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January 12, 2018

VIA E-MAIL

Brent J. Fields
Secretary
Securities and Exchange Commission
100 F Street, N.E.
Washington, D.C., 20549-1090

Re: Securities Exchange Act Release No. 80683 (May 16, 2017), 82 FR 23320 (May 22, 2017) (SR-BatsBZX-2017-34) (the "BZX Proposal")

Dear Mr. Fields:

NYSE Group, on behalf of New York Stock Exchange LLC ("NYSE"), NYSE Arca, Inc. ("NYSE Arca"), and NYSE American LLC ("NYSE American"), appreciates the opportunity to provide additional comments to the Securities and Exchange Commission ("Commission") on the above-referenced proposed rule change by Cboe BZX Exchange, Inc. ("BZX") (filed as Bats BZX Exchange, Inc.) to add a "Bats Market Close."

NYSE Group previously expressed its views that the BZX Proposal is not consistent with the Securities Exchange Act of 1934, as amended ("Exchange Act") and the Commission's rules thereunder.[1] As the NYSE Group explained in its letters, the primary listing exchanges are required to support the technology and regulatory costs associated with running a closing auction and establishing an official closing price; to approve the use of this price by another exchange, which bears none of the costs or risks associated with the closing auction process, would be an unfair burden on competition.[2]

On December 1, 2017, the Commission's Division of Economic and Risk Analysis ("DERA") published a memorandum documenting its analysis of the correlation among closing price discovery and closing price efficiency with off-exchange trading activity at the close (the "DERA Memo").[3] NYSE Group engaged D. Timothy McCormick, Ph.D, to review DERA's conclusions.

The attached report, which NYSE Group submits with this letter, concludes that the findings in DERA's December 1, 2017 memorandum should not be interpreted as evidence that the BZX Proposal would have no negative impact on price discovery or the efficiency of closing prices. Accordingly, we continue to believe that the Commission cannot find that the BZX Proposal is

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[1]   See Letters from Elizabeth K. King, General Counsel and Corporate Secretary, NYSE, to Brent J. Fields, Secretary, Commission, dated June 13, 2017, August 9, 2017, and November 3, 2017.

[2]   15 U.S.C. 78f(b)(8).

[3]   The DERA Memo is available here: https://www.sec.gov/files/bats_moc_analysis.pdf.

consistent with the requirements of the Exchange Act and the rules and regulations thereunder and that, therefore, it must disapprove the BZX Proposal.

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For the foregoing reasons, the reasons set forth in its earlier comment letters, the reasons set forth in the attached report, as well as the dozens of opposing comment letters from concerned listed companies, investors, and index providers, NYSE Group respectfully requests that the Commission disapprove the BZX Proposal.

Sincerely,

Elizabeth K. King

Encl.

cc: Hon. Jay Clayton, Chairman
          Hon. Robert J. Jackson, Jr., Commissioner
          Hon. Hester M. Peirce, Commissioner
          Hon. Michael Piwowar, Commissioner
          Hon. Kara Stein, Commissioner
          Brett Redfearn, Director, Division of Trading and Markets
          Gary Goldsholle, Deputy Director, Division of Trading and Markets
          David Shillman, Associate Director, Division of Trading and Markets

Proposed Rule to Introduce Bats Market Close

Assessment of DERA Study Published on December 1, 2017

D. Timothy McCormick, Ph.D.[1]

January 11, 2018

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Executive Summary

The closing auction mechanisms on the listing exchanges are designed to facilitate price discovery and maximize the informational efficiency of the official closing price. Commenters have raised potential concerns that the Bats Market Close proposal might have a negative impact on the quality of the closing mechanisms used by the primary listing exchanges to execute on-close orders and determine the official closing price. Specifically, commenters have expressed concerns that the Bats proposal might undermine price discovery and pricing efficiency, and might introduce new incentives for market manipulation.

The Securities and Exchange Commission ("SEC")'s Division of Economic and Risk Analysis ("DERA"), in a memo dated December 1, 2017 ("DERA Study"), reports research evaluating whether, under the current market structure, there is a statistically significant cross-sectional relationship between the amount of volume executed off-exchange at the closing price and certain metrics of price discovery and efficiency. By and large, DERA's regressions fail to show any statistically significant findings. Section II below provides background information on the structure of the existing closing mechanisms, the Bats proposal, and the DERA Study.

For reasons discussed in detail in Section III below, DERA's findings should not be interpreted as evidence that the Bats Market Close proposal would have no negative impact on price discovery or the efficiency of closing prices. As the DERA Study itself states, the available data "does not allow [DERA] to predict how the proposed rule change would affect price discovery in the closing auction process, and market participants' use of limit-on-close orders in the closing auction process." The amount of volume currently executed off-exchange at the close under the current market structure is relatively low and does not exhibit enough cross-sectional variation to enable researchers to predict what might happen if a large proportion of

market-on-close orders was diverted away from the primary auction, as might be the case under the Bats proposal.

