LME
An HKEX Company

Working Paper – LME Daily Price Limits

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1 The LME daily price limits

1.1 Background

The LME introduced daily price limits for its physically-deliverable base metals contracts on 16 March 2022. Further detail can be found in LME Notices 22/064 and 22/067. The drivers to adopt these daily price limits included the volatility in base metals, and market participant concerns, in light of the geopolitical backdrop at that time, regarding the risk of sudden, extreme price moves.

The LME believes that the introduction of daily price limits has provided additional protection against significant price moves that may be indicative of market distortions, particularly in extreme conditions. Daily price limits will therefore remain a permanent feature of the LME market[1].

1.2 Changes to the daily price limit levels

Any change to the daily price limit levels, or the contracts to which the daily price limits apply, will continue to be announced to the market by Notice under the LME's current arrangements.

1.3 Disruption events

As part of the implementation of daily price limits, the LME considered the potential implications of a price discovery event being impacted as a result of prices being restricted by the daily price limits. The LME therefore introduced the Disruption Events framework, detailed in Notice 22/092.

Broadly, this framework establishes the scenarios in which price discovery is "disrupted" for the Official Prices or Closing Prices. The procedures supporting this framework include informing the market via Notice and updating the relevant section of the LME website so it is clear a Disruption Event has taken place. The Disruption Event framework applies more broadly than just to the impacts of daily price limits and also covers scenarios in which the market is suspended in a way that may impact discovery of reference prices.

In terms of Disruption Events driven by daily price limits, in summary, the framework defines the relevant scenarios as those where the daily price limits impact the ability of market participants to appropriately hedge during the relevant price discovery window.

For the Official Prices, which are widely used in physical metals supply chains and in averaging contracts on and off exchange, it is important to consider the potential impact of Disruption Events on how participants trade and manage risk, in order to minimise any negative risks to liquidity that may arise from the Disruption Event. In this regard, for the Monthly Average Settlement Price ("**MASP**") and Notional Average Price ("**NAP**"), which are used for settlement of and margining for the LME Monthly Average Futures ("**MAFs**") and Traded Average Price Options ("**TAPOs**"), the LME defined a process by which, if there was a Disruption Event for the Official Prices, the averaging prices would use the next available non-disrupted Official Price so that those targeting the monthly average are still able to hedge.[2]

In configuring and calibrating volatility controls there is inherently a balance between applying restrictive controls that impact price discovery and, conversely, having less restrictive controls which could allow market distortions to significantly impact prices.

[1] Subject to any future evolution that the LME may consider necessary or desirable in the future.

[2] See Notice 22/092 for detail on where a Disruption Event occurs on the last business day of the month.

1.4 The continuing need for daily price limits

The LME is of the view that the daily price limits remain an effective control in relation to the LME's physically-deliverable base metal contracts, to protect against the potential impacts of market distortions that could lead to disorderly markets. Following their implementation in 2022 the daily price limits have operated effectively and will remain a permanent feature of the LME market (subject to future desirable evolution).

As outlined in the Action Plan the LME will look to further enhance transparency around the operation of the full suite of volatility controls (with this working paper being a key first step in that process).

1.5 Other volatility control mechanisms

In addition to daily price limits, there are other intraday volatility controls that exchanges can utilise. One common control is a dynamic circuit-breaker, which establishes a channel in which the market can trade, updating this over time (such as with an hourly look-back) so that the market cannot move beyond a certain distance within a certain time-frame. Under a typical circuit-breaker arrangement, any trade outside of the channel causes the market to move into a "halt" state (where no trades are matched) for a short period.

There are positives and negatives in operating a circuit-breaker type control. Halting the market via a circuit breaker may give participants time to consider their orders and react to information. However, it also means that trades cannot be executed for the duration of the trading halt, which necessarily impacts risk management and can leave participants exposed to risks arising from, or related to, their current positions, by restricting their ability to execute further trades. This issue is noted by the IOSCO Report on Trading Halts and Market Closures[3], which states: "*Moreover, there are potential costs to trading halts. For example, they may delay the price development process (if fundamental information arrives during the interruption), and/or increase volatility".* While some people argue that circuit breakers can give participants time to think about their activity, which can avoid overreactions and panic, others argue that circuit breakers lead to orders being pulled and liquidity being reduced, which can ultimately lead to price distortions and increased volatility.

