

The background of the top half of the page is a dark blue and black image featuring various financial data visualizations. On the left, there's a green diagonal line. The background includes a grid of blue squares, a candlestick chart with green and yellow bars, and several line graphs in blue and orange. Binary code (0s and 1s) is scattered throughout the scene.

Equity Market Resilience

Recommendations to Improve Market Resilience to Venue Outages

In partnership with:



Table of Contents

Introduction.....	3
Primary objectives of this proposal:	3
Acronyms used	3
Guiding Principles.....	4
Key Stakeholders and their Roles.....	4
Specific Recommendations	5
Trading Venues Experiencing an Outage.....	5
Definition of an Outage.....	5
Communication during an Outage.....	5
Enabling market participants to trade elsewhere	5
Enabling trading to be resumed on the venue that has experienced an outage.....	6
Outages impacting the ability to operate an Opening, Derivatives Expiry or Closing Auction.....	6
Other Venues.....	6
Regulatory Considerations.....	7
Market Data Vendors & CT Operators.....	8
Trading Venue Members.....	8
Index calculators	8
Derivatives exchanges	8
Feedback on Common Outage Scenarios	9
LV outage Pre-Open.....	9
LV outage post-Open, but unlikely to impact the Close	9
LV outage impacting the Close.....	9
Conclusions	9
Appendix 1 – 2020 Listing Venues Outages.....	10

Introduction

Technical outages at stock exchanges (see Appendix 1) are a reasonably regular occurrence and largely inevitable. They have been highly disruptive, particularly when experienced by national stock exchanges (Listing Venues, or “LV”), which facilitate trading in the stocks they list and are also the sole operators of official opening and closing auctions for those stocks. Such Listing Venue outages (“LV outages”) in recent years have seen market-wide trading in instruments listed on those exchanges dry up to almost nothing, with knock-on disruption to the pricing of indices and derivatives.

Given the presence of well-established pan-European trading venues that support continuous trading in the affected instruments, offer the same or broader trading functionality and have most of the same brokers and market makers connected to them, this tendency for trading to dry up is both surprising and frustrating to market participants – especially when the US market appears largely resilient to such outages. Most market participants substantially attribute this greater resilience to the existence of the Consolidated Tape in the US markets.

LV outages during official opening and closing auctions are especially problematic due to the lack of alternative/competing mechanisms, and to the importance of auction prices (in particular the Closing auction) to fund and ETF benchmarking.

This situation weakens the overall resilience of the European market as LVs remain single points of failure, vulnerable to accidental technical outages and other threats such as cyber-attacks.

It is clear that a European Pre-Trade Consolidated Tape (“CT”) would materially improve market resilience. In the absence of such a CT, Cboe Europe and Aquis Exchange were asked by banks, brokers, the buy-side, market makers and their respective trade bodies across Europe to examine this issue and identify additional measures to improve resilience. The European Securities and Markets Authority (ESMA) and the UK’s HM Treasury have also both sought industry views on this topic in recent consultations.

Having consulted with our stakeholders we set out below a proposed framework to improve market resilience.

Primary objectives of this proposal:

- To improve the resilience of European (including the UK) equity and equity-linked markets through industry-led changes supported where necessary by regulatory guidance;
- To outline the creation of a minimum set of incident management standards for all venues, (particularly relating to communications, fair treatment, and the provision of market data), designed to provide market participants, investors and issuers with more certainty and the confidence to continue trading.

Acronyms used

CT – Consolidated Tape

EDSP – Exchange Delivery Settlement Price

LV – Listing Venues – typically national stock exchanges

MRM - Most Relevant Market (as defined in MiFID II)

MTF – Multilateral Trading Facility

SI – Systematic Internaliser

Guiding Principles

This proposal is informed by the following principles:

- In the face of a venue outage, and that of a LV in particular, it is preferable for trading to continue uninterrupted on alternative venues than for trading to halt and a mechanism be required to restart it;
- To enable the market to continue functioning in the event of an outage, it is essential to provide all market participants (including institutional investors without a direct relationship with the venue experiencing an outage) with certainty about the status of their orders/executions. This will require venues to:
 - Have pre-defined incident management procedures designed to deliver that certainty at the point of an outage, or as soon as practically possible;
 - Ensure that communications relating to outages are frequent and publicly available;
 - Have a standardized process for re-commencing trading on their venue, including standardized criteria and notice periods for the resumption of trading, and a process that does not undermine broader market resilience.
- In the absence of a pre-trade Consolidated Quote system in Europe, venues need a common approach to ensure that, during an outage, they do not disseminate stale or erroneous market data that would be disruptive to the ability of participants to continue trading on alternative venues;
- In circumstances where an Auction mechanism on an alternative venue is required (either to start/restart trading, or to generate an official Opening or Closing Price), market participants will need certainty as to which venue would be responsible for hosting that Auction;

Key Stakeholders and their Roles

Whilst much of the responsibility for improving overall market resilience lies with the venue experiencing an outage, it is important to recognise all of the stakeholders which have a part to play in improving our collective situation.

