BlackRock

A global perspective on market-on-close activity

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Introduction

The closing price, or the last price at which a stock trades during a trading day, is a key reference price in equity markets. Institutional traders place enormous importance on closing stock prices as benchmarks of value. Closing prices are used to calculate portfolio returns, tally the net asset values of mutual funds, and as a basis for many types of derivative contracts. Equity closing prices are often determined using auctions, which are exchange mechanisms that aggregate orders from multiple market participants and match buyers and sellers at a distinct point in time to establish the market clearing price.

Closing auction volumes have increased substantially in recent years, doubling from 2016 to about 13.4% of daily traded volume in 2020.[1] In response, policymakers and academics have begun to voice concerns that this growth may create or exacerbate risks to financial stability.

In this *ViewPoint*, we address the issues raised around heightened market-on-close (MOC) activity by identifying key drivers behind this proliferation and demonstrating that this growth is not a cause for concern. In fact, **the growth of closing auction volumes has amplified its critical role as a forum for deep liquidity and accurate price discovery, thus providing greater market stability and investor protection.**

Summary

- There has been a notable escalation globally in MOC activity, which has often been wholly attributed to the increases in indexing and exchange-traded funds (ETFs).
- While the expansion of indexing and ETFs has partly contributed to rising MOC volumes, we estimate that the creation and redemption of ETF shares (also known as the primary market) contributes less than 5% to stock trading in the US and EMEA.
- Several other factors have also contributed to this trend, including market participants being attracted to the price efficiency and liquidity that the close offers, and the development of algorithmic and high-frequency trading.
- Furthermore, we believe that despite the potential risks that critics have associated with elevated levels of MOC activity, these fears are unlikely to materialize.
- In fact, increased MOC volumes bring significant benefits to the markets, including playing a crucial role in liquidity and price discovery.

The opinions expressed are as of July 2020 and may change as subsequent conditions vary.

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Background on Closing Auctions

Exchanges offer different mechanisms for matching buyers and sellers, such as the continuous limit order book, which is the prevailing execution method used during the trading day. Apart from the continuous trading model, many exchanges utilize auctions to set opening and closing prices. The closing auction, which takes place at the end of the trading day, is designed to establish the closing price for every stock. There are many different order types available at the close, including market-on close (MOC), limit-on-close (LOC), and imbalance offset orders. Of these, MOC and LOC orders play the most important role in determining closing prices.

A MOC order represents an order that must trade in the closing auction, irrespective of price, while a LOC order indicates an interest to buy or sell a specific number of shares, but only if the closing price is at or better than an indicated limit price.

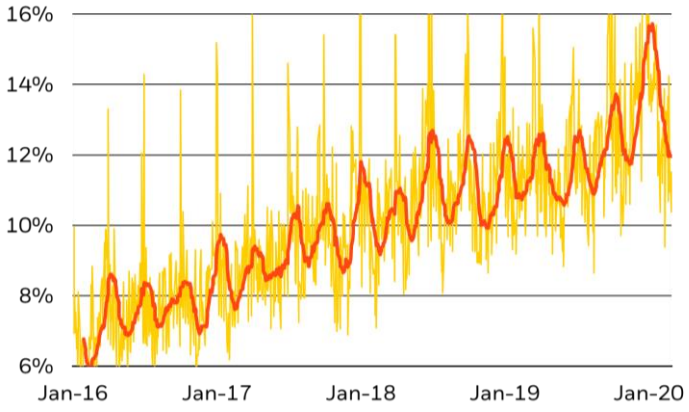
In the closing auction, orders from all market participants are aggregated and matched at a final clearing price. This is done according to the "principle of highest executable volume," by determining the price at which the largest possible executable volume of trades can be achieved (and unfilled orders are minimized).

Growth of MOC Activity

Since the early 2000s, there has been significant growth in MOC activity around the globe, a trend that has been particularly pronounced since 2016.

Over the month of January 2016, global MOC activity represented on average less than 7% of total volume throughout the trading day (see Exhibit 1). In contrast, as of January 2020, the closing auction represented 13.4% of the full trading day's activity.[2]

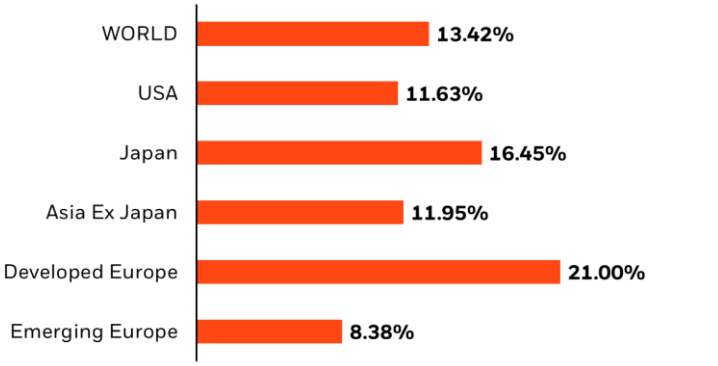
Exhibit 1: Global Closing Auction Volume, Close Volume % of Day



Source: Instinet, MSCI. As of February 28, 2020.

In the US, the volume in the closing auction (11.63%) is less than the global average, while this phenomenon is particularly outsized in certain markets like Japan, where the closing auction represented 16.45% of the trading day activity, and developed Europe,[3] where as much as 21% of the trading day's activity was concentrated at the close (see Exhibit 2).[4]

Exhibit 2: Closing Auction Proportional Volume %



Source: Instinet, MSCI. Data reflects information as of January 2020.

Rising Global Concerns

Academics and policymakers have raised concerns that this growth in MOC activity could potentially lead to systemic issues.