In addition, as explained in Section IV below, the metrics and methodology employed in the DERA Study to analyze potential effects on price discovery and market efficiency are not appropriately designed to address the concerns raised by the commenters. The "Price Contribution" metric looks only at the magnitude of the total return over the last 15 minutes of the day, relative to the return over the entire day. It does not distinguish price discovery from price movements caused by transitory volatility or market manipulation, nor does it consider the extent to which the closing mechanism facilitates a smooth transition from continuous trading to the final auction, an important aspect of price discovery approaching the close. The "Price Reversal" metric, while grounded in economic theory, is an imprecise measure of market efficiency and is not well suited for interpretation when used in the regression framework.

As explained in Section V below, the DERA Study does not attempt to address the important concern raised by commenters that the Bats proposal introduces new incentives for market manipulation and the potential for gaming by arbitrageurs. Section V also contains a discussion of the kinds of manipulation and gaming that might occur under the Bats proposal, which goes beyond any incentives for manipulation that might exist under the current market structure. Section VI provides additional high-level analysis and a summary of my conclusions.

I.   Qualifications

I am an independent economic consultant with special expertise in the trading and regulation of financial markets. Recently, I have worked on a number of economic analysis projects for

Cornerstone Research. My professional career in this area spans more than 25 years and includes seven years as a financial economist at the SEC and over 15 years at the NASD/Nasdaq.

While at Nasdaq, I was involved in the development of the Nasdaq opening and closing crosses. In addition, my Ph.D. dissertation examined the probability of execution in electronic call auctions under a variety of security and order flow characteristics and found, among other things, that regular liquidity provision in these call auctions is important for securities with low and medium trading volume. I have conducted numerous research studies on issues related to market quality, public securities offerings, trading, market making, and short sale rules.

Some of my research has been published in the *Financial Review*, the *Journal of Empirical Finance*, the *Journal of Finance*, the J*ournal of Financial Economics*, and the *Journal of Financial Intermediation*. I have also taught financial markets as an Adjunct Professor at George Washington University. I received a Doctorate in Applied Statistics from the University of Maryland in 1999.

II.   Overview of Proposed Rule

A.   Background

Official closing prices for exchange-listed securities are determined using an auction process conducted by the security's primary listing exchange. These include the "Closing Auction" at the New York Stock Exchange ("NYSE"), NYSE Arca, and NYSE American, and the Nasdaq "Closing Cross." These auctions determine the closing price through a process that integrates all market-on-close ("MOC") and limit-on-close ("LOC") orders sent to the exchange, disseminates information about the status of the auction to market participants in the minutes leading up to the close, and enables market participants to submit orders to offset order imbalances.

On May 5, 2017, Bats BZX Exchange, Inc. ("Bats," "BZX") filed a proposed rule change with the SEC to introduce Bats Market Close, a closing match process for securities listed on other exchanges.[2] Under the current market structure, market participants typically participate in the primary listing markets' closing auction in order to receive the official closing price.[3] The Bats Market Close would match buy and sell MOC orders in a crossing session conducted at 3:35 PM, before the cutoff time for submitting orders to the primary exchange auctions, and would execute the cross at the official closing price.

B.   Current Closing Process on the Primary Listing Exchanges

The NYSE Closing Auction begins accepting orders at 7:30 AM and accepts MOC and LOC orders until 3:45 PM. From 3:45 PM to 3:59:55 PM the exchange disseminates the matched quantity, order imbalance, closing-only interest price, and indicative clearing price to market participants every five seconds. At 3:45 PM, the exchange publishes a mandatory imbalance if the imbalance is larger than 50,000 shares (or otherwise determined by exchange officials as significant as a percentage of average daily trading volume).[4] During the 3:45 PM to 3:59:55 PM time period, market participants may enter MOC and LOC orders to offset a mandatory published imbalance, but may not enter MOC and LOC orders otherwise. Market participants may submit closing-offset ("CO") orders, which only execute against the contraside of an imbalance and can only better the closing price.[5] At 3:55 PM, d-Quotes, which are orders

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[2] Securities and Exchange Commission, "Notice of Filing of a Proposed Rule Change to Introduce Bats Market Close, a Closing Match Process for Non-BZX Listed Securities Under New Exchange Rule 11.28," May 5, 2017, Filed on May 16, 2017, https://www.sec.gov/rules/sro/batsbzx/2017/34-80683.pdf.

[3] According to the DERA Study, on average 9.3% of total closing volume occurs off-exchange, but at the official closing price. *See* "Bats Market Close: Off-Exchange Closing Volume and Price Discovery," Division of Economic and Risk Analysis, December 1, 2017.

[4] NYSE Rule 123C(1).

[5] "NYSE Open and Closing Auctions," New York Stock Exchange, https://www.nyse.com/publicdocs/nyse/markets/nyse/NYSE_Opening_and_Closing_Auctions_Fact_Sheet.pdf.

submitted by NYSE floor brokers to the Designated Market Maker ("DMM"), are added to the indicative clearing price. At 4:00 PM, the closing auction process begins and the official closing price is published to market participants. The DMM is obligated to fill all MOC orders at the closing price. LOC orders that are better than the closing price must also be filled, and LOC orders placed exactly at the closing price may or may not be filled depending on their priority. DMMs typically offset any imbalances that remain once the auction commences. If the closing auction is not completed by 4:02 PM, the DMM may electronically run the closing auction.[6]

