General

What is the Cboe Periodic Auctions book?

The Cboe Europe ("Cboe") Periodic Auctions book is:

> A lit order book that independently operates frequent randomised intra-day auctions throughout the day.

> Orders subject to European Best Bid and Offer (EBBO) constraints to ensure orderly markets

> MiFID II compliant and adheres to pre-trade transparency requirements for a lit order book as noted in RTS 1 of MiFID II;

> Based on a true price formation process;

> Comprised of and based on long-standing market constructs and guiding principles;

> A good solution for firms looking to trade with minimal market impact, while meeting the MiFID II best execution needs;

> Comprised of diverse, addressable liquidity.

Why did Cboe launch a Periodic Auctions book?

> Cboe launched its Periodic Auctions Book in response to demand by market participants for a sub-LIS execution alternative to existing trading book models where size is given priority over speed, and also one which would continue to be available after MiFID II was implemented.

> An auctions model was settled upon as it meets both of these objectives: it removes absolute speed of connection to the venue as an advantage and, by delivering genuine price formation, it does not represent the perceived threat to wider price formation that the dark trading waiver caps were explicitly developed to address.

> In designing its Periodic Auctions book, Cboe has been careful to ensure that it meets the explicit transparency requirements set out for periodic auctions platforms detailed in RTS 1.

When did Cboe launch its Periodic Auctions book?

> Cboe Europe launched its Periodic Auctions book on 19th October 2015.

How does Cboe's Periodic Auctions book operate?

> The Cboe Periodic Auctions operate in exactly the same way as the scheduled and non-scheduled auctions operated by most European exchanges. The key difference is that the auctions run consecutively throughout the trading day and, to date, are less material for Cboe's business than the existing auctions are for the incumbent/primary listing exchanges.

Pre-Trade Transparency

What pre-trade transparency is provided on Cboe Periodic Auctions?

> The Cboe Periodic Auctions book provides pre-trade transparency, as stipulated by MiFID II regulation, publishing indicative price and size prior to an auction. It follows exactly what is required by RTS 1 for periodic auction systems.

> All market participants are able to see in real time the price and quantity that is predicted to execute in the auction.

> What exactly does RTS 1 state about pre-trade transparency requirements for periodic auctions systems?

> Annex 1, table 1 of RTS 1 provides a description of the type of trading systems and the related information to be made public. Regarding periodic auction trading systems it states:

> The price at which the auction trading system would best satisfy its trading algorithm in respect of shares, depositary receipts, ETFs, certificates and other similar financial instruments traded on the trading system and the volume that would potentially be executable at that price by participants in that system.

Call Phase

When does the auction call phase begin and how long does it last?

> The Cboe Periodic Auction call phase is triggered by the first order that arrives in the order book and continues as other orders are entered into the book.

> An auction can uncross at any point from its start up to 100 milliseconds. This ensures that it is possible for every order entered into an auction to execute. This differentiates it from a minimum duration model that gives firms a known time frame to influence the published indicative price and volume, and to fish for information without running the risk of execution.

> The actual auction call period is fully randomised within that maximum duration. The auction duration is randomised by design for exactly the same reason as the listing exchange opening and closing auctions in that it prevents gaming of the auction process.

> Auctions run continuously and consecutively throughout the day.

What information is disseminated during the call phase?

> Indicative uncrossing size and price messages are recalculated and published in real time.

Does the Cboe Periodic Auction call phase only start when a cross has been identified?

> The Cboe Periodic Auctions call phase starts at the receipt of the first order and repeats back to back until there are no more orders in the book.

› There are other auction on demand mechanisms where the call phase does not start until a match is found, and others that wait a further time period before publishing pre-trade information.

Is it possible to identify the start of a Periodic Auction?

› On BXE, Cboe will not publish specific start times or Trading Status messages for the Periodic Auctions Book. Market data will only be published when the indicative auction value or executable volume changes. On DXE, the start of an auction is indicated by the first Auction Update message after an Auction Summary message or the first Auction Update message of the day.