In July of 2019, for example, the Autorité des Marchés Financiers (AMF) identified the "concentration of transactions in the closing auction on Euronext" as a new market risk in their annual risk assessment report.[5] They elaborated on the associated risks of this "change in market structure" in a follow-up study a few months later.[6] They cite, for instance, the potential for this growth in closing auctions to undermine the price formation process, as buy- and sell-orders that can be matched and offset each other (which the AMF estimates to be about ~40% of these orders) do not contribute to price formation. The AMF notes that the concentration of volumes at the end of the day at the expense of the rest of the trading session could increase intraday volatility. Finally, the AMF contends that larger volumes in closing auctions could potentially lead to more trades being impacted by operational errors.[7]

Echoing these concerns, the European Securities and Markets Authority (ESMA) raised in its February 2020 consultation a question on whether it should "take actions to influence this market trend."[8]

Some recent academic research has been critical of the concentration of volume at the close. In their November 2019 working paper, authors Bogousslavsky and Muravyev echo the AMF's concern about the growth in closing volumes detracting from the price discovery process, and argue that there is a problematic trend where closing prices "frequently and significantly deviate from closing quote midpoints" which then revert overnight. This, the authors claim, leads to issues like ETF mispricing and put-call parity violations.[9] Wu draws a similar conclusion in his November 2019 working paper, concluding that the price impact from large MOC order imbalances is economically large and transitory, leading to short-term price reversals.[10]

Often, fears about the risks accompanying the rise in MOC activity are intertwined with criticism about the role that indexing (particularly exchange-traded products, or ETPs) plays in this growth. The AMF writes that the growth of MOC activity "is probably mainly due to the rapid development of passive investing, notably the ETF," citing ETF creation and redemption activity executed at the end of the day in order to replicate the net asset value (NAV) of the fund's underlying basket.[11] Bogousslavsky and Muravyev similarly note that "ETF ownership is a major determinant of auction volume" and that there are "major spikes [of auction volume] on index rebalancing days,"[12] while Wu writes that MOC orders are "an important trading channel through which passive investing affects underlying stocks."[13]

In the following sections, we explore the role of indexing in the growth of MOC activity as well as the claims that this growth is problematic and introduces risks to financial stability.

What are the True Drivers Behind MOC Activity?

Although some commentators have linked the growth of indexing to the increasing volumes at the close, the data does not support this conclusion. As we discuss in this section, indexing is not the primary driver behind rising MOC volumes.

BlackRock estimates that only 18% of US equities and 13% of equities in EMEA would be considered "indexed," or held by a strategy designed to match the market rather than to beat it, which includes mutual funds, ETFs, institutional indexing, and internal indexing.[14]

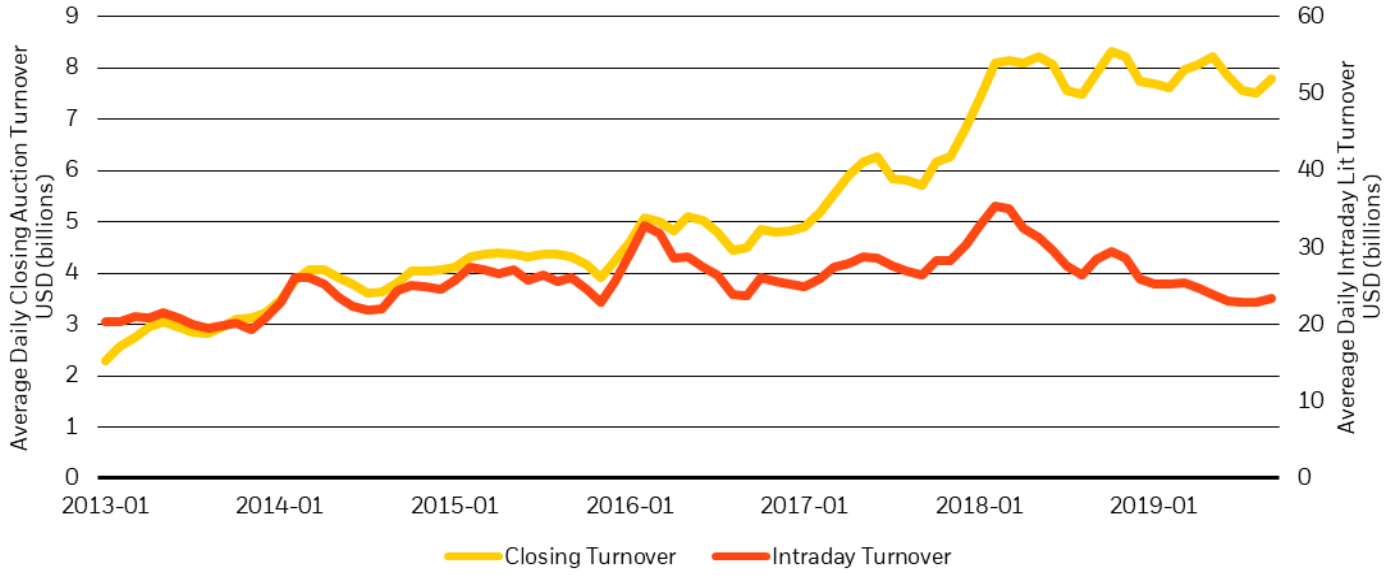
"Passive Investing" vs. "Index Investing"

The term "passive investing" (which is commonly understood to indicate a fund that closely tracks an underlying index) often appears in juxtaposition to "active investing" (in which a fund manager will choose securities to try to beat the returns of its index benchmark).

