, trading rules, and position and exercise limits. Similar to NDX, XND options are European-style and cash-settled, and have a contract multiplier of 100. The contract specifications for XND options mirror in

[3] See Securities Exchange Act Release No. 91524 (April 9, 2021), 86 FR 19909 (April 15, 2021) (SR-Phlx-2021-07) (Approval Order).

all respects those of the NDX options contract already listed on the Exchange, except that XND options are based on 1/100th of the value of the Nasdaq-100 Index, and are p.m.-settled pursuant to Options 4A, Section 12(a)(5).

The Exchange proposes to amend Phlx Options 4A, Section 12(a)(6) to make permanent the current XND Pilot. The XND Pilot was extended various times with the last extension through May 4, 2023.[4] The Exchange continues to have sufficient capacity to handle additional quotations and message traffic associated with the listing and trading of XND options. In addition, index options are integrated into the Exchange's existing surveillance system architecture and are thus subject to the relevant surveillance processes. The Exchange also continues to have adequate surveillance procedures to monitor trading in XND options thereby aiding in the maintenance of a fair and orderly market. Additionally, there is continued investor interest in XND.

Nonstandard Pilot

Phlx filed a proposed rule change for the listing and trading on the Exchange, on a twelve month pilot basis, of p.m.-settled options on broad-based indexes with nonstandard expirations dates.[5] The Nonstandard Pilot permits both Weekly Expirations and End of Month ("EOM") expirations similar to those of the a.m.-settled broad-based index options, except that the exercise settlement value of the options subject to the pilot

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4 See Securities Exchange Act Release No. 93447 (October 28, 2021), 86 FR 60719 (November 3, 2021) (SR-Phlx-2021-66); 94631 (April 7, 2022), 87 FR 21990 (April 13, 2022) (SR-Phlx-2022-16); and 95993 (October 6, 2022), 87 FR 62161 (October 13, 2022) (SR-Phlx-2022-39).

5 See Securities Exchange Act Release No. 82612 (February 1, 2018), 83 FR 5470 (February 7, 2018) (approving SR-ISE-2017-111) (Order Approving a Proposed Rule Change To Establish a Nonstandard Expirations Pilot Program).

are based on the index value derived from the closing prices of component stocks. The Nonstandard Pilot was extended various times and is currently extended through May 4, 2023.[6]

Phlx Options 4A, Section 12(b)(5)(A) provides that the Exchange may open for trading Weekly Expirations on any broad-based index eligible for standard options trading to expire on any Monday, Wednesday, or Friday (other than the third Friday-of-the-month or days that coincide with an EOM expiration). Weekly Expirations are subject to all provisions of Options 4A, Section 12 and are treated the same as options on the same underlying index that expire on the third Friday of the expiration month. Unlike the standard monthly options, however, Weekly Expirations are p.m.-settled.

Pursuant to Options 4A, Section 12(b)(5)(B) the Exchange may open for trading EOM expirations on any broad-based index eligible for standard options trading to expire on the last trading day of the month. EOM expirations are subject to all provisions of Options 4A, Section 12 and treated the same as options on the same underlying index that expire on the third Friday of the expiration month. However, the EOM expirations are p.m.-settled.

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6 See Securities Exchange Act Release Nos. 84835 (December 17, 2018), 83 FR 65773 (December 21, 2018) (SR-Phlx-2018-80); 85669 (April 17, 2019), 84 FR 16913 (April 23, 2019) (SR-Phlx-2019-13); 87381 (October 22, 2019), 84 FR 57788 (October 28,2 019) (SR-Phlx-2019-43); 88684 (April 17, 2020), 85 FR 22781 (April 23, 2020) (SR-Phlx-2020-24); 90256 (October 22, 2020), 85 FR 68393 (October 28, 2020) (SR-Phlx-2020-48); 91484 (April 6, 2021), 86 FR 19050 (April 12, 2021) (SR-Phlx-2021-21); 93464 (October 29, 2021), 86 FR 60952 (November 4, 2021) (SR-Phlx-2021-65); 94631 (April 7, 2022), 87 FR 21990 (April 13, 2022) (SR-Phlx-2022-16) and 95993 (October 6, 2022), 87 FR 62161 (October 13, 2022) (SR-Phlx-2022-39).

At this time, the Exchange proposes to make permanent the Nonstandard Pilot. The Exchange has sufficient systems capacity to handle p.m.-settled options on broad-based indexes with nonstandard expirations dates and has not encountered any issues or adverse market effects as a result of listing them. Additionally, there is continued investor interest in these products.

In support of the permanency of the XND Pilot and the Nonstandard Pilot, the Exchange empirically assessed the impact of p.m.-settled NDX options on options market quality and examined market capacity around the market close.[7] Specifically, the Exchange analyzed trading volume, open interest, spreads, and closing auction volumes. In recent years, Phlx has implemented changes and introduced new types of index options tied to the Nasdaq-100 Index® (ticker symbol "NDX"). This report presents a set of empirical findings relating the impact of these changes, submitted in support of a request for permanency of the XND Pilot and the Nonstandard Pilot.

A general timeline of events since 2017 is as follows:

- In January 2017, the Exchange discontinued licensing agreements with competing options exchanges for the listing and trading of NDX options. This discontinuation led to a gradual reduction in the number of NDX expiries listed on these exchanges. By 2019 trading in NDX-related options therefore became exclusively done on three Nasdaq-affiliated exchanges: Phlx, Nasdaq ISE, LLC ("ISE") and Nasdaq GEMX, LLC ("GEMX").

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7 This includes p.m.-settled products trading on Phlx (XND Pilot and the Nonstandard Pilot) as well as p.m.-settled products trading on ISE (NQX Pilot and the Nonstandard Pilot). ISE filed a similar request for permanency of its p.m.-settled pilots. See SR-ISE-2023-07 (not yet noticed).

- In January 2018, the expiration of NDX options on Fridays, other than the third Friday-of-the-month, was changed from a.m.-settled to p.m.-settled. Third-Friday expirations continued to be a.m.-settled as before. The p.m.-settled index options were given the new trading symbol "NDXP". These contracts were exclusively listed on Phlx and ISE.
- In June 2018, a new contract was introduced based on the Nasdaq-100 Index but with reduced notional value. The underlying index of the new contract, symbol "NQX," was set at one-fifth the value of the NDX (with contract multiplier remaining at $100). This contract trades exclusively on ISE, and is p.m. settled on Fridays.
- In September 2018, a p.m.-settled index option, "NDXP," was introduced that expired on Wednesdays of each week. It was listed exclusively on Phlx and ISE.
- In February 2020, a p.m.-settled NDXP index option was introduced that expired on Mondays of each week. It was listed exclusively on Phlx and ISE.
- In April 2021, a second reduced value contract was introduced. The underlying index, "XND", is set at one-hundredth (1%) of the NDX (with contract multiplier remaining at $100). The notional value is therefore equal to the level of the Nasdaq-100 Index. This contract trades on Phlx and is p.m.-settled.

- On July 29, 2022, ISE received approval to list and trade p.m.-settled NDX index options that expire on Tuesday or Thursday under its Nonstandard Expirations Pilot Program.[8]
- On October 3, 2022, ISE commenced listing p.m.-settled quarterly option on the Nasdaq-100 Index.

Following terminological convention, the Exchange refers to the traditional third Friday expiration series as "monthly" contracts, while the other series are referred to as "weekly" contracts. In this report, the new p.m.-settled index options will be written as NDXP-Fri, NDXP-Wed, and NDXP-Mon based on their expiration day. The NDX contracts that formerly expired on Fridays, other than the third Friday-of-the-month, will be referred to as NDX-Weekly, indicating their status as weekly contracts. The monthly third Friday NDX contract will be denoted NDX-Monthly. NQX and XND are considered weekly contracts. It may be noted that when Friday is a market holiday, the expiration moves to the prior Thursday.[9] When Wednesday is a holiday, expiration of Wednesday contracts moves forward to Tuesday. When Monday is a holiday, Monday expirations move back to Tuesday.[10]

The purpose of this report is to empirically assess the impact of these changes on NDX options markets, with a special focus on the market quality of the incumbent a.m.-settled NDX index options and market capacity around the market close. The Exchange

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8 The Exchange notes that Tuesday and Thursday weeklies on the Nasdaq-100 Index have been trading for less than one month. See http://www.nasdaqtrader.com/MicroNews.aspx?id=OTA2022-26.

9 See Phlx Options 4A, Section 12(b)(5)(A).

10 Id.

provides a comprehensive analysis in this report on the impact of p.m.-settled index options on a.m.-settled NDX index options, including option trading volume, option open interests and option liquidity.[11] In assessing the impact of the innovations on market quality, the Exchange uses options on the Invesco QQQ Trust Series 1 ("QQQ")[12] as a control group. While activity in QQQ options would capture trading interest in the Nasdaq-100 Index generally and may reflect market conditions, it would be largely unaffected by the innovations considered in this report. QQQ options include monthly third Friday expirations, weekly non-third Friday expirations, and contracts expiring the end of the quarter.[13]

Historically there have been concerns that p.m.-settled index options could result in increased market and price volatility in the underlying component stocks, due to the unwinding of hedge-related positions at the close on expiration. A study conducted on behalf of the Securities and Exchange Commission's Division of Economic and Risk Analysis[14] shows that the market share for p.m.-settled options on S&P 500® Index has grown substantially since 2007. As the expiration date for p.m.-settled index options is more scattered compared to that for a.m.-settled options, only a smaller percentage of

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11 Today, NDX options are a.m.-settled and p.m.-settled.

12 Invesco QQQ™ is an exchange-traded fund based on the Nasdaq-100 Index.

13 For the purpose of spread analysis we match on option price, moneyness category, time to maturity and option's expiration month.

14 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"), available at: https://www.sec.gov/dera/staff-papers/studies-and-reports/analysis-of-pm-cash-settled-index-option-pilots.

open interest expires on each date. As a result, p.m.-settled index option expirations are unlikely to cause any disruptive effect on the market. The DERA Staff PM Pilot Memo also shows that expiring open interest of a.m.-settled options may have had an economically small impact on the volatility of the Nasdaq-100 index around the open.[15] The DERA Staff PM Pilot Memo further shows that, although p.m.-settled index option trading volume may have a statistically significant relationship with the volatility of the underlying index around the market close, the economic significance was generally small. In its report, the Exchange provides additional analysis on market capacity around the market close. As the closing auction price is the most widely used reference price for mutual funds and for many exchange-traded products, closing auction volume has grown substantially in recent years. In this report, the Exchange shows that the closing auction volume on the equity market have become much larger than the opening auction, which may indicate that there is sufficient liquidity in closing auctions to absorb liquidity demand associated with p.m.-settlement of NDX and XND index options.

In addition to analysis on closing auctions, the report presents findings on three market characteristics: trading volume, open interest, and spreads. The Exchange finds that the trading volume and the notional open interests for options that had NDX and XND as the underlying increased during our sample period. In conclusion, there is no evidence that NDX and XND options contracts, which are p.m.-settled, would result in

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15 Table 20 of the DERA Staff PM Pilot Memo suggests that a $10 billion increase in option settlement quantity is associated with an increase in absolute return of 0.025% near the open. The report also shows that expiring open interest of a.m.-settled options had no significant impact on the volatility of the underlying index near the open for the S&P 500 Index.

reduced trading activity or degradation in market quality of the a.m.-settled index options.

Analysis of Volume

The introduction of p.m.-settled index options and its impact on the trading activity of a.m.-settled options is likely the single most important factor under consideration. Volume is the primary indicator of trading interest and it drives market quality to a large extent. Consolidated volume information is available from The Options Price Reporting Authority ("OPRA"), the source of information used in this section. The sample period used for this report is 2017 through April 2022.