› The Periodic Auction book will be available and always in Auction from 0800 up to 1630 London time at the latest. After the final auction of the day (which could be just before 1630) all new orders will be rejected.

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Price Formation Process

How does the auction match process work on Cboe Periodic Auctions?

The auction match process comprises two steps:

› **Step 1:** Price Formation – determines equilibrium price of auction

› **Step 2:** Execution Allocation – Orders are matched off based on the price determined. Orders allocated on a broker (if they have opted into broker preferencing)/price/size/time basis.

How does the Price Formation process work on Cboe Periodic Auctions?

› The Cboe Periodic Auctions book is based on an industry standard true price formation process that includes all orders in the order book.

› The price arrived at is not constrained to the mid, bid or offer but any (half-tick) price point in-between.

› Cboe does not default to mid-point reference prices or import mid-point prices from another book. The price formation process is a genuine price forming process like the process utilised in the opening and closing auctions.

How is the auction match price determined?

> The Cboe auction is a genuine auction in that all orders entered are considered by the price determination algorithm.

> The algorithm then selects the equilibrium price at which the executed volume is maximised. In the event of a tie break on price, a four-step tie breaker process, one that is reasonably standard across European auction alogrithms, is invoked.

> To determine a single equilibrium match price the following criteria shall be assessed in sequence:
> 1. Maximum executable volume. If a single auction price can be chosen which uniquely maximises the auction volume, then this is chosen as the auction price.
> 2. Minimum surplus. If, within the set of prices identified in (i) which maximise executable volume, there is a price which minimises the order volume which would be left on the order book priced at the auction price, then this price level is selected.
> 3. Market pressure. If the set of prices identified in (ii) would always result in unexecuted order volume on the buy side of the book, then the highest price identified in (ii) is selected as the auction price. Similarly, if the remaining volume would always be on the sell side of the book, then the lowest price would be used.
> 4. Reference price. If (iii) does not yield a unique price level, then out of the set of potential prices identified in (ii), the price which is closest to the Reference Price for the security is chosen. Reference Price is defined as the last auction traded price, open or close price of the BXE environment; whichever is the most recent; if none of these exist then the prospectus price or equivalent shall be used.

On top of this, Cboe imposes an EBBO collar, to ensure that auctions do not uncross outside the prevailing European best bid and offer (the EBBO is generally made up of the best bid and offer available on Cboe's two lit books, the Turquoise lit book and the primary listing exchange). On DXE, the PAB uncrossing price collar is expanded to an additional tick either side of the Cboe EBBO.

Why does Cboe impose an EBBO collar?

> The EBBO collar provides comfort to users that participation in the auction will not create best execution problems and also addresses one of the historic barriers to effective competition for auctions - namely that a competitor auction can diverge significantly from prevailing prices in the market.

> It also removes any incentive to move the price away from the prevailing market price to create an artificial arbitrage opportunity.

> In the event that the EBBO collar prevents an auction from uncrossing, the next auction is triggered which provides an immediate opportunity to form a new price that meets the requirements of the collar. However, it is worth stressing again that the uncrossing price itself is formed entirely by the auction algorithm based on the price limits on the orders in the auction.

Cboe Periodic Auctions checks all orders against the Cboe EBBO collar. Doesn't that price collar reduce the chance that the auction is useful as a tool to determine prices?

> Price collars are used in all phases of the day by many markets on many different trading mechanisms. Their purpose is to ensure orderly markets and price formation.

> Open and close auctions enact call phase extensions when collars are breached, continuous order books prevent or halt trading when collars are breached.

> The purpose of the collar in Cboe's Periodic Auctions book is to ensure that the price formation that takes place there does not create or incentivise the creation of arbitrage opportunities on the various continuous order books. This is very much like the use of the SIP consolidated tape in U.S. markets where it is not permitted to trade outside of the NBBO unless there are very specific exceptions.

Given the rapid nature of Cboe's Periodic Auctions, how is it possible for them to be price forming?