- Trading Venues must develop and follow incident management processes designed to encourage broader market resilience as discussed in detail below;
- Regulatory supervision could be extended to include the effectiveness of incident management processes developed by venues, and, alongside other planned reviews of the regulatory framework, regulators could conduct a wider review of aspects of regulation that exacerbate the potential for LV venues to be a single point of failure in the ecosystem;
- Brokers and market makers must ensure that they are connected (directly or indirectly) to alternative venues and their supporting post-trade infrastructure providers, that they are transparent with clients about how they manage outages, and that they are able to participate in alternative auction events (should they be introduced);
- Market data vendors and Consolidated Tape providers must have processes in place to suppress data from venues that are experiencing outages, to avoid onward dissemination of erroneous market data;
- Index calculators and derivative exchanges must ensure that, in the event of an outage, they can continue to calculate and/or publish benchmark/EDSP levels based on constituent prices drawn from alternative venues, whether by leveraging a Post-trade Consolidated Tape (if and when introduced) or by having arrangements to source prices directly from alternative venues;
- Buy-side firms should be clear in their expectations of their brokers in these scenarios.

Specific Recommendations

Trading Venues Experiencing an Outage

Definition of an Outage

All trading venues should have a defined and publicly communicated policy where the inability to trade by a significant proportion of trading participants, or an inability to distribute timely and accurate market data renders the market unfair or disorderly, and therefore constitutes an outage.

Communication during an Outage

All trading venues should adhere to a set of minimum standards for the handling and communication of such outages. These standards should include:

- A policy of communicating immediately if a potentially disruptive incident is detected or suspected, including the treatment of executions and open orders;
- A publicly accessible website through which notifications of incidents can be disseminated in a standardized and machine-readable format, and through which the timeline of current and historical incidents can be reviewed;
- The publication of all such notices in local language (if applicable) and in English;
- An opt-in system via whereby trading venues members and the public can elect to receive electronic alerts if a new incident is detected;
- A “conference call bridge” for the duration of the outage, open to all member firms, market data vendors, CT providers and CCP’s;
- A responsibility to provide periodic updates, no less frequently than every 30 minutes during market hours and every hour outside of those times;
- Introduction of a new ‘Market Outage’ phase status, to be disseminated on market data feeds and via public information streams (e.g. website, text alerts), indicating that the market is experiencing an outage, and that market data quotes and updates should be disregarded by participants and all market data vendors.

Enabling market participants to trade elsewhere

To ensure market participants have the certainty and confidence needed to continue trading on other venues, those venues experiencing an outage should:

- Immediately cancel all open Day orders (GTC orders may be cancelled/retained according to the preference of members), and if unable to immediately do so, confirm to participants that they can unilaterally mark orders as cancelled;
- Where an outage may have resulted in erroneous orders/trades requiring cancellation, immediately communicate a last-known order-processed and trade time, after which participants can assume any subsequent orders submitted and executions received will be cancelled;
- Reject all new orders for the duration of the outage;
- Unless able to communicate via a trading phase indicator on the market data feeds that the market is in an outage state, disable further market data dissemination, and ensure the outage phase indicator is publicly disseminated via other means.

Enabling trading to be resumed on the venue that has experienced an outage

To ensure an orderly re-commencement of trading on its venue following an outage, the venue experiencing an outage should;

- If the venue has been unable to do so previously, perform an order-book clear down (cancelling all open orders except GTC orders) to provide clarity to participants on the status of their orders and the make-up of the order book more generally;
- Consult all member firms, or as many as practical, on their readiness prior to any decision to resume trading, and confirm that the proportion (by number and volume) meets the venue's defined criteria for a fair and orderly resumption of trading;
- Provide all market participants with a minimum 30 minutes notice of intention to resume trading;
- If essential to resume trading via an auction; In recognition that entering a pre-Opening auction phase may in itself disrupt trading on alternative venues, limit the duration of any such pre-opening phase to the 15 minutes prior to the scheduled resumption of trading.

Outages impacting the ability to operate an Opening, Derivatives Expiry or Closing Auction

Given the sole reliance on LVs for opening, derivatives expiry and closing auctions, and the importance of auctions to fund and ETF benchmarking, measures should be implemented to improve resiliency in this area.

It is common in such circumstances for LVs to declare their Last Trade price (prior to the outage) as the official Closing Price for the day. However, this approach eliminates the price formation that is necessary to establish a fair Closing price essential to fund valuations, and also discourages participants from continuing to trade on alternative venues.