The LME understands that many peer commodities futures markets operate either a daily price limit or a type of dynamic circuit breaker. Some comparable commodity markets operate intraday circuit breaker type controls which can reset multiple times in a day; this allows potentially large daily price moves to occur.

Accordingly, the LME is comfortable with the current configuration of operating a daily price limit. This could be considered to be more conservative than many peers in terms of the total daily price moves that can occur.

The LME will, as a matter of course, keep under consideration whether it would be appropriate to supplement its daily price limit with additional intraday volatility controls and if so, what the specification of such any such controls should be. This includes whether any such intraday control should include a trading halt (circuit-breaker) or simply limit trading in line with an intraday price collar that periodically updates a reference price during the day.

The introduction of an additional intraday control may give the LME more configuration options for the exact combination of controls, and could support the widening of the daily price limits on certain contracts. However, based on the geopolitical environment and the specific factors impacting the LME's physically-delivered base metals at present, the LME would not look to remove the daily price limits, even if such additional controls were in operation, because the daily price limits remain an effective control which positively contribute to the LME markets.

In considering the potential introduction of any additional intraday control in the future, the LME may choose to reassess the calibration of its other existing controls.

[3] https://www.iosco.org/library/pubdocs/pdf/IOSCOPD138.pdf

2 Calibration of the daily price limits

This section details the key factors to be considered when calibrating the daily price limits and outlines the proposed calibration methodology the LME intends to move to.

2.1 Background

The initial calibration of the daily price limits in March 2022, was focused on analysis of the historical volatility of each of the contracts for which the limits were applied. This analysis focused on assessing what limit levels could reasonably be applied to prevent excessive price moves that may be indicative of potential market distortions, without overly restricting the price discovery process and while still allowing for orderly trading in one direction where new information or supply and demand dynamics lead to a sustained change in fair value.

The LME has continued to develop its thinking, following the implementation of daily price limits and informed by ongoing monitoring of their performance, and intends to move to a new methodology incorporating a number of additional factors when assessing the appropriate limit levels. This paper explores some of those key factors and proposes an enhanced methodology which supports more granularity in the calibration across different metals.

At the date of this paper, the LME believes that the current calibration of the daily price limits is effective. However, the LME intends to move to the new enhanced methodology in Q2 2023. This will provide a more granular calibration across different metals The LME will continue to periodically review the limit levels, with any changes communicated via market Notice.

2.2 Key factors in calibrating the daily price limits

There are a number of regulatory requirements that trading venues need to consider when calibrating volatility control mechanisms. The LME has taken into consideration all relevant regulatory requirements applicable to it, as well as relevant global standards, in determining the intended methodology. The purpose of this paper is not to provide an analysis of how the LME meets such regulatory requirements and global standards, and this paper does not do so. The focus of this paper is rather to give market participants an overview of the key factors that the LME considers should be included in the calibration methodology.

2.2.1 Volatility

It is important to note that it is not the purpose of daily price limits to constrain or reduce the inherent volatility of contract prices, but rather to protect against significant price moves that may be indicative of market distortions. Therefore, daily price limits for contracts that display generally higher price volatility will normally require wider (ie less constraining) price limit levels to avoid unwanted interference with price discovery.

2.2.2 Liquidity

The liquidity of the instrument is another important factor in determining the optimal levels for the daily price limits. In general, tighter price limits are more appropriate for more liquid instruments, whereas less liquid instruments generally necessitate wider parameters to enable orders to be entered and so as not to impact price discovery. The relevant guidance from the European Securities and Markets Authority makes this clear: *"Trading venues should in particular have tighter parameters for instruments considered to be liquid. The calibration should accommodate subscription rights and instruments with low quotation levels by allowing broader parameters"*[4].

[4] https://www.esma.europa.eu/document/guidelines-calibration-circuit-breakers-and-publication-trading-halts-under-mifid-ii-0

2.2.3 The potential magnet effect

Another factor that requires consideration is the fact that daily price limits themselves can lead to more volatility if they are too narrowly calibrated. The so-called “magnet effect” describes situations where traders may rush to execute trades as prices approach the limits, which can lead to an increase in volatility as prices move further or faster because of the existence of price limits. It is therefore important to be aware of this potential unintended impact when calibrating controls and to allow some buffer or tolerance to avoid such impacts. It is noted that there are mixed views in the market and within academic literature on the role of the magnet effect, but it is generally acknowledged as a relevant consideration in the design and operation of volatility control mechanisms.