Similar to the NYSE closing auction, the NYSE Arca closing auction accepts MOC, LOC, and auction-only orders. Beginning at 3:00 PM, NYSE Arca disseminates and updates in real time the indicative match price, matched volume, the market imbalance, and the total imbalance. Market participants can submit MOC and LOC orders until 3:59 PM, at which point they can only submit LOC and MOC orders that decrease the order imbalance. The closing auction occurs at 4:00 PM and the closing price is set to maximize the number of shares that are matched. If there are multiple prices that satisfy this condition, the price closest to the last sale price on the consolidated tape is used. NYSE Arca also places a price collar on the auctions such that the price from the auction will not deviate by more than 10% from the last sale price for stocks priced $10 and above and by more than 25% from the last sale price for stocks priced below $10.[7] The closing process for NYSE American is the same as the process for NYSE Arca, except that the restriction on submitting MOC and LOC orders begins at 3:50 PM instead of 3:59 PM and the price collar for the auction is the greater of $0.50 or 10% away from the last sale price.

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[6] "Behind the Scenes: An Insider's Guide to the NYSE Closing Auction," New York Stock Exchange, https://www.nyse.com/article/nyse-closing-auction-insiders-guide.
[7] "NYSE Arca Auctions," New York Stock Exchange Arca, https://www.nyse.com/publicdocs/nyse/markets/nyse-arca/NYSE_Arca_Auctions_Brochure.pdf.

The Nasdaq Closing Cross begins accepting MOC, LOC, and imbalance-only ("IO") orders at 4:00 AM. Between 3:50 PM and 4:00 PM, Nasdaq disseminates the current reference price, the near indicative clearing price, the far indicative clearing price, number of matched shares, and the order imbalance every five seconds. During this time market participants may enter IO orders. Any LOC orders that are submitted are treated as IO orders. IO orders are intended to be liquidity providing orders (unlike an aggressively priced LOC or an MOC) and help offset any imbalances. At 4:00 PM, the closing cross occurs and the official closing price is published to market participants. The auction is designed to, first, maximize the number of shares executed; second, minimize the imbalance of crossed orders; and third, minimize the distance of the closing cross price from the last Nasdaq inside bid-ask midpoint in the continuous market. MOC orders hold priority over LOC orders.[8] Unlike the NYSE auction, there is no DMM to facilitate the closing process. However, market makers and other participants are free to submit IO orders to provide liquidity to offset the imbalance.

Each exchange runs the primary closing auction for the securities listed on its exchange. Some exchanges also run competing auctions for securities not listed on their exchanges. These non-primary market closing auctions discover their own cross prices and do not reference prices generated from the primary listing auction. These auctions serve as a backstop in the event that the primary listing auction fails and ordinarily have not been very successful at garnering much trading interest.[9] The Nasdaq June 12, 2017 comment letter states that while it continues to offer the Closing Cross in non-Nasdaq listed securities, Nasdaq does not currently encourage its use

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[8] "The Nasdaq Opening and Closing Crosses: Frequently Asked Questions," Nasdaq, https://www.nasdaqtrader.com/content/ProductsServices/Trading/Crosses/openclose_faqs.pdf.
See also "The Nasdaq Opening and Closing Crosses," Nasdaq, https://www.nasdaqtrader.com/content/TechnicalSupport/UserGuides/TradingProducts/crosses/opencloseequickguide.pdf.
[9] The Nasdaq comment letter on September 18, 2017 provides statistics on the miniscule amount of closing volume executed away from the primary market. It states that "[f]or June, July and August of 2017, less than one tenth of one percent of closing volume in Nasdaq-listed stocks was executed in competing auctions." Comment Letter filed by Nasdaq, September 18, 2017.

but rather keeps it in operation as a utility for the importance of market resiliency.[10] The NYSE also stated that their closing auctions in non-primary securities are offered as an alternative "in the event that NYSE, NYSE American, NASDAQ, or BZX is unable to conduct a closing auction in some or all of their listed securities," but that they "[do] not otherwise have a business interest in running closing auctions in non-primary securities."[11]

C.   Proposed Bats Market Close

The proposed Bats rule would match buy and sell MOC order in non-BZX listed securities and report those matched orders to the consolidated tape at the official closing price. Under the proposal, market participants would submit MOC orders to the Bats Market Close between 6:00 AM and 3:35 PM. At 3:35 PM, all MOC orders submitted to the Bats Market Close would become final and would be matched based on time priority. Any orders that are not matched would be canceled back to the participant and the quantity of matched orders would be disseminated to the market through Bats' proprietary data feed. The matched MOC orders would be executed at the official closing price of the security once the primary listing exchange disseminates the closing price to the market. The official closing price is typically established by the primary market closing auction but when there is no closing auction, the last sale price is used. Although Bats has not disclosed the exact fees charged per share executed in its proposed market close, it expects to charge a fee that is slightly lower than the fee generally charged by primary markets for MOC order executions.[12]

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[10] Comment Letter filed by Nasdaq, June 12, 2017.

[11] Comment Letter filed by NYSE, November 3, 2017, p. 6.

