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# Principles for CCP Stress Testing

*How the world advances*

 CME Group

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# I. INTRODUCTION

## Purpose of Stress Testing

Central counterparties (“CCPs”) employ stress testing as a critical component of prudent risk management practices. The primary functions of this tool are aggregate financial resource sizing, liquidity resource sizing, and identification of material impacts of tail events on clearing member and customer exposures. Global standards, and the local regulatory adoption thereof, require that stress testing encompasses market scenarios that are deemed ‘extreme but plausible.’ Determining what constitutes extreme but plausible market conditions depends on a number of factors including, but not necessarily limited to, asset class, product volatility, historical market movements and current market conditions. In addition, CCPs should use reverse stress testing to confirm the appropriateness of its stress testing framework and financial resource sizing.

## The Financial Crisis and CCP Risk Management

The events of the 2008 financial crisis, such as the bankruptcy of Lehman Brothers, the bail out of American International Group, and the injection of capital into the banking system by governments throughout the world resulted in a reevaluation of financial market structures and a pivot towards centrally cleared markets which demonstrated transparency and resiliency during the financial crisis. The result was the G-20 declaration following the September 2009 meeting in Pittsburgh that sufficiently standardized over-the-counter (“OTC”) derivatives contracts should be cleared through central counterparties. Pursuant to this declaration, many jurisdictions have moved towards mandating central clearing of certain OTC derivatives in tandem with the adoption of the Principles for Financial Market Infrastructures (“PFMIs”) to enhance regulatory standards for infrastructures such as CCPs in advanced financial jurisdictions throughout the world. The move towards central clearing has led to an enhanced focus on the adequacy and transparency of CCP risk management practices. The adoption of increased risk management standards at CCPs, beyond even those that held up well during the financial crisis, have been one of the successes of the PFMIs and CCP practices have continued to be evaluated with a recent focus on stress testing standards and transparency. While we welcome all dialogue in relation

to CCP risk management, we are concerned that the current conversations about CCP stress testing fail to account for the demonstrable success of CCP risk management during the financial crises (and before) and the enhanced regulatory standards already being applied to CCPs in sophisticated financial markets globally via the PFMIs.

## CCP Risk Management Expertise

Given the recent attention focused on the role of central counterparties in financial markets, it may be surprising to some that these entities have successfully navigated serious crises and systemic risk events repeatedly over time; in fact, the first central clearing infrastructure was put in place more than a century ago. Over this long time frame, CCPs have developed substantial experience in guaranty fund sizing, mark-to-market settlement variation, initial margin, and default management; some of the primary tools of risk management that allowed them to successfully weather prior periods of systemic stress. On at least a daily basis, portfolios cleared by CCPs are marked-to-market, and participants are called for variation margin payments to eliminate losses. Some products, such as exchange-traded derivatives, may be settled more frequently to include both an intraday and end-of-day cycle. Initial margin is also called to cover any losses associated with the potential liquidation of defaulting clearing member positions. However, during times of systemic stress, excess losses may also be cured by that member’s guaranty fund contribution. These ‘defaulter pays’ prefunded resources are intended to prevent costs from being mutualized in the next tiers of the waterfall: the CCP contribution or the mutualized guaranty fund.

It is important to note, however, that stress testing and guaranty fund sizing cannot be considered in a vacuum. CCPs employ a vast array of risk management tools which, together, protect the integrity of the CCP and the markets that it clears. Initial margin acts as the first line of defense; covering a high level of price and volatility moves under normal market conditions. By way of example, CME Clearing’s current risk waterfall could withstand the largest systemic event experienced over the past 50 years, such as the bankruptcy of Lehman Brothers or the equities crash in 1987,

though we note the portfolio itself was liquidated within the cover of initial margin at the time. Initial margin is further supported by concentration charges and liquidity add-ons, additional requirements that cover heavily concentrated clearing member and customer exposures or potentially higher liquidation costs in less liquid markets. In addition to the principles and transparency proposals provided herein, the demonstrable success of initial margin levels historically should provide assurance to the market that the guaranty fund is robust enough to withstand severe market moves. The guaranty fund is an inverse function of initial margin; the more margin on deposit, the lower the guaranty fund requirement.

The guaranty fund is sized using a **stress shortfall** approach calculated as:

**CM (Clearing Member) Available Collateral\* – CM Stress Loss = CM Stress Shortfall**

\*Available Collateral may include the following: initial margin, concentration margin, liquidity add-ons, and option value

Historically, the clearing member's initial margin layer of the waterfall has been more than sufficient to cure losses associated with the liquidation of a clearing member's portfolio, including those of Lehman Brothers, Refco, and MF Global. Given the performance of CCPs, there is a very remote chance that the mutualized portion of the waterfall will be necessary to cure losses in a default