In this paper, and across most of our papers, we use the term "index investing" instead of "passive investing." "Passive" investing is a misleading term that does not accurately capture the work of professional portfolio managers who manage these funds. For example, in "passive" investing, asset managers are responsible for making decisions on how to best control tracking error against the fund's benchmark by minimizing trading costs, optimizing portfolio construction (i.e., choosing to hold only a subset of the benchmark's constituents), netting cash inflows and redemptions, and using tools like derivatives to compensate for cash drag (i.e., the difference caused by a fund holding cash instead of being fully invested in assets). As a result, the term "index investing" offers a clearer description of a fund that seeks to minimize tracking error to an index. We recommend that this term be adopted consistently by commentators, academics, policymakers, and other market participants.

Not only is the relative proportion of indexed investments low, but index funds are rebalanced when their benchmark indexes undergo a change (i.e., on rebalance days). Therefore, an increase in index funds should lead to an increase in closing volumes on rebalance days and a reduction in intraday trading volumes. However, as JP Morgan demonstrates in their 2019 study "Drifting into the Close," intraday volumes have shown some long-term growth since 2013, and closing volumes have seen an increase in trading volumes on normal trading days (i.e., non-rebalance days) (see Exhibit 3 on following page). JP Morgan notes that "if passive investment strategies are responsible for the increase in closing volumes on normal trading days, there must be a mechanism by which they generate significant closing volume outside of re-balance days. ETFs might offer such a mechanism," referencing the creation and redemption process of ETFs.[15]

Exhibit 3: Closing vs. Intraday Turnover Evolution



Source: JP Morgan Tick+. Adapted from JP Morgan, *Drifting into the Close*.

However, looking specifically at ETF trading activity, there is relatively little impact on the underlying equity securities. There are 670 ETFs listed across the US and Europe that provide physical exposure to European equity markets and 1,679 that provide physical exposure to US equity markets.[16] As of March 31, 2020, the combined ownership of European stocks held by these ETFs was approximately $308 billion, or 4.2% of the $7.4 trillion European stock market. The combined ownership of US stocks held by these ETFs was approximately $2.3 trillion, or 7.8% of the $29.3 trillion US stock market (as of March 31, 2020).[17]

Secondary market trading in ETFs and primary market trading in the underlying stocks are often conflated. The link between ETFs and single stocks is established by the primary market, where authorized participants and ETF issuers exchange securities for shares of the ETF. Because the majority of ETF trading activity occurs in the secondary market between buyers and sellers, only a fraction of ETF trading activity results in primary market activity and, hence, leads to trades of the underlying securities. In 2019, primary market activity accounted for just 15.8% of total European equity ETF trading activity.[18] In the US, just 20% of ETF trading activity resulted in trades in the underlying market in 2019.[19] Notably, the percentage of ETF trading activity in the secondary market increases during times of heightened market volatility, meaning ETF trading has even less impact on underlying markets when markets are moving quickly.

We estimate that 2.63% of European stock trading is a result of ETF primary market activity, while in the US, approximately 5% of trading in individual US stocks is attributable to ETF flows. Despite record ETF trading volumes in the first quarter of 2020, this number compressed to 2.50% and 4% in Europe and the US, respectively.[20] At such low market shares of single stock trading, it is clear that ETF activity cannot be the primary driver of closing auction volume growth. The magnitude of single stock auction volume increases is many times higher than the entire ETF market's volume, meaning that this growth must be driven by other forces beyond primary market ETF creations or redemptions.

In "Drifting into the Close," JP Morgan reaches a similar conclusion about ETF redemption and creation activity not accounting for the rise of MOC activity after comparing actual MOC volumes with hypothetical volumes assuming that all MOC flows were being driven by index funds. They found that aggregate MOC volume is rising across all stocks, consistently across all dates (both rebalance and non-rebalance days), even after removing demand from index funds caused by index rebalancing. The paper concludes, "We think it reasonably certain that truly passive asset flows are not the direct cause of increased trading in the closing auction."[21] A Traders Magazine article adds data to this story, the author calculating that index funds represent around 41% of MOC flows on index rebalance days, but only around 5.5% on the 245 non-index rebalance days.[22]

Given the conclusion that indexing is not the main driver of the growth of MOC activity, in the remainder of this section, we step through some of the other contributing factors to this phenomenon.

Price Efficiency

One key factor is that traders may be gravitating towards the close because they are more likely to be able to trade at an efficient price at the end of the day, after a full day of price discovery. Particularly in today's macro-driven markets where news announcements during the day may move prices substantially, trading at the close often gives traders the opportunity to trade on prices that reflect all relevant information. Additionally, bid-ask spreads are generally tighter and intraday volatility is lower at the end of the day, creating a more favorable trading environment for market participants.

Growth of High-Frequency Trading

Another key factor is that investors may be transacting at the close to minimize their interaction with HFT. HFT firms have grown to become a prominent feature of modern markets, due to their investment in superior automation and trading tools. According to data published by the AMF, HFT is responsible for a significant proportion of market volume during continuous trading, with the five largest pure HFT participants accounting for a combined 38% of the market.[23] On balance, this has improved the functioning of markets as academic research suggest that their participation lowers transaction costs and facilitates price discovery.[24]

However, as explained in more detail in the sidebar "Algorithmic Trading vs. High-Frequency Trading," HFT firms pursue a broad spectrum of strategies, including some that are more predatory in nature. Investors who are concerned about practices such as latency arbitrage, employed by some HFT participants, may turn to closing auctions to avoid this activity. As a CFA Institute blog post notes, "continuous time auctions will, by design, always afford the opportunity for latency arbitrage since someone must always be first to the top of the order book under continuous price-time priority."[25]

Algorithmic Trading vs. High-Frequency Trading

Under MiFID II, **algorithmic trading** is defined as "trading in financial instruments where a computer algorithm automatically determines individual parameters of orders such as whether to initiate the order, the timing, price or quantity of the order or how to manage the order after its submission, with limited or no human intervention, and does not include any system that is only used for the purpose of routing orders to one or more trading venues or for processing of orders involving no determination of any trading parameters or for the confirmation of orders or the post-trade processing of executed transactions."[26] Put simply, algorithmic trading relies on computers processing various inputs to ascertain the right time, price, and amount to trade.