[12] Securities and Exchange Commission, "Notice of Filing of a Proposed Rule Change to Introduce Bats Market Close, a Closing Match Process for Non-BZX Listed Securities Under New Exchange Rule 11.28," May 5, 2017, Filed on May 16, 2017, https://www.sec.gov/rules/sro/batsbzx/2017/34-80683.pdf. Given that current fees at exchanges for MOC orders are in the range of $0.0004 to $0.0010, I would expect the lower fees to be of the magnitude of hundredths of a penny per share less than the

D.   Issues Raised by Commenters

As of January 10, 2018, 61 comments on the proposal have been submitted to the public file. The list of commenters includes stock exchanges, brokerages, trading firms, industry trade groups, U.S. Congress members, publicly traded companies, and individuals. Many commenters expressed concern that the proposal would fragment the closing auction process and harm price discovery. The commenters expressed concern that the closing auction for small-cap companies would not be able to withstand the loss of MOC orders to the Bats Market Close. They also expressed concern that the proposal would introduce new avenues for manipulating the market close. Commenters in favor of the proposal focused on the potential for increased competition and the lower fees that the proposal would generate.

E.   The DERA Study

On December 1, 2017, DERA published the DERA Study that sought to address whether trading volume executed off-exchange at the close[13] affects closing price discovery and closing price efficiency. To address this question, DERA conducted a study of U.S.-incorporated common stocks and exchange-traded products listed on the NYSE, NYSE Arca, NYSE American, and Nasdaq. The sample was limited to the first quarter of 2017 and included only those stock-days on which a closing auction occurred.

In the DERA Study, closing price discovery was measured using the "Price Contribution" metric, which is the return in the final 15 minutes of the day expressed as a percentage of the

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current primary market rates. For a 1,000-share order, a one-hundredth of a penny savings amounts to ten cents saved. For the current fee schedules for MOC orders, see, for example, "New York Stock Exchange Price List 2018," New York Stock Exchange, https://www.nyse.com/publicdocs/nyse/markets/nyse/NYSE_Price_List.pdf; "Price List – Trading Connectivity," Nasdaq, http://nasdaqtrader.com/Trader.aspx?id=PriceListTrading2.

[13] This off-exchange volume likely represents MOC orders that were routed to market makers who agreed to execute the orders at the official closing price, or orders that were executed on an Alternative Trading System at the official closing price.

return from the open to the close of the market on the same day. Closing price efficiency was measured using two variables designed to measure the propensity of the market price to experience price reversals between the last 15 minutes of the trading day and the subsequent overnight return.

The DERA Study used a regression framework to investigate the correlation between each of these variables and the amount of off-exchange activity at the close. It ran a regression over the entire sample as well as some sub-groups such as ETPs and common stocks. The study found that the relationship between the off-exchange volume variable and the closing price discovery and efficiency variables was generally insignificant across these multiple regressions, suggesting that, at current levels of off-exchange activity, the measures of closing price discovery and efficiency are unrelated to the amount of closing volume that occurs off-exchange.

DERA does not appear to interpret this result as evidence that the Bats proposal would be innocuous or would have no impact on price discovery and pricing efficiency. Rather, DERA states (p. 2) that "the data we have does not allow us to predict how the proposed rule change would affect price discovery in the closing auction process, and market participants' use of limit-on-close orders in the closing auction processes."

I agree with DERA's assessment about the limitations of the data. In the following sections, I explain why the results of the DERA Study cannot be extrapolated to draw conclusions regarding how the Bats Market Close would impact price discovery and the efficiency of the closing price. I also explain why the DERA Study does not adequately address the concerns raised by commenters that the Bats proposal might undermine price discovery, have a negative effect on the quality of the closing price, and introduce new concerns related to market manipulation and gaming.

III.   The Results of the DERA Study Cannot Be Extrapolated to Determine the Effect of the Proposed Rule

The DERA Study clearly states that DERA does not interpret its study as a prediction of how the Bats proposal would impact the market close. To draw any conclusions from the DERA Study regarding the potential impact of the Bats proposal requires the additional assumption that the degree of MOC orders that are executed away from the primary market in the current market is a reasonable proxy for impact of the Bats close proposal. Unfortunately, there are a number of problems with this assumption. Market makers who cross orders on behalf of clients at the market closing price are potentially risking capital on such transactions. This is very different from an exchange operator such as Bats which has no obligation to commit capital in its market close. Thus, the magnitude of orders crossed away from the primary market by market makers is likely to be constrained to some extent by risk capital. On the other hand, the proposed Bats market close will not be constrained by risk capital. Since market maker MOC volume is likely to account for the bulk of the DERA measure, it may not be a good proxy for evaluating the potential impact of the Bats close proposal.

If the Bats proposal is successful, it could result in a much higher percentage of MOC orders diverted away from the primary market than is observed in the current market.[14] Any empirical analysis using current market data will be constrained by the limited variation in the degree that MOC orders are diverted away from the primary market. Table 1 of the DERA Study shows that the median off-exchange MOC volume is 8.9% of closing volume and the 75th percentile is 11.4%. Thus, the data sample likely does not have sufficient data to measure the effects when

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[14] In addition, other markets have commented that if the Bats proposal is approved, they will offer their own MOC execution facility so the aggregate percentage of MOC orders diverted away from the primary market could be quite high relative to current levels even if no one market garners all the MOC orders. *See, for example,* Comment Letter filed by Investors Exchange LLC, June 23, 2017.

off-exchange MOC volume is high. Analysis of instances where the off-exchange MOC volume

is high is likely to yield greater power to find an effect.