> The maximum duration of 100 milliseconds sounds like, and indeed is in absolute terms, a very short period of time. However, it must be viewed in the context of the speed at which trading platforms now generally operate in European equity markets.

> It is now possible to enter an order, have it interact with an order book and receive confirmation of what has happened within 50 microseconds, meaning that, in effect, you could adjust prices and/or trade 2,000 times on a continuous order book within the 100 milliseconds of a trade on the Periodic Auctions book.

> The frequency of the auctions is not relevant as it relates to price formation. An auction must feature a call period long enough for firms to enter orders and to react to the indicative price and volume information that is disseminated.

> Market participants can - and we have seen in our own auctions, do - react to indicative auction messages with the intent to join the price formation process. We see this when the indicative auction size published increases during the call phase of auctions.

Since Cboe's Periodic Auctions doesn't disseminate data showing auction imbalance information, even if this is entirely on one side of the book, how can it be price forming?

> This has nothing to do with price formation, it is a question of transparency, which was dealt with by RTS 1. Additionally, publishing imbalance information is not required under RTS 1.

> Price formation is the result of the interaction of orders, in the auction algorithm to create the auction price. For that to happen, participants need enough transparency to know whether or not they want to interact with an auction. The price and potential volume disseminated are sufficient to guide Participants as to whether they want to submit or adjust their orders to participate in the price formation process.

> Imbalance information could be considered additive for open and close auctions when there is a single price point being determined but it must be remembered that imbalance information is not required under RTS 1.

> The opening and closing auctions take place when other markets are closed. Providing auction imbalance information for periodic auctions while other markets are open can potentially jeopardize the participant's trading strategy.

Cboe's Periodic Auctions offers pegged EBBO midpoint order types. Isn't that essentially just the same as importing mid-point prices so making the system not truly price forming?

> Peg to mid-point orders are optional. They are a mechanism for updating a Participant's risk price at which they are willing to trade. They can additionally specify a limit price up to which this order type should be included in forming a price.

> This order type is used to provide all participants the ability to manage their risk in real-time without the need for costly and sophisticated systems to take into consideration prices on various venues trading the same security.

> Peg orders feature on all of Cboe's (and many other venues') different trading platforms, lit and dark and are an efficiency that is useful in competitive multi-platform markets.

> To argue against peg orders is to effectively argue against trading venue competition, which is a debate that was settled a long time ago.

> Furthermore, removal of pegging functionality would hand back the advantage to those firms with the fastest technology, to the detriment of smaller and less technologically advanced firms.

Cboe's Periodic Auctions offers broker preferencing. Doesn't that impact the price formation process?

> No, broker preferencing does not impact the price formation process.

> An auction match consists of price determination, followed by execution allocations.

> Broker preferencing is the (optional) first step in the allocation stage, followed by the general allocation. For price formation all orders in the book are considered equally.

What is the Marketable Order Lock feature?

> Marketable Order Lock is an optional feature that ensures marketable orders are locked in until the end of an auction even if a cancel request is received.

> With the mechanism enabled:
> - An order cancel request will be rejected with a unique text reason if an auction is active and the order is marketable in auction
> - If a cancel request is rejected and order partially executes at the end of auction, the order will then be cancelled
> - Any cancel request made when an order is not marketable in auction will be accepted and the order cancelled

An order amendment will continue to be actioned as normal.

Execution Allocation

How does the Execution Allocation process work? How are orders allocated?

> Execution allocations take place on a Price x Volume x Time basis. Market orders will be deemed to have the highest Price priority, meaning they will be allocated first at the equilibrium match price.

> Brokers can optionally choose broker preferencing attribute, which provides priority in the execution allocation phase.

Broker Priority/Preferencing

What is broker priority or broker preferencing?

> Broker priority is a function that allows orders to match with other orders from the same broker ahead of similarly priced orders from other brokers, before time priority is considered.

Why does Cboe offer broker priority on Periodic Auctions?

> Allowing for broker priority enables brokers to minimise clearing and settlement costs when they happen to be on both sides of an auction.