An example of an execution algorithm is the Percentage of Volume (POV) strategy. This algorithm attempts to trade along with market volume at a user-defined participation rate, while dynamically reacting to events such as unusually large transactions. POV algorithms are suitable when a user is satisfied with the current market price and wants to limit transaction costs by trading commensurately to realized volume.

Algorithmic trading can be beneficial for investors. For instance, trading algorithms can be used to minimize market impact by executing a sizeable order over time in smaller increments when sufficient liquidity to accommodate the entire order is not immediately available. Furthermore, algorithms can reduce errors and eliminate subjectivity from the trading process by removing the human element.

High-frequency trading (HFT) is considered a subset of algorithmic trading. According to the definition set out under MiFID II, high frequency trading is any algorithmic order entry that, on average, meets the description of at least one of the following:

- At least 2 messages per second with respect to any single financial instrument traded on a trading venue
- At least 4 messages per second with respect to all financial instruments traded on a trading venue[27]

As implied by the definitions above, HFT is associated with high speeds of execution. HFT firms often employ sophisticated technology to reduce latency (i.e., the delay between a stimulus and a response) in their trading platform, and thus usually have a technical advantage over investors who have not prioritized similar infrastructure investments. As a result, HFT firms may execute trades at better prices because they are able to obtain advantageous queue position or be first to interact with resting orders by reacting more quickly than other investors.

Some HFT practices are predatory and seek to manipulate the market or disadvantage investors, and BlackRock is firmly opposed to these behaviors. However, it is important to note that HFT encompasses a wide variety of trading strategies, including activities that benefit investors. For example, electronic market making is a practice that tangibly benefits investors by reducing spreads and delivering intermediation in a highly fragmented equity ecosystem.

Closing auctions limit the effect of latency in order submission by aggregating all trading interests and matching them at a discrete point in time. As such, investors may find that a benefit of transacting at the close is the avoidance of practices such as latency arbitrage. In fact, in sharp contrast to their influence during continuous trading, HFT participants only account for about 1.2% of market share during the closing auction.[28]

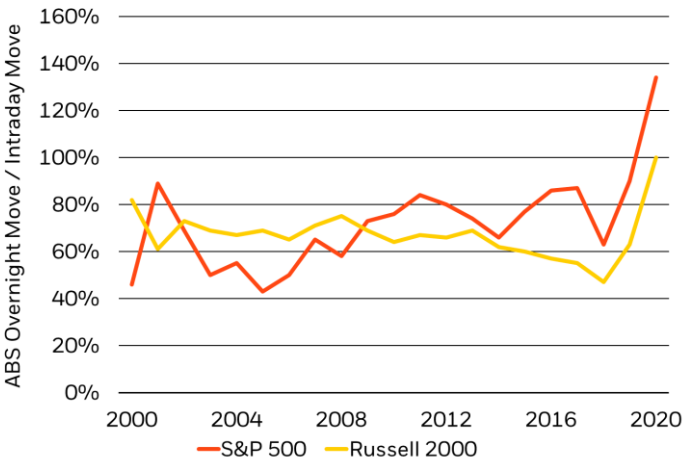
Banking Activity Post-Financial Crisis

A third key factor is the increasing preference of market participants to avoid overnight risk after the 2007-2008 Global Financial Crisis (GFC), and growing number of brokers who are offsetting their intraday hedges at the close. Prior to the GFC, some broker dealers sought higher yields in riskier assets rather than investing in cash, which became an issue when many of these riskier assets became extremely illiquid after the onset of the financial stress. This changed post-GFC, and many brokers now typically seek to reduce their overnight risk.

There are two main driving factors for this change of behavior. In part, this is in response to the increased capital requirements for banks. However, brokers also electively trade out of their positions instead of holding an open ticket overnight, likely due in some measure to the growing magnitude of overnight moves. As BofA Securities demonstrates in their 2020 study, overnight price moves in US markets have "increased significantly relative to the intraday move" (see Exhibit 4).[29]

As a result, brokers and other market participants now may prefer to complete residual orders or trade out of their positions at the end of each trading day, contributing to the growth of MOC activity.

Exhibit 4: Ratio of Overnight Move to Intraday Move



Source: Bloomberg, BofA Securities, as of April 2020. Adapted from BofA Securities, *Volatility through the Crisis – Out of the Woods?*

Growth of Algorithmic Trading

Another key factor driving the increase in MOC activity has been the trends in algorithmic trading, an execution method that uses pre-programmed instructions to submit orders based on market signals like time, price, and volume. The significant growth in the availability and popularity of algorithmic trading has in part been propelled by the rising adoption of MOC algorithms. Continued growth is expected, with a recent report estimating that the scale of global algorithmic trading will increase from $11.1 billion in 2019 to $18.8 billion by 2024, due to increasing demand for fast, reliable, and effective order execution, reducing transaction costs, growing government regulations, and a rising demand for market surveillance.[30]

Furthermore, the impact of algorithmic trading on MOC activity is not limited to the emergence of MOC algorithms as an essential trading strategy. Rather, increasing closing auction volumes also reflect the changes in non-MOC algorithms, which have progressively been modified to take advantage of the abundant liquidity at the close.

The placement of a portion of an order in closing auctions was often an optional feature of VWAP algorithms, which seek to minimize slippage relative to the volume-weighted average price (VWAP). However, over time, brokers have increasingly added auction participation as a default component of non-MOC algorithms such as liquidity-seeking and implementation shortfall strategies. This has helped to drive more activity into the close.