2.2.4 Consistency and simplicity vs granularity

There is an inherent balance between having a more granular (and therefore more complicated) calibration of daily price limits, and having a less granular approach which has the benefits of simplicity and ease of understanding for participants active on the LME market. On many exchanges, across a number of asset classes, simplicity and standardisation is preferred, with one level applied to volatility controls across a number of instruments rather than a complex set of individual calibrations per instrument. An exchange could adopt a very granular approach, where limits are re-calibrated for each metal on a monthly basis, and where limit values may be calibrated to a number of decimal places. Alternatively, in line with the current LME calibration and many peer exchanges, a more standardised level could be applied across multiple instruments. The LME intends to calibrate a separate limit for each applicable contract, taking into account relevant contract characteristics such as historical volatility and other relevant factors. As part of the calibration process, the LME will also factor in operational and other relevant considerations from an exchange and market participant perspective.

2.2.5 Interaction between overlapping volatility controls

The combined effectiveness of all volatility control mechanisms in place for a given instrument is also a factor in calibrating each individual control. For example, if an instrument has a very stringent intraday price collar, this may limit the risk of certain types of potential price move and therefore support a wider daily price limit calibration.

2.2.6 Controls in place for similar contracts on other trading venues

Another consideration is what controls and what parameters are in place on other relevant trading venues that might impact activity on the LME market for a given instrument. This will not be a principal driver of the LME levels but, because there are potential negative impacts where different venues have different parameters, it will be considered when assessing any changes to the daily price limit levels.

2.3 Proposed calibration methodology for the daily price limits

This section provides an overview of the proposed daily price limit calibration methodology the LME intends to move to by the end of Q2 2023, taking into consideration the key factors outlined in section 2.2. Please note that parameters shown in this paper are purely illustrative; the exact specification of the proposed methodology is subject to change and, in line with peers, the LME does not intend to publish externally the full set of parameters and inputs used in its calculation.

The LME also reserves the right to modify or further enhance the calibration methodology and the processes surrounding it, in line with its regulatory obligations. Any changes to the daily price limits levels will be communicated to the market via Notice.

2.4 *Objective of the calibration*

The daily price limits aim to protect against significant price moves that may be indicative of market distortions, while minimising the impact on fundamental price discovery. The purpose of the daily price limits is not to reduce volatility in the underlying metal, however having a fixed daily price limit does restrict the potential future volatility of an asset. The proposed methodology therefore uses historical intraday price data to support the appropriate calibration while reducing the risk of the limits impacting the inherent volatility of each metal.

2.5 *Review process*

The LME Trading Operations team will review the daily price limits at a fixed frequency[5] as well as on an ad-hoc basis where specific circumstances warrant additional review (including, for example but not limited to, the daily price limits frequently being hit (which may indicate that they are calibrated too narrowly) alongside other scenarios such as a fundamental change in volatility or liquidity that warrant a review).

2.6 *Quantitative analysis*

The LME will initially consider each metal individually in assessing the optimal calibration, and will then look at the levels across all metals.

The LME will use a number of key historical datasets in the assessment to support the optimal calibration of the daily price limit levels. This includes (but is not limited to) intraday high, low, close data for each metal over a range of lookback periods.

The LME's analysis to date shows that for most base metal contracts the maximum price deviations from the previous night's closing price are not "normally distributed" (in quantitative analytical terms), and demonstrate a high prevalence of extreme events (high kurtosis). However, there is generally not a large amount of skew in the distribution, and therefore the LME deems it appropriate to consider absolute deviations from the previous Closing Price in some of its analysis.

The LME intends to use a combination of data on the magnitude of high percentile moves (eg, 95th, 99th, 99.9th percentile) when calibrating the daily price limits. In its analysis, the LME has compared the historical intraday price moves to volatility levels in certain longer time horizons. In this analysis, the intraday data appears to exhibit some mean-reverting excess volatility vs longer time horizons, supporting the view that daily price limits would not inadvertently suppress fundamental volatility as long as a sufficiently high percentile absolute price move is selected.

