

**Report of the Market-Wide Circuit Breaker (“MWCB”) Working Group
Regarding the March 2020 MWCB Events**

Submitted March 31, 2021

Introduction

On September 17, 2020, the Director of the Securities Exchange Commission's ("SEC") Division of Trading and Markets formally asked the national securities exchanges and FINRA (collectively, "SROs") to conduct a study of the volatility events of March 2020 that resulted in four market-wide trading halts prescribed by common SRO rules governing Market Wide Circuit Breakers ("MWCB").

In response to the request, the SROs created a MWCB "Working Group" composed of SRO representatives and the following industry advisers: Hubert De Jesus of BlackRock; Joseph Mecane of Citadel Securities; Adam Nunes of Hudson River Trading; Andrew Upward of Jane Street; Paul O'Donnell of Morgan Stanley; and Marc Rosenthal of Virtu Financial. The Working Group has met regularly since September 2020 to consider the SEC's request, review data, and compile this study. The Working Group's efforts in this respect have incorporated and built on the work of an earlier MWCB "Task Force," which was assembled in late 2019 and met weekly during the Spring and Summer of 2020 to discuss market volatility and the MWCB events as they were occurring.

This study provides: (1) in Section 1, a comprehensive timeline of the MWCB events in March 2020; (2) in Section 2, the analysis and recommendations of the MWCB Task Force in Spring-Summer 2020; (3) in Section 3, an evaluation of the operation of the current MWCB rules during the March 2020 events; (4) in Section 4, an evaluation of the design of the current MWCB system; and (5) in Section 5, the conclusions and recommendations of the Working Group.

Executive Summary

As detailed below, the Working Group concludes:

- the MWCB mechanism worked as intended during the March 2020 events;
- the MWCB Halts triggered in March 2020 appear to have had the intended effect of calming volatility in the market, without causing harm;
- the design of the MWCB mechanism with respect to reference value (S&P 500 Index, or "SPX"),¹ trigger levels (7% / 13% / 20%), and halt times (15 minutes) is appropriate;
- the change implemented in Amendment 10 to the Plan to Address Extraordinary Market Volatility (the "Limit Up/Limit Down Plan" or "LULD Plan") did not likely have any negative impact on MWCB functionality; and

¹ The S&P 500 Index ("SPX") is a product of S&P Dow Jones Indices ("S&P DJI").

- no changes should be made to the mechanism to prevent the market from halting shortly after the opening of regular trading hours at 9:30 a.m.

The Working Group notes that CME has implemented changes that were recommended by the Task Force to better align the futures and cash equities markets, as discussed in Section II.B below.

The Working Group makes four recommendations:

- The 2012 amendments made on a pilot basis by the U.S. stock exchanges and FINRA to their existing cash equities uniform MWCB rules (the “Pilot Rules”)² should be made permanent without any changes.
- S&P DJI should establish an independent SPX calculation to be conducted and maintained by a separate, independent entity, to further reinforce redundancy and resiliency of the SPX calculation. As noted below, S&P DJI has indicated that it intends to do so.
- All markets should take appropriate action to minimize the reporting of trades to the SIP after the imposition of a MWCB halt.
- U.S. exchanges should adopt a rule requiring all designated Regulation SCI firms to participate in at least one Level 1/Level 2 MWCB test each year and to verify their participation by attesting that they are able to or have attempted to: (i) receive and process all SIP and exchange halt messages; (ii) receive and process trading resumes; (iii) receive and process any market data messages relevant to MWCB halts; and (iv) send orders following a Level 1 or 2 MWCB halt in a manner consistent with their usual trading behavior.

I. Timeline of March 2020 MWCB Events

The MWCB rules (“MWCB Rules”) provide an important, automatic mechanism that is invoked to promote stability and investor confidence during a period of significant stress when cash equities securities experience extreme market-wide declines. The MWCB Rules are designed to slow the effects of extreme price movement through coordinated trading halts across both cash

² See Securities Exchange Act Release No. 67090 (May 31, 2012), 77 FR 33531 (June 6, 2012) (SR-BATS-2011-038; SR-BYX-2011-025; SR-BX-2011-068; SR-CBOE-2011-087; SR-C2-2011-024; SR-CHX-2011-30; SR-EDGA-2011-31; SR-EDGX-2011-30; SR-FINRA-2011-054; SR-ISE-2011-61; SR-NASDAQ-2011-131; SR-NSX-2011-11; SR-NYSE-2011-48; SR-NYSEAmex-2011-73; SR-NYSEArca-2011-68; SR-Phlx-2011-129) (“MWCB Approval Order”).

equities and equity options securities markets when severe price declines reach levels that may exhaust market liquidity. The cash equities rules governing MWCB were first adopted in 1988 and, in 2012, all U.S. stock exchanges and FINRA amended their existing cash equities uniform rules on a pilot basis (the “Pilot Rules”). Currently, MWCB Rules provide for trading halts in all cash equity and equity options markets during a severe market decline as measured by a single-day decline in SPX. Under the Pilot Rules, a market-wide trading halt will be triggered if SPX declines in price by specified percentages from the prior day’s closing price of that index. Currently, the triggers are set at three circuit breaker thresholds: 7% (Level 1), 13% (Level 2), and 20% (Level 3). A market decline that triggers a Level 1 or Level 2 halt after 9:30 a.m.³ and before 3:25 p.m. would halt market-wide trading for 15 minutes, while a similar market decline at or after 3:25 p.m. would not halt market-wide trading. (Level 1 and Level 2 halts may occur only once a day.) A market decline that triggers a Level 3 halt at any time during the trading day would halt market-wide trading for the remainder of the trading day.

The following is a timeline of events leading to the four MWCB events on March 9, 12, 16, and 18, 2020:

- February 21, 2020 (Friday): Related to COVID-19 concerns, market volatility began to increase, with SPX falling 1.1%.⁴
- February 22-23, 2020 (Saturday-Sunday): Concerns related to COVID-19 increased during the weekend.
- February 24, 2020 (Monday): SPX opened 2.4% below the previous Close and ended the day down 3.4%. Unrelatedly, Amendment 18 of the LULD Plan) (which eliminated double-wide bands for some symbols at the open and close) was implemented on this date.
- February 27, 2020 (Thursday): Elevated volatility persisted during the week, peaking with a 4.4% drop in SPX on this date.
- February 28, 2020 (Friday): Amid continuing volatility stemming from COVID-19 concerns and a rebalance of MSCI indices at the close, the U.S. equity market traded 19.375 billion shares -- at the time, the second most active volume day in history.⁵

³ All times in this report refer to Eastern Time.

⁴ All market index statistics sourced from <http://finance.yahoo.com>.

⁵ Source: NYSE Daily Trade and Quote.

- February 29-March 1, 2020 (Saturday-Sunday): Over this weekend, various global actors including the Federal Reserve, the European Central Bank, and the Bank of Japan, issued statements indicating that they would intervene to support markets.
- March 2, 2020 (Monday): In response to expectations of central bank stimulus, the market rallied with a 4.6% increase in SPX.
- March 3, 2020 (Tuesday): Markets remained volatile, with SPX falling 2.8%. The market trading range on that date was 5.2%. By comparison, the average daily move over the first three weeks of February had been 0.7%.
- March 2-6, 2020 (Monday-Friday): On average, the close-to-close market decreased 3.3% per day between March 2 and March 6.
- March 7-8, 2020 (Saturday-Sunday): Negative news regarding COVID-19 multiplied over the weekend, with increasing deaths in Italy⁶ and multiple members of Congress forced to self-quarantine.⁷ As Asian markets opened for Monday trading (during Sunday evening Eastern Time), oil prices “collapsed” after Saudi Arabia announced plans to boost output, with Brent crude dropping as much as 30%. These developments led the E-mini S&P 500 futures contract to reach its limit-down state (a 5% decline) on the Chicago Mercantile Exchange (“CME”) overnight Sunday into Monday.⁸
- March 9, 2020 (Monday) (First MWCB Halt): As cash equity markets in the U.S. opened at 9:30 a.m., SPX began updating its value as each component stock commenced trading. At 9:34:13 a.m., SPX crossed the 7% threshold to trigger a **Level 1 MWCB halt**, halting trading for 15 minutes. Reopening auctions began on primary exchanges at 9:49:13 a.m. Shortly after trading resumed, SPX gained value, reaching as high as 5.5% down from Friday’s close, before closing down 7.6% from Friday’s close.
- March 10, 2020 (Tuesday): The market recovered somewhat on this date.

⁶ <https://www.wsj.com/articles/italy-with-elderly-population-has-worlds-highest-death-rate-from-virus-11583785086>

⁷ <https://www.wsj.com/articles/number-of-congressional-lawmakers-in-self-quarantine-grows-to-five-11583785594>

⁸ <https://www.bloomberg.com/news/articles/2020-03-08/rout-in-u-s-stock-futures-would-trigger-trading-curbs-at-5>

- March 12, 2020 (Thursday) (Second MWCB Halt): COVID-19 fears took hold again after “global health authorities declared the virus a pandemic,”⁹ with the E-mini S&P 500 futures contract reaching its limit-down state overnight. At 9:35:44 a.m., SPX crossed the 7% threshold to trigger a **Level 1 MWCB halt**. Reopening auctions began on primary exchanges at 9:50:44 a.m. After trading resumed, the market recovered value somewhat before falling again and ending the day down 9.5%.
- March 13, 2020 (Friday): The market vacillated throughout the day before rallying into the close, with SPX closing up 9.3% on the day but down 8.8% for the week.
- March 14-15, 2020 (Saturday-Sunday): Negative COVID-19 news continued over the weekend, with more parts of the U.S. economy shutting down. On Sunday, the Federal Reserve cut interest rates to nearly 0%.
- March 16, 2020 (Monday) (Third MWCB Halt): E-mini S&P 500 futures again hit a limit-down state in overnight trading. Selling pressure was so intense that the **Level 1 MWCB** threshold of 7% down was crossed at 9:30:01 a.m. Given the rapid and severe price drops, the vast majority of SPX stocks did not complete a primary listing exchange opening auction prior to the Level 1 halt being triggered. Reopening auctions began on primary listing exchanges at 9:45:01 a.m. Trading resumed at lower price levels before the market recovered over the course of the day, but SPX started falling in the final 35 minutes of the trading day after President Trump said the virus “may not be under control until July or August.”¹⁰ The day ended down 12% from Friday’s close.
- March 17, 2020 (Tuesday): The Federal Reserve announced a lending facility to support short-term debt markets, and the Trump Administration indicated support for a stimulus plan including direct payments to individuals.¹¹ The market rallied, with SPX gaining 6%.
- March 18, 2020 (Wednesday) (Fourth MWCB Halt): Negative sentiment returned, with price drops across multiple asset classes. After initially rising after the open, the market started dropping around 10:45 a.m. and crossed the **Level 1 MWCB** threshold at 12:56:17 p.m. Reopening auctions began on primary exchanges at 1:11:17 p.m. SPX fell further after the market reopened but then rallied into the close to finish the day down 5.2%. After the close, the New York Stock Exchange

⁹ <https://www.wsj.com/articles/global-stocks-follow-u-s-markets-lower-11583975524>

¹⁰ <https://www.wsj.com/articles/stocks-dow-slide-after-fed-slashes-rates-11584310328>

¹¹ <https://www.wsj.com/articles/u-s-futures-rise-as-asia-markets-gyrate-11584413763>

(“NYSE”) announced that its Trading Floor would close effective Monday, March 23, 2020, due to COVID-19.

- March 20, 2020 (Friday): SPX dropped an additional 4.3%.

II. Analysis and Recommendations of MWCB Task Force

In late 2019, before any of the events described above, SEC staff requested the formation of a MWCB Task Force to evaluate the operation and design of the MWCB mechanism. The Task Force, which conducted several organizational meetings in December 2019 and January 2020, included representatives from the exchanges, FINRA, SEC, CME, and the Commodity Futures Trading Commission (“CFTC”), along with industry representatives (several of whom were already serving as advisors to the CTA/UTP NMS Plans and the LULD Plan).¹²

From the first quarter of 2020 through early summer 2020, a series of ten MWCB Task Force meetings was held on a weekly or bi-weekly basis, each including approximately 45 participants. The goal of the meetings was to establish key MWCB topics and sub-topics to consider and study on an expedited basis. In March, with the experience of the four MWCB Halts, the Task Force’s focus shifted from theoretical analysis to an examination of the actual events, focusing on identifying areas, if any, where the MWCB mechanism did not work properly. Given the risk of unintended consequences, the Task Force stayed away from recommending changes that were not rooted in a noted deficiency.

The Task Force focused principally on the four issues described below.

A. Halts Shortly After the Market Open

Since three of the four halts (March 9, 12 and 16) were triggered within the first five minutes of the 9:30 a.m. start of regular trading hours and before all stocks had opened for regular hours trading, the Task Force zeroed in on issues relating to the appropriateness of halting the market so soon after its opening or before all securities were fully open. After considering data related to the effectiveness of the open and re-open auctions and reports of market participants’ experiences during the March 2020 MWCB events, the Task Force did not recommend that changes be made to the MWCB mechanism, which permits halts even shortly after the 9:30 a.m. market open.

¹² Based on SEC guidance, meetings of the MWCB Task Force were conducted independently under the umbrella of the LULD Plan, but the LULD Plan’s Operating Committee had no involvement or oversight of the MWCB Task Force or the MWCB Working Group.

B. Alignment of Futures and Cash Markets

The Task Force noted that the E-mini S&P 500 futures had entered a limit-down state before the March 9, 12, and 16 Level 1 MWCB halts, and considered whether improvements could be made to the relationship between the cash and futures markets. Specifically, the Task Force considered:

- Whether futures limit-down percentages could be widened to 7% from 5% to align with equities;¹³ and
- Whether resumption of futures trading in relevant futures, such as the E-mini S&P 500 futures, should precede the re-opening of the equities markets to provide more price discovery.