Notably, the use of these non-MOC algorithms is widespread among market participants. Such algorithms are employed by active funds and investors seeking liquidity, underscoring the point that the growth of MOC activity should not be attributed to indexing alone.

Liquidity Begets Liquidity

The final factor is the self-reinforcing nature of trading at the close. As liquidity accumulates, the closing auction becomes more attractive to a broad spectrum of investors who seek to transact with minimal price impact. This view is consistent with a Norges Bank Investment Management (NBIM) paper, which notes that auctions provide a "focal point for liquidity" and that as more activity shifts to the close, the benefits of trading at the close increases in turn. The paper adds that the pursuit of liquidity underpins the "trading volume shifting from the intraday, continuous session to auctions, particularly to the closing auction" and that therefore, this shift can be thought to be "structural and not limited to the commonly cited growth in 'passive' investing."[31]

Despite the linkages that both policy makers and academics have drawn between the growth of MOC activity and indexing, as these factors demonstrate, there are a host of additional drivers of this trend, each contributing to the shift in market structure. In the following section, we examine the validity of the claim that growing MOC activity is a problem and introduces systemic risk.

Are Growing MOC Volumes a Problem?

Although many critics have pointed to risks that they associate with growing MOC activity, such as price distortions and price movements, they are unrelated to the growing volume at the close.

First, as discussed above, a common criticism is that ETP trading in volume can distort pricing, with critics noting that "the price impact of large market-on-close orders is one important but overlooked mechanism through which ETFs influence underlying assets" and that this "significant price impact… suggests that the closing price for some stocks may be distorted due to the increasing volume of market-on close orders."[32]

This claim is easily refuted, as these studies are neglecting important institutional elements. First, ETFs rebalance periodically, based on the index that they track, and can use in-kind transactions (i.e., transfer financial assets, rather than cash) to avoid executing at the close. In fact, JP Morgan notes that 85% of ETF activity is priced intraday, and only 15% of activity is priced at the close.[33] While ETFs priced at the close will generate closing auction activity, ETFs priced at prevailing intraday prices may not. Furthermore, in the US, even with cash-created ETFs that trade on the close, the impact of such flows on price formation may be muted because market makers and authorized participants will often hedge the ETF transaction intraday in either cash or derivatives markets.[34] Second, in a 2019 BlackRock Policy Spotlight titled *Index Investing Supports Price Discovery*, we showed that only around 4-6% of total trading volumes in US stocks are attributable to ETF activity, with most ETF trades netting off in the secondary market (i.e., representing a change of ownership).[35] Finally, missing in the argument is the idea that if closing imbalances led to predictable return effects, these would be quickly arbitraged away. Therefore, there is little evidence of systematic and large return reversals on index rebalancing days, except in names where liquidity may be challenged.

A second criticism occasionally raised around this MOC growth is about the spike in end-of-day volatility. An early study on the US closing auction in 1999 found that the last five minutes of the trading day explain a disproportionate fraction of the variation in daily returns (almost 18% of portfolios), although the closing period constitutes only about 1.3% of trade time.[36] At the time of the study, price movements due to imbalances at the close, sometimes driven by index rebalancing, could be large. However, in the two decades since, exchanges and markets have evolved to better accommodate index flows and events. Exchanges like the NYSE have adjusted their rules regarding order submission cutoffs, price indications, and imbalance dissemination to better adapt to trading activity at the close. Exchanges have also introduced a variety of new order types and access mechanisms to strengthen the closing call, while some brokers have launched closing cross facilities of their own. Market structure evolution now allows institutional traders to place large orders at the close with confidence that there will be sufficient liquidity, and that any price movement or reversals will be minimal.

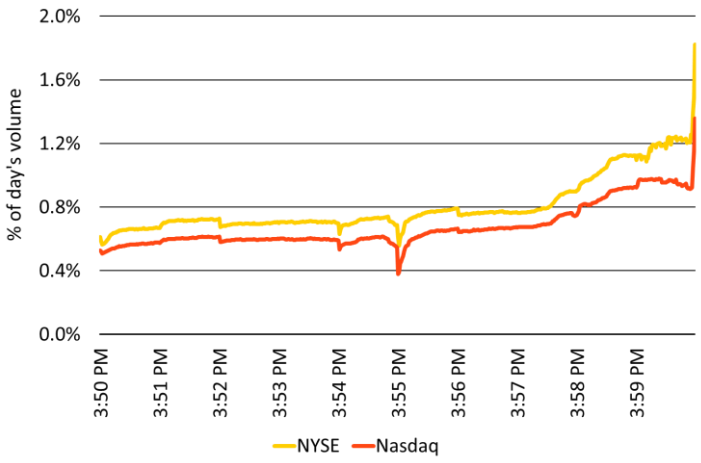
Benefits of Growing MOC Activity

Despite the criticisms of growing MOC activity, higher volumes are not a problem; on the contrary, the auction process increases market stability and the quality of price discovery. Price discovery is the dynamic process in which investors identify the proper market price of securities or other instruments based on factors like supply and demand. This process is essential in improving market liquidity and resiliency, as high-quality price discovery ensures that assets are accurately priced and that end investors are not over- or under-paying for these securities. By centralizing liquidity and setting the closing price of stocks at a level that satisfies all parties that are willing to buy and sell, the closing auction plays a critical role in this process.