Subject to further public consultation with regulators and market participants around the preferred approach and the process by which these could be established, these measures could include:

- LVs establishing arrangements with another venue(s) to operate a back-up auction where necessary, and/or
- Regulators designating alternative venue(s) to operate auctions in the event of LV outages impacting their ability to do so.

Assuming adoption of a mechanism to support an alternative provider operating the auction, then where a LV is in an outage state within 20 minutes of the official close, the LV would relinquish their responsibility to run a closing auction and pass that responsibility to the designated backup market.

Other Cash Equity Venues

To ensure continuity of trading on alternative venues during LV outages (including for the trading of derivative contracts), the following options should be considered:

- Introduction of a set of protocols for alternative venues to adopt during a LV outage, such as the use of tighter price collars, at least initially, with a view to providing market users with the confidence they need to continue trading. This would be similar to the Limit Up/Limit Down construct used in US equity markets to ensure orderly trading; and/or
- Where deemed necessary (e.g. to generate a Closing Price or EDSP), one alternative venue should hold a price forming auction with a call period duration of at least 30 minutes.

To support resilience of index calculations during an LV outage (or outage of another venue contributing prices towards calculation of an index):

- Venues whose data is not routinely used for calculating the impacted indices or EDSPs should be required to allow their data to be used free of charge for the specific purpose of ensuring continuity of index/EDSP calculation.

Regulatory Considerations

Whilst we believe it should primarily be the responsibility of market participants to agree upon and implement minimum standards in the event of outages, it is important that the regulatory framework is also supportive of such standards.

The following areas are where regulatory guidance or action could be supportive to improving the resilience of Europe's equity markets to technical outages:

- A realtime pre- and post-trade **European Consolidated Tape** would ensure that market data from the full range of European equity execution venues is easily accessible to all types of investors and intermediaries. To that end:
 - CT operators could be assigned responsibility and authority to designate a venue's data as suspect/erroneous, and to remove that venue's market data from the consolidated feed;
 - By leveraging a CT for essential "market status" information, brokers would be less dependent on the LV for this information, and hence better able to continue trading on alternative venues during an LV outage.
- Supervision of the **effectiveness of outage protocols developed by Venues** to ensure they seek to enhance broader market resilience and adhere to the recommendations laid out in this document;
- Requiring venues to publish **annual documentation on their infrastructure resilience model**, including identification of any trade-offs between system performance and resilience;
- **Curtailing reliance on the Most Relevant Market (MRM) concept:**
 - The MRM concept has been a successful component in driving standardisation of tick sizes across venues and should be retained for that purpose;
 - However, in other contexts we believe the MRM concept exacerbates the single point of failure; by requiring use of the MRM BBO for Reference Price Waiver (RPW) venues, SI-quoting and other uses, regulation has driven an over-reliance on LV market data and trading phase/status;
 - Instead, RPW venues and SIs should be able to derive a reference price from a CT (once available), or absent a CT from any venue(s) that offer(s) best execution – either on a permanent basis or specifically in the event of a LV outage.
- **Amendment or removal of rules requiring exchanges to resume trading within a maximum timeframe** of a disruptive incident:
 - We believe this obligation is unnecessary (because venues will naturally seek to restore service as soon as possible) but also counterproductive; as it creates an incentive for venues to resume trading at an arbitrary point in time, even if there are still system issues or if a material number of participants are unable to connect/trade;
 - An alternative would be to require venues to compensate market participants for outages through a rebate of membership, trading, data and connectivity fees for any week in which an outage occurs. This would strengthen incentives to avoid outages (through improved resilience) whilst leaving venues to focus on resuming trading in the most responsible manner.
- Mandating Index providers and derivatives exchanges to have **resilience in sourcing prices and index/EDSP computation:**
 - Confirming the conditions to be met when using alternative prices to calculate benchmarks and indices with a view to providing administrators with the confidence to source alternatives;
 - Ensuring that, in the event of an outage impacting the primary source, that data from alternative venues is freely available for the purpose of ensuring continuity of index/benchmark/EDSP computation.
- **Defining a new regulatory-defined group of alternative auction venues**, designated to handle auctions in the event of a LV outage at the Close and recognised as the producer of the Official Closing Price to ensure resilience and transparent formation of essential benchmark prices in such circumstances.

Market Data Vendors & CT Operators

Market data vendors and CT operators must have processes in place to avoid onward dissemination of erroneous market data, including:

- Subscribing to available venue outage-notification systems/services and participating in relevant incident teleconferences to help collect and disseminate venue outage information;
- Introduction of a standardised Market Technical Outage trading phase indicator across all European venues so as to avoid erroneous dissemination of a market phase indicator that signals the exchange is open/opening during an outage;
- Implementing processes to detect and designate a venue's data as stale/erroneous in a timely fashion (e.g. through detection of sustained crossed prices with other venues, and of elapsed time since last updates), and a process to immediately thereafter suppress erroneous/stale data from a venue experiencing an outage from the vendor's data feed.