> Broker preferencing is a market construct that has been used for years on other lit markets in Europe, so it's a functionality that the market has long been familiar with.

> The broker preferencing functionality only comes into play during the execution allocation process and has no impact on the auction price formation process, which takes into account all orders in the book.

What percentage of Cboe Periodic Auctions volume is broker preferenced?

> Up-to-date metrics are available on the Cboe website.

Is broker preferencing enabled for all brokers?

> No, broker preferencing is an opt-in feature.

Are participants able to submit pre-matched/pre-arranged trades to the Cboe Periodic Auctions book?

> There is absolutely no facility to guarantee "pre-matching" of broker preferenced orders in the Periodic Auctions book.

> Market participants cannot guarantee an order price or execution in the auction and any buy and sell orders must be submitted individually and thus are at risk of being in separate periodic auctions.

How exactly does Broker Preferencing work on the Cboe Periodic Auctions book?

> Participants are able to select a Broker Preferencing attribute at a port level where orders submitted to the Periodic Auctions book will be executed in priority against each other at the Execution Allocation phase.

> At the end of the auction call period, once the equilibrium price has been determined for the maximised volume and data disseminated, the Execution Allocation takes place.

> Broker Preferencing will take effect at the Execution Allocation point and will move the allocation priority from Price x Volume x Time to Broker x Price x Volume x Time for all orders submitted with this attribute.

> Broker Preferencing orders will be uncrossed starting from the non-surplus side, at the equilibrium price and within the indicative volume previously disseminated.

Order Entry

Is Minimimum Acceptable Quantity (MAQ) supported?

> Yes, MAQ gives participants control over the minimum total execution size of their order. Orders with MAQ designated do not execute unless the minimum quantity or greater can be fulfilled.

Will any information derived from my order be disseminated in Auction Updates on the data feed if the executable quantity is less than my specified MAQ?

> No, only the executable quantity of an auction is disseminated. If there is insufficient contra volume to satisfy a MAQ on an order then that order is not considered for execution (at that time) and so will not contribute to any calculated indicative executable volume in auction update messages.

Can orders be updated or cancelled during the auction?

> Yes, orders can be amended and cancelled throughout the auction.

Market Data

What information is disseminated on the public market data feeds during each periodic auction cycle?

> The indicative price and executable volume are published to the market. You only know what is executable when there is a match. Nothing is disseminated for a one sided or unlocked book. Additionally:
> - If the execution price falls outside of the EBBO check, the indicative price and volume are blanked and an "Outside Tolerance" flag is populated. Therefore there is no leakage of direction if the auction price deviates from the EBBO constraints.

When will the Auction Summary message be published?

> On BXE, the Auction Summary message will only be published at the end of the auction phase, if the auction executes volume. Auctions with zero executed volume will not generate an Auction Summary message.

> On DXE, the Auction Summary message will be published at the end of the auction phase, if the auction executes volume. If no execution takes place during the auction, an Auction Summary message will still be published. Price will be 0; Shares will be 0.

What will the frequency be at which Auction Update Messages will be published?

> An indicative auction update will be published each time the indicative auction value or executable volume changes. If there is no executable volume then no auction update messages shall be disseminated.

> Cboe will only publish zero values in the 'Indicative Price' and 'Indicative Shares' fields to indicate a change to the indicative auction value or executable volume.

Will market data depth be available during auctions?

> No, the order book will not be disseminated. Only the indicative auction price and executable volume will be disseminated via the Auction Update message.

Which MMT flags are present on Periodic Auction executions?

> Periodic Auction executions are flagged as Central Limit Order Book and Scheduled Intraday Auction.

Is market data for Periodic Auctions be published down a new feed?

> No, all Periodic Auction market data is published over existing BXE or DXE feeds.

Additional Questions

How is Periodic Auctions different than a dark pool?

> Dark MTF venues utilise the reference price waiver, which provides an exemption from pre-trade transparency. Cboe's Periodic Auctions book provides pre-trade transparency in accordance with RTS 1 in MiFID II and so does not require a waiver.

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