The benefits of the auction process to investors and financial stability were discussed as early as 1988, when academics theorized that "liquidity begets liquidity." In their paper, authors Admati and Pfleiderer posited that when some traders exhibited a preference to trade at the close, other traders (such as liquidity providers and those with stock-specific information) would naturally gravitate to the end of the day as well. In short, they hypothesized that when some traders move to trading at the close, this would invite more liquidity, resulting in a deep closing auction.[37] In a 1992 paper, author Madhavan modeled price discovery under both a continuous market and a periodic auction. He demonstrated that a closing auction, by batching trades for multilateral transactions at a single price, would exhibit greater stability, depth, and resiliency than the continuous bilateral intraday market.[38]

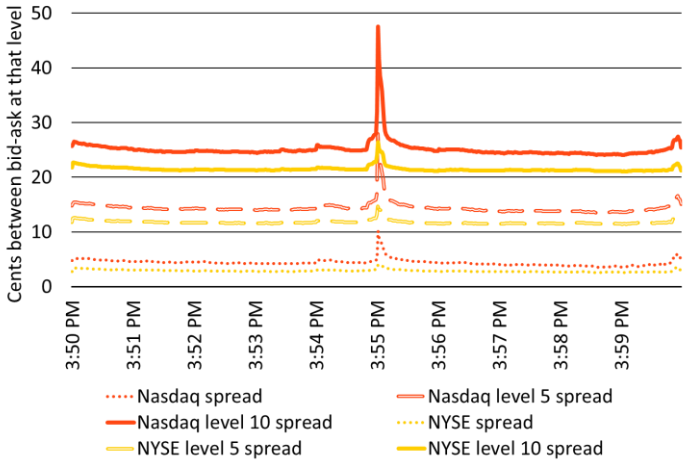
These predictions appear to have borne out over time. Pagano and Schwartz, in a 2003 paper, confirmed Madhavan's predictions, showing that at what is now Euronext Paris, the introduction of a closing call auction led to lower execution costs and more efficient price discovery.[39] Similarly, in a 2020 analysis by BofA Securities, the authors proved that the closing auction is characterized

Exhibit 5: How much volume is available to trade in 10 levels?



Source: TAQ, June 2019. Adapted from BofA Securities, *Two Minute Warning*. Analysis of largecap names.

Exhibit 6: Average spread at different book levels (largecaps)



Source: BofA Securities, TAQ, June 2019. Adapted from BofA Securities, *Two Minute Warning*.

by deep liquidity.[40] For example, the total size across the first 10 levels of the order book at 3:50pm is 70,000 shares for Nasdaq listings and 50,000 shares for NYSE listings. In comparison, by 4pm, the size has increased by almost 50%. In other words, there is a dramatic increase of volume available to trade, as shown in Exhibit 5. However, despite this increase of volume, the paper demonstrates that the bid-ask spread at various levels of the order book for large-cap securities on NYSE and Nasdaq barely change at all during the final 10 minutes of the day, at any level of the book (other than at 3:55pm) (Exhibit 6). In other words, the paper concludes that "you can access up to twice as much volume for the same price in the final few minutes."[41]

NYSE released its own statistics on auction liquidity, noting that there are significant amounts of unexecuted interest in the closing auction near the closing price. In March 2019, for example, on an average trading day, "36% more volume could have traded within 10 basis points of the closing price" in the S&P 500, and 161% more volume could have been traded within 50 basis points in the Russell 2000 (see Exhibits 7 and 8).[42]

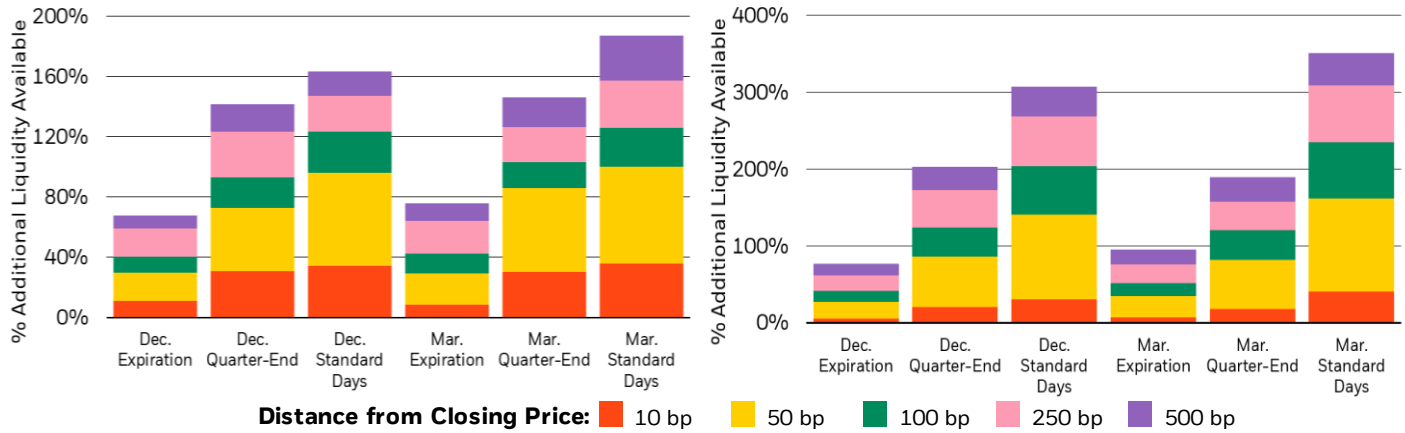
Norges Bank Investment Management reaches the same conclusions in a recent paper, noting that "well-designed closing auctions can attract natural liquidity interest contributing to efficient price and liquidity discovery."[43]

Furthermore, the positive effect of closing auctions on market stability is not limited to the auction itself, but rather impacts the entirety of the trading day. In 2013, researchers Pagano, Schwartz, and Peng discovered that

Exhibits 7 and 8: NYSE – Additional Liquidity Near Closing Price

S&P 500 - December 2018 and March 2019

Russell 2000 - December 2018 and March 2019



Source: New York Stock Exchange (NYSE). Adapted from NYSE, *Closing Auction Update*. As of April 16, 2019.

the introduction of call auctions in the NASDAQ market in 2004 had had a "positive spillover effect" on the dynamic behavior of price formation in the continuous market, because the call auctions had "significantly reduced both spreads and volatility for all market capitalization groups."[44] In short, the closing auction is not only a period of price discovery and deep liquidity, but it also has beneficial effects on the rest of the continuous trading day. As such, the closing auction—and the growing volumes in the auction—play a critical role in ensuring market stability and protecting investors.