Consolidation of Trading on Nasdaq Affiliated Exchanges

As noted above, trading in NDX options began to consolidate exclusively onto Nasdaq-owned affiliated exchanges starting in 2017; the impact on volume was not immediate. Since January 2017, non-Nasdaq exchanges ceased listing new NDX options series, but continued with previously listed NDX options. The following table shows the percentage of NDX options contract volume traded on non-Nasdaq exchanges, which at the time included Cboe Exchange, Inc. ("Cboe"), NYSE American LLC, and NYSE Arca, Inc. Of these three markets, Cboe was the largest in volume. The Nasdaq affiliated exchanges trading NDX options were Phlx, ISE and GEMX.

Table 1. NDX Volume on Non-Nasdaq Exchanges

Year	Quarter	Non-Nasdaq Share
2017	1	22.2%
	2	16.4%
	3	2.2%
	4	5.5%
2018	1	0.3%
	2	0.7%
	3	0.1%
	4	4.2%

By 2018 volume on the non-Nasdaq exchanges had largely disappeared. The surge in volume during the final quarter of 2018 was likely due to the end-of-year final closing of positions—note the similar bump in 2017. There was no NDX options volume from non-Nasdaq exchanges after 2018.

Contract Volume and Notional Volume

Contract volume in the regular-sized Nasdaq-100 Index contracts may be broken down into five time series: (1) the incumbent NDX-Monthly;[16] (2) the NDX-Weekly contract transitioning to NDXP-Fri;[17] and (3) the introduction of NDXP-Wed and NDXP-Mon.[18] The following graph shows monthly totals for each of these five groups.[19]

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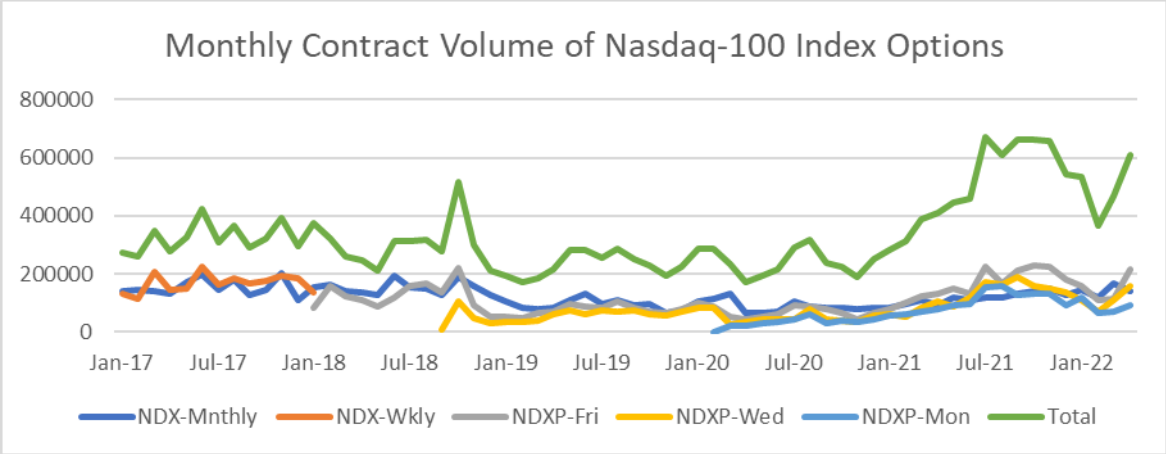
16 As noted herein, this refers to the monthly third Friday a.m.-settled NDX contract.

17 As noted above, this refers to the p.m.-settled NDX contracts that formerly expired on Fridays, other than the third Friday-of-the-month.

18 NDXP-Wed and NDXP-Mon are the p.m.-settled NDX contracts expiring on Wednesday and Monday, respectively.

19 The full data supporting the graph is shown in the appendix.

Figure 1. Monthly Contract Volume of Nasdaq-100 Index Options



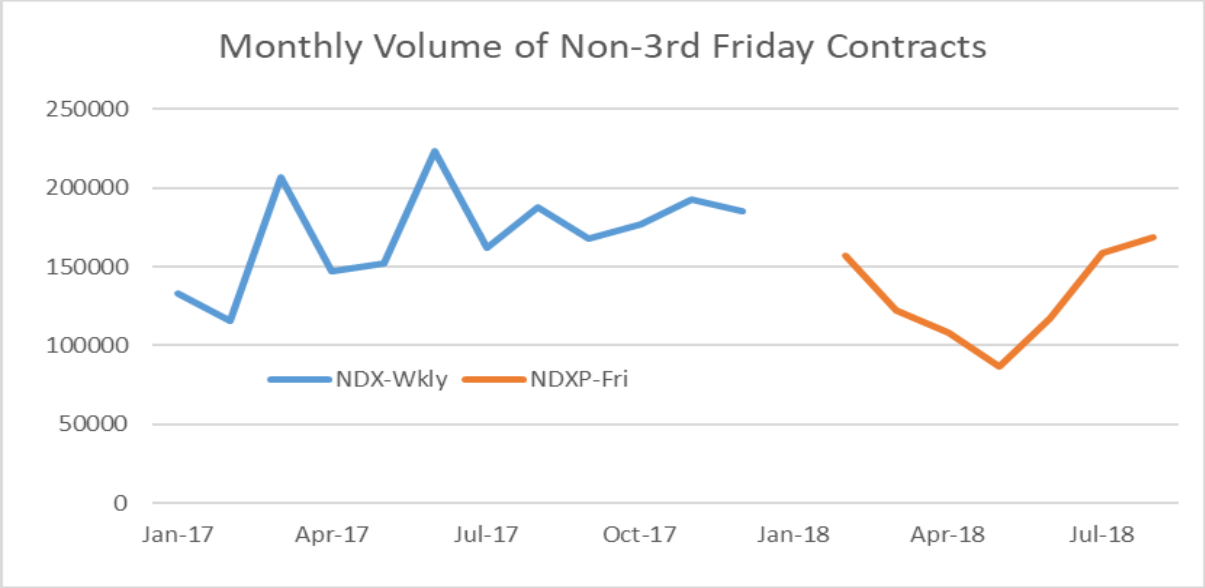
A number of observations can be drawn from the graph.

- The overall total contract volume remained almost flat until the pandemic market recovery started in the Spring of 2020. From Fall 2020 forward there has been substantial growth in volume. It appears that most of the recent growth has come from the NDX-Weekly contracts.
- The volumes of NDX-Monthly and NDX-Weekly were roughly equivalent during 2017. This is noteworthy for the fact that for any given month there would usually be at least three, and sometimes four times, the number of front-month expiries for the weekly contract. The Exchange can infer, then, that the monthly contracts tend to have substantially higher volume per series than the weekly contracts.
- When NDX-Weekly transitioned to NDXP-Fri, the volume relationship with NDX-Monthly remained roughly the same.
- Soon after launch, the NDXP-Wed contracts achieved volume levels not much lower than the NDXP-Fri contracts, and, in turn, not much lower than the monthly contracts.

- Soon after launch, the NDXP-Monday contracts achieved volume levels not much lower than the NDXP-Fri contracts, and, in turn, not much lower than the monthly contracts.
- By the end of the sample period, each of the four remaining contract types had roughly the same value (again recognizing the differing number of expiries). Each of the current contract types garner substantial trading volume.

Regarding the NDX-Weekly/NDXP-Fri transition, Figure 2, which ends in August 2018, takes a closer look at the timeframe immediately prior to the launch of NDXP-Wed. The transition month of January 2018 is not shown (both contract types had volume during January).

Figure 2. Monthly Volume of Non-3rd Friday Contracts



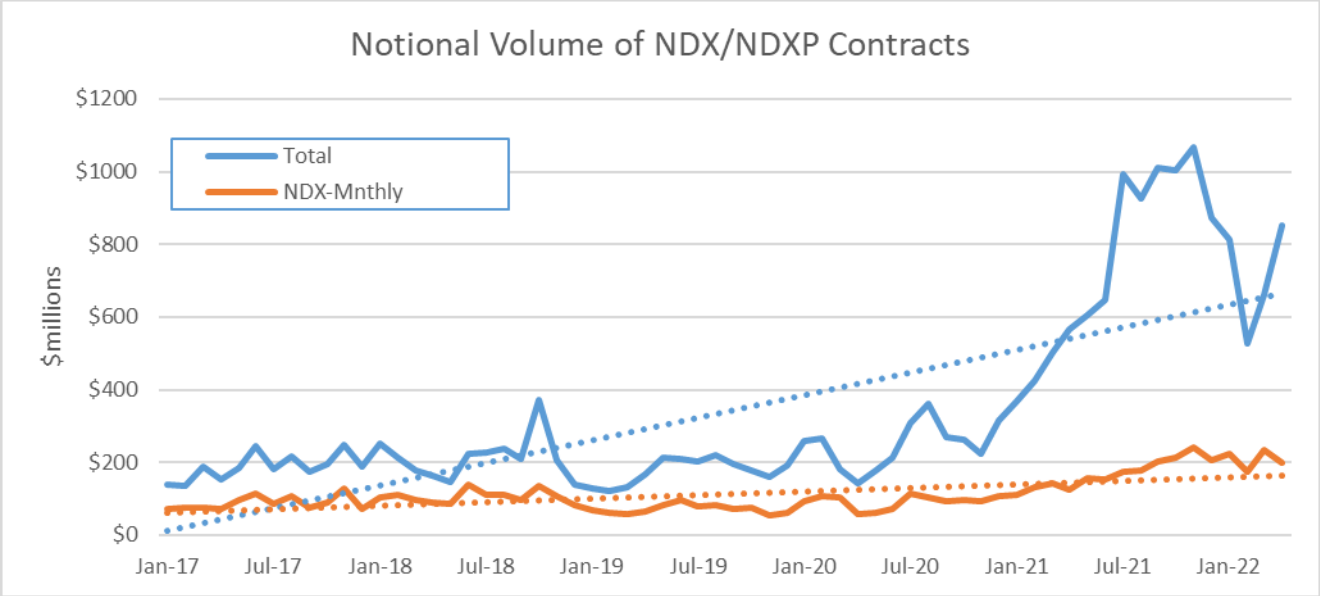
Though NDXP-Fri volume was relatively low in May 2018, there is no sign of a substantial sustained drop in volume accompanying the transition.

During the timeframe under consideration in this report there has been a remarkable increase in the level of the Nasdaq-100 Index, a rough tripling of the index

from early 2017 to April 2022. The notional value of a regular-sized contract is $100 times the level of the index, and so it has tripled during the sample period, and is currently roughly $1.3 million. In light of these changes, it is useful to consider volume from the perspective of notional value traded rather than contracts.

Figure 3 shows the sum of monthly notional value traded for NDX-Monthly and for the total of all five of the contract types. The notional value traded was computed as the sum of contracts traded times the monthly average value of the Nasdaq-100 Index times $100. The graph also shows linear trend lines for each time series.