After analysis, the MWCB Task Force made the following recommendations to CME:

1. Consider changing the trigger for the limit-down state for the E-mini S&P 500 futures contract to 7% from 5%, to align with the Level 1 MWCB trigger of 7% for equities.
2. During a Level 1 or Level 2 MWCB halt, consider reopening the E-mini S&P 500 futures five minutes before the end of the 15-minute trading halt for equities, to enhance the cash market price discovery process.

Based upon these recommendations, CME adopted the following changes, which became effective on October 12, 2020:¹⁴

1. Overnight Trading Hours (“OTH”) Price limits in certain futures and options on futures were changed from 5% hard limits to 7% hard limits. During OTH hours, such contracts are also subject to Dynamic Special Price Fluctuation Limits at 3.5%. This change applies to the following products: S&P 500; E-mini S&P 500;

¹³ The Working Group considered, but does not support, lowering the Level 1 MWCB trigger for equities to 5% from its current 7%, because of the industry’s earlier experience with triggers being too low. See *infra* Section IV.A and IV.C.

¹⁴ In its filing with the CFTC, CME stated that “The Exchanges conducted significant market outreach regarding the amendments including an industrywide task force initially convened in 2019. Market participants are in favor of the amendments.”
https://www.cmegroup.com/content/dam/cmegroup/market-regulation/rule-filings/2020/9/20-392_1.pdf; https://www.cmegroup.com/content/dam/cmegroup/market-regulation/rule-filings/2020/9/20-392_2.pdf

Micro E-mini S&P 500; E-mini Select Sectors; E-mini Russell 1000 and 2000; Micro E-mini Russell 2000; E-mini Nasdaq; Micro E-mini Nasdaq 100; E-mini Dow; Micro E-mini Dow; Dow Real Estate; E-mini FTSE; and E-mini IPOX.

2. During regular trading hours, after a Level 1 or Level 2 MWCB trading halt in equities, trading in the products listed below will resume after 10 minutes (5 minutes before the equities markets can reopen):
 - S&P 500 Stock Price Index futures and options (E-mini, Micro E-mini, Annual Dividend Index, Quarterly Dividend Index, BTIC)
 - Nasdaq-100 futures and options (E-mini, Micro E-mini, BTIC, including Nasdaq VolQ futures, which is currently pending CFTC review)
 - Dow Jones Industrial Average (“DJIA”) futures and options (E-mini, Micro E-mini, BTIC)
 - Russell 2000 futures and options (E-mini, Micro E-mini, BTIC)

C. The Use of SPX as MWCB Triggering Mechanism

The MWCB Task Force discussed the use of SPX as the reference index for MWCB triggers. Specific areas of consideration were the reliability of the SPX calculation, and whether a ‘tradeable’ instrument such as the E-mini futures contract or an S&P 500 SPDR ETF (“SPY”) was a better trigger. Representatives from S&P DJI provided a presentation to the Task Force about S&P DJI’s resiliency and redundancy protections for the SPX index, along with supporting documentation. After examining the information provided by S&P DJI and considering potential alternative reference indices, the Task Force preliminarily determined that SPX remained an appropriate reference source for measuring market-wide declines that could trigger a MWCB Halt. Issues related to the computational aspects of the index, including the frequency of such computations and the latency of the index, were also examined and determined to be satisfactory. (See Section IV.C. below for further discussion.)

D. MWCB Industry Testing

CTA, CQ, and UTP (the “SIPs”) conduct MWCB testing four times per year. Participants in the CTA/CQ and UTP NMS Plans (the “Participants”) – the national securities exchanges and FINRA – are required to participate in at least two tests per year. Member firms and vendors are encouraged to participate and test their ability to receive and process MWCB messages and to participate in reopening auctions following Level 1 or Level 2 MWCB halts. In 2018, NYSE

amended its rules to require that NYSE member firms that are designated as Regulation SCI testers for a particular test year must participate in one MWCB test that year.¹⁵

In 2019, the Participants also conducted the first test of the “Day 2 opening procedures” for opening trading on the day after a simulated Level 3 breach, which halts trading for the remainder of the trading day on which it occurs. Intermarket preparation for that test, run on June 8, 2019, revealed several differences in how the primary listing exchanges planned to open on the next trading day.¹⁶ The SIP Systems Subcommittee of the CTA/UTP Operating Committee discussed the need to standardize such procedures, and in March 2020, the primary listing exchanges revised their procedures, systems, and rules to provide that they will open their markets on the day after a Level 3 breach using their standard opening procedures, i.e., that if an exchange has early trading hours, trading would resume during those early trading hours and not wait until the opening of regular trading hours at 9:30 a.m. Those changes were successfully tested industry-wide on September 12, 2020. The Participants have determined that, because the Day 2 opening procedures for all markets are now the same as for any other trading day, there is no need to test next day opening procedures after a Level 3 breach in 2021.

To enhance the testing of Level 1 and Level 2 trading halts, the MWCB Task Force also recommended that the other SROs adopt a rule requiring all designated Regulation SCI firms to participate in at least one Level 1/Level 2 MWCB test each year and to verify their participation by attesting that they are able to or have attempted to: (i) receive and process all SIP and exchange halt messages; (ii) receive and process trading resumes; (iii) receive and process any market data messages relevant to MWCB halts; and (iv) send orders following a Level 1 or 2 MWCB halt in a manner consistent with their usual trading behavior.

¹⁵ See NYSE Rule 49(c)(1); Securities Exchange Act Release No. 83836 (August 13, 2018), 83 FR 41117 (August 17, 2018) (SR-NYSE-2018-31).

¹⁶ One risk identified during the preparation for MWCB testing in 2019 was a restriction on the CTA SIP’s dissemination of closing prices after 4:00 p.m. for Tape A and B securities. Pursuant to the CTA SIP’s procedures at that time, trade messages that it received during a Regulatory Halt were either rejected (if from the primary listing exchanges) or held until after the close (if received from non-primary markets). Since closing price reports are considered trade messages, such reports sent to the CTA SIP by primary listing exchanges would be rejected. This treatment was rectified in March 2020 as part of another initiative. Going forward, in the event of a Level 3 breach and a trading halt for the remainder of the day, the CTA SIP will disseminate all closing price reports received from the primary listing exchanges after 4:00 p.m. See Securities Exchange Act Release No. 88384 (March 13, 2020), 85 FR 15836 (March 19, 2020) (SR-CTA-2019-02).

III. Evaluation of the Operation of MWCB Mechanism during the March 2020 Events

This section of the study examines whether the MWCB halts and reopening auctions operated as designed and expected on each of the four MWCB events in March 2020.

A. How MWCB Halts Are Intended to Work

The current MWCB mechanism works as follows. At 7:00 a.m. and again at 8:00 a.m., the CTA SIP generates the three decline values (7% (breach Level 1), 13% (breach Level 2), and 20% (breach Level 3)), based on the index value of SPX at 4:00 p.m. the prior trading day. The three levels are generated by the CTA SIP's MWCB application to CTS/CQS (Tapes A and B) and the UTP SIP (Tape C), which are then disseminated to subscribers over multicast lines.

Beginning at 9:30 a.m., SPX is ingested by the CTA SIP from a data stream provided by S&P DJI via CBOE.¹⁷ SPX values are generated every one second and the CTA SIP's MWCB application tracks the values, specifically monitoring for percentage of index decline. If SPX declines 7%, the MWCB application generates "Breach Level 1" messages to CTS/CQS and the UTP SIP, which are then disseminated to subscribers. Primary listing exchanges then send "Regulatory Halt" messages for each listed security to the respective SIPs for dissemination to subscribers. At the end of a 15-minute halt period, the primary listing exchanges generate "Resume" messages for each listed security to the SIPs, which are again disseminated to subscribers. However, pursuant to individual SRO rules, an SRO does not resume trading in a security until it receives LULD price bands in that security, which effectively means that trading does not resume on an unlisted trading privileges basis in a security until the primary listing exchange has reopened trading for that security. The same process is followed for a Level 2 breach of 13%. For a Level 3 Breach of 20%, the market remains halted until the end of the trading day.

B. During the March 2020 Events, the Markets Halted in a Timely Manner

On March 9, 12, 16, and 18, 2020, as market conditions indicated that a Level 1 MWCB Halt was likely, NYSE activated an "Intermarket Bridge" call and sent an email alert to a pre-existing distribution list comprising multiple staff from securities and futures exchanges, FINRA, the SEC, the CFTC, the Depository Trust & Clearing Corporation, and the Options Clearing Corporation. On each day, the call opened before the 7% trigger was hit and remained open during the entire period of the halt, until trading in all symbols was reopened.

¹⁷ Cboe disseminates two primary feeds from two data centers and one disaster recovery feed. CTA SIP reads all three feeds and can failover to any of them.

When SPX declined 7% from the previous day's closing value, the MWCB Level 1 Breach messages and resulting Regulatory Halt messages operated as designed. All 9,000+ equity symbols were halted in a timely manner.

In addition, the NYSE and Cboe markets sent blast halt alerts to industry subscribers. For example, on March 18, 2020, Cboe sent the following notice:

Effective **12:56:17 ET** Cboe Equities exchanges have halted trading due to a Level 1 Market Wide Circuit Breaker breach.

During the entirety of the Halt period, new orders and cancels will be accepted on the BYX, EDGA, and EDGX exchanges for all symbols and on the BZX Exchange for non BZX-listed symbols. Orders will be entered in a queued state and wait for the re-opening requirements. BZX will reject new orders in BZX-listed symbols until 5 minutes before the halt is scheduled to lift. Orders placed prior to the halt may be cancelled depending on cancel on halt port settings. The exchanges will be scheduled to re-open at approximately **13:11:17 ET**.

Similarly, NYSE sent the following notice on the same date:

Due to a 7 percent decline in the S&P 500 index, in accordance with the NYSE, NYSE Arca, NYSE American, NYSE National and NYSE Chicago Rule 7.12, equity trading at the NYSE Exchanges has been halted. Information about order entry during the halt and the reopening process is available here.

The market will re-open today at the following time: 13:11:17 ET.

When the Regulatory Halt messages reached the options markets, consistent with their respective rules that require the options markets to halt if there is a MWCB Halt in the cash equities market, they halted trading in approximately 900,000 options series. A total of approximately 5,000 options trades that were sent to OPRA after the time of the four MWCB Halts were nullified. Specifically, the Nasdaq options markets (BX, PHLX, NOM, ISE, GEMX, MRX) nullified approximately 4,800 trades and the two NYSE options markets (NYSE American and NYSE Arca) nullified approximately 180 trades pursuant to those markets' "obvious error" rules.¹⁸

CME is not a subscriber to the equity SIP data feeds. In the event of a MWCB Halt, CME halts trading in affected symbols manually upon notification of the breach during the Intermarket Bridge call. At the outset of each event in March 2020, CME staff responded to NYSE staff's announcement of the halt during the Intermarket Bridge call. CME halted affected symbols

¹⁸ Recommendations concerning this activity are included in Section V below.

approximately one minute after each breach was triggered. Approximately 4,400 contracts (futures and options on futures on all U.S. equity indices) traded on the CME between the time the breach was declared and the time CME halted trading. No trades on CME were nullified.

C. Volatility and Liquidity Preceding the March 2020 MWCB Events

In connection with its request for the SROs to study the March 2020 MWCB Halts, SEC staff requested that the Working Group consider various metrics of liquidity and volatility during that period. In response to that request, the Working Group examined the following measurements of liquidity and volatility preceding each of the March 2020 MWCB Halts and compared them to liquidity and volatility measurements for other trading periods. In particular, the Working Group examined:

1. Activity before the opening of regular trading hours;
2. Occurrence of opening on a trade versus opening on a quote;¹⁹
3. Size and liquidity in the opening auctions and post-MWCB halt reopening auctions as measured by shares available based on imbalance messages;
4. Quote volatility as measured by average mid-point to mid-point price change every second in basis points; and
5. Liquidity at the national best bid and offer (“NBBO”); and
6. LULD Trading Pauses following MWCB Reopening Auctions.

In the graphs and discussion below, the following abbreviations apply:

- **Group 1 (G1)** = S&P 500 Tier 1²⁰ securities
- **Group 2 (G2)** = Other non-ETP Tier 1 securities
- **Group 3 (G3)** = Tier 1 ETPs
- **Group 4 (G4)** = Non-ETP Tier 2 securities and symbols not included in the in LULD Plan (i.e., rights/warrants)
- **Group 5 (G5)** = Tier 2 ETPs

¹⁹ An opening auction can conclude two ways: (1) orders are paired off and a trade is executed (“opening on a trade”), or (2) orders are not paired off and the auction ends with the publication of a quote (“opening on a quote”).

²⁰ Tier 1 and Tier 2 refer to groups of securities prescribed in the LULD Plan. Tier 1 comprises S&P 500/Russell 1000 securities as well as the active ETPs. Tier 2 comprises the balance of NMS securities, except rights and warrants.