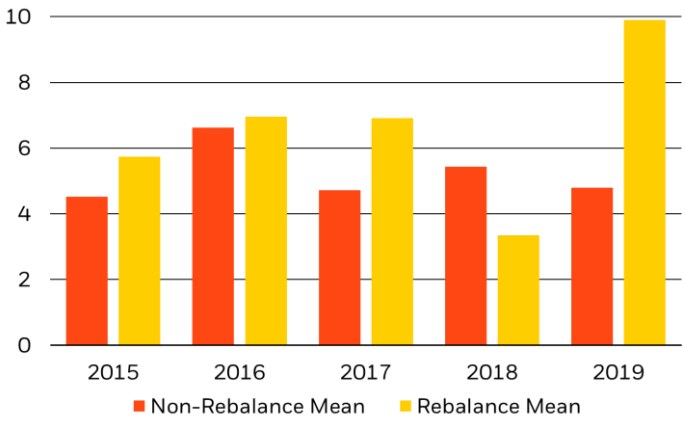
Case Study: BlackRock's Proactive Approach

Managers of index funds, such as BlackRock, have discretion to manage their trading at the close. Depending on the mandate, a fund may trade prior to or after the close if it is in the clients' best interest. Closing auction liquidity is thus an important factor in determining our trading strategy.

One way to gauge if indexing flows materially affect closing prices is to examine post-close reversals in price for stocks involved in index rebalancing and compare these to reversals on other days. Exhibit 9 provides insights into the potential price effects associated with index rebalancing in the period from January 1, 2015 to January 1, 2020 for US-listed securities. We examine 14 rebalance effective dates (for the S&P, Russell, and MSCI indexes) randomly dispersed throughout the time period.

As illustrated in Exhibit 9, there are modest reversals on rebalance days relative to non-rebalance days, suggesting

Exhibit 9: Mean Closing Price Reversals in Basis Points on Rebalance and Non-Rebalance Days



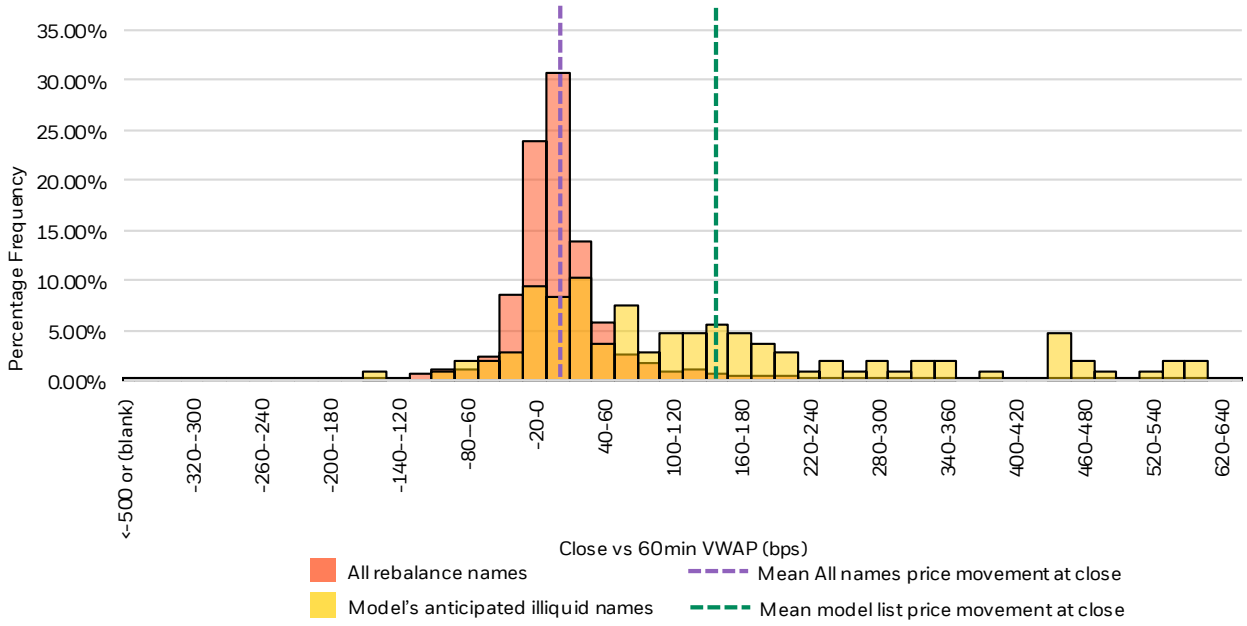
Source: BlackRock.

that there is potential value from assessing the volume available at the close in names where liquidity may be limited, especially on days when there is an index rebalance.[45]

To address this point, BlackRock has devised a machine learning model, which forecasts closing auction liquidity on index rebalance days and the associated price impact for individual stocks. This model can systematically identify potentially illiquid trades ahead of time, helping us optimize execution for index funds and thereby reduce market impact and tracking error.

How does the machine learning model perform? As demonstrated in Exhibit 10, our model was able to predict illiquid names (represented in yellow) successfully ahead of time. Identification of these trades allows us to source

Exhibit 10: Frequency Distribution of Imputed Costs (in basis points) for All Rebalance Names and Model Anticipated Illiquid Names for MSCI November 2019 Rebalance



Source: BlackRock.