Trading Venue Members

Brokers should be transparent with their customers about their ability to continue trading during an LV outage: Brokers' Order Execution Policies should be enhanced to outline:

- Whether a broker can continue trading on alternative venues during a LV outage, and whether this is a default behaviour or is subject to a client opt-in;
- Whether a broker is able to participate in an alternative venue auction if necessary.

Index calculators

In the event of a LV outage, index calculators should be encouraged to have arrangements in place to calculate and publish index prices based on constituent prices drawn from alternative venues, and should:

- Make public a clear methodology (across all cash equity indices) for sourcing constituent prices, indicating whether one/multiple prices sources are utilised during continuous trading, and a fallback plan in case the LV is unavailable during continuous trading and/or for a Closing Auction;

Where an index calculator elects to use price data from alternative venues *only* for the purpose of ensuring continuity of calculation during an outage on the venue from which prices would otherwise be sourced, the alternative venues should be obliged to offer their data license free for that limited purpose in order support development of a more resilient market.

Derivatives exchanges

In the event of an outage impacting the primary source of market data for the EDSP, derivatives exchanges should be encouraged to have arrangements in place to calculate and publish EDSPs using constituent prices drawn from alternative venues, and should:

- Make public, as part of each derivative contract's definition, a clear methodology for sourcing EDSP constituent prices, indicating whether one/multiple prices sources are utilised, and a fallback plan in case the primary source is unavailable during an expiry event.

Where a derivatives exchange elects to use constituent price data from alternative venues *only* for the purpose of ensuring continuity of calculation during an outage on the venue from which prices would otherwise be sourced, the alternative venues should be obliged to offer their data license free for that limited purpose in order support development of a more resilient market.

Feedback on Common Outage Scenarios

LV outage Pre-Open

Pre-Open outages are the most common, typically arising due to overnight infrastructure or software changes:

- Due to the presence of overlapping limit orders, a volume-maximising auction is required to find a fixing price and ensure an orderly market ahead of the commencement of Continuous trading;
- If the LV is unable to open, then it may be necessary for an alternative venue to operate such an auction;
- The design of an auction on an alternative venue could mirror that operated by LVs with a longer call-period and with standardised time extensions for volatility adjustments;
- Ahead of its introduction, regulators could consult market participants (banks, brokers and institutional investors in particular) on their support and readiness for such an alternative auction.

LV outage post-Open, but unlikely to impact the Close

In the case of LV outages during the trading day, but sufficiently early to be unlikely to impact the Closing Auction, market participants would prefer trading to continue uninterrupted on alternative venues, rather than for trading on alternative venues to halt and then require a recovery auction mechanism for to resume.

LV outage impacting the Close

Outages impacting the ability to operate a Closing Auction are the most disruptive due to the dependency on official Closing prices for fund and derivative benchmarking, and due to the absence of competition/alternatives:

- It is common in such circumstances for LVs to declare their Last Trade price (prior to the outage) as the official Closing Price for the day. This approach eliminates the price formation that is necessary to establish a fair Closing price essential to fund valuations, and also discourages participants from continuing to trade on alternative venues;
- Another approach would be for a Closing Auction to be held on an alternative venue, applying the mechanisms proposed above for market opening;
- Ahead of its introduction, regulators could consider whether to consult market participants (banks, brokers and institutional investors in particular) on their support and readiness for such an alternative auction.

Conclusions

Europe's equity market structure has made significant strides forward over the last decade, by introducing the foundations for competition, lowering explicit trading costs and offering choice to market participants and end users. However, a conspicuous flaw that remains is the limited resiliency to LV outages. Given the presence of alternative venues which continue to function during these outages, it is in the interests of all market participants to solve this issue. In the absence of a Pre-Trade Consolidated Tape, we believe the measures laid out in this document would contribute to improving the overall resiliency of the equity market.

Appendix 1 – 2020 Listing Venues Outages

- 14 April:** Deutsche Boerse outage affects trading in German equities and derivatives. Several other smaller European exchanges which use Deutsche Boerse technology were also impacted.
- 1 July:** A second Deutsche Boerse outage affects trading in German equities and derivatives for several hours. Several other smaller European exchanges which use Deutsche Boerse technology were also impacted.
- 25 August:** The New Zealand Stock Exchange (NZX) suffered a three-day outage following a distributed denial of service (DDoS) attack.
- 1 October:** The Tokyo Stock Exchange (TSE) experiences a full day outage caused by a software issue.
- 19 October:** Euronext, the operator of several European stock exchanges, suffered an outage which also affected the closing auction process.
- 16 November:** The Australian Securities Exchange (ASX) suffered an all-day outage following a software fault.