Figure 3. Notional Volume of NDX/NDXP Contracts



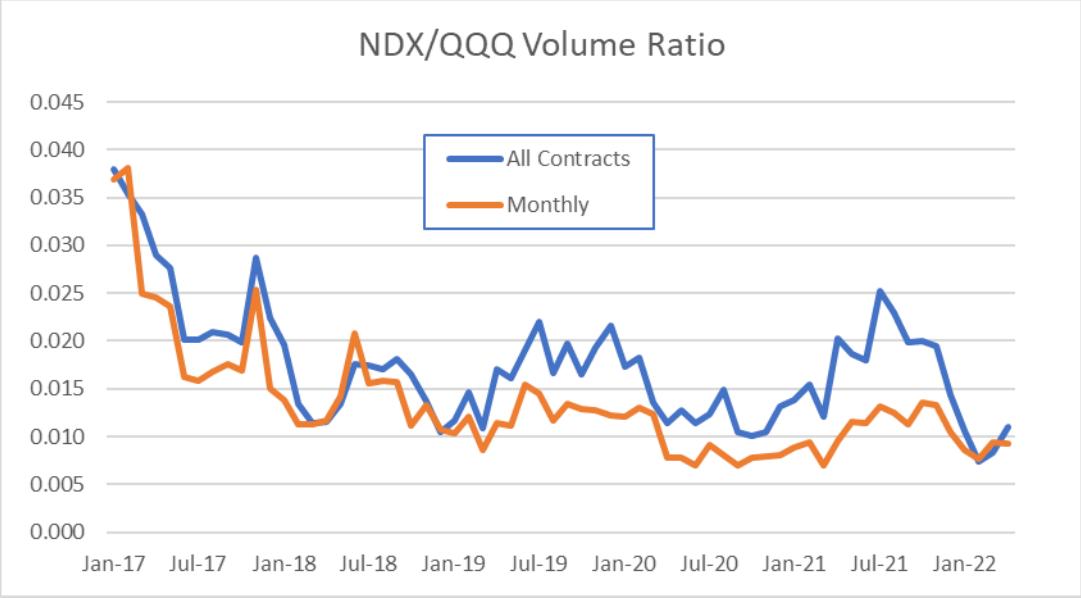
It appears that while the notional volume of the incumbent monthly contract has been flat, the total volume of all contract types exhibit a positive trend, with remarkable growth since the Fall of 2020. It appears, therefore, that the introduction of p.m.-settlement is associated with an increase in NDX options trading.

Comparison with QQQ Volume

The positive volume trend may be due to the remarkable performance of the Nasdaq-100 Index during this timeframe. To rule out this alternative explanation, the exchange compare the volume in NDX/NDXP index options to QQQ ETF options. It is worth noting that the notional volume of a QQQ option contract has been much lower than that of an index option. During the sample period, the average notional value of an index option contract was about $936,000, while a single QQQ contract had notional value of about $23,000.

Figure 4 presents a time series of the ratio of the sum of monthly contract volume in the indicated index option contracts to the sum of contract volume in QQQ options. For NDX-Monthly index options, only QQQ volume from third Friday expiring contracts was used. Since both the index and ETF options have the same underlying index, the observed trend is similar if notional volumes were used instead.

Figure 4. NDX/QQQ Volume Ratio

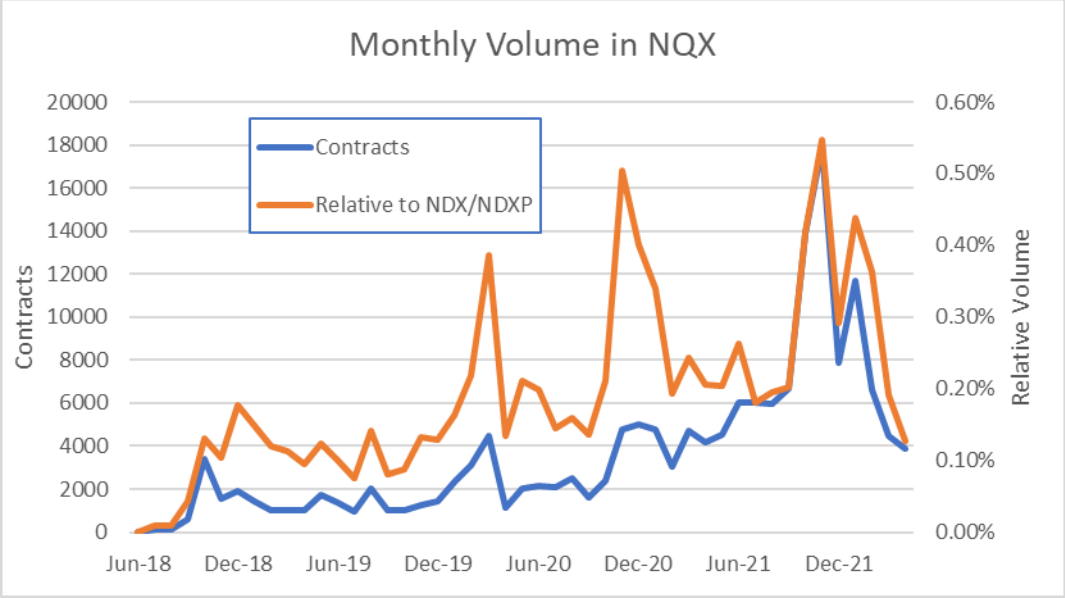


The graph shows a substantial decline in the relative level of the index option volume during 2017. This decline is too large to be explained by the reduction in the share of options trading on non-Nasdaq exchanges. The decline stabilized at the start of 2018.

NQX Volume

In spite of the very high notional volume of NDX/NDXP options, volume in the reduced-value NQX options has never been higher than NDXP trading volume (perhaps due to the availability of QQQ options). Figure 5 shows monthly volume for all NQX contracts. Shown are both the volume in terms of contracts traded, as well as NQX volume relative to the total volume of NDX/NDXP contracts. For the latter calculation, the NQX contract volume was divided by 5 to reflect its reduced notional value.

Figure 5. Monthly Volume in NQX



Since launch, NQX volume has grown, both in absolute terms and relative to NDX/NDXP volume. The period of extreme market volatility surrounding the pandemic crisis in the Spring of 2020 led to a volume spike, as did the market recovery of the Fall

of 2020. Even so, the relative level of NQX volume was very low relative to that of the regular-valued indexes. Due to the low level of NQX volume, it seems unlikely that its introduction had a significant impact on the market quality of the full-sized NDX contracts. Therefore, no further analysis was attempted on NQX options.

XND Volume

Trading in XND options contracts is relatively new.[20] The following table shows XND monthly contract volume for the first year of trading.

Table 2. XND Trading Volume

Apr 2021	292
May 2021	1,128
Jun 2021	4,334
Jul 2021	6,452
Aug 2021	3,222
Sep 2021	5,319
Oct 2021	3,860
Nov 2021	2,700
Dec 2021	2,492
Jan 2022	4,941
Feb 2022	3,634
Mar 2022	6,593
Apr 2022	12,990

The low level of XND options volume suggests that the introduction of XND did not have a noticeable impact on the trading of the incumbent NDX/NDXP contracts.

Analysis of Open Interest

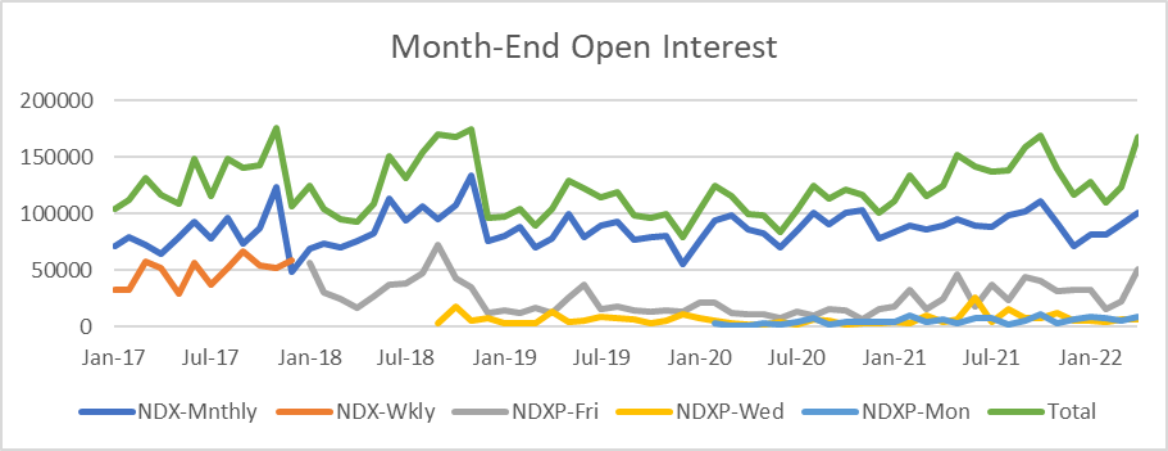
The Exchange next considered trends in open interest for the Nasdaq-100 Index options. The Options Clearing Corporation ("OCC") data was utilized as source data for

[20] As noted herein, XND began trading in April 2021.

this analysis. Open interest measures positions held overnight; positions that are established and closed during the day are not captured.

Figure 6 shows the open interest, in contracts, as of the last trading day of the indicated month.

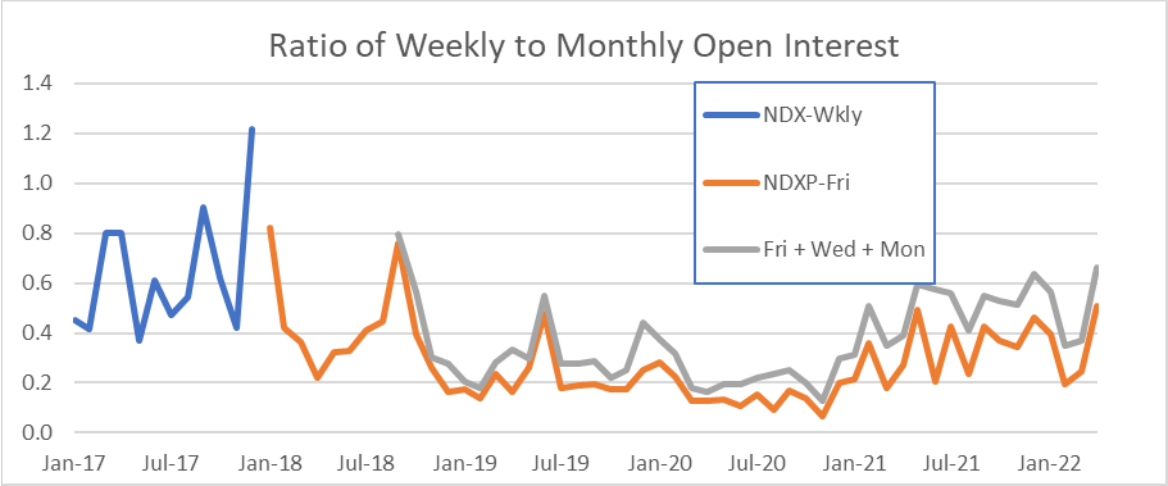
Figure 6. Month-End Open Interest



The open interest in NDX-Monthly is remarkably stable during this timeframe, and is substantially higher than that of the weekly contracts. After transitioning to p.m.-settlement, the open interest in NDXP-Fri contract started to decline while it increased in the second half of 2022. The open interest in the Wednesday and Monday contracts has always been relatively low.

Further insight is shown in the following graph, which shows the ratio of open interest in weekly contracts to that of the monthly contract (that is, the open interest sum of NDX-Weekly, NDXP-Fri, -Wed, and Mon divided by the open interest in NDX-Monthly).