When using historical data for time periods during which daily price limits were in place, the LME is aware that the dataset is impacted by the existence of the limits which could create a misleading impression that the market is fundamentally less volatile. For this reason the LME will consider other metrics that it deems valuable, such as changes in lower percentiles and historical daily volatility. This approach will be taken forward, due to the now permanent[6] existence of the daily price limits in LME markets.

The LME will also consider the overall liquidity in each metal when assessing the application of statistical analysis. For example, for some very low liquidity contracts there is very little intraday activity and any calibration needs to accommodate moves that can occur when new interest comes to the market after a long period of no activity.

2.7 *Qualitative overlay*

The fundamental purpose of the daily price limit is to protect against significant price moves that may be indicative of market distortions. This does not mean that the daily price limit calibration should attempt to deterministically predict the exact maximum reasonable daily price move per metal. The LME is also aware of

[5] The periodic review frequency is defined internally.

[6] Subject to any future evolution that the LME may consider necessary or desirable in the future.

the potential for daily price limits themselves to increase volatility when calibrated too stringently: the so-called "magnet effect" described in section 2.2.3. Therefore, given the market benefit of a simpler set of limits, the LME will round the limit levels for each metal as deemed appropriate (e.g. upwards to the nearest 2%, 3%, 5% or otherwise).

The LME is also conscious of the benefits of simplicity for market participants in the application of such limit levels. Many peer markets apply one standard limit level across multiple products. The LME will therefore consider the limit levels of other metals when assessing the potential recalibration of any limit level for a specific metal. Practically, the LME will apply some tolerance when balancing the benefits of simplicity versus granularity.

As stated at paragraph 2.2.6, the LME is aware of the potential impact of other markets. While it is not a primary driver in calibrating the limit levels, the LME will consider the effect where other relevant markets calibrate their volatility control mechanisms in different ways.

2.8 *Expert judgment*

The LME reserves the right to set the daily price limits at levels that are different from the levels which the statistical analysis would suggest should the LME deem it to be in the best interests of the market. For example the LME takes into account historical data analysis, but where this would result in a calibration that is too restrictive for current market conditions, taking into account current macroeconomic factors and other relevant information, the LME may set a different limit.

2.9 *Illustrative output of the proposed calibration methodology*

The following table provides an illustrative view of the outcomes of the calibration methodology discussed in this paper, if the methodology were to be applied in its current form as at the date of this paper. This takes into account the quantitative analysis and qualitative overlay. **This information is purely illustrative and has been set out in this paper to provide readers with a gauge as to indicative daily price limit levels based on the application of the enhanced calibration approach described in this paper. The methodology remains subject to further development by the LME**. Once any changes to the methodology have been adopted, the LME will formally communicate any revisions to existing limit up / limit down settings to the market by Notice.

Metal / Contract	Limit up	Limit down
Aluminium outrights	12%	12%
Copper outrights	12%	12%
Zinc outrights	15%	15%
Nickel outrights	15%	15%
Lead outrights	15%	15%
Tin outrights	15%	15%
Aluminium Alloy outrights	15%	15%
NASAAC outrights	15%	15%
Cobalt outrights[7]	15%	15%

[7] Physically delivered cobalt and cash settled cobalt, as per LME Notice 22/099 the daily price limit applies to both to ensure consistency across the two cobalt contracts

3 Next steps

The LME will continue to regularly review the calibration methodology of all of its volatility control mechanisms and to consider relevant enhancements to the calibration methodology and procedures, where deemed beneficial (including ad-hoc reviews in certain circumstances). As outlined in section 2.2 above, the LME intends to move to a new calibration methodology for daily price limits that includes the additional factors outlined and other factors should it deem them relevant. The LME intends to move to this methodology by the end of Q2 2023, and will inform the market via Notice in due course.

The LME will also continue to assess the full suite of volatility control mechanisms and to consider whether additional controls may provide additional protection without leading to negative unintended consequences in terms of liquidity and price discovery. The LME will consider the most effective delivery vehicle for any additional controls in the context of the delivery of the new trading platform in 2024. In this regard, the LME will also consider whether introducing additional controls requires a recalibration of existing controls to minimise potential unintended consequences.

As outlined in the Action Plan the LME will look to further enhance transparency around the operation of the full suite of volatility controls (with this working paper being a key first step in that process).

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