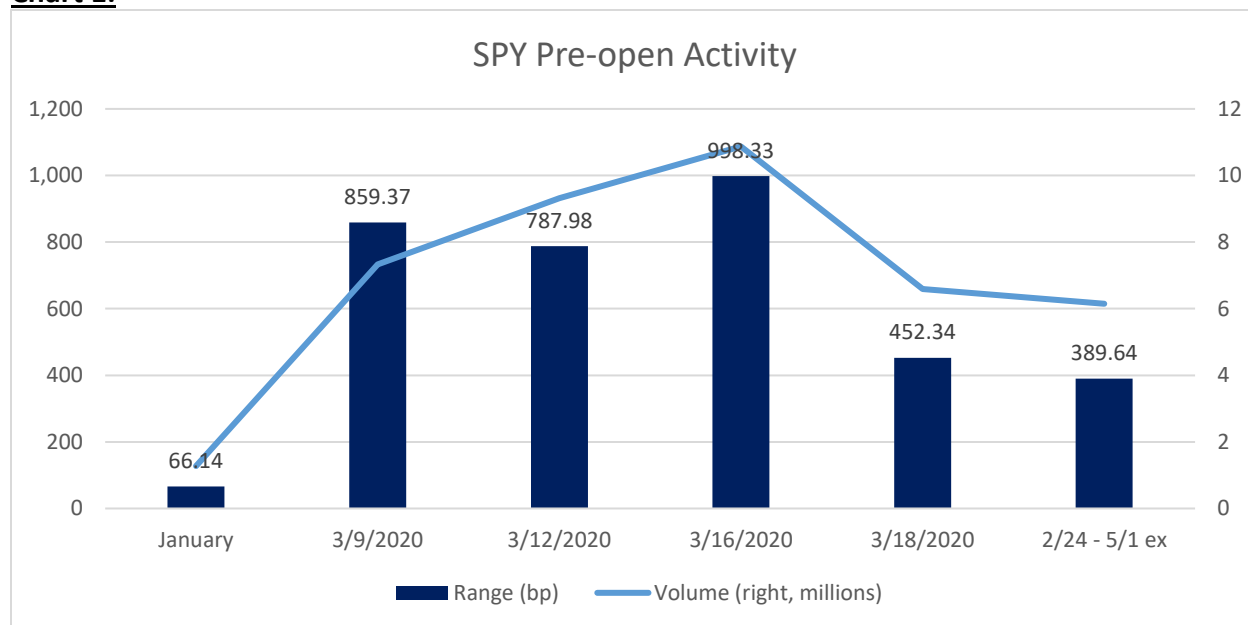
In general, the graphs and discussion break out data for each of the four MWCB Halt days individually, and compare it to two time periods: (i) January 2020, and (ii) the period from February 24 through May 1, 2020, excluding the four days with MWCB Halts (also referred to as the “High-Volatility Period”).

1. Activity before the Opening of Regular Trading Hours

SEC staff asked the Working Group to review volatility and liquidity preceding the four MWCB Halts. To do so, the Working Group examined activity in SPY before the opening of regular trading hours on the four MWCB Halt days. With the exception of the occasional “news,” stock impacted by earnings surprises, or other significant corporate or socio-political events, early morning trading activity is typically limited. This baseline is shown in **Chart 1** below by the data from January 2020. Specifically, in January 2020, prior to the opening of regular trading hours at 9:30 a.m., SPY averaged barely over one million shares traded per day, and its average trading range was 66 basis points.

The impact of COVID-19 and the rapid adjustment in attitudes towards economic activity changed that. During the High-Volatility Period that began on February 24, pre-opening activity in SPY rose to six million shares traded per day, with an average trading range of 390 basis points. The pre-regular trading hours activity on the four MWCB days in March 2020 was even higher, resulting in volumes roughly five to nine times those January levels, with pre-market ranges reaching as high as 10%.

Chart 1:



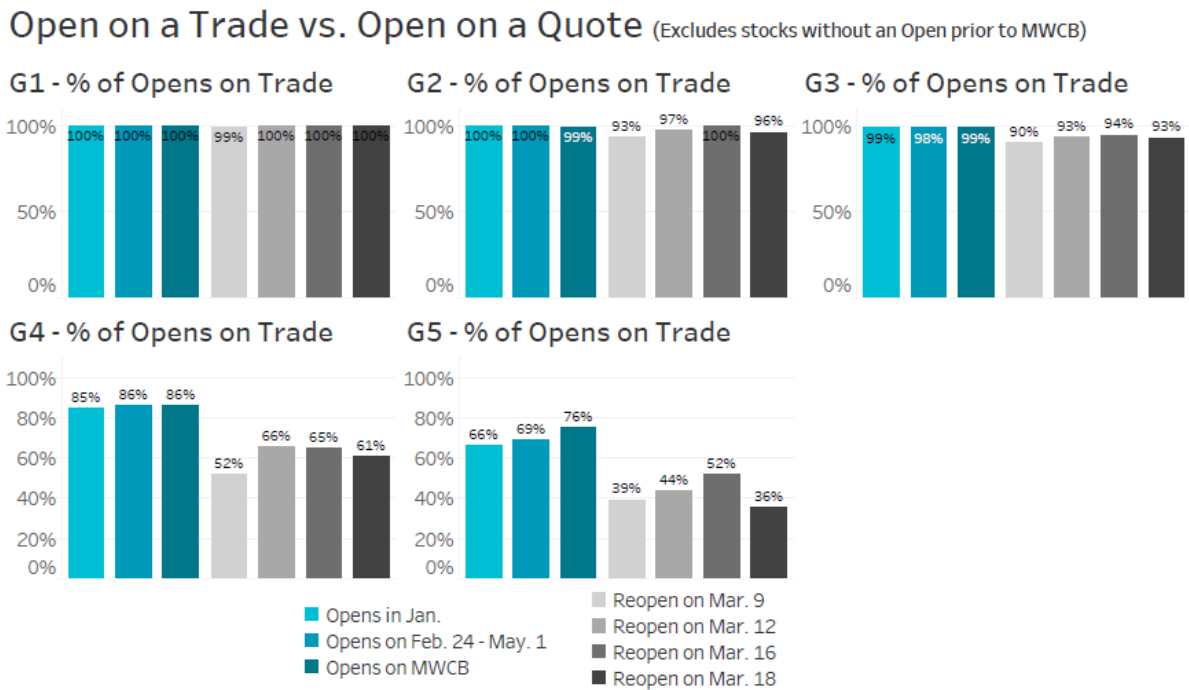
2. Securities Opening on a Trade vs. Opening on a Quote on Days with MWCB Halts

SEC staff also asked the Working Group to review whether there were any differences between the number of securities that opened on a trade vs. opened on a quote on the four days with MWCB Halts. By including this information in this report, the Working Group does not express any opinion about whether opening on a trade is preferable or superior to opening on a quote. In the Working Group’s view, as long as the opening quote represents a fair price for the security, opening on a quote is not an indication of an ineffective opening or reopening process.

As shown in **Chart 2** below, there was no meaningful difference in the percentage of securities opening on a trade versus on a quote (i) on each of the four MWCB Halt days, (ii) during January 2020, and (iii) during the High-Volatility Period. The one exception was in G5 securities (i.e., Tier 2 ETPs), a higher percentage of which opened on a trade on the four MWCB Halt days than in January or during the High-Volatility Period.

Note that in **Chart 2**, “reopens” are reopening auctions for stocks that had already opened prior to the MWCB halts. We accordingly expect there to be less interest represented in those reopening auctions.

Chart 2:

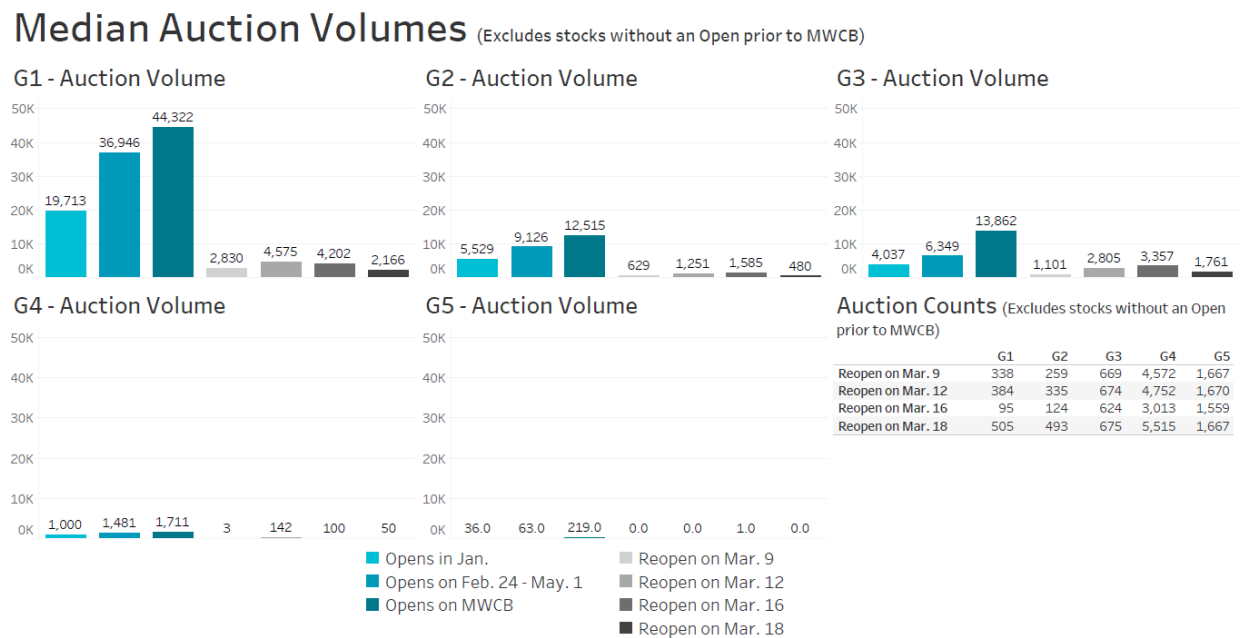


3. Size and Liquidity of Opening and Reopening Auctions

In order to assess the liquidity available in the reopening auctions following the four MWCB Halts, the Working Group compared the volumes in these reopening auctions to the average volumes in opening auctions in January 2020. **Chart 3** below compares (i) the median opening auction volumes in shares traded for the January 2020 period, (ii) the median opening auction volumes in shares traded for the High-Volatility Period, and (iii) the median volumes in shares traded in the reopening auctions following the MWCB Halts for symbols that had already executed opening auctions.

Given that many securities had already opened before the MWCB Halt on the four MWCB Halt days, the size of the reopening auctions for those securities was somewhat smaller. This is unsurprising, given that we would not expect a reopening auction to be as large as an opening auction.

Chart 3:



The Working Group also compared the size of the *opening auctions plus reopening auctions* following the MWCB Halts on the MWCB Halt days to the size of opening auctions in the January 2020 period, in order to try to assess whether the MWCB Halts resulted in a loss of liquidity overall during the auctions.

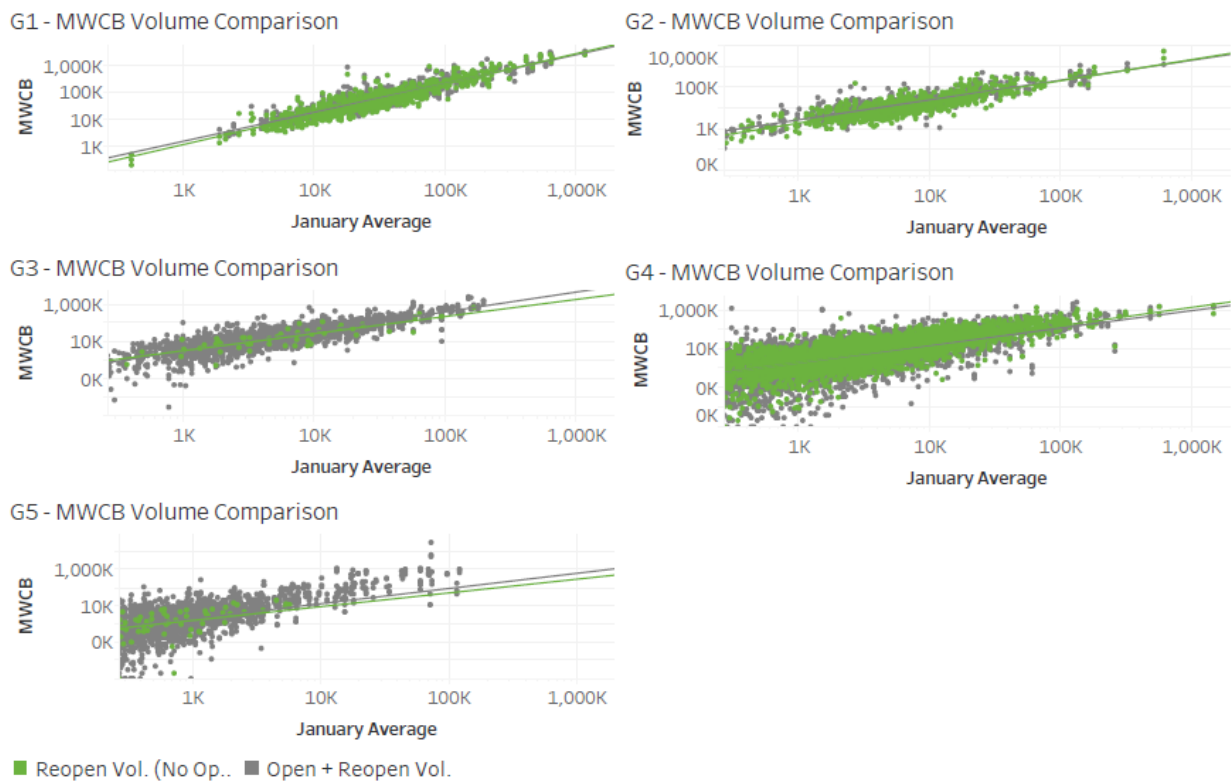
Charts 4a and 4b below are two scatter plot charts that compare average daily volume in opening auctions during the January 2020 period with the average of the volume in opening

auctions *plus* post-MWCB Halt reopening auctions on March 9, 12, and 16.²¹ **Chart 4a** shows those three MWCB Halt days combined, while **Chart 4b** focuses on the March 16 MWCB Halt, which occurred less than two seconds after the opening of regular trading hours.

These scatter plot charts show that, on average, the size of the opening auctions plus reopening auctions on the MWCB Halt days was not very different than the size of opening auctions in the January 2020 period. The charts include regression lines, which show that the opening auction plus MWCB reopening auction volumes on the MWCB Halt days hewed closely to the January 2020 auction volumes.

Chart 4a:

Average January Volume vs. MWCB Combined Open/Reopen Volume (excl. March 18th)



²¹ March 18 was excluded from this analysis since the MWCB Halt that day occurred midday, not in the early morning period.

In **Chart 4b** below, regarding the March 16 MWCB Halt, the green dots show that many securities had not started trading or quoting before the halt at 9:30:01 a.m. However, even under those conditions, the green trendline shows that the size of the reopening auctions after the March 16 MWCB Halt were still similar to opening auction volumes in the January 2020 period.