The academic literature on the impact of off-exchange volume on market quality is generally

mixed, but my study on the impact of preferencing on market quality may be particularly

relevant to the question of whether off-market trading affects market quality. It finds that quoted

spreads, effective spreads, and dealer quote aggressiveness are all positively related to the degree

of internalization (trades executed internally/off-market by the dealer).[15] One key innovation of

the study is its use of Audit Trail data to precisely measure the degree of internalization and

preferencing in Nasdaq stocks. Another important aspect of the study is that the degree of off-

market trading was generally higher, particularly in Nasdaq stocks, than in today's markets,

which allowed us to adequately test the effect of a high degree of off-market trading on market

quality. If nothing else, my study provides evidence that higher levels of off-market trading

under certain market structures can harm market quality.

There likely are not many examples of high percentages of MOC orders being diverted away

from the primary market so it is hard for any empirical analysis to thoroughly evaluate what

might happen to market quality at higher levels. In addition, it is a known fact there is an impact

on what represents the closing price when all MOC orders are diverted away and there are no

other orders in the closing auction. If there is no closing auction, the closing price is represented

by the last sale price in the continuous market, which could be different from the closing price if

there was a closing auction with these on-close orders. The NYSE comment letter on June 13,

2017 on page 5 provides examples of instances over the past six months where paired-off MOC

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[15] *See* Kee H. Chung, Chairat Chuwonganant, and D. Timothy McCormick, "Order Preferencing and Market Quality Before and After Decimalization, *Journal of Financial Economics*, 71 (2004), 581–612.

orders accounted for the entire closing auction volume and, therefore, its price discovery.[16] The difference between the last sale price in the continuous market and the closing auction price, particularly for less active securities where the last sale price may be stale, can be significant. Thus, at extreme levels of diversion of MOC orders, there is an impact on price discovery.

Even if there are some instances where a relatively high percentage of MOC orders are executed away from the primary market, the outcomes observed on such occasions are not necessarily indicative of what would happen if routing MOC orders off-exchange became the norm because other market participants would almost certainly adapt their behavior. The primary market auctions are designed to facilitate price discovery through an iterative process in which market participants are provided periodic information about order imbalances, indicative price, matched volume, and other metrics to help them anticipate the likely closing price. MOC orders are an integral component in this process. Anticipation that there will be MOC orders in the closing auction is a critical component feeding into the decisions of liquidity providers and other market participants who trade in the closing auction with LOC orders. Current market data are not sufficient to reveal how the equilibrium price discovery process would be affected if a large portion of MOC orders were diverted away from the closing auction process.

The closing mechanisms on primary markets are carefully designed as a sequence of information feedback loops to optimize price discovery. They are not black boxes. The dissemination of the matched MOC volume by the Bats close prior to the start of closing processes on the primary markets changes the initial information set for those closing processes, which will likely change order submission behavior at the primary market. The absence of any

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[16] Comment Letter filed by the New York Stock Exchange, June 13, 2017. The closing price using the last sale price in the continuous market instead of the midpoint of the Auction NBBO is not generally going to be a better price, that is, better price discovery. The design of the closing mechanisms on the primary markets, including the aggregation of order flow, allows them to typically achieve better price discovery than a single trade in the continuous market.

MOC orders that would otherwise be sent to the primary market will change the information set at every point in time during the closing process. It is important to remember that information is regularly disseminated in the closing processes to help facilitate price discovery and to help attract liquidity, particularly when there are potentially large price gaps between the indicative closing price and continuous market prices. Therefore, any change in the information set could lead to changes in price discovery and liquidity. It is likely that information on the lack of matched MOC orders in the closing process will discourage liquidity providers from participating in the closing process since their orders will be less likely to interact with market orders.

The fact that the DERA Study drops from its regression analysis instances where there is no closing auction could result in dropping instances where price discovery in the closing auction is most impacted by the diversion of MOC orders in the current market. Suppose all MOC orders are diverted away from the primary market in the current environment and there are no other orders in the closing auction. Then, there is no closing auction and the closing price is the last sale price. The closing price is potentially different because of this diversion of orders so these are the cases where there is a greater likelihood of finding a negative impact on price discovery. The DERA Study completely ignores them.

The Bats proposal would not only divert MOC orders away from the primary exchange, it would also create new and stronger incentives for market manipulation than exist under the current structure. Analysis of current off-exchange trading data cannot capture the effects of such incentives. The information set leading up to the close and the choice of where to send orders will become more complex in the presence of a Bats close relative to the current market.

Additional complexity often gives professional traders an edge and facilitates gaming of the close price. I discuss potential gaming further in Section V.

In summary, the fact that the DERA Study generally finds insignificant results cannot be extrapolated to draw any conclusions for how the Bats proposal might negatively impact price discovery and the efficiency of the closing price. This does not mean, however, that the proposal cannot be subjected to economic analysis. There are widely accepted approaches in the theoretical market microstructure and auctions literature for analyzing how market participants are likely to behave under alternative market structures, and for analyzing how potential structures might create incentives for market manipulation and gaming. In addition, it may be possible to use a simulation approach to investigate what might happen under various "what if" scenarios. A simulation approach could potentially be used to trace out the degree to which routing MOC orders away from the primary exchange impacts price discovery on the primary exchange, or to investigate the effects of potential changes in order submission behavior or gaming that might occur.