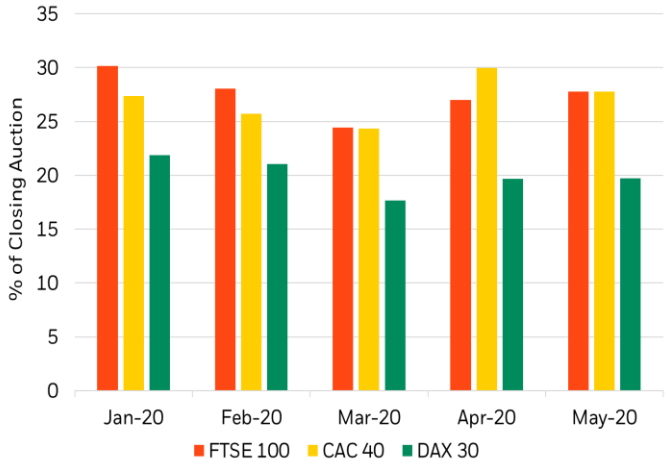
liquidity optimally, thus potentially mitigating future index rebalancing impacts. For example, traders, anticipating a lack of liquidity at the close in a particular name, might negotiate a block trade with a broker or execute the stock over the day in the continuous market. Such strategies mitigate reversals and reduce tracking error to the index.

Case Study: COVID-19 Crisis in EMEA

During the March to June 2020, when the COVID-19 crisis was ongoing, there was a drop in the percentage of auction flow in EMEA, as noted by several broker studies.

In March 2020, closing auction percentages fell to twelve-month lows across stocks in the FTSE 100, CAC 40, and DAX 30 indexes, as Morgan Stanley showed in a recent study. Only 24.7% of addressable volume in FTSE stocks was available in the closing auction, relative to preceding months when roughly a third of all addressable volume was in the close (see Exhibit 11).[46]

Exhibit 11: Monthly Average Closing Auction Percentage (FTSE 100, CAC 40, DAX 30)



Source: BIG XYT. Adapted from Morgan Stanley, *Market Microstructure Monthly: March 2020.*

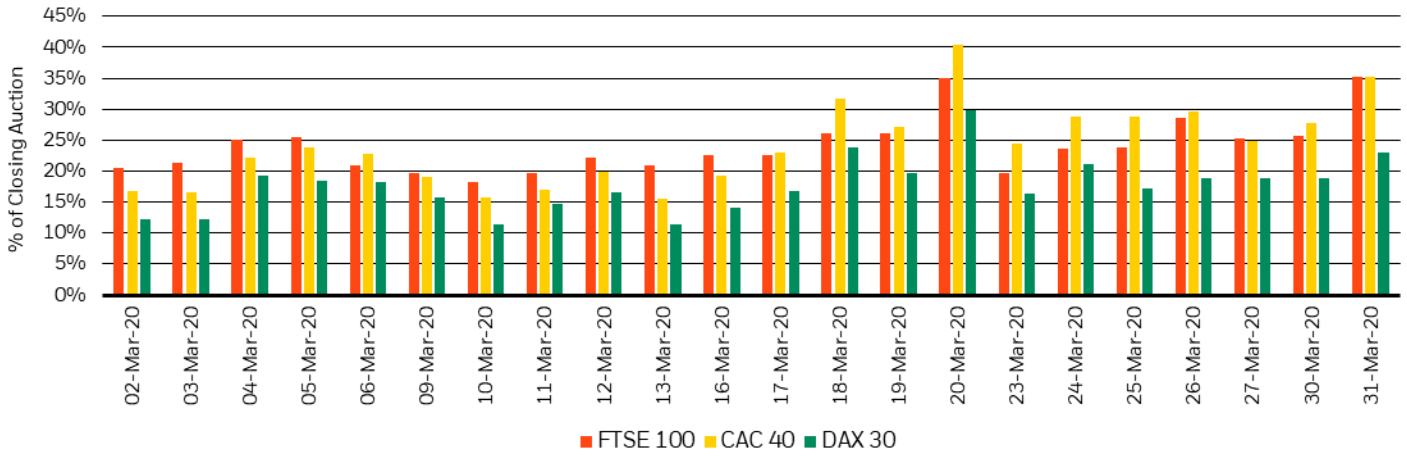
This decline of closing auction activity during the COVID-19 crisis evidences that traders' desire for immediacy during this highly volatile period caused them to move away from the close and trade during the day in continuous markets. This directly contradicts the argument that stressed markets will give rise to systemic risk from trading at the close and reinforces the point that there needs to be a diverse set of liquidity providers and venues through which liquidity can be sourced.

Furthermore, while the data show that there was a peak in the daily closing auction percentage on March 20th, which was an index rebalance day, market participants were nonetheless driven away from the closing auction throughout the rest of the month during this time of heightened market volatility (see Exhibit 12).[47] Thus, while index rebalancing plays a role in the growth of MOC activity, the evidence shows that this is not the sole determinant for this phenomenon. Rather, there are other considerable forces at play that have caused the growth in MOC volumes during normal market conditions.

Conclusion

There has been significant growth in MOC activity over the past decade, and we anticipate that this trend will continue into the future. As discussed in this paper, the increase in MOC activity can be attributed to a number of factors, including the rise of algorithmic trading and HFT, the quality of liquidity and price discovery at the close, and changes in banking activity post-GFC. Importantly, increased MOC activity has provided benefits to investors, such as fostering deep liquidity and market stability. Thus, while targeted improvements may enhance the functioning of closing auction mechanisms, as a market participant, we caution against large-scale changes to the closing auction.

Exhibit 12: March 2020 Daily Closing Auction %



Source: BIG XYT. Adapted from Morgan Stanley, *Market Microstructure Monthly: March 2020.*

Endnotes

1. MSCI, Instinet (February 2020).
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BlackRock.