Chart 4b:

Average January Volume vs. MWCB Combined Open/Reopen Volume (March 16th)



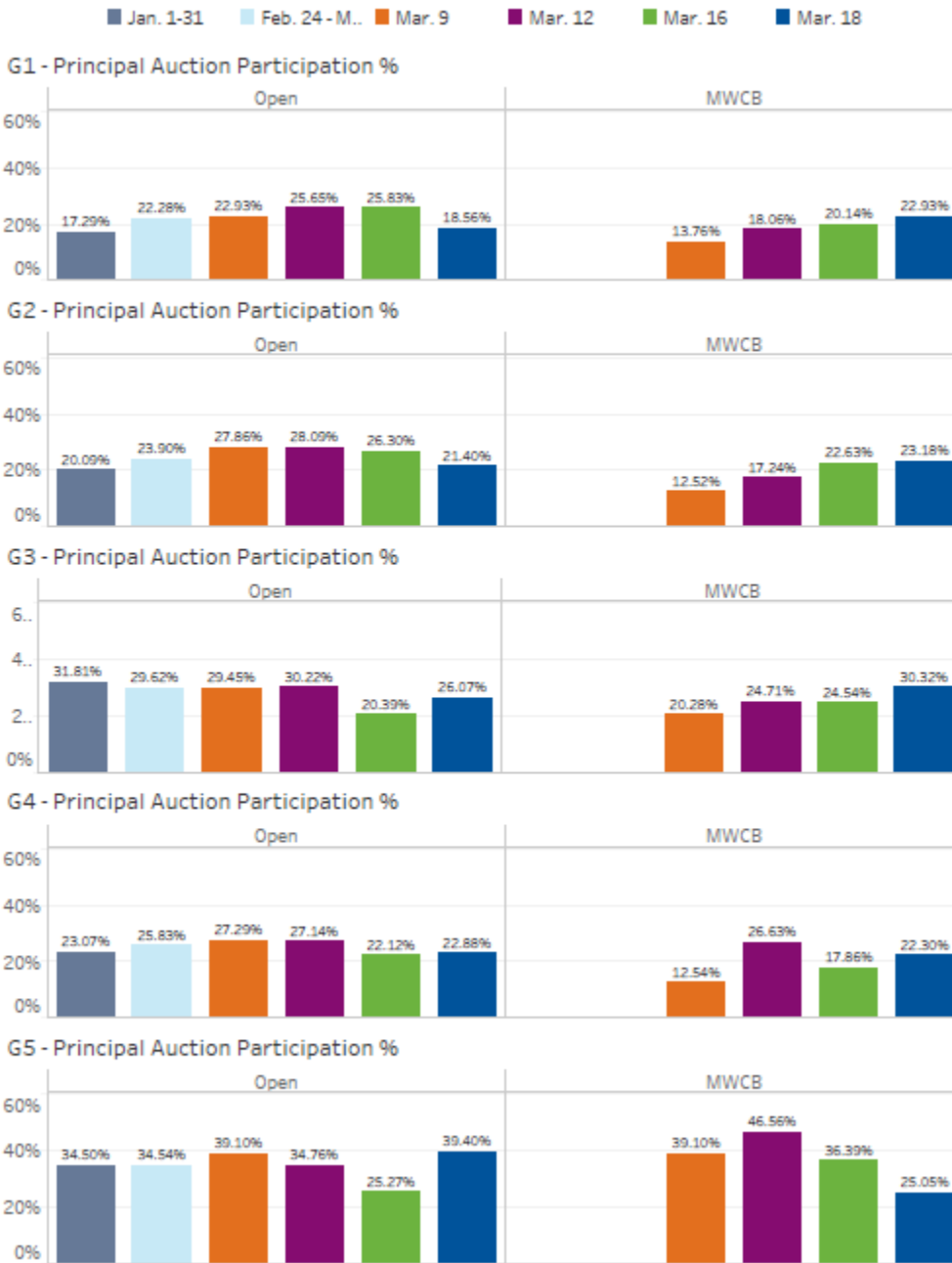
SEC staff also asked the Working Group to review the participation by market makers in the reopening auctions after the MWCB Halts. The Working Group did so by examining principal versus agency activity as a proxy for gauging the level of proprietary market maker trading activity, since liquidity providers generally act as principal on such transactions and agency trades are more typically associated with customer flow from institutional or retail investors. The Working Group also reviewed the Top 5 firms in each category, using January 2020 activity as a point of comparison.

As **Chart 5** below shows, compared to the January 2020 period, the share of the opening auctions represented by principal transactions was higher on the MWCB days, as well as during

the High-Volatility Period. Although principal activity was lower in the reopening auctions than the opening auctions, each of the MWCB Halt days (except for March 18) showed generally increasing principal participation over the previous MWCB Halt days.

Chart 5:

MWCB Participation - Principal



Similarly, **Chart 6** shows the share of trades executed in the opening auctions and executed in the MWCB reopening auctions represented by transactions involving the top five participants from the January 2020 period. In almost all breakouts, the top five firms represent a larger share of MWCB reopening auctions than of the opening auctions, further highlighting the critical importance of liquidity from the most active market participants in providing liquidity in the MWCB reopening auctions.²²

[Chart 6 appears on the next page]

²² The result for G5 was impacted by a 30 million share reopen in one leveraged ETP, which accounted for a very large share of the total G5 reopen.

Chart 6:

MWCB Participation - Top 5 January Participants



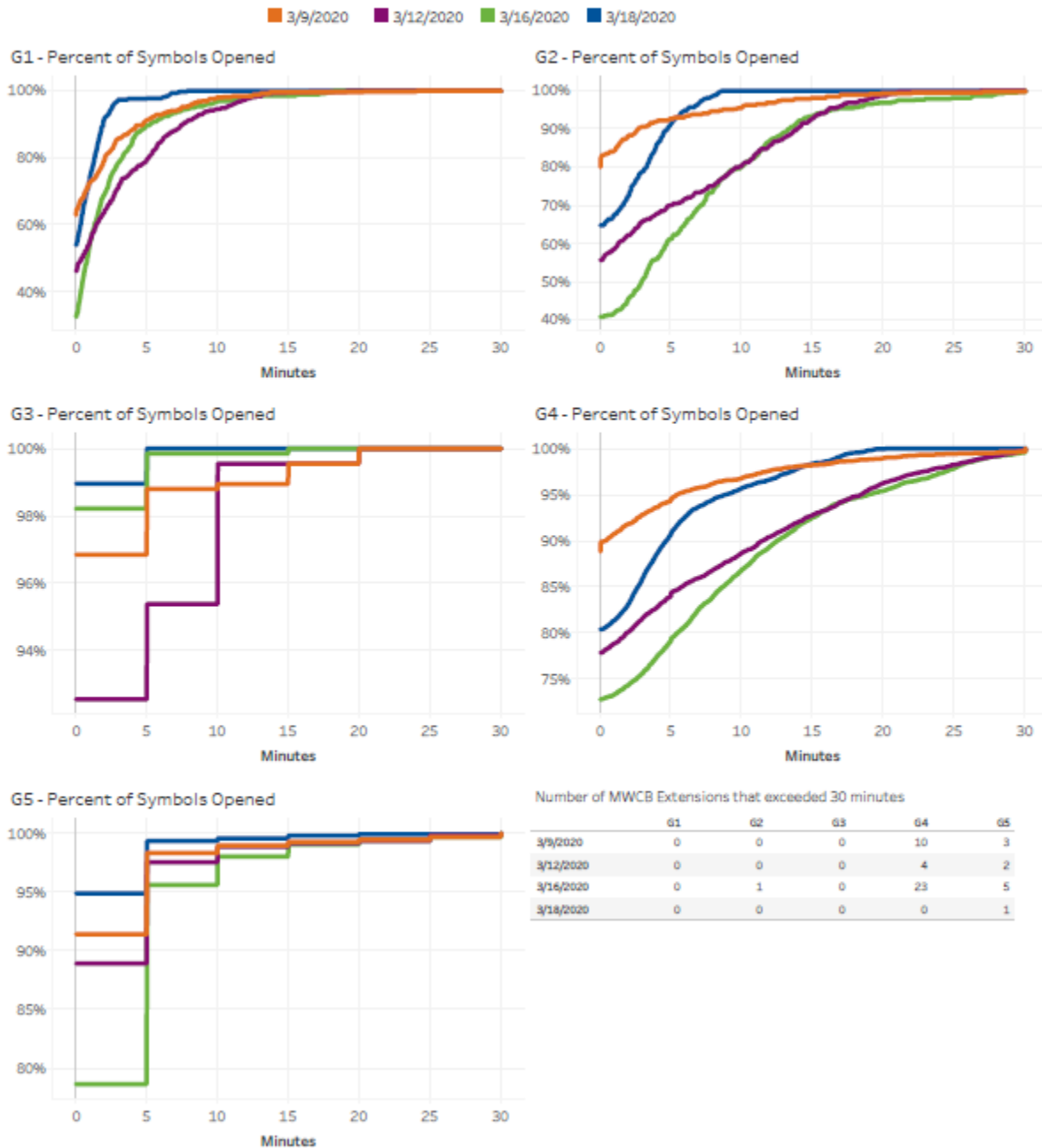
SEC staff also asked the Working Group to examine how quickly stocks opened following each of the four MWCB Halts. **Chart 7** shows that, on all four dates, even given the uncertainty caused by the MWCB Halts, all SPX stocks reopened within 15 minutes of the end of the MWCB Halt. The quickest reopens were on March 18, which may be due to the fact that (i) all securities had been trading, allowing for better price discovery and faster accretion of liquidity, (ii) the improved learning curve from the prior three MWCB Halts in just over a week,²³ and (iii) the MWCB Halt was triggered by a gradual price drop and there was no sudden price dislocation at that time.

[Chart 7 appears on the next page]

²³ Industry participants in the Working Group noted some initial uncertainty created by differences in market practices (e.g., order submission/cancellation, auction collars), but also recognized that real world experience gained after the first halt mitigated the issue.

Chart 7:

Percent of symbols opened following the MWCB (Minutes)



4. Quote Volatility

The Working Group also examined quote volatility on the MWCB Halt days. Liquidity typically decreases with higher volatility, so examining quote volatility is another way to study the

effects of the MWCB Halts on liquidity. If quote volatility stabilized following the reopening auctions after the MWCB Halts, that would indicate that the MWCB Halts had the intended effect of calming volatility.

As **Chart 8** shows, although the median second-to-second quote volatility was generally higher on the four MWCB Halt days as compared to January 2020 and the High-Volatility Period, volatility quickly subsided following the reopening auctions after the MWCB Halts and stabilized at a level similar to volatility in the High-Volatile Period. ETP volatility (G3 and G5) largely subsided after the reopening auctions following the MWCB Halts and stabilized near January 2020 levels, apart from brief spikes midday on March 12 and 18. This stabilization may be an indication that the MWCB Halts on these days helped to calm the market, since volatility did not continue to escalate throughout the day.

Chart 8:

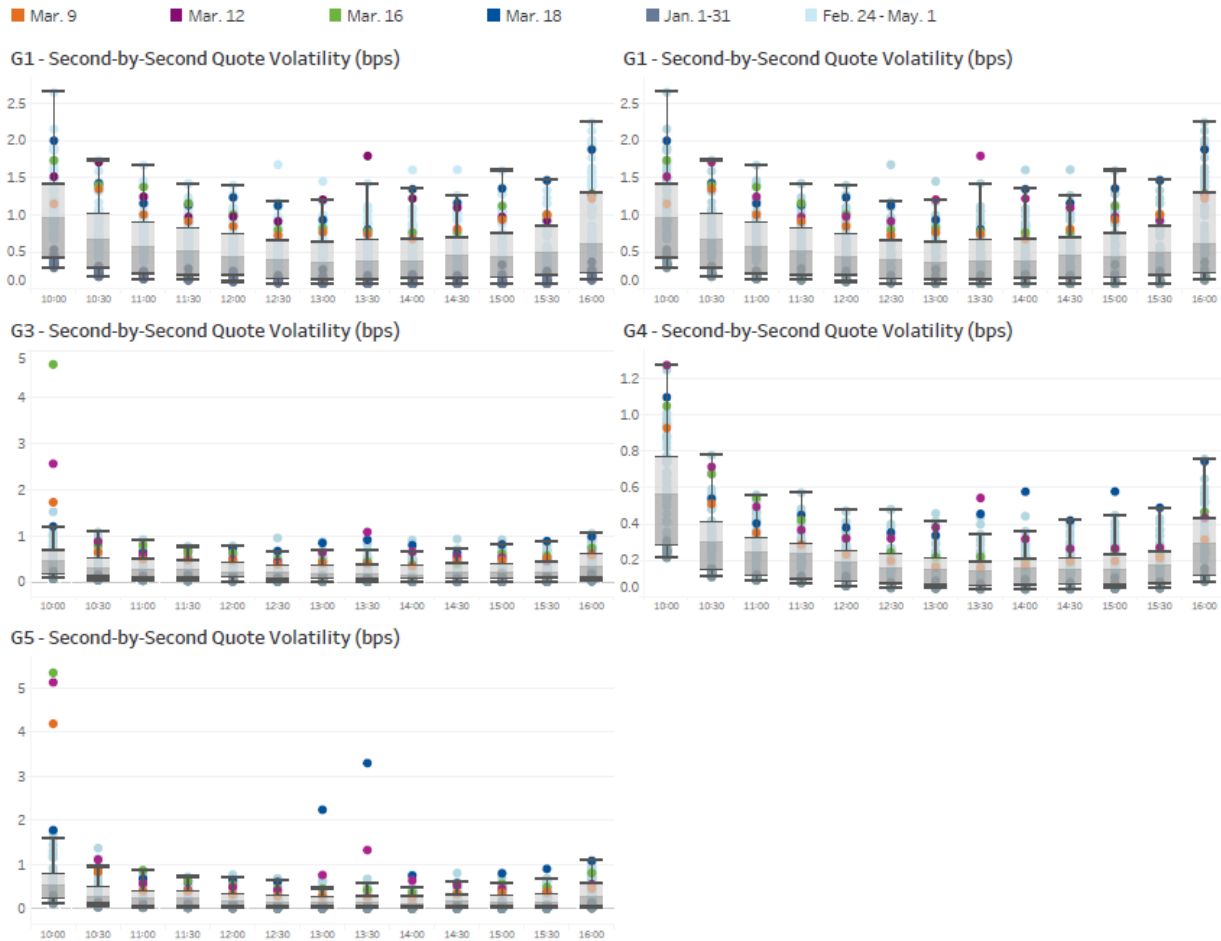
Quote Volatility - Median



Chart 9 shows that almost all of the days with the most quote volatility were the four days with MWCB Halts.