IV. **The Empirical Design of the DERA Study Does Not Address the Concerns about Market Quality Raised by Commenters**

A. **The "Price Contribution" Metric**

The "Price Contribution" metric used in the DERA Study attempts to measure the degree of price discovery during the last 15 minutes of the day, relative to the remainder of the day. However, it is a simplistic measure that interprets any price movement over the final 15 minutes of the day as "price discovery." Large price movements leading up to the close may represent either price discovery or the effects of transitory volatility due to large order imbalances or market manipulation. If a change in the closing mechanism made the closing price significantly

less efficient and subject to large arbitrary swings, the Price Contribution metric would classify that as "price discovery" and treat it as a good thing. Unfortunately, this makes the metric unsuitable for evaluating the quality of the close.

The Price Contribution metric is based on the total return over the final 15 minutes of regular trading hours. It does not and cannot distinguish between a market where the closing mechanism facilitates smooth price discovery over the final 15 minutes of regular trading hours and a market where price discovery occurs exclusively in the final auction, resulting in a large price gap as the market transitions from continuous trading to the closing auction. Large price gaps between the last sale prices near the close and the closing auction price are generally indicative of poor market quality.

Further, the DERA Study cites to two published papers by Barclay and Hendershott as support for using a regression-based approach to study the information content of the closing price. However, the DERA Study does not actually use the Barclay-Hendershott methodology.

An alternative approach could provide some pertinent information regarding price discovery at the close. Market microstructure economists often measure market quality by examining price continuity measures. The basic premise of such a measure is that a buyer (seller) should not have to pay too much above (receive too much below) the prevailing last sale price for the privilege of accessing market liquidity. In fact, if every buy follows every sell in a continuous market and there are no informational movements in price, a price continuity measure is very similar to the spread, another often-used market quality measure. In the context of the closing auction, the trade prices in the continuous market near the close are typically a good benchmark for evaluating the quality of the price in the closing auction since traders have a choice of seeking an execution in the continuous market at prevailing prices or participating in the closing

auction. For example, measuring the absolute difference between the volume-weighted trade prices during the last 30 seconds of the trading day and the auction price provides a reasonable metric of the quality of auction price. In addition, controlling for the size of the auction and its initial imbalance may be important because price deviations that are the result of large imbalances or large demand are more likely to be indicative of informationally-driven price moves (good price discovery) rather than liquidity-driven price moves (bad price discovery).

B.   The "Price Reversal" Metric

The "Price Reversal" metric employed in the DERA Study is simply the stock return over the final 15 minutes multiplied by the overnight return. If the closing price is fully informationally efficient, the return over the final 15 minutes of the day should not be correlated with the overnight return, in which case the expected value of the Price Reversal metric would be zero. As a measure of the efficiency of the closing price, it is noisy and imprecise.

The imprecision of the Price Reversal metric makes it unlikely that the study would find a significant results, even if one did exist. To illustrate, suppose that on one day for a stock the last 15-minute return is -3% and the overnight return is 1%, yielding a Price Reversal measure of (-3) x 1 = -3. Suppose on a different day for a stock the last 15-minute return is -1% and the overnight return is 1%, yielding a Price Reversal measure of (-1) x 1 = -1. According to this measure, the first reversal is three times worse than the second reversal. Yet, in the first reversal, only one-third of the 15-minute return was reversed so two-thirds of the price move at the close can be viewed as a good price move. On the other hand, in the second reversal example, the entire price move near the close was reversed so there was ultimately no price discovery at the close. Therefore, the first example actually had better price discovery than the second example

yet the Price Reversal metric instead treats the first example as having much worse price discovery than the second example.

Another problem with the metric can be illustrated with slightly different examples. Suppose the last 15-minute return is 1% and the overnight return is -3%. According to the Price Reversal measure, the reversal is -3. Alternatively, suppose the last 15-minute return is 1% and the overnight return is -1%, yielding a Price Reversal of -1. Comparing the metric in the two examples would suggest that the first reversal was three times "worse" than the second reversal. Yet, in both cases the original return (last 15-minute return) was fully reversed. Economic theory suggests that the maximum "temporary mispricing" in both cases is 1% so an accurate reversal measure should yield identical results in these two instances. The same problem exists for the metric when there are price continuations as well. In some instances, large price moves overnight may completely overwhelm the price move near the close, thus becoming the primary driver of the measure. As such, as a measure for price discovery at the close, it is extremely weak.[17]

The Price Reversal metric has no clear interpretation. As the DERA Study correctly notes (pp. 5–6), if the Price Reversal metric is systematically negative, this suggests that the closing price is not informationally efficient and end of day returns tend to reverse overnight. However, if the value of the Price Reversal metric is systematically positive, this also indicates that the closing price is not informationally efficient, and that end of day returns tend to continue overnight. This makes it difficult to know how to interpret the results of the regressions in the DERA Study. Academic literature suggests that markets may "overreact" to some kinds of

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[17] Barclay, Hendershott, and Jones (2008) use a similar metric to measure reversals. However, they aggregate these reversals across securities for each day before they use the metric in a regression. In addition, they only examine S&P 500 securities that represent the most liquid and price efficient stocks in the market. These two differences in implementation of the measure may have a positive effect on its utility.

information and "underreact" to other kinds of information. In the context of the DERA regression equation, a negative coefficient on the "Off Exchange MOC" variable could be an indication that higher off-exchange volume causes reversals (market overreaction) to be more common and more severe, suggesting a decrease in market efficiency. However, it could also mean that higher off-exchange volume causes continuations (market under reaction) to be less common and less severe, in which case it would suggest an increase in market efficiency.