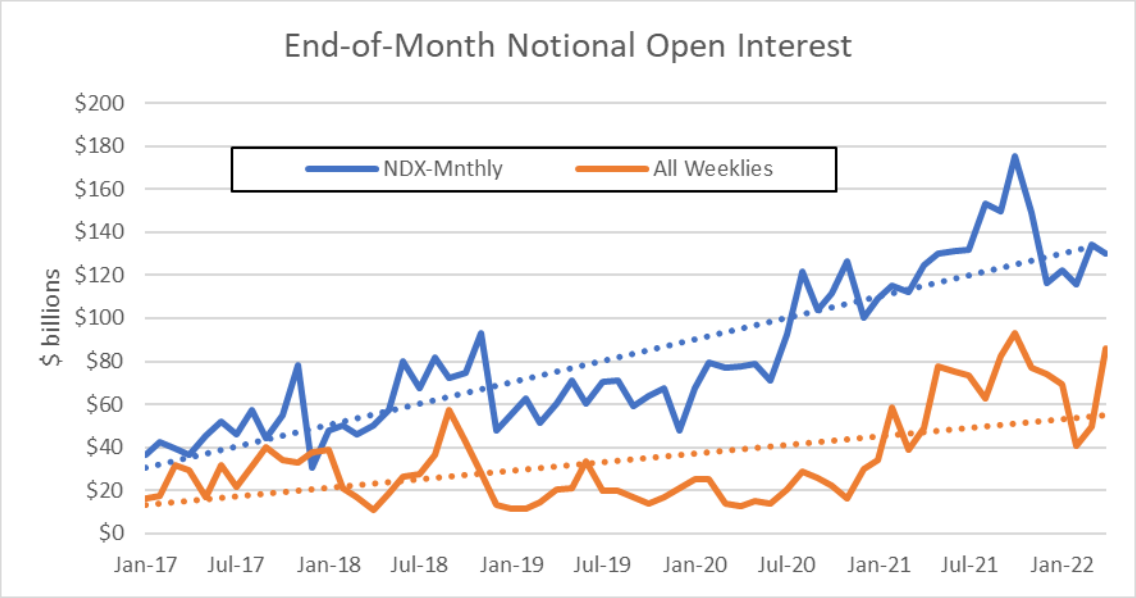
Figure 7. Ratio of Weekly to Monthly Open Interest



The graph shows a clear decline in the ratio of weekly to monthly open interest, starting at the beginning of 2018, but the declining trend stabilized at the end of Q1 2018. When considered with the volume information shown above, this may be because options traders with longer holding horizons may be more likely to trade the monthly contract, while those with shorter intra-day positions are more likely to use the weekly contracts. This tendency is reflected in the listing of expiries. At any given time, expirations out to a year or more are available for the monthlies, while expirations only out a month or so are available for the weeklies.

As noted above, the notional value of Nasdaq-100 Index options has roughly tripled during this timeframe. It is therefore useful to consider the trends in open interest from a notional perspective, as shown in the following graph.

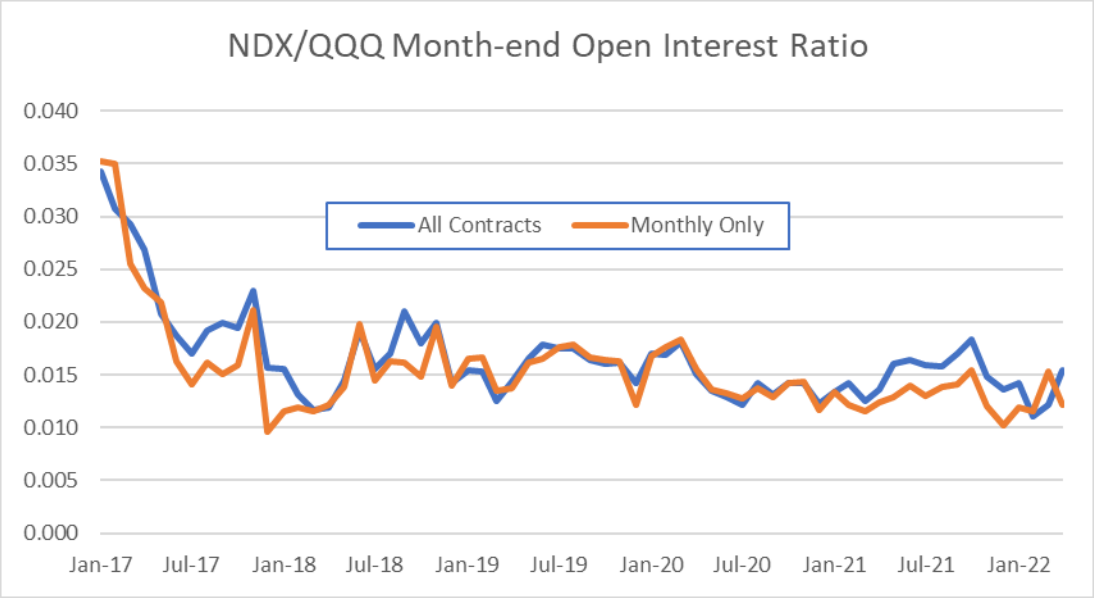
Figure 8. End of Month Notional Open Interest



A clear positive trend is evident for the monthly contract in terms of notional value. The weeklies showed a flat trend that has increased since the Fall of 2020.

As discussed above, we designate QQQ options as a control group for our analysis. Figure 9 shows the ratio (in contracts) of Nasdaq-100 Index options to QQQ options. As noted herein, the trend is unaffected when measuring open interest in contracts or notional value. The graph shows the ratio for monthly contracts for NDX and QQQ, as well as for NDX/NDXP and QQQ.

Figure 9. NDX/QQQ Month-End Open Interest Ratio



This graph closely mirrors the volume graph shown above in Figure 9. There was a distinct decline during 2017 in month-end open interest, but the trend stabilized at the start of 2018 and has remained flat since then.

Analysis of Spreads

An important dimension of market quality is the cost of trading. Following Holden and Jacobsen (2014)[21], the Exchange used duration weighted relative quoted spread as a measure of the cost of trading. In this section, the Exchange examines whether there is any deterioration of spreads to a.m.-settled Nasdaq-100 Index options by introducing p.m.-settled index options. A particular challenge for measuring quoted spreads is created by the large number of options series tied to a particular underlying. In addition to the range of expiries, a given expiration will have many available strike

[21] See Holden, C. and Jacobsen, S., 2014, Liquidity Measurement Problems in Fast, Competitive Markets: Expensive and Cheap Solutions. Journal of Finance. 69, 1747-17852 (https://onlinelibrary.wiley.com/doi/abs/10.1111/jofi.12127)

prices. This set of combinations then is doubled by considering calls and puts. Many listed options series will be very infrequently traded. For example, at the start of the sample period on January 3, 2017, there were 3,720 individual options series that had NDX as the underlying, made up from 14 expiration dates and 382 strike prices. Of these listed options series, only 458 had traded volume on that date, with 233 options series with volume of at least 10 contracts. Nearer to the end of the sample period, on April 29, 2022, there were 16,624 listed options series with NDX or NDXP as the underlying, consisting of 33 expiration dates and 675 strikes. Of the listed options series, 2,192 had some volume and 538 had volume of at least 10 contracts.

To assess the trend in the relative NBBO quoted spread, the Exchange limited the number of options series under consideration by reviewing spreads in the front-month contracts (contract nearest expiration) on the first trading day of each month.[22] The Exchange considered an NBBO quotation to be "live" and used in the computation when the National Best Offer (NBO) was non-zero.

In the following section, the Exchanges shows the impact of the introduction of p.m.- settled index options on the liquidity of NDX contracts by showing the average monthly NDX spread over time (in Figure 10) as well as comparing the trend of relative quoted spread of NDX contracts with that of QQQ contracts (Figures 11 and 12). Figure 10 shows the average monthly relative quoted spread for all options with NDX as the underlying. To better reflect the trend of the relative quoted spread, the Exchange plotted

[22] Although the Exchange believes that sampling the first trading day of each month between date January 2017 and April 2022 would reflect the trend of market quality, the Exchange acknowledges that in some cases there may some information loss given a particular trading day. For example, a volatile trading day may not be representative of the market for that trading month.

the average relative quoted spread benchmarked against (subtracted by) the average spread of 2017 as the dotted line in Figure 10. The dotted vertical line highlights the time when p.m.-settled index options were introduced. Specifically, the time series in the dotted line was computed using the following steps. First, the Exchange calculated the duration weighted average relative quoted spread for each contract on each day. Second, the Exchange took the average of the above daily spread across all contracts with NDX as the underlying for each day. Third, the Exchange calculated the average relative quoted spread for all months in 2017. Finally, the 2017 average was subtracted from the monthly average to create a time series dataset. As can be seen from the plot, a consistent decrease in the relative quoted spread is prevalent from 2017 to 2022 and most importantly, there is no obvious change in the trend following the introduction of p.m.-settled index options.

Although the above method is intuitive, it is well known that the option premia are correlated with option characteristics such as expiry, strike price, and whether the contract is a put or a call option. Also, option premia tend to increase when the expected volatility of the underlying asset increases, and premia increase may in turn cause the spread to increase. Inspired by Kaul, Nimalendran and Zhang (2004)[23] and Albuquerque, Song and Chen (2020)[24], the Exchange also employed the following regression model to

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23 See Kaul, G., Nimalendran, m., and Zhang D., 2004, Informed Trading and Option Spreads Working Paper (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=547462).

24 See Albuquerque, R., Song, S., and Yao, C., 2020, The Price Effects of Liquidity Shocks: A Study of SEC's Tick-Size Experiment. Journal of Financial Economics. 138, 700-724 (https://www.sciencedirect.com/science/article/pii/S0304405X20301884).

control for factors related to option characteristics unrelated to the XND Pilot and the Nonstandard Pilot:[25]

$$\text{Spread} = \alpha + InverseofPrice + \text{Call/Put Dummy} + \text{Expiry} + \text{Moneyness Categories} + \text{Month Fixed Effect} + \varepsilon \quad (1)$$

In the above model, *Spread* is the relative quoted spread. *InverseofPrice* is the inverse of the option price. *Call/Put Dummy* is a dummy variable that equals 1 for call options and 0 otherwise. *Expiry* is the number of the days to the expiration date. *Moneyness* is a dummy variable for moneyness category of each option. Specifically, all option contracts were classified into 5 moneyness categories. The moneyness for call options was calculated as:

$$\frac{S-X}{X} * 100\%$$

and

$$\frac{X-S}{X} * 100\%,$$

for put options, where "S" is the stock price and "X" is the exercise price. The cut-offs for the five moneyness groups were: -30%; -10%; 10%; and 30%. Month Fixed Effect is a dummy variable for each month.

In constructing the plot, the coefficients for those month fixed effects were adjusted. The raw coefficients for each month were collected from the regression output. The first month in the sample, January 2017, implicitly had a coefficient of zero. The

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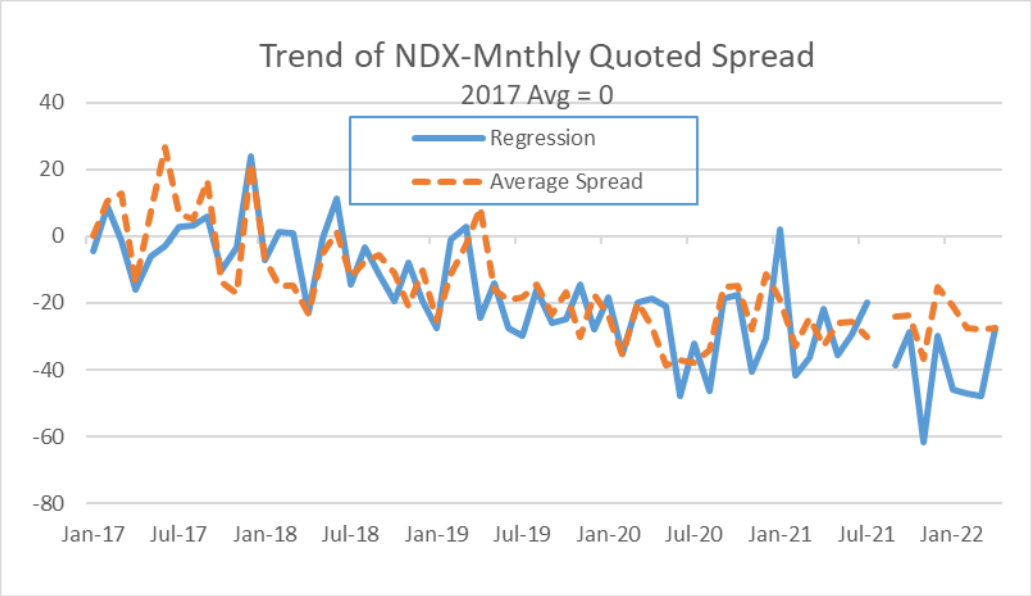
[25] The calculation was inspired by Kaul, G., Nimalendran, m., and Zhang D., and Albuquerque, R., Song, S., and Yao, C. See notes 21 and 22 above. The Exchange includes control variables used in Albuquerque, R., Song, S., and Yao, C. (2020) liquidity analysis and constructs *Moneyness Categories* following Kaul, Nimalendran and Zhang (2004).

average coefficient for the 12 months in 2017 was then calculated. Finally, the average coefficients across all 12 months in 2017 were subtracted from the raw coefficients to create a time series dataset, which is depicted as the unbroken line in Figure 10.