Chart 9.²⁴

Quote Volatility - Median - Box and Whisker



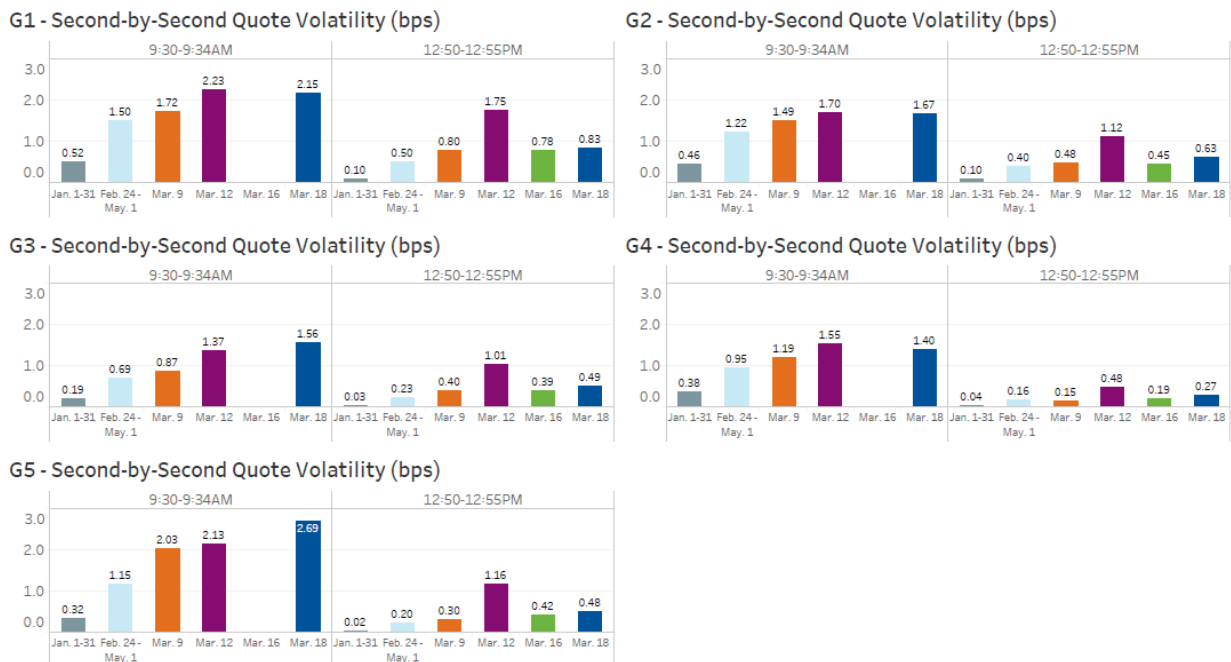
The Working Group also calculated quote volatility for the five-minute time periods preceding the MWCBs, for (i) the four MWCB dates, (ii) January 2021, and (iii) the High-Volatility Period. As shown in **Chart 10** below, the opening volatility was noticeably higher on the MWCB days,

²⁴ These charts show, for each time period, the high and low quote volatility measures. The point where the dark grey and light grey meet are the median volatility. The boxes are represented by 1.5 times the interquartile range with the quartiles at the 75th percentile and the 25th percentile. For example, if the 25th percentile is 10 basis points and the 75th quartile is 14 basis points, we had $(14 - 10) * 1.5$ or 6 basis points to the 75th quartile and subtract that from the 25th quartile. Thus, the box would represent all values between 4 and 20 basis points and outliers would be results above or below those figures.

including March 18, when the market did not halt until midday. Note that measurements for March 16 represent only one second of trading and are based on limited observations.

Chart 10:

Quote Volatility (Intraday) - Median



5. Liquidity at the NBBO

The Working Group also examined liquidity at the NBBO on the days when MWCB Halts were triggered, in order to understand the impact of the MWCB Halts on liquidity. To do so, the Working Group compared the median size at the NBBO for (i) each of the four MWCB Halt days, (ii) January 2020, and (iii) the High-Volatility Period. As shown in **Chart 11** below, early morning liquidity was lower on the MWCB Halt days, but many stocks did not open at 9:30 a.m., and on the three days with early morning MWCB Halts, many stocks did not open on the primary listing exchange until after trading resumed.

The results prior to the March 18 midday MWCB Halt tell a different story. That MWCB Halt was not a sudden adjustment to overnight activity. In most of the groups of securities, size at the inside on March 18 was similar to January 2020 levels for the 12:50-12:55 p.m. period and was slightly larger for non-ETPs when compared to the remainder of the High-Volatility Period.

Chart 11:

Size At NBBO (Intraday) - Median

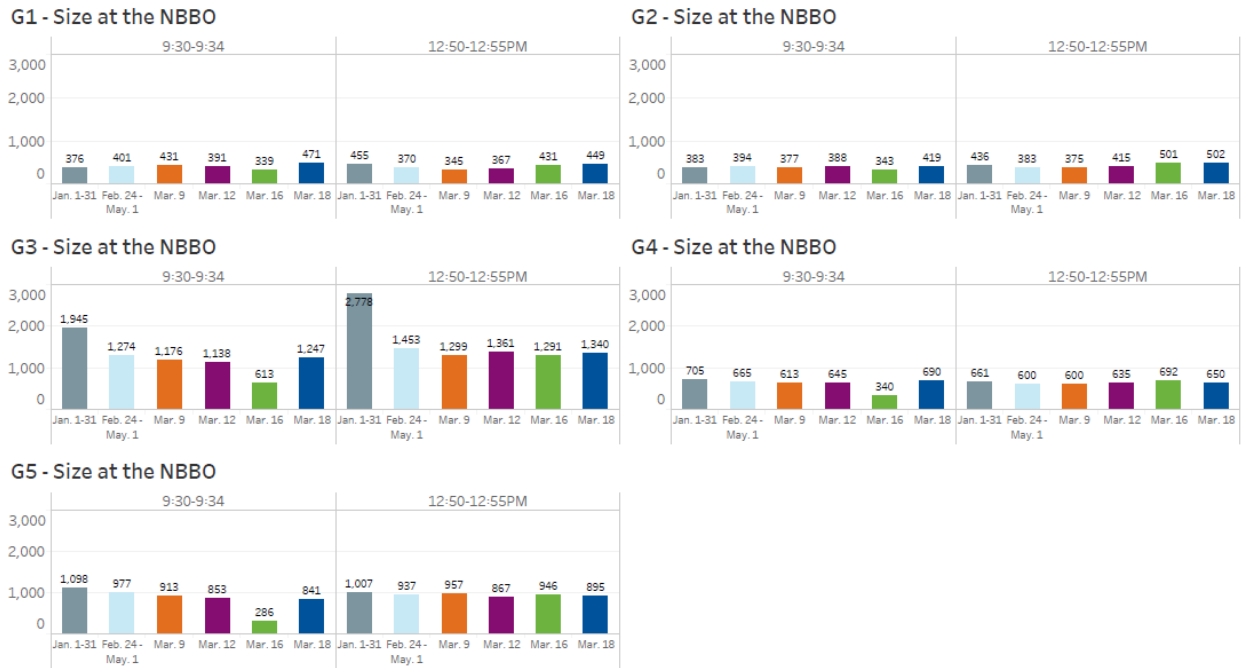


Chart 12 below shows that most of the large decreases in size at the inside were on the four days with MWCB Halts.

[Chart 12 appears on the next page]

Chart 12:

Size at NBBO - Median - Box and Whisker



6. LULD Trading Pauses Following MWCB Reopening Auctions

The Working Group also reviewed how often securities entered into an LULD Trading Pause following the reopening auctions after the MWCB Halts. A large number of LULD Trading Pauses could be interpreted to suggest that more robust reopening procedures were required, or that the reopenings occurred too quickly after the MWCB reopens and the market did not have the opportunity to truly reprice. The Working Group therefore also compared how many LULD Trading Pauses were caused by a limit-up state versus a limit-down state.

Not surprisingly, there were more limit-up LULD Trading Pauses following MWCB reopening auctions from MWCB Halts, as the markets (at least initially) bounced back following the large

drops at the opening auction. March 18 was the exception, where there was little difference between the number of limit-up and limit-down pauses. March 16, the day on which a MWCB halt was triggered one second after the opening of regular trading hours, saw the greatest number of LULD Trading Pauses, especially within 30 minutes of the market reopening; this is unsurprising since there was little trading prior to the MWCB Halt and far fewer stocks had opened prior to the halt.

Charts 13 and 14 show the number of LULD Trading Pauses within 5 and 30 minutes of MWCB reopening auctions, broken out by whether the stock had opened prior to the MWCB Halt and whether the reopening auction concluded with a trade or a quote.

There were few consistent results across dates or Groups, although in almost all cases there were more limit-up pauses than limit-down pauses. The main observation for G1 securities is that stocks that did not have their primary listing market opening auction until after the MWCB Halt had more LULD Trading Pauses than stocks that opened before the MWCB Halt was triggered. There were consistently more limit-up Trading Pauses than limit-down Trading Pauses, and the increase in Trading Pauses over the 30-minute period after the opening auction compared to the first five minutes after the opening auction was larger for stocks that did not open until after the MWCB Halt.

G2 stocks did not show as clear a trend. On March 9, for stocks that already opened before the MWCB Halt, there were more limit-down Trading Pauses than limit-up Trading Pauses. On March 12, the incidence of Trading Pauses was similar for stocks that had opened prior to the MWCB and those that did not, while March 16th showed a pattern similar to G1 stocks.

For both G1 and G2 stocks, there were relatively few reopens on a quote.

G3 (Tier 1 ETPs) all opened prior to the MWCB Halt on March 9, 12 and 18. Most reopened on a trade, and those that reopened on a quote only had LULD Trading Pauses on March 18 in the five minutes after the reopening auction. Limit-up Trading Pauses were far more likely on March 12 and March 16, but the differences were smaller on March 9 and 18. Note also that some ETPs, such as inverted equity and some fixed income based, may naturally move opposite the overall market.

Regarding G4 (Tier 2 non-ETPs), LULD pauses were less frequent in the first five minutes following the MWCB Halts. Limit-up Trading Pauses were more common than limit-down. ETPs that did not open prior to the MWCB Halts had a slightly higher likelihood of pausing in the next five and 30 minutes, but not across all dates and time frames.

G5 (Tier 2 ETPs) hit very few Trading Pauses within five minutes of reopening, although more occurred in the following 25 minutes.

Chart 13:

**Percent of Stocks with LULD Pauses within 5 minutes of MWCB Reopen
By date and Open on Trade or Quote**

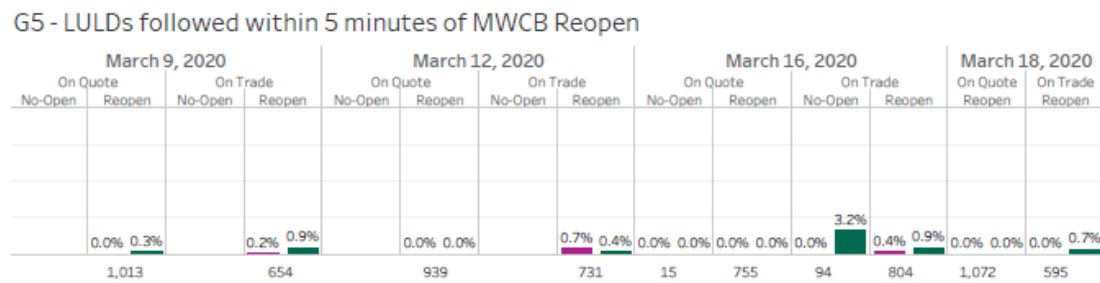
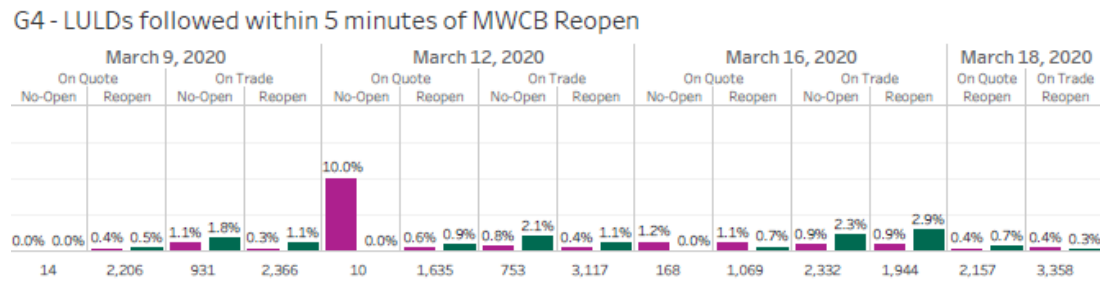
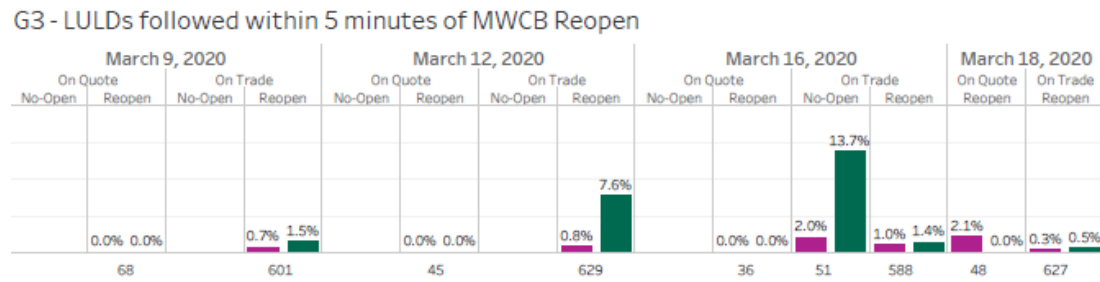
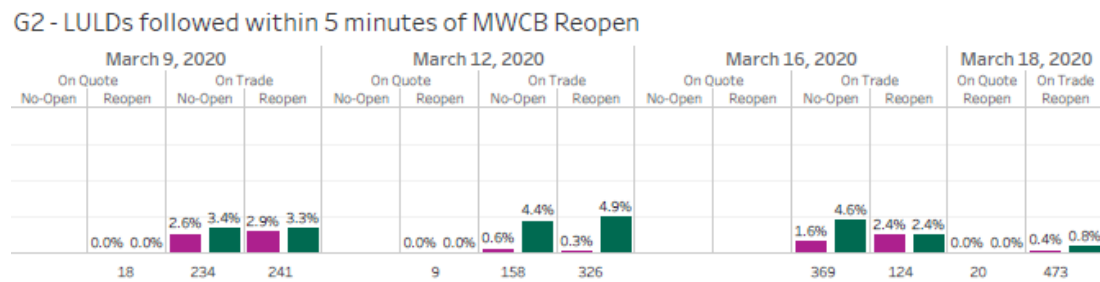
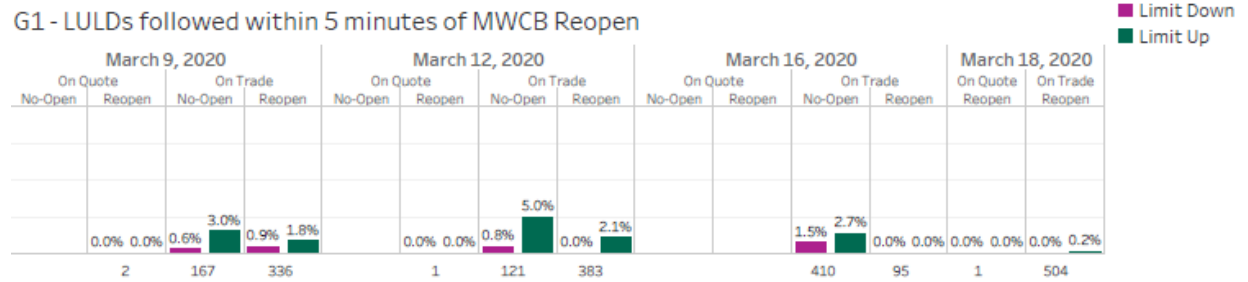
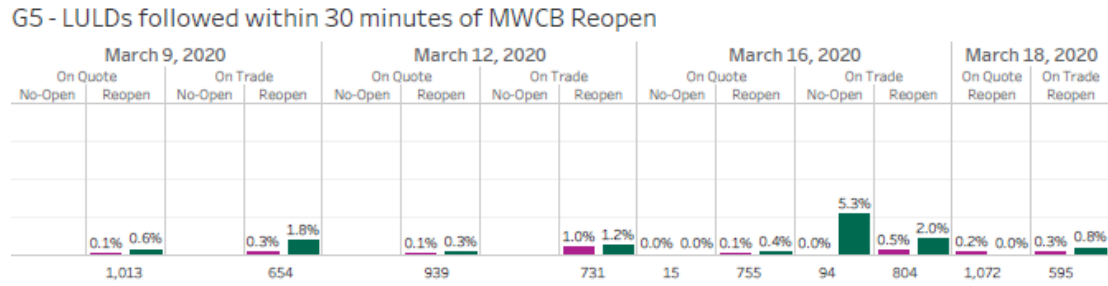
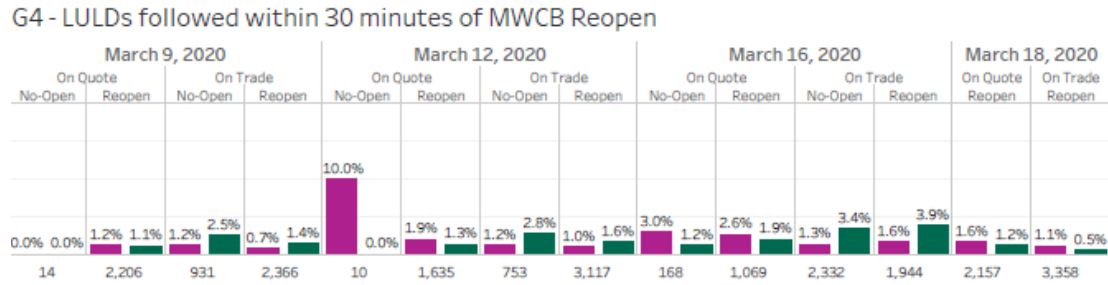
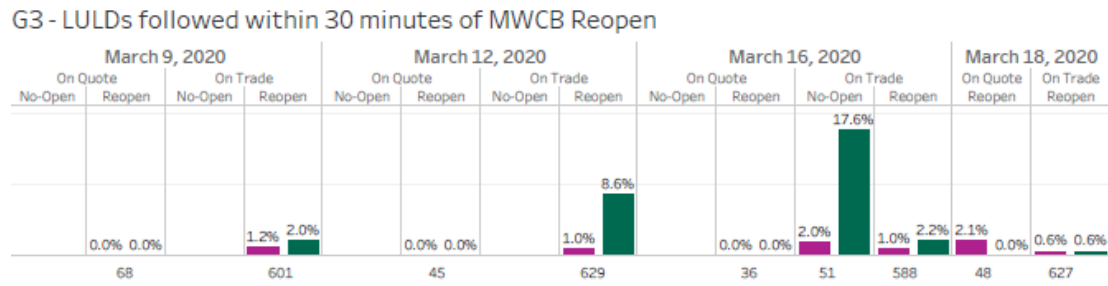
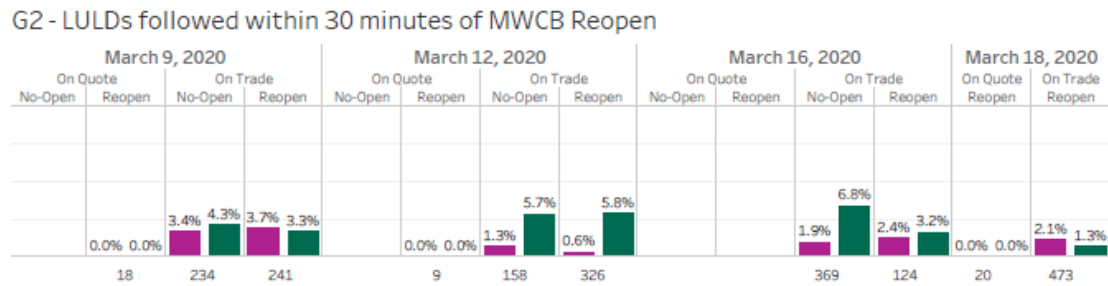
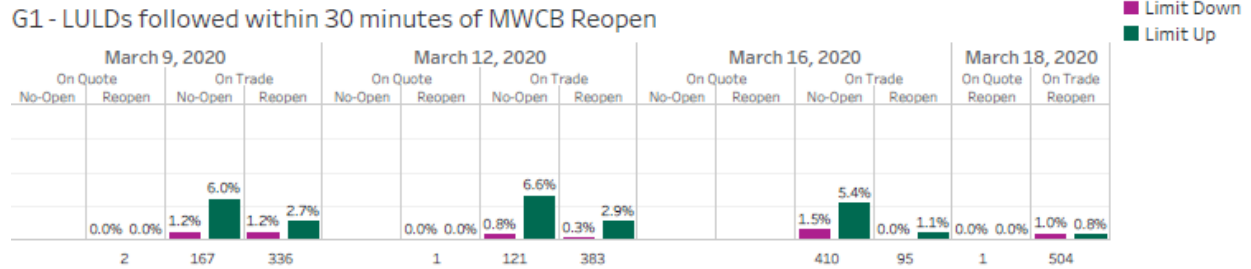


Chart 14:

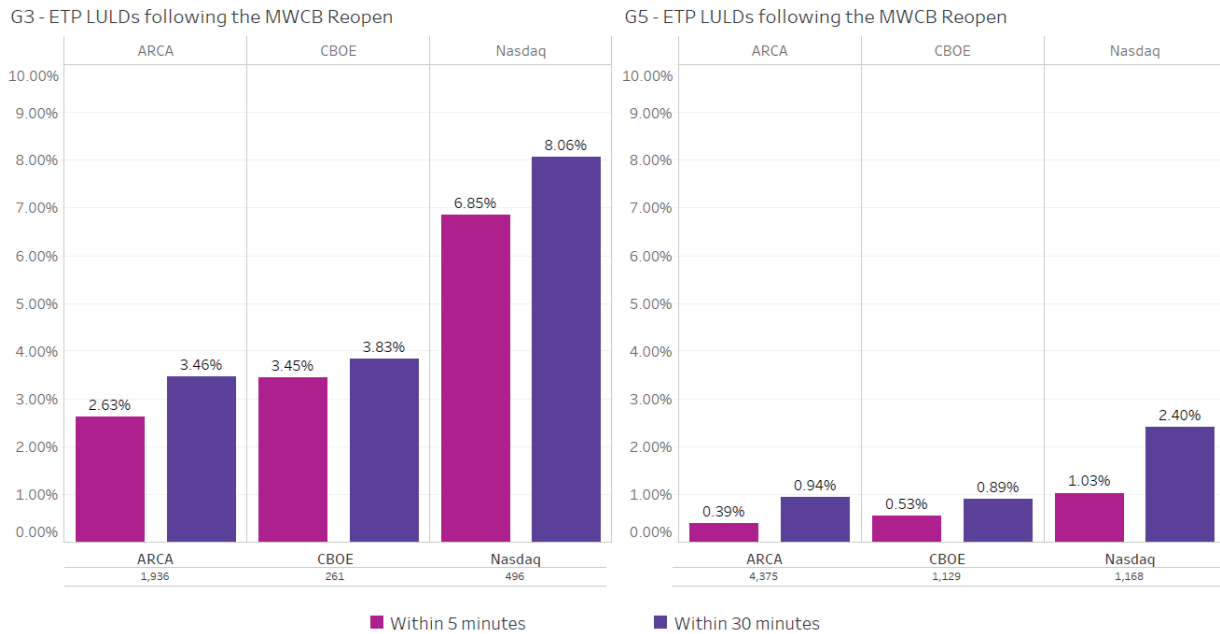
Percent of Stocks with LULD Pauses within 30 min. of MWCB Reopen
By date and Open on Trade or Quote



The Working Group also reviewed the likelihood of an LULD Trading Pause being triggered following the MWCB reopening auctions in ETPs that were subject to extension logic for trading collars, as compared to those that were not subject to extension logic. At the time of the MWCBs, NYSE Arca and CBOE BZX maintained collars for their reopening auctions with extension logic, but Nasdaq did not. (Nasdaq has since implemented collars with extension logic for MWCB reopening auctions.) **Chart 15** below shows that, across the four days with MWCB Halts, the likelihood of an LULD Trading Pause within five minutes or 30 minutes of reopening after the MWCB Halt was higher for ETPs that were not subject to a collar with extension logic than for those that did have a collar with extension logic.

Chart 15:

LULDs following the MWCB Halts (ETPs Only)



D. Conclusions Regarding the Operation of MWCB Mechanism during the March 2020 Events

The Working Group concludes from the foregoing analysis that the MWCB mechanism operated as intended in March 2020. The markets were in communication before, during, and after the MWCB Halts occurred, and all 9,000+ equity symbols were successfully halted in a timely manner.

Furthermore, ***the Working Group concludes that the analysis shows that the MWCB Halts triggered in March 2020 appear to have had the intended effect of calming volatility in the market, without causing harm.***

Specifically:

- There was no significant difference in the percentage of securities that opened on a trade versus on a quote on the four days with MWCB Halts versus the other periods studied.
- While the post-MWCB Halt reopening auctions were smaller than typical opening auctions, the size of those post-MWCB Halt reopening auctions *plus* the earlier initial opening auctions in those symbols is on average equal to opening auctions in January 2020. This indicates that the MWCB Halts on the four days in question did not cause liquidity to evaporate.
- All securities in SPX reopened within 15 minutes following the end of the MWCB Halts.
- Quote volatility was generally higher on the four MWCB Halt days as compared to the other periods studied, but quote volatility stabilized following the MWCB Halts at levels similar to the January 2020 levels.
- LULD Trading Pauses following the MWCB Halts worked as designed to address intra-day volatility.

IV. Evaluation of the MWCB Mechanism Design

In evaluating the design of the MWCB mechanism, the Working Group focused on two key elements: (i) the reference value and (ii) the halt triggers. Currently, the MWCB mechanism uses SPX as the reference for determining when the market has fallen 7% / 13% / 20% triggering a Level 1 / Level 2 / Level 3 halt, respectively. To determine whether these elements are appropriately set, the Working Group reviewed the history of MWCB Halts, reference value, and trigger levels since their inception in 1988. While surgical precision in setting these levels is

not possible, the Working Group concludes, based on the real-world testing of the trigger levels and reference index during more than 30 years of trading and a review of alternative indices, that the current trigger levels and reference index are appropriately set.

A. History of the Development of the MWCB Mechanism since 1988

On October 19, 1987, the DJIA declined 22.6%. In response, U.S. exchanges established the first “circuit breakers,”²⁵ designed to temporarily restrict trading in stocks, stock options, and stock index futures when markets experience a severe, rapid decline.²⁶ This original circuit breakers mechanism, approved by the SEC in 1988, provided that halts would be triggered by declines of a set number of points in the DJIA. Specifically, if the DJIA declined by 250 points from its previous day's close, the markets would halt trading for one hour. If, on that same day, the DJIA declined by a total of 400 points from the previous day's close, the markets would halt for two hours.²⁷

Amendments approved by the SEC in July 1996 reduced the duration of the 250 and 400 points halts to 30 minutes and 60 minutes from one hour and two hours, respectively.²⁸ This reduction in halt duration corresponded to the “significant technological progress made by the securities markets and the broker-dealer community since 1988 in efficiently accommodating large order imbalances that may occur under volatile market conditions.” Further amendments approved in January 1997 increased the two trigger values to 350 and 550 points.²⁹ In their filings, the exchanges noted that the proposed new levels of 350 and 550 points would represent approximately a 5.4% and 8.5% decline in the DJIA, respectively, reflecting significant

²⁵ The Report of the Presidential Task Force on Market Mechanisms (the “Brady Report”) noted that the market disorders of October 1987 “became, in effect, ad hoc circuit breakers, reflecting the natural limits to market liquidity.” Accordingly, the Brady Report maintained that the October 1987 Market Break “demonstrates that it is far better to design and implement coherent, coordinated circuit breaker mechanisms in advance, than to be left at the mercy of the unavoidable circuit breakers of chaos and system failure.” See Nicholas Brady, Report of the Presidential Task Force on Market Mechanisms (January 1988) at 66.

²⁶ See Securities Exchange Act Release No. 26198 (October 19, 1988), 53 FR 41637 (October 24, 1988) (SR-CBOE-88-14; SR-NASD-88-46; SR-NYSE-88-22; SR-NYSE-88-23; SR-NYSE-88-24; SR-AMEX-88-24).

²⁷ The 250-point and 400-point triggers represented 12% and 19% of the DJIA when implemented.

²⁸ See Securities Exchange Act Release Nos. 37457 (July 19, 1996), 61 FR 39176 (July 26, 1996) (SR-NYSE-96-09); 37458 (July 19, 1996), 61 FR 39167 (July 26, 1996) (SR-Amex-96-13); and 37459 (July 19, 1996), 61 FR 39172 (July 26, 1996) (SR-BSE-96-4; SR-CBOE-96-27; SR-CHX-96-20; SR-Phlx-96-12).

²⁹ See Securities Exchange Act Release No. 38221 (January 31, 1997), 62 FR 5871 (February 7, 1997) (SR-NYSE-96-38; SR-Amex-96-49; SR-CBOE-96-78; SR-CHX-96-33; SR-BSE-96-12; SR-Phlx-97-03). The Commission approved each of the Exchanges' revised circuit breaker rules on a one-year pilot basis that expired on January 31, 1998.

market declines that they believed served as appropriate levels for triggering a brief trading halt.

These circuit breakers were triggered for the first time since their adoption on October 27, 1997, when the DJIA experienced two declines, totaling 554 points, or 7.2%. The first circuit breaker of 30 minutes was triggered at 2:36 p.m. when the DJIA declined 350 points (4.54%) from the previous day's close. After the market reopened at 3:06 p.m., the DJIA continued to drop another 200 points, triggering the second circuit breaker at 3:30 p.m. Because the second circuit breaker was triggered at 3:30 p.m., within the last hour of trading, the market was closed for the remainder of the day.

The consensus view of the October 27, 1997 halts was that the circuit breaker thresholds of 350 and 550 points needed to be raised significantly as the percentage declines associated with those hard values did not justify halts in trading.³⁰ It was believed that the circuit breakers' low point value level, close proximity to each other, and the fact that the second circuit breaker would close the market for the remainder of the day, may have contributed to selling pressure after the first halt was lifted. Additionally, the 7% decline in the DJIA around 3:30 p.m. should not have caused trading to be halted for the remainder of the day.³¹

In a report by SEC staff analyzing the event, the staff stated:

First, the circuit breaker thresholds needed to be raised significantly from those in place on October 27. When the 350-point trigger was reached on October 27, the DJIA was down only 4.54%, a level that had been reached on 11 previous days since 1945. Moreover, there was little evidence of the types of market liquidity constraints that would have justified cross-market halts. Circuit breaker halts should be reserved for an abrupt market decline of a magnitude that raises concerns that the exhaustion of market liquidity might result in uncoordinated, *ad hoc* market closures.³²

In January 1998, the exchanges adopted interim changes to the circuit breaker rules. These changes provided that if, at or before 3:00 p.m., the DJIA were to fall 350 or more points below its previous trading day's closing value, trading in all stocks and equity-based options on the exchanges would halt for 30 minutes, while trading would not be halted for such a decline after 3:00 p.m. In addition, if, on the same day, the DJIA dropped 550 or more points from its

³⁰ See Trading Analysis of October 27 and 28, 1997, A Report by the Division of Market Regulation U.S. Securities and Exchange Commission, dated September 1998, available at <https://www.sec.gov/news/studies/tradrep.htm#cbs>.

³¹ See id. at Part III, Section IV.

³² See id.

previous trading day's close, trading in all stocks and equity-based options on the exchanges would halt for 60 minutes, except that if the 550-point decline occurred after 2:00 p.m. but before 3:00 p.m., the halt would be for 30 minutes instead of 60 minutes, and if the 550-point drop occurred at or after 3:00 p.m., trading would close for the remainder of the day. These interim changes were adopted only until the markets could agree on modifications to raise the circuit breaker trigger levels significantly.

In April 1998, the exchanges implemented new circuit breaker trigger levels based upon percentage declines in the DJIA, rather than specified point declines.³³ These percentage declines were set at 10%, 20%, and 30%, as follows:

Level 1	10% decline in DJIA	<ul style="list-style-type: none"> • Before 2:00 p.m., the market will close for one hour • Between 2:00 p.m. and 2:30 p.m., the market will close for 30 minutes • No Level 1 after 2:30 p.m.
Level 2	20% decline in DJIA	<ul style="list-style-type: none"> • Before 1:00 p.m., the market will close for two hours • Between 1:00 p.m. and 2:00 p.m., the market for one hour • After 2:00 p.m., the market will close for the day
Level 3	30% decline in DJIA	<ul style="list-style-type: none"> • The market will close for the remainder of the day, regardless of what time the decline occurs

These values were calculated at the beginning of each calendar quarter, using the average closing value of the DJIA for the previous month to establish specific point values for the quarter.

These values were approached but not breached on May 6, 2010, when the U.S. securities and futures markets experienced a severe disruption, often referred to as the "Flash Crash." Between 2:32 p.m. and 2:45 p.m., the DJIA dropped about 9% and then rebounded within

³³ See Securities Exchange Act Release No. 39846 (April 9, 1998), 63 FR 18477 (April 15, 1998) (SR-NYSE-98-06; SR-Amex-98-09; BSE-98-06; SR-CHX-98-08; SR-NASD-98-27; SR-Phlx-98-15).

minutes.³⁴ The decline never reached the 10% trigger, so securities trading continued unhalting.³⁵

In response to the events of May 6, 2010, the SEC adopted several new rules and approved NMS Plans and changes to SRO rules,³⁶ including: (i) a ban on stub quotes; (ii) single stock circuit breakers, which were later replaced by the LULD Plan; (iii) revisions to the MWCBC rules; (iv) the Consolidated Audit Trail; and (v) Regulation Systems Compliance and Integrity (Regulation SCI). Specifically, the changes made to the MWCBC rules were:

- The DJIA was replaced by the SPX, which provides a broader base of securities against which to measure volatility.³⁷
- Circuit breaker thresholds are calculated on a daily rather than quarterly basis.
- Level 1 and 2 halts are allowed only once per day.
- Level 1 and 2 halts were shortened from 30 minutes to 15 minutes. Non-primary markets are allowed to reopen after 15 minutes even if the primary market has not reopened.³⁸
- Level 1 and 2 halts are permitted up to 3:25 p.m., instead of only until 2:30 p.m. (the Flash Crash occurred after 2:30 p.m.).
- The triggers for each Level were reduced, as follows:

³⁴ Approximately 86% of securities reached lows for the day that were less than 10% away from the 2:40 p.m. price. The other 14% of securities suffered greater declines than the broader market, with some trading all the way down to one penny. <https://www.sec.gov/sec-cftc-prelimreport.pdf>

³⁵ At approximately 2:45 p.m., CME's Globex stop logic function initiated a five-second trading pause in the E-mini S&P 500 futures contract because of a rapid 5% decline in the contract's value.

³⁶ See Securities Exchange Act Release No. 67090 (May 31, 2012), 77 FR 33531 (June 6, 2012) (SR-BATS-2011-038; SR-BYX-2011-025; SR-BX-2011-068; SR-CBOE-2011-087; SR-C2-2011-024; SR-CHX-2011-30; SR-EDGA-2011-31; SR-EDGX-2011-30; SR-FINRA-2011-054; SR-ISE-2011-61; SR-NASDAQ-2011-131; SR-NSX-2011-11; SR-NYSE-2011-48; SR-NYSEAmex-2011-73; SR-NYSEArca-2011-68; SR-Phlx-2011-129).

³⁷ From the joint CFTC/SEC report: "Use of the S&P 500 Index would lead to easier coordination with halts in the E-Mini and the SPY." In addition, as noted by the Committee, using an index that correlates closely with derivative products, such as the E-mini S&P 500 futures contract or SPY, will allow for a better cross-market measure of market volatility.

³⁸ Many, if not all, equity markets have adopted rules requiring the receipt of LULD bands in non-listed symbols before reopening after MWCBC Halts.

Level 1	7% decline in SPX	<ul style="list-style-type: none"> • Before 3:25 p.m., the market will close for 15 minutes • No Level 1 halts at or after 3:25 p.m.
Level 2	13% decline in SPX	<ul style="list-style-type: none"> • Before 3:25 p.m., the market will close for 15 minutes • No Level 2 halts at or after 3:25 p.m.
Level 3	20% decline in SPX	<ul style="list-style-type: none"> • The market will close for remainder of trading day, regardless of what time the trigger is reached

The MWCB mechanism described above has remained substantively unchanged since it was implemented in 2012 with the Pilot Rules.

B. Evaluation of the Halt Triggers and Length of Halts

The Working Group observes that since the inception of MWCB trading halts in 1988, the pendulum has swung from wider triggers to narrower ones, then back to wider ones, and then to narrower ones again. In 1988, the two triggers were, based on DJIA point values of 250 and 400, 12% and 19% market declines, which were deemed to be too high. In 1997, the DJIA point value declines triggering halts were increased to 350 and 500, which represented declines of the DJIA of 5.4% and 8.5%. When the first ever MWCB halt was triggered in October 1997, the industry concluded that the halt trigger of a 4.5% decline from the then reference (DJIA) and “close for the day” trigger of a 7% decline to be too low. The triggers were then increased to 10%, 20% and 30%. But in May 2010, when the Level 1 trigger was not breached after a 9% drop, the industry determined, in effect, to split the difference and lower the trigger levels to the current 7%, 13%, and 20% levels.

In 2016, the Equity Market Structure Advisory Committee’s (“EMSAC”) Subcommittee on Market Quality questioned whether the 7% decline for triggering for a Level 1 halt should be changed back to the previous trigger of 10%:

[The Subcommittee] . . . considered evidence in international markets that having a circuit breaker often acts as a magnet rather than a cushion. There is some evidence from China that when markets began to approach the 7% band, selling pressure intensified as market participants tried to get their trades in

before the market was closed. As such the Subcommittee feels that a wider band around the 10% range is warranted.³⁹

Experience suggests that such a change is unnecessary. Since 1962, intraday losses as large as 7% have been rare in SPX, occurring just 16 times from the prior day close to next day's low. The only four times it did occur since the implementation of the LULD Plan was on the four dates in March 2020 that triggered the MWCB Halts.

Since the LULD Plan was implemented, there have been only five days where the SPX fell as much as 6%, and all took place during the March 9 - March 18 period. On March 11, the index fell as much as 6.07%, but did not continue lower to trigger a Level 1 MWCB halt at 7%. On March 16, SPX declines triggered a Level 1 halt, and continued to fall after reopening to a low of -12.18%, but did not continue to fall to the 13% trigger for a Level 2 halt. Furthermore, on March 9, 12, and 18, SPX experienced further losses after the Level 1 halt, with intraday lows of -8.01%, -9.58%, and -9.83%. The fact that SPX continued to decline after the halt at 7% suggests that the market found an equilibrium level that was not particularly tied to the 7% Level 1 trigger or the 13% Level 2 trigger.

Accordingly, the Working Group concludes that the available evidence does not support the conclusion that the current 7% and 13% triggers create a "magnet effect." The sole member of the Working Group who was also a member of the EMSAC Subcommittee agrees that, with the benefit of actual data and a review of the March 2020 activity, there is no evidence of possible selling pressure or a need to raise the trigger for a Level 1 MWCB halt to 10% from the current 7%. The Working Group does not draw any conclusions about whether a "magnet effect" exists when market declines approach 20% (the Level 3 MWCB trigger that would end trading for the remainder of the day), given the lack of data.

The Working Group thus concludes that the evidence does not support making any changes to the current halt triggers.

As noted above in Section II.B, in October 2020, CME implemented the Task Force recommendation to reopen the E-mini S&P 500 futures five minutes before the end of a 15-minute Level 1 or Level 2 MWCB halt, in order to enhance the equity market price discovery process. Given that change, the Working Group opted not to simultaneously recommend a change to the length of the Level 1 and 2 MWCB Halts. ***The Working Group, therefore, does not recommend any change to the 15-minute length of the Level 1 and Level 2 MWCB halts at this time.***

³⁹ <https://www.sec.gov/spotlight/emsac/emsac-market-quality-subcommittee-recomendation-072516.pdf>

C. Evaluation of the Reference Value

As described above, the MWCB Task Force conducted a preliminary evaluation of whether SPX is the appropriate reference for the MWCB mechanism. As noted, the Task Force met with representatives of S&P DJI, who provided a presentation explaining their redundancy and resiliency protections for the SPX calculation, as well as supporting documentation. The Task Force concluded at that time that there was no immediate need to replace SPX as the reference value.