Further, if the diversion of MOC orders away from the primary exchange causes the closing price to be less informationally efficient, this does not necessarily mean that it would change the propensity of the market to experience reversals or continuations. It could simply result in less information impounded into the closing price. To the extent this information is revealed in the following day's opening price, this would be reflected in higher overnight volatility, but would not necessarily affect the relative frequency of reversals and continuations.

The "Price Reaction" metric used in the DERA Study is also imprecise and problematic. It is just an indicator-variable version of the Price Reversal metric, and is subject to the same general criticisms articulated above. In addition, since every reversal is set to -1 and every continuation is set to 1, the magnitude of the price move is completely lost with this measure. Thus, the Price Reaction metric imprecisely measures the imprecise Price Reversal metric. It is likely that the power of the test to find significant results is severely hampered so the DERA Study's lack of finding significant results is not surprising.

For these reasons, the methodology used by the DERA Study does not provide meaningful evidence on the extent to which off-exchange MOC trading in the current market impacts the informational efficiency of the closing price.

V. The DERA Study Does Not Address the Potential for Market Manipulation and Gaming

Nothing in the DERA Study is designed to address concerns raised by commenters that the Bats proposal introduces new incentives to manipulate the closing price. The SEC's order memo does not address these concerns, other than to cite comments by Professor James Angel (and by IEX). Professor Angel opines that he does not believe it is likely that the proposal will increase manipulation, but provides no explanation for this view, other than observing that incentives to manipulate the close already exist.

The apparent *laissez-faire* attitudes toward potential manipulation of the market close do not offer me any comfort. I believe that the Bats proposal creates opportunities for types of manipulation that do not exist under the current market structure. For example, a person wishing to purchase 10,000 shares at the close might lock in a purchase of 100,000 shares in the Bats crossing session and then sell 90,000 shares in the primary auction, pushing down the closing price. Market participants might also have legitimate reasons to change their mind after 3:35 PM and reverse trades executed in the Bats clearing session by trading in the primary market auction. This is often referred to as "positioning." Therefore, it might be difficult for regulators to tell whether such activity is manipulative in intent or just positioning.

Another dimension of manipulation to consider is the manipulation of the information prior to the market close. Suppose that two participants want to manipulate the information leading up to the close. One participant enters an MOC order in the Bats close to buy 100,000 shares while another colluding participant enters an MOC order in the Bats close to sell 100,000 shares.[18] To

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[18] Or suppose that the order size is 1 million shares. There is no limit to how large an order they could place and potentially offset in the Bats close.

ease the explanation, suppose that the size of other orders entered is zero.[19] After hours, the two participants trade with each other for 100,000 shares to reverse the positions. The manipulation effectively sends a false information signal about high demand, similar to a large block that is reported during continuous trading as being indicative of a potential large buyer or seller, and potentially causes liquidity providers to widen their spreads in response, thereby making it easier to move prices during the time the Bats close information is disseminated to the market. This manipulation scheme may also be implemented in conjunction with something similar to the first manipulation scenario that I mentioned above in order to make it easier to move prices near the close.

I want to reiterate that any additional manipulations such as the ones I described previously will change the information set leading up to the close. As such, all my previous comments concerning how the information at each step of the closing process will likely change order submission strategies, liquidity provision, and the entire price dynamic of the primary market's closing auction apply. Thus, the impact on market quality of any additional manipulation is not likely to be trivial.

In addition, the fact that there is no fee charge on shares that are not matched in the Bats close gives traders a free option to enter orders into the Bats close.[20] There are no built-in safeguards to prevent manipulation mentioned by Bats other than the normal regulatory oversight process. Of course, it is likely that the additional regulatory oversight "baggage" of the Bats close will be borne mostly by the primary markets because they have a much stronger interest in

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[19] As long as the orders matched by the colluding participants are large relative to true demand, the information signal is successfully manipulated.

[20] It is interesting to note that if the Bats close charged a fee for entry of orders into its system, then it would severely discourage usage of the system. I expect this free option to be taken advantage of and experimented with by many trading firms and trading professionals.

ensuring a good market close for their listed companies. I also fear that if there is no additional oversight or built-in safeguards to prevent manipulation in conjunction with the Bats close introduction, it could be months and years before any manipulations are found and prosecuted since these cases are often very time-consuming to investigate and prove. How much harm could potentially be wrought by these manipulations on market participants, investors, and issuers before the normal regulatory oversight process stops them?