As can be seen from the plot, there is a steady decrease in the relative quoted spread for NDX option contracts. The average relative quoted spread for NDX contracts decreased by about 30% - 40% from the beginning of 2017 until the end of the sample period. Since the regression model controls for factors that affect the spread, the unbroken line based on the regression model tends to be less volatile. However, there is no large difference in the results between the average spread and results based on the regression models, but there is some divergence at certain points in time. The Exchange conjectures that the divergence is due to higher option premia caused by the elevated levels of volatility. In summary, based on both methods, a consistent decrease in relative quoted spread is observed from 2017 to 2022.

Figure 10. Trend of NDX-Monthly Quoted Spread[26]



The Exchange then compared the spread trend of NDX monthly contracts to that of QQQ monthly contracts. The average monthly spread for QQQ contracts was constructed the same way as that for the NDX monthly contracts (as described in detail above). Figure 11, below, displays the patterns of relative quoted spread for NDX and QQQ, which are remarkably similar and decreased during the sample period. Figure 12, below, highlights the difference in Figure 11 as between NDX and QQQ. Relative to a QQQ control, there is therefore no evidence of a deterioration of NDX monthly spreads during the sample period. In summary, the results suggest that there is gradual decrease in both the NDX monthly contracts spread and the QQQ contracts spread during the sample period.

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26 NBBO data was unavailable between August 1, 2021 and August 11, 2021, and, therefore, August 2021 was excluded from the plot. Also, with respect to Figure 10, Regression plots the coefficients of dummies for each month (i.e., fixed effects). Average Spread plots the average monthly relative quoted spread subtracted by the 2017 average relative quoted spread.

As the introduction of p.m.-settled index options may affect the transaction cost for NDX monthly contracts, it is unlikely to affect the spread of QQQ options. Therefore, the Exchange uses the following regression to formally test whether the spread of NDX contract changed after the introduction of p.m.-settled index options. NDX and QQQ options are included in the sample for the period between January 2017 and December 2018. This regression looks at a sample period starting from one year before and ending one year after the introduction of p.m.-settled index options.

Spread = α + NDX + Post + NDX * Post + $InverseofPrice$ + Call/Put Dummy + Expiry +Moneyness Categories + Month Fixed Effect + ε (2)

Similar to regression model (1), *Spread* is the relative quoted spread. *InverseofPrice* is the inverse of the option price. *Call/Put Dummy* is a dummy variable that equals 1 for call options and 0 otherwise. *Expiry* is the number of the days to the expiration date.[27] *Moneyness* is a dummy variable for moneyness category of each option. *NDX* is a dummy variable that equals one if the underlying asset of the option is NDX index and zero otherwise. *Post* is a dummy variable that equals to one for days after January 2018 and zero otherwise. The Exchange also includes the interaction terms of the post dummy and the NDX dummy (NDX * Post).

Table 3 shows that the coefficient of the interaction term is negative but it is statistically insignificant. Therefore, the Exchange concludes that the introduction of p.m.-settled index options did not negatively affect the liquidity of a.m.-settled NDX options.

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[27] The Exchange notes that there was no transformation.

Figure 11. Trend of NDX-Monthly and QQQ Quoted Spread[28]

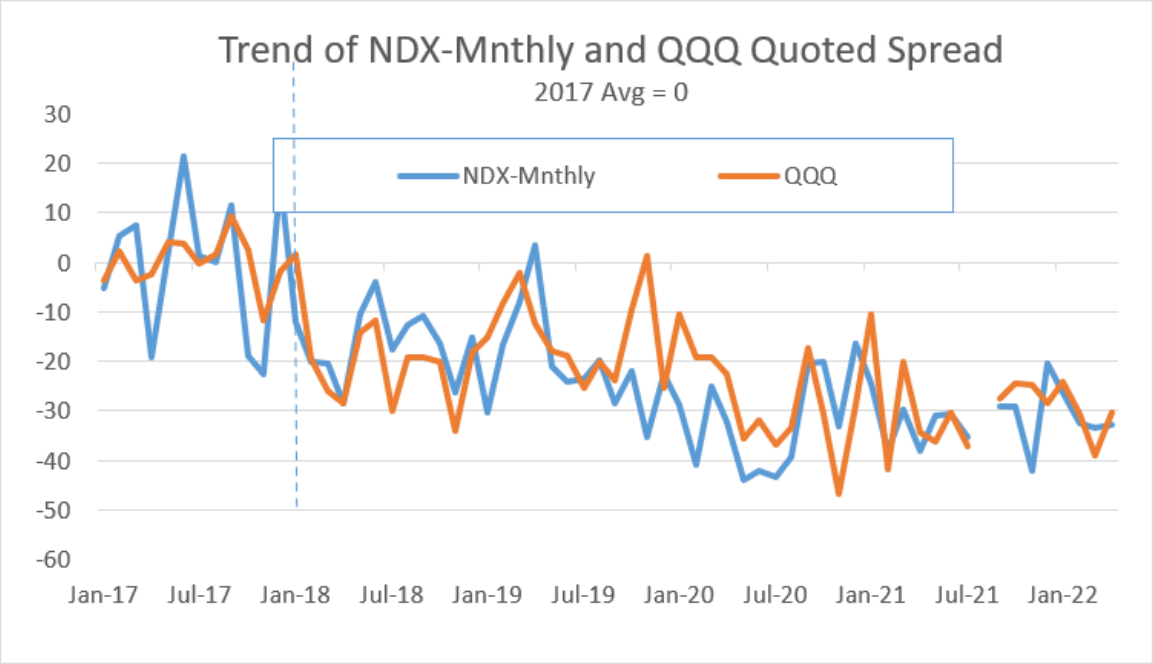
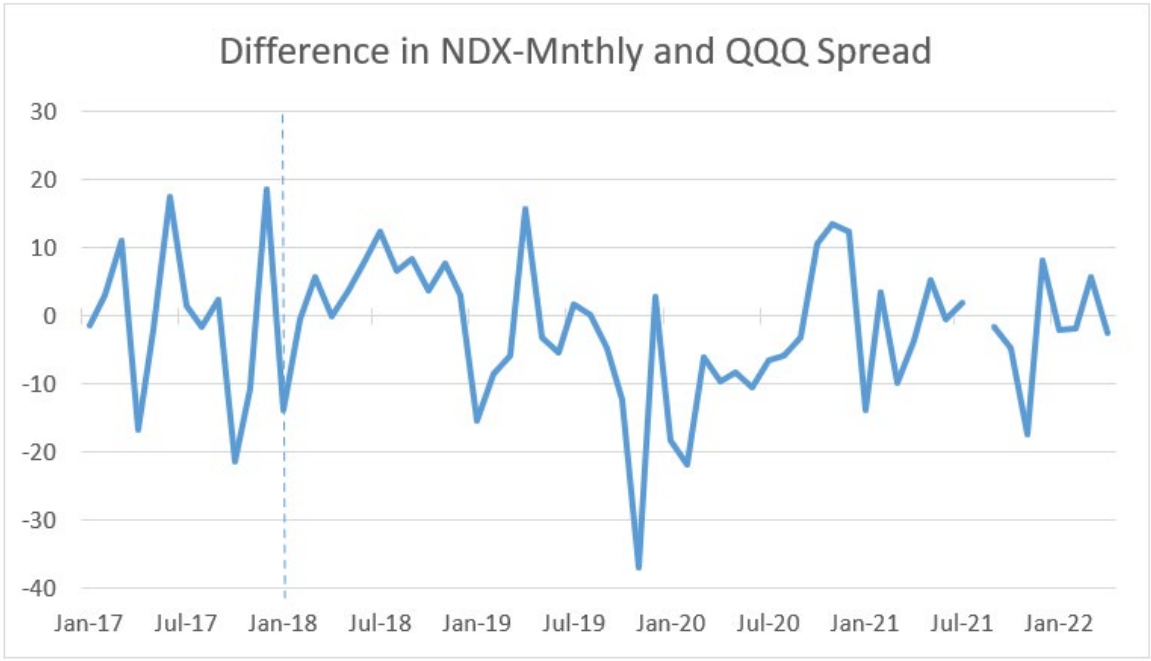


Figure 12. Difference in NDX-Monthly and QQQ Spread[29]



28 Id.

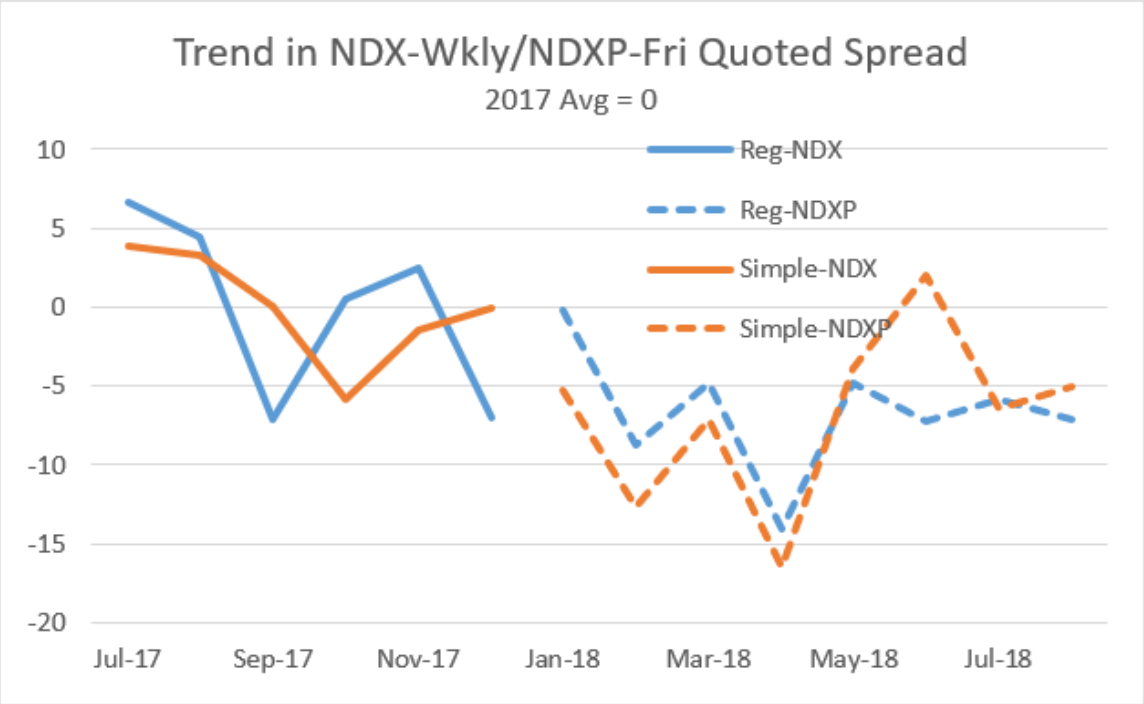
Table 3. Regression Results

	coef	std	t
Constant	0.26***	0.01	37.50
NDX	0.28***	0.01	28.62
Post	-0.01	0.02	-0.80
NDX*Post	-0.02*	0.01	-1.73
InverseofPrice	0.00***	0.00	48.65
Call/Put Dummy	0.26***	0.01	37.77
Expiry	0.00***	0.00	46.29
Moneyness Categories Fixed Effect	Yes		
Month Fixed Effect	Yes		

The report considered one additional question regarding quoted spreads — whether the move from a.m.-settlement to p.m.-settlement for Friday weeklies (NDX-Weekly to NDXP-Fri) led to changes in spreads for those contracts. This sample timeframe was from July 2017 through August 2018, prior to the launch of NDXP-Wed contracts. As before, the Exchange presented both the simple average monthly relative quoted spread as well as the average spread calculated using the regression model.

[29] Id.

Figure 13. Trend in NDX-Wkly/NDXP-Fri Quoted Spread[30]



The relative quoted spread went down at the first part of 2018 and up in May and June 2018; it remained comparable to the 2017 average.

Overall, the Exchange sees no evidence of deterioration of spreads associated with the introduction of p.m.-settled NDX options.

Market Capacity Around the Market Close

The Exchange next analyzed the impact that p.m.-settled index options may have on the closing process of the equity markets.[31] The DERA Staff PM Pilot Memo

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30 With respect to Figure 13, Reg-NDX plots the coefficients of dummies for each month for NDX contracts. Reg-NDXP plots the coefficients of dummies for each month for NDXP contracts. Simple-NDX plots the average monthly relative quoted spread subtracted by the 2017 average relative quoted spread for NDX contracts. Simple-NDXP plots the average monthly relative quoted spread subtracted by the 2017 average relative quoted spread for NDXP contracts.

31 This analysis considers the DERA Staff PM Pilot Memo.

concluded that while p.m.-settled index options activity may have had a statistically detectable impact on volatility, the economic significance was generally small. The DERA Staff PM Pilot Memo provided,

> However, the report suggests that the magnitude of the effect of expiring p.m. cash-settled index options open interest on the measure of volatility and price reversals for index futures, the underlying cash index, and index component securities is economically very small.[32]

The following provides an illustration using some of the regression results from the DERA Staff PM Pilot Memo. Among the volatility variables analyzed by the DERA Staff PM Pilot Memo was the "Magnitude of Maximum Reversal Overlapping Close" of index futures prices. The DERA Staff PM Pilot Memo found that this metric was higher when the options settlement volume was higher, for both the S&P 500 and the Nasdaq-100 Index options. Using data provided in the DERA Staff PM Pilot Memo, the Exchange can estimate the impact of a very large increase in settlement volume: an increase from its 25th percentile to its 75th percentile. The following table shows the steps of the calculation.

Table 4[33]

	Settlement Volume			Regression Coefficient	Impact	Median of Variable	Rel. Impact
	25th	75th	Diff.				
S&P500	0.40	1.66	1.26	0.317	0.40	1.96	20.4%
Nq-100	0.07	0.17	0.10	2.39	0.24	1.58	15.4%

The percentiles of settlement volume (in units of $10 billion notional) are shown in Table 25 of the DERA Staff PM Pilot Memo, which indicated that the volume of S&P 500 contracts was much higher than that of Nasdaq-100 contracts. The regression

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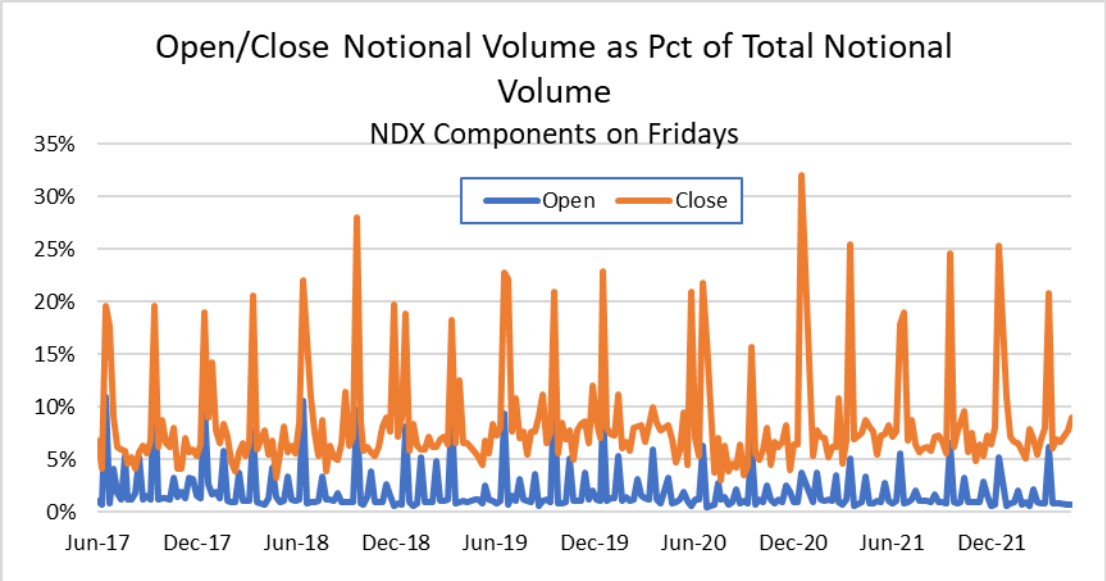
32 See DERA Staff PM Pilot Memo at page 1.

33 See DERA Staff PM Pilot Memo

coefficients are from Table 5 (S&P 500) and Table 19 (Nasdaq-100) of the DERA Staff PM Pilot Memo. The estimated impact is the product of the volume difference times the coefficient. Table 5 of the DERA Staff PM Pilot Memo provided the median of the volatility metric during the sample period. The relative impact is the estimated impact divided by the sample median, i.e., the estimated change in the volatility metric, relative to its median value, due to an increase in settlement volume. As shown, the relative impact was small for both indexes, about 20% for the S&P 500 and 15% for the Nasdaq-100.

The Exchange provides some additional analysis on market capacity around the market close. Specifically, the Exchange believes it is important to recognize that in recent years the closing auctions on the equity markets have steadily grown to a point where they are much larger than the opening auctions. To illustrate this point, the following chart shows the percentage of dollar volume of Nasdaq-100 Index components executed in the opening and closing auctions on Fridays.

Figure 14. Open/Close Dollar Volume as Pct of Total Dollar Volume NDX Components on Fridays



The percentage of volume executed in the close is uniformly higher than that of the open. The spikes in the closing percentages represent third Fridays, and in a few cases Fridays that corresponded to the end of a month. The opening percentage is slightly declining, the closing percentage slightly increasing during this timeframe. As another illustration, consider the opening and closing dollar volume percentages for Fridays, other than the third Friday-of-the-month, from the second half of 2017 compared with the first half of 2018. This timeframe corresponds to the introduction of NDXP options,[34] in which non-third Friday series moved to p.m.-settled. The following table present the average percentages.

Table 5. Dollar Volume for Nasdaq-100 Components on non-3rd Fridays

	Auction Vol. as Pct of Total Vol.	
	Opening	Closing
Jul – Dec 2017	1.48%	6.40%
Jan – Jun 2018	1.13%	6.76%
Difference	-0.35%	0.36%

As would be expected, the relative size of the opening auction declined, and the closing auction increased by roughly the same amount. The percentage of about 0.35% would be an estimate of the volume impact of NDX/NDXP options settlement on the equity market auctions. This percentage is small to begin with, but it is a much smaller proportion of the closing auction than the opening auction. Therefore, the Exchange believes that the liquidity available at or around the close would be able to mitigate any excess volatility created by the options settlement at the market close.

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34 NDXP options are p.m.-settled index options on broad-based indexes with nonstandard expirations dates which are also the subject of a pilot program. NDXP are listed on ISE and Phlx.

As a third example, the Exchange considered the level of options settlement volume relative to the size of the closing and opening auctions.[35] To provide the most up-to-date view of the current situation, the Exchange examined activity from the start of 2021 through April 2022. The below table shows the notional settlement volume (in billions of dollars) along with the notional volume in the auctions for Nasdaq-100 Index components. Settlement volume is the average dollar volume settled at OCC, Closing Auction is the average dollar volume executed in the closing auction, Pct of Close is calculated as Settlement Volume divided by Closing Auction, Open Auction is the average notional volume executed in the open auction, and Pct of Open is calculated as Settlement Volume divided by Opening Auction.

Table 6. Settlement Volume for NDX/NDXP vs Auctions: Jan 2021– Apr 2022

Exp. Day	Settlement Volume	Closing Auction	Pct of Close	Opening Auction	Pct of Open
NDXP					
Monday	$2.4	$9.9	25.9%		
Wed	$2.7	$9.0	30.2%		
Non 3rd Fri.	$4.1	$9.6	44.7%		
NDX					
3rd Friday	$13.1	$23.0	78.0%	$6.6	230.4%

Table 6 shows that the settlement volume for NDXP settlements averages between 26% and 45% of the closing auction volume, the Friday NDXP settlements being the largest. NDX settlement volumes are larger, and relative to the opening auction—the relevant auction—they average more than twice the size of the auctions. By contrast, the relative size of the settlement volume would be about a third less if it were

[35] Options settlement volume is the primary size metric used in the DERA Staff PM Pilot Memo. Options settlement volume is the notional volume settled in the closing auction.

compared to the closing auctions on the third Fridays. As documented in the DERA Staff PM Pilot Memo, p.m.-settled option activities only have a very small impact on the volatility of the underlying index. Additionally, the size of the option settlement value is relatively small compared with the size of the closing auction value. Therefore, the Exchange believes that it is difficult to manipulate the underlying Nasdaq-100 Index during the closing auction. The equity closing auctions have grown to be substantial liquidity events (for the period examined the closing auction volume is larger than the opening auction volume) and would therefore be suited for handling the excess liquidity demand created by index options settlement.

Technical Amendment to Rule Text

The Exchange proposes to amend Options 4A, Section 12(b)(5) to remove "C" and re-letter "D" as "C."

2. Statutory Basis

The Exchange believes that its proposal is consistent with Section 6(b) of the Act,[36] in general, and furthers the objectives of Section 6(b)(5) of the Act,[37] 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 proposing to make permanent the XND Pilot and the Nonstandard Pilot.

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36 15 U.S.C. 78f(b).

37 15 U.S.C. 78f(b)(5).

Previously, the Commission has raised concerns about expanding p.m. settlement.[38] Specifically, the Commission noted in the Cboe Pilot Order that it had concerns about the adverse effects and impact of p.m. settlement upon market volatility and the operation of fair and orderly markets on the underlying cash market at or near the close of trading.[39] The Commission noted in the Cboe Pilot Order that the information requested of Cboe would enable the Commission to evaluate whether allowing p.m. settlement for EOW and EOMs will result in increased market and price volatility in the underlying component stocks.[40] Further, the p.m. settlement Pilot information should help the Commission assess the impact on the markets and determine whether other changes are necessary.[41] Furthermore, the Exchange's ongoing analysis of the Pilot should help it monitor any potential risks from large p.m.-settled positions and take appropriate action if warranted.[42]

Similar to Cboe, Phlx has provided pilot data to the Commission with respect to its XND Pilot and Nonstandard Pilot. The Exchange's analysis presents data that the introduction of p.m.-settlement has led to an increase in options trading tied to the Nasdaq-100 Index. The Exchange notes within its analysis that it seems unlikely that the

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38 See Securities Exchange Act Release No. 62911 (September 14, 2010), 75 FR 57539 (September 21, 2010) (SR-CBOE-2009-075) (Order Approving Notice of Proposed Rule Change, as Modified by Amendment Nos. 1 and 2, To Establish a Pilot Program To List P.M.-Settled End of Week and End of Month Expirations for Options on Broad-Based Indexes) ("Cboe Pilot Order").

39 Id at 57540.

40 Id at 57540.

41 Id at 57540.

42 Id at 57540.

introduction of XND option contracts or NQX contracts[43] had a significant impact on the market quality of the full-sized Nasdaq-100 Index option contracts. The Exchange observed a consistent decrease in relative quoted spread is observed from 2017 to 2022 for NDX options. When the Exchange compared the spread trend of NDX monthly contracts to that of QQQ monthly contracts, the results suggest that there is gradual decrease in both the NDX monthly contracts spread and the QQQ contracts spread during the sample period.

The Exchange also considered whether the move from a.m.-settlement to p.m.-settlement for Friday weeklies (NDX-Weekly to NDXP-Fri) led to changes in spreads for those contracts. Overall, the Exchange sees no evidence of deterioration of spreads associated with the changes the Exchange has made to its Nasdaq-100 Index product offering by introducing p.m.-settled products.

Finally, in considering impact on the closing process in equity markets, the Exchange concluded that it is difficult to manipulate the underlying Nasdaq-100 Index. Specifically, the equity closing auctions have grown to be substantial liquidity events that are much larger than the opening auctions, and would therefore be better suited for handling the excess liquidity demand created by index options settlement. The Exchange believes the expiration of p.m.-settlement options would not adversely affect the options market or the underlying cash equities market.

Further, the Exchange has sufficient systems capacity to handle p.m.-settled options on broad-based indexes with nonstandard expirations dates and has not encountered any issues or adverse market effects as a result of listing them.

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43 See note 7 above.

Accordingly, the Exchange believes that weekly expirations and EOMs, including the XND expirations, in the p.m.-settled products should create greater trading and hedging opportunities and flexibility and provide customers with the ability to more closely tailor their investment objectives.

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. Making permanent the XND Pilot and the Nonstandard Pilot will not impose an undue burden on competition, rather, it will continue to provide investors with greater trading and hedging opportunities and flexibility, as well as the ability to more closely tailor their investment objectives.

Additionally, the Exchange does not believe the proposal will impose any burden on intermarket competition as market participants are welcome to become members or member organizations and trade at Phlx if they determine that this proposed rule change has made Phlx more attractive or favorable. Finally, all options exchanges are free to compete by listing and trading their own broad-based index options with weekly or end of month expirations.

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. 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 (i) as the Commission may designate up to 90 days of such date 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 shall: (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. Please include File Number SR-Phlx-2023-07 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-Phlx-2023-07. 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 Web site (http://www.sec.gov/rules/sro.shtml).

Copies of the submission, all subsequent amendments, all written statements with respect to the proposed rule change that are filed with the Commission, and all written communications relating to the proposed rule change between the Commission and any person, other than those that may be withheld from the public in accordance with the

provisions of 5 U.S.C. 552, will be available for website viewing and printing in the Commission's Public Reference Room, 100 F Street, NE, Washington, DC 20549, on official business days between the hours of 10:00 a.m. and 3:00 p.m. Copies of the filing also will be available for inspection and copying at the principal office of the Exchange. All comments received will be posted without change; 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-Phlx-2023-07 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.[44]

J. Matthew DeLesDernier
Assistant Secretary

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44 17 CFR 200.30-3(a)(12).

EXHIBIT 3

Data Appendix

1. Monthly Contract Volume for Nasdaq-100 Index Options

Month	NDX-Mnthly	NDX-Wkly	NDXP-Fri	NDXP-Wed	NDXP-Mon	Total
Jan-17	139,700	133,205				272,905
Feb-17	144,694	115,223				259,917
Mar-17	142,107	206,815				348,922
Apr-17	131,687	147,201				278,888
May-17	172,564	152,245				324,809
Jun-17	199,901	223,416				423,317
Jul-17	147,320	161,954				309,274
Aug-17	180,687	187,422				368,109
Sep-17	125,941	167,403				293,344
Oct-17	146,237	176,517				322,754
Nov-17	201,339	193,066				394,405
Dec-17	112,437	184,830				297,267
Jan-18	154,927	136,218	82,070			373,215
Feb-18	163,633		157,034			320,667
Mar-18	139,291		121,852			261,143
Apr-18	138,029		108,311			246,340
May-18	127,430		86,639			214,069
Jun-18	194,212		117,506			311,718
Jul-18	154,115		159,011			313,126
Aug-18	150,637		168,655			319,292
Sep-18	127,983		137,979	10,379		276,341
Oct-18	190,744		220,268	107,387		518,399
Nov-18	159,292		93,179	48,422		300,893
Dec-18	129,194		52,405	30,723		212,322
Jan-19	103,978		54,745	35,016		193,739
Feb-19	85,368		50,414	36,272		172,054
Mar-19	79,237		66,030	38,775		184,042
Apr-19	83,113		70,953	63,793		217,859
May-19	110,776		97,535	76,123		284,434
Jun-19	130,374		88,764	62,609		281,747
Jul-19	99,112		83,313	75,016		257,441
Aug-19	108,752		107,798	71,763		288,313
Sep-19	90,656		82,338	76,476		249,470
Oct-19	97,353		68,397	62,955		228,705
Nov-19	66,046		68,058	58,464		192,568
Dec-19	73,272		79,842	72,372		225,486

Jan-20	104,347		100,756	82,672		287,775
Feb-20	113,992		87,604	84,148	1,673	287,417
Mar-20	131,844		53,230	26,963	20,706	232,743
Apr-20	67,646		43,388	35,870	23,399	170,303
May-20	66,657		53,052	42,542	31,729	193,980
Jun-20	71,555		62,242	46,074	36,886	216,757
Jul-20	106,985		93,223	45,197	43,921	289,326
Aug-20	90,382		87,188	77,468	63,032	318,070
Sep-20	83,074		80,906	42,607	30,860	237,447
Oct-20	82,780		66,163	39,242	37,790	225,975
Nov-20	77,404		42,100	35,987	33,351	188,842
Dec-20	84,224		65,143	56,981	44,333	250,681
Jan-21	85,210		78,079	62,545	55,673	281,507
Feb-21	97,260		102,223	54,676	60,538	314,697
Mar-21	109,387		125,297	84,975	68,900	388,559
Apr-21	90,802		131,657	106,241	79,628	408,328
May-21	117,372		149,655	89,715	91,269	448,011
Jun-21	110,217		134,175	119,222	95,576	459,190
Jul-21	117,856		225,935	172,242	152,883	668,916
Aug-21	117,166		169,904	165,038	158,842	610,950
Sep-21	133,378		211,845	188,268	127,592	661,083
Oct-21	140,666		231,210	157,178	133,515	662,569
Nov-21	148,447		224,041	151,522	132,543	656,553
Dec-21	127,531		182,517	136,747	94,052	540,847
Jan-22	147,503		159,186	108,553	118,390	533,632
Feb-22	119,717		109,037	69,597	66,554	364,905
Mar-22	166,320		116,456	111,071	72,612	466,459
Apr-22	142,402		218,438	157,163	92,625	610,628

2. Open Interest for Nasdaq-100 Index Options

Date	NDX-Mnthly	NDX-Wkly	NDXP-Fri	NDXP-Wed	NDXP-Mon	Total
1/31/2017	71,683	32,269				103,952
2/28/2017	79,258	32,794				112,052
3/31/2017	72,840	58,172				131,012
4/28/2017	64,966	52,134				117,100
5/31/2017	79,060	29,382				108,442
6/30/2017	92,494	56,323				148,817
7/31/2017	78,484	37,007				115,491
8/31/2017	95,889	52,256				148,145
9/29/2017	74,150	66,828				140,978

10/31/2017	87,815	54,559				142,374
11/30/2017	123,347	52,219				175,566
12/29/2017	48,265	58,681				106,946
1/31/2018	68,543		56,330			124,873
2/28/2018	73,287		30,879			104,166
3/29/2018	69,796		25,276			95,072
4/30/2018	76,090		16,791			92,881
5/31/2018	82,429		26,626			109,055
6/29/2018	113,834		37,446			151,280
7/31/2018	93,721		38,338			132,059
8/31/2018	106,741		47,646			154,387
9/28/2018	94,781		72,091	3,233		170,105
10/31/2018	107,545		42,707	18,199		168,451
11/30/2018	134,295		35,139	5,571		175,005
12/31/2018	75,729		12,515	8,275		96,519
1/31/2019	80,582		14,033	2,634		97,249
2/28/2019	88,482		12,366	3,574		104,422
3/29/2019	69,836		16,472	3,244		89,552
4/30/2019	77,819		12,708	13,278		103,805
5/31/2019	99,495		25,976	3,882		129,353
6/28/2019	78,865		37,785	5,694		122,344
7/31/2019	89,541		15,928	9,076		114,545
8/30/2019	92,796		17,501	8,270		118,567
9/30/2019	76,662		14,978	6,954		98,594
10/31/2019	78,771		13,735	3,507		96,013
11/29/2019	80,124		14,130	5,993		100,247
12/31/2019	54,888		13,726	10,643		79,257
1/31/2020	75,328		21,123	7,151		103,602
2/28/2020	94,164		21,224	5,984	2,927	124,299
3/31/2020	98,445		12,817	3,379	1,438	116,079
4/30/2020	86,271		11,252	1,498	1,233	100,254
5/29/2020	82,769		11,119	1,972	2,864	98,724
6/30/2020	70,000		7,490	4,379	1,735	83,604
7/31/2020	84,980		13,054	1,890	3,749	103,673
8/31/2020	100,590		9,494	6,537	7,867	124,488
9/30/2020	90,712		15,502	5,173	1,920	113,307
10/30/2020	101,004		13,985	2,114	3,982	121,085
11/30/2020	103,254		6,797	2,746	3,870	116,667
12/31/2020	77,794		15,543	3,592	4,204	101,133
1/29/2021	84,364		18,142	3,933	4,238	110,677
2/26/2021	89,026		32,149	3,314	9,767	134,256

3/31/2021	85,563		15,358	10,361	4,170	115,452
4/30/2021	89,978		24,488	4,345	6,442	125,253
5/28/2021	94,873		46,885	6,962	2,803	151,523
6/30/2021	90,005		18,241	25,754	7,683	141,683
7/30/2021	88,083		37,331	4,524	7,388	137,326
8/31/2021	98,219		23,194	15,504	1,740	138,657
9/30/2021	102,014		43,649	7,265	5,345	158,273
10/29/2021	110,713		40,831	7,363	10,610	169,517
11/30/2021	92,350		31,714	12,626	3,233	139,923
12/31/2021	71,240		32,757	5,719	6,928	116,644
1/31/2022	81,851		32,228	5,869	8,308	128,256
2/28/2022	81,278		15,947	4,666	7,929	109,820
3/31/2022	90,352		22,104	6,072	5,305	123,833
4/29/2022	101,070		51,364	6,855	8,739	168,028

3. Quoted Spread Regression for NDX-Mnthly:

Trends in quoted spreads were obtained using the following regression model to control for factors related to option characteristics but unrelated to the pilot

Spread = α + $InverseofPrice$ + Call/Put Dummy +Expiry + Moneyness Categories + Month Fixed Effect + ε

where Spread is the relative quoted spread. InverseofPrice is the inverse of the option price. Call/Put Dummy is a dummy variable that equals 1 for call options and 0 otherwise. Expiry is the number of the days to the expiration date. Moneyness is a dummy variable for moneyness category of each option. Specifically, we classify all option contracts into 5 moneyness categories. We calculate the moneyness for call options as $\frac{S-X}{X} * 100\%$ and that for put options as $\frac{X-S}{X} * 100\%$, where S is the stock price and X is the exercise price. The cut-offs for the five moneyness groups are -30%, -10%, 10% and 30%. Month Fixed Effect is a dummy variable for each month. The sample was drawn from the first trading date of each month. As the Option's NBBO data is not available between Aug 1, 2021 and Aug 11, 2021, we exclude August 2021 from the sample.

The coefficients for those month fixed effects are of our interest. The regression estimates are shown as follows:

Coefficient	Estimate	Std. Error	t value
Intercept	15.04	3.45	4.36
Dt: 2017-02-01	13.46	3.75	3.59
Dt: 2017-03-01	2.82	3.49	0.81
Dt: 2017-04-03	-11.68	4.31	-2.71
Dt: 2017-05-01	-1.72	4.58	-0.38
Dt: 2017-06-01	1.28	2.81	0.46
Dt: 2017-07-03	7.03	4.12	1.71
Dt: 2017-08-02	7.65	3.72	2.06
Dt: 2017-09-01	10.34	2.76	3.75
Dt: 2017-10-02	-5.98	4.39	-1.36
Dt: 2017-11-01	0.97	3.67	0.26
Dt: 2017-12-01	28.39	2.39	11.91
Dt: 2018-01-02	-2.67	4.51	-0.59
Dt: 2018-02-01	5.50	3.39	1.62
Dt: 2018-03-01	5.11	3.10	1.65
Dt: 2018-04-02	-18.42	4.16	-4.43
Dt: 2018-05-01	3.65	3.80	0.96
Dt: 2018-06-01	15.77	2.73	5.78
Dt: 2018-07-02	-10.13	4.09	-2.47
Dt: 2018-08-01	1.05	3.48	0.30
Dt: 2018-09-04	-6.99	3.82	-1.83
Dt: 2018-10-01	-14.93	4.06	-3.67
Dt: 2018-11-01	-3.50	3.10	-1.13
Dt: 2018-12-03	-14.93	4.00	-3.74
Dt: 2019-01-02	-23.28	3.35	-6.96
Dt: 2019-02-01	3.45	2.82	1.23
Dt: 2019-03-01	7.27	2.81	2.59
Dt: 2019-04-01	-19.96	3.95	-5.06
Dt: 2019-05-01	-9.83	3.39	-2.90
Dt: 2019-06-03	-23.25	3.87	-6.01
Dt: 2019-07-01	-25.37	3.95	-6.42
Dt: 2019-08-01	-11.47	3.03	-3.79
Dt: 2019-09-03	-21.62	3.55	-6.10
Dt: 2019-10-01	-20.48	3.62	-5.66
Dt: 2019-11-01	-9.90	2.95	-3.35
Dt: 2019-12-02	-23.34	3.82	-6.11
Dt: 2020-01-02	-14.06	3.02	-4.66
Dt: 2020-02-03	-30.70	3.96	-7.76

Dt: 2020-03-02	-15.58	3.77	-4.14
Dt: 2020-04-01	-14.33	3.15	-4.55
Dt: 2020-05-01	-16.47	2.67	-6.18
Dt: 2020-06-01	-43.64	4.05	-10.78
Dt: 2020-07-01	-27.88	3.27	-8.52
Dt: 2020-08-03	-41.91	3.92	-10.68
Dt: 2020-09-02	-14.27	3.21	-4.45
Dt: 2020-10-01	-13.23	2.87	-4.61
Dt: 2020-11-02	-36.07	3.76	-9.58
Dt: 2020-12-01	-26.30	3.39	-7.76
Dt: 2021-01-04	6.59	1.76	3.74
Dt: 2021-02-01	-37.25	3.82	-9.75
Dt: 2021-03-01	-32.12	3.79	-8.48
Dt: 2021-04-01	-17.27	2.78	-6.21
Dt: 2021-05-03	-31.37	3.82	-8.22
Dt: 2021-06-01	-25.24	3.32	-7.61
Dt: 2021-07-01	-15.38	2.72	-5.66
Dt: 2021-09-01	-34.40	3.02	-11.39
Dt: 2021-10-01	-24.34	2.41	-10.11
Dt: 2021-11-01	-57.25	3.73	-15.36
Dt: 2021-12-01	-25.52	3.05	-8.36
Dt: 2022-01-03	-41.48	3.68	-11.28
Dt: 2022-02-01	-42.78	3.36	-12.73
Dt: 2022-03-01	-43.49	3.36	-12.93
Dt: 2022-04-01	-23.19	2.07	-11.18
InverseofPrice	8.98	0.11	83.42
Call/Put Dummy	-4.85	0.49	-9.84
moneyness2	5.67	1.02	5.57
moneyness3	-68.18	0.91	-74.87
moneyness4	-78.43	1.06	-74.04
moneyness5	-54.00	0.80	-67.18
Expiry	4.98	0.38	13.25

The number of observations in the sample was 36,334 and the R-squared value was 0.513.

Trends in the observation date coefficients were shown in the report. The omitted date was from January 2017, thus having implicitly a value of zero.

Simple Average

The following table shows the average percent quoted spread for NDX-monthly contracts in each month.

	Simple Average
Dt: 2017-01-03	54.85
Dt: 2017-02-01	65.33
Dt: 2017-03-01	67.53
Dt: 2017-04-03	40.79
Dt: 2017-05-01	62.29
Dt: 2017-06-01	81.41
Dt: 2017-07-03	61.49
Dt: 2017-08-02	59.98
Dt: 2017-09-01	71.62
Dt: 2017-10-02	41.27
Dt: 2017-11-01	37.59
Dt: 2017-12-01	77.01
Dt: 2018-01-02	48.07
Dt: 2018-02-01	40.09
Dt: 2018-03-01	39.81
Dt: 2018-04-02	31.52
Dt: 2018-05-01	49.65
Dt: 2018-06-01	55.98
Dt: 2018-07-02	42.51
Dt: 2018-08-01	47.32
Dt: 2018-09-04	49.19
Dt: 2018-10-01	43.70
Dt: 2018-11-01	33.81
Dt: 2018-12-03	44.78
Dt: 2019-01-02	29.61
Dt: 2019-02-01	43.39
Dt: 2019-03-01	52.18
Dt: 2019-04-01	63.45
Dt: 2019-05-01	38.96
Dt: 2019-06-03	35.84
Dt: 2019-07-01	36.43
Dt: 2019-08-01	40.20
Dt: 2019-09-03	31.56
Dt: 2019-10-01	38.26
Dt: 2019-11-01	24.69
Dt: 2019-12-02	37.47
Dt: 2020-01-02	31.29
Dt: 2020-02-03	19.17
Dt: 2020-03-02	34.90
Dt: 2020-04-01	27.87

Dt: 2020-05-01	16.21
Dt: 2020-06-01	17.81
Dt: 2020-07-01	16.80
Dt: 2020-08-03	20.70
Dt: 2020-09-02	39.58
Dt: 2020-10-01	39.95
Dt: 2020-11-02	26.83
Dt: 2020-12-01	43.55
Dt: 2021-01-04	35.69
Dt: 2021-02-01	21.88
Dt: 2021-03-01	30.22
Dt: 2021-04-01	22.11
Dt: 2021-05-03	29.05
Dt: 2021-06-01	29.29
Dt: 2021-07-01	24.72
Dt: 2021-09-01	30.89
Dt: 2021-10-01	30.98
Dt: 2021-11-01	17.98
Dt: 2021-12-01	39.77
Dt: 2022-01-03	33.77
Dt: 2022-02-01	27.49
Dt: 2022-03-01	26.76
Dt: 2022-04-01	27.16

4. Quoted Spread Model for QQQ Monthly Options

The following table shows the average percent quoted spread for QQQ contracts in each month.

	Simple Average
Dt: 2017-01-03	53.38
Dt: 2017-02-01	59.45
Dt: 2017-03-01	53.63
Dt: 2017-04-03	54.68
Dt: 2017-05-01	61.36
Dt: 2017-06-01	61.01
Dt: 2017-07-03	57.03
Dt: 2017-08-02	58.60
Dt: 2017-09-01	66.36
Dt: 2017-10-02	59.66
Dt: 2017-11-01	45.31
Dt: 2017-12-01	55.44

Dt: 2018-01-02	58.88
Dt: 2018-02-01	37.65
Dt: 2018-03-01	31.13
Dt: 2018-04-02	28.61
Dt: 2018-05-01	42.98
Dt: 2018-06-01	45.30
Dt: 2018-07-02	27.21
Dt: 2018-08-01	37.91
Dt: 2018-09-04	37.88
Dt: 2018-10-01	37.07
Dt: 2018-11-01	23.16
Dt: 2018-12-03	38.78
Dt: 2019-01-02	42.01
Dt: 2019-02-01	48.89
Dt: 2019-03-01	55.06
Dt: 2019-04-01	44.73
Dt: 2019-05-01	39.27
Dt: 2019-06-03	38.40
Dt: 2019-07-01	31.83
Dt: 2019-08-01	37.03
Dt: 2019-09-03	33.27
Dt: 2019-10-01	47.70
Dt: 2019-11-01	58.58
Dt: 2019-12-02	31.78
Dt: 2020-01-02	46.65
Dt: 2020-02-03	38.04
Dt: 2020-03-02	38.07
Dt: 2020-04-01	34.52
Dt: 2020-05-01	21.50
Dt: 2020-06-01	25.29
Dt: 2020-07-01	20.30
Dt: 2020-08-03	23.55
Dt: 2020-09-02	39.90
Dt: 2020-10-01	26.38
Dt: 2020-11-02	10.48
Dt: 2020-12-01	28.35
Dt: 2021-01-04	46.53
Dt: 2021-02-01	15.36
Dt: 2021-03-01	37.09
Dt: 2021-04-01	22.78
Dt: 2021-05-03	20.92

Dt: 2021-06-01	26.80
Dt: 2021-07-01	19.95
Dt: 2021-09-01	29.52
Dt: 2021-10-01	32.77
Dt: 2021-11-01	32.43
Dt: 2021-12-01	28.71
Dt: 2022-01-03	32.88
Dt: 2022-02-01	26.41
Dt: 2022-03-01	18.13
Dt: 2022-04-01	26.69

EXHIBIT 5

New text is underlined; deleted text is in brackets.

Nasdaq PHLX LLC Rules

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Options Rules

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Options 4A Options Index Rules

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Section 12. Terms of Index Options Contracts

(a) *General*.

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(6) In addition to A.M.-settled Nasdaq-100 Index options approved for trading on the Exchange pursuant to Options 4A, Section 12(e)(II), the Exchange may also list options on the Nasdaq 100 Micro Index Options ("XND") whose exercise settlement value is derived from closing prices on the expiration day ("P.M.-settled"). [XND options will be listed for trading for a pilot period expiring on May 4, 2023.]

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(b) No change.

* * * * *

(5) **Nonstandard Expirations Pilot Program**

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[(C) Duration of Nonstandard Expirations Pilot Program. The Nonstandard Expirations Pilot Program shall be through May 4, 2023.]

([D]C) Weekly Expirations and EOM Trading Hours. Transactions in Weekly Expirations and EOMs may be effected on the Exchange between the hours of 9:30 a.m. (Eastern Time) and 4:15 pm (Eastern Time), except that on the last trading day, transactions in expiring Weekly Expirations and EOMs may be effected on the Exchange between the hours of 9:30 a.m. (Eastern time) and 4:00 p.m. (Eastern time).

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