In preparing this study, the MWCB Working Group has revisited the issue and performed additional analysis regarding whether to retain SPX as the reference for triggering MWCB halts. The Working Group examined criteria for considering an instrument or methodology to replace SPX and compared a number of potential alternatives to SPX. Specifically, the Working Group considered the following alternatives through various “lenses” noted below:

Potential alternatives to SPX considered:

- DJIA
- S&P 100 ("OEX")
- Nasdaq 100 ("NDX")
- Russell 1000 ("R1000")
- Russell 3000 ("R3000")
- Wilshire 5000 ("W5000")
- E-Mini S&P 500 Futures
- Exchange Traded Products related to SPX / E-Mini (i.e., SPY, IVV, VOO)⁴⁰

“Lenses” for considering potential alternatives:

- Breadth of securities in an index or in the index underlying a specific product
- Breadth of sectors represented by product / index
- Breadth of listing exchanges represented by product / index
- Correlation with related products, including derivatives and ETPs
- Does the reference value demonstrate dislocations from the underlying value?
- Industry awareness of the index / product level
- Activity level in / liquidity generally present in the product (or correlated products if reference value is an index)
- If reference value is a traded product, susceptibility of that product to short term liquidity imbalances that might erroneously trigger a MWCB
- Potential concerns regarding cross-market coordination
- Whose regulatory purview does the reference value fall under

⁴⁰ Note that while the analysis below focuses on SPY – the related ETP with the largest AUM – the Working Group believes that the assessment would be comparable for IVV or VOO.

- Reference calculation method
- Index methodology

The Working Group’s analysis is summarized below:

Potential Reference	Type	Approximate Number of Securities in Index / Underlying	Traded Product	Correlation with and Liquidity of Related Products	General Awareness of Product	Breadth of Product
SPX	Index	500	N	Extremely High	High	High
DJIA	Index	30	N	Moderate	High	Low
OEX	Index	100	N	Moderate	Moderate	Moderate, only largest cap securities
NDX	Index	100	N	Moderate	High	Moderate, only Nasdaq listings
R1000	Index	1,000	N	High	Moderate	High
R3000	Index	3,000	N	High	Moderate	High
W5000	Index	3,500	N	Low	Low	High
E-mini S&P 500 Futures	Future	500	Y	Extremely High	High	High
SPY	ETF	500	Y	Extremely High	High	High

After substantial consideration and analysis, the Working Group concludes that SPX remains an appropriate product to use as the reference for the MWCB mechanism, and does not recommend making a change.

- The industry practitioners in the Working Group strongly believe that the reference should be based on an index rather than an individual tradeable product (whether a

derivative or an ETP) because individual products are vulnerable to temporary order imbalances or price shocks, which may result in transient premiums or discounts.⁴¹ In addition, individual products may themselves be subject to single stock price bands or circuit breakers. An index has far less potential to be influenced by these factors than an individual product.

- Of the indices examined, SPX contains a large number of securities with a high degree of breadth, an extremely high correlation with the liquidity of its underlying securities, and a well-understood calculation methodology. S&P DJI disseminates documentation regarding the calculation of SPX, especially at and around market open and reopen that addresses technical questions regarding the index calculation and value dissemination.⁴² We recognize the lack of regulatory oversight of non-traded products, but nevertheless believe that SPX is an appropriate reference given the numerous safeguards provided by S&P DJI.⁴³
- The Working Group notes that S&P DJI periodically improves its calculation methods for SPX. For example, following the events of August 24, 2015, S&P DJI changed its methodology for calculating SPX to use consolidated prices.⁴⁴ This change likely helped to ensure that SPX accurately reflected market conditions preceding the MWCB Halts in March 2020.

In addition, S&P DJI has been forthcoming and transparent in responding to the Working Group's questions about the resiliency and redundancy of the SPX calculation. In meetings with the Working Group, S&P DJI confirmed that it supports three data centers – in New Jersey, Chicago, and London – with two output nodes per center. Each of the three data centers independently calculates SPX, and S&P DJI monitors for consistency of values. Alerts are generated if these values are not consistent the three data centers. Should there be an issue with the feed from any one node, S&P DJI can switch over to a different node within the site or

⁴¹ For example, on December 21, 2020, at 1:25 p.m., a sudden influx of Intermarket Sweep Orders caused a flash surge in SPY, resulting in a price jump from around \$365.00 to \$378.46, and back down to \$367.50 in less than one second. <https://www.bloomberg.com/news/articles/2020-12-23/flash-surge-in-world-s-biggest-etf-linked-to-outlandish-trades>.

⁴² S&P DJI's [Equity Indices Policies & Practices Methodology](https://us.spindices.com/governance/methodology-information/), <https://us.spindices.com/governance/methodology-information/>. The rules governing the S&P 500 are available in the [S&P U.S. Indices Methodology](https://us.spindices.com/indices/equity/sp-500) and published at <https://us.spindices.com/indices/equity/sp-500>

⁴³ See *id.* regarding disclosure from S&P DJI.

⁴⁴ <https://www.prnewswire.com/news-releases/sp-dow-jones-indices-announces-changes-to-us-indices-intraday-calculations-300228793.html>

to a new site. S&P DJI conducts ongoing tests between their three data centers, and performs independent internal SPX modeling to detect any aberrations.

The Working Group did consider the fact that, while S&P DJI's index computations are conducted and made available from all three geographic locations with delivery through separate communications lines, there is no completely independent backup maintained for SPX, which we believe remains a single point of failure. S&P DJI has responded that it intends to establish an independent index calculation to be conducted and maintained by a separate, independent entity thus further reinforcing redundancy and resiliency of the calculation.

In sum, the Working Group concludes that SPX remains an appropriate product to use as the MWCB reference, and does not recommend changing to another index or product as a reference value.

D. Evaluation of the Impact of LULD Trading Pauses and LULD Amendment 10 on the MWCB Mechanism

The Working Group considered the number of LULD Trading Pauses experienced on days with MWCB Halts, noting that the elimination of double-wide bands for all securities during the first 15 minutes of trading went into effect on February 24, 2020. On March 9 and March 12 – the first two days with early morning MWCB Halts – there were a combined 101 LULD pauses, only three of which were symbols included in the S&P 500. Of the stocks that had a LULD Trading Pause, 47 were in symbols that opened on a trade, while 54 opened on a quote.

The Working Group also considered whether fewer LULD Trading Pauses would have occurred if exchanges had used the midpoint of opening quotes as the reference price for LULD Trading Pauses instead of using the previous night's closing price (i.e., reversing the change that was implemented in Amendment 10 to the LULD Plan). Of the 101 LULD Trading Pauses on March 9 and March 12, 31 symbols paused within the first 30 seconds, which might have indicated that the prior day's closing price was stale. Of those 31 symbols, however, 15 in fact opened on a trade, indicating that the LULD Trading Pauses were based on Price Bands calculated from same-day trades.

The fact that S&P 500 symbols virtually always open with a trade makes the use of SPX for triggering a MWCB Halt preferable as compared with using a wider index, which may have more component securities paused in LULD Trading Pauses. ***This led the Working Group to conclude that it was unlikely that the Amendment 10 change had any negative impact on MWCB functionality.***⁴⁵

⁴⁵ See https://www.sec.gov/dera/staff-papers/white-papers/dera_wp_effect_of_amendment_10_of_luld_pilot_plan.

E. Evaluation of Whether Halts Are Appropriate Shortly After the Opening of Regular Trading Hours

Since three of the MWCB halts were triggered within the five minutes of the 9:30 a.m. start of regular trading hours and before all stocks had opened for regular trading, the Task Force that reviewed these issues in the Summer of 2020 focused on issues relating to the appropriateness of halting the market so soon after its opening. The Task Force considered various theoretical ways to modify the MWCBs such that a halt could be bypassed close to the cash opening. These included:

- Beginning the covered period at a later time, such as 9:45 a.m.;
- Relying on the futures market as being indicative of a 7% level having been breached in advance of the cash open and halting only if the market declines 13%; and
- Using a higher trigger for an initial period, e.g., the first 15 minutes after the open.

At that time, the Task Force did not recommend any modifications of the MWCB process around the open. While several Task Force members initially questioned after the March 9 MWCB event whether halts so early in the day made sense, their views evolved as additional halts occurred over the next two weeks. With the experience of several halt events behind them, market participants became familiar with the mechanism and understood the transparency, certainty, and simplicity that it provides. The Task Force's inquiry subsequently involved identifying whether there were compelling reasons to deviate from the current system that offers familiarity, certainty, and simplicity, such that changing to an unfamiliar, untested, and more complex system could be justified.

Based on its review of the operation of the three MWCB events near the opening of regular trading hours, the Task Force concluded that the current process was not causing any harm that would have justified moving away from it. Specifically, the Task Force concluded:

- Leaving the markets unprotected (or less protected) for the first 15 minutes was not the right outcome for investors, particularly as the first 15 minutes of the day are often the most volatile, and/or when technology issues arise.
- Market participants are already accustomed to the behavior of MWCBs starting at 9:30 a.m. Implementation of any changes would lead to additional market structure complexity and introduce new operational risk to the markets.
- While market volatility in March 2020 may have been discernable before the opening of regular trading hours, which allowed market participants time to prepare for the event, future scenarios may unfold in a manner that is not so easily

anticipated – such as when the market moves in response to news breaking right at the open.

The Task Force also noted that the 5% limit-down trigger on the E-mini S&P 500 futures contract limited price transparency at a critical time by preventing the market from more definitively knowing whether the futures market was trading at a level that indicated an expected 7% halt in the equities market upon their opening. The Task Force, which included representation from CME, believed that it would be beneficial for the limit-down trigger for the E-mini S&P 500 futures contract to be moved to a 7% decline (from 5%) before the equities market open, for the following reasons:

- The E-mini S&P 500 futures contract is the most liquid instrument; a higher limit-down trigger would enhance price discovery and give more certainty to the equity market open; and
- Better alignment of the various traded instruments (e.g., SPY) would enhance price discovery and lead to a more stable opening process.

As such, the Task Force recommended that CME consider moving the limit-down trigger for the E-mini S&P 500 futures contract to a 7% decline, as an initial step. As noted above, CME in fact implemented this recommendation on October 12, 2020. This CME change further reinforced the view that making additional changes to either the 7% MWCB level for equities or changing the time at which the equities markets would begin measuring for MWCB Halts was not warranted.

The Working Group, in revisiting this question, spent considerable time looking at the effectiveness of the auctions that occurred close to the opening (see Section III above), and observed the following:

- The auction pricing mechanisms operated effectively.
- The amount of marketable interest in the MWCB reopening auctions was sufficient.
- Effective price discovery occurred, as evidenced by lower post-auction volatility.
- Future scenarios may involve extraordinary volatility event / news at 9:29 a.m., making it preferable for the MWCB triggers to apply from 9:30 a.m. onward.

As a result, the Working Group does not recommend that changes be made to the MWCB halt process around the opening of regular trading hours.

F. Evaluation of Whether Excessive LULD Pauses Should Trigger a MWCB Halt

Finally, the Working Group notes that, in the 2012 approval order for the Pilot Rules,⁴⁶ the Commission requested comment on how the proposed changes would interact with the single-stock circuit breaker pilot program or the proposed LULD Plan. The Commission further asked whether the MWCB should be triggered if a sufficient number of single-stock circuit breakers or LULD price limits were triggered. One commenter hypothesized that calculating the SPX values for measuring the market decline percentage might be difficult if symbols comprising SPX were paused.

The LULD Trading Pause data prior to the four MWCB halts in March 2020 does not shed light on this issue. The four March 2020 MWCB halts were preceded by very few LULD Trading Pauses: (i) on March 9, only three SPX symbols were in an LULD Trading Pause prior to the MWCB halt; (ii) on March 12, no SPX symbols had been paused; (iii) on March 16, the market went into a MWCB Level 1 too rapidly for any LULD Trading Pauses to occur; and (iv) on March 18, only one SPX symbol had been paused. These events do not foreclose the possibility, however, that future MWCB Halts may be preceded by numerous LULD Trading Pauses, or that a future episode of numerous LULD Trading Pauses may prompt inquiry into whether a MWCB Halt should have occurred.

V. Conclusions and Recommendations

In sum, the Working Group concludes that:

- the MWCB mechanism worked as intended during the March 2020 events;
- the MWCB Halts triggered in March 2020 appear to have had the intended effect of calming volatility in the market, without causing harm;
- the design of the MWCB mechanism with respect to reference value (SPX), trigger levels (7% / 13% / 20%), and halt times (15 minutes) is appropriate;
- the change implemented in Amendment 10 to the LULD Plan did not likely have any negative impact on MWCB functionality; and
- no changes should be made to the mechanism to prevent the market from halting shortly after the opening of regular trading hours at 9:30 a.m.

⁴⁶ See supra note 36.

The Working Group is pleased that the CME has implemented the changes first recommended by the Task Force.

The Working Group makes four recommendations:

- The Pilot Rules should be made permanent without any changes.
- S&P DJI should establish an independent SPX calculation to be conducted and maintained by a separate, independent entity, to further reinforce redundancy and resiliency of the SPX calculation. As noted above, S&P DJI has indicated that it intends to do so.
- All markets should take appropriate action to minimize the reporting of trades to the SIP after the imposition of a MWCB halt.
- U.S. exchanges should adopt a rule requiring all designated Regulation SCI firms to participate in at least one Level 1/Level 2 MWCB test each year and to verify their participation by attesting that they are able to or have attempted to: (i) receive and process all SIP and exchange halt messages; (ii) receive and process trading resumes; (iii) receive and process any market data messages relevant to MWCB halts; and (iv) send orders following a Level 1 or 2 MWCB halt in a manner consistent with their usual trading behavior.

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