More generally, there is no shortage of market participants seeking to implement arbitrage trading strategies involving trading in the minutes leading up to the close and in the closing auction. The proposed Bats clearing session would introduce a new level of complexity in the closing process. Undoubtedly, arbitrageurs will scrutinize the new closing mechanism looking for opportunities to extract trading profits by gaming the system in ways that could have adverse effects on the closing process, but which may or may not be considered market manipulation. It is hard to predict all of the ways in which, and the degree to which, this might occur because it will depend on a wide range of variables, including the degree of usage of the Bats close, the changes to order flow and liquidity provision in the primary market's closing mechanism, the profits realized from manipulation, and the vitality of market oversight.

As one possible example of arbitrageurs aggressively using the Bats close, an interesting situation arises on index reconstitution days when mutual funds and other indexers are seeking to sell large quantities of shares of stocks that are dropped from the Russell 2000 or the S&P 500 (or buy stocks that are added to the indices), and have a strong preference to transact at the closing price. In this situation, there is likely to be a strong predictable component to the MOC order flow. Arbitrageurs may seek to find profitable trading strategies using various combinations of trading in the Bats crossing session, trading in the continuous market, and

trading in the primary closing auction. Some of these trading strategies might have an impact on the closing process similar to the effects of market manipulation, even if the arbitrageurs are not acting with manipulative intent.

VI.   Additional Analysis and Conclusions

The closing auctions on the listing exchanges currently process the vast majority of the MOC and LOC orders in the market.[21] While some exchanges have introduced closing auction mechanisms for securities listed on other exchanges, these appear to be functioning mainly as backup facilities in case of technical problems at the listing exchange, and these have not resulted in significant fragmentation at the close.[22]

It is hard to predict what would happen if the Bats proposal were to be approved, but one plausible outcome is that the majority of MOC orders would migrate to the Bats close. If the fee for MOC orders in the Bats Market Close is set lower than the current fees charged by the primary exchanges, market participants who wish to achieve execution at the official closing price through MOC orders would likely find the lower fees attractive. In the absence of any competitive response by the primary exchanges, it would not be surprising to see brokers adopt a standard practice of routing most or all their customers' MOC orders to the Bats closing then re-routing them to the primary exchange if not executed on Bats. The extent to which MOC orders

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[21] According to the DERA Study, volume executed off-exchange constitutes 9.3% of trading volume on average, with a standard deviation of 4.1%, meaning that it would be quite rare (a three standard deviation event) for more than 21.6% of volume to be executed off-exchange.

[22] See footnote 9.

are diverted away from the primary exchange might be an order of magnitude larger than is the case in the current market.[23]

A decrease in the expected number of MOC orders routed to the primary exchanges might then affect the decision of liquidity providers to participate in the closing auction using LOC orders. Also, if the fees for the Bats closing session are set lower than the fees charged by the primary exchanges, it might induce some market participants who otherwise would submit LOC orders to use MOC orders. As described above, the Bats crossing structure also creates new incentives and opportunities for market manipulation, and it is hard to predict what new opportunistic trading strategies might emerge under the new structure and what effect such strategies might have on the closing process.

As other commenters have correctly noted,[24] the closing price is the most important price of the day. The closing price is used by investment companies to compute Net Asset Values at which fund transactions are consummated, and by other asset managers and investment advisors to compute and report daily portfolio values. Closing prices are used in customer margining, collateral cash flows in stock lending transactions, marking to market of clearing firms at the clearinghouse, and numerous other applications. Closing prices are used as the basis for settlement for derivative securities such as cash settled options and total return swaps, and for marking to market derivatives positions at the clearinghouse. Closing prices of individual

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[23] Without knowing how the other exchanges would respond to such a development, it is difficult to predict what would actually happen. One possibility is that other exchanges or dark pools might seek to introduce their own competing crossing session for MOC orders at 3:35 PM, or seek to preempt the Bats crossing session by introducing a crossing session at 3:30 PM. Another possibility is that the primary exchanges could respond by lowering their fees for MOC orders submitted to the primary auction. To the extent the current fees charged for MOC orders correspond to the exchanges' costs of developing and maintaining the technology associated with the closing auction (and the opportunity cost of capital in a competitive market), a decrease in fees might pressure the primary exchanges to subsidize the costs of the closing auction by charging higher listing fees.

[24] Comment Letter filed by James Angel, July 30, 2017.

securities feed into closing values for indices. Daily closing prices feed into calculations of risk metrics such as volatility and covariance.

Given the importance of the closing price in these and numerous other applications, there are broad implications for the potential costs imposed on market participants if the Bats proposal does have a negative impact on the integrity of the process leading up to the close and the quality of the closing price, as commenters have suggested. Any structural change that potentially undermines the informational efficiency of the closing price should be considered very carefully by the SEC. Even if the impact on the quality of the closing price is modest, given the central role played by closing prices in financial markets, the aggregate costs imposed on the market could dwarf the benefits associated with slightly lower fees for MOC orders.

Although the DERA Study finds no statistical evidence of harm from the modest amount of off-exchange trading in the current environment, this does not imply that the Bats proposal would have no impact. As explained above, the DERA Study does not fully address commenters' concerns about price discovery and efficiency, nor does it address the potential for the Bats Market Close to introduce new incentives for market manipulation and new forms of gaming. While the analysis above identifies some concerns with the metrics used in the DERA Study, the more fundamental point is that it is inherently difficult if not impossible to use an empirical approach to extrapolate from data under the current market structure to determine what would happen under the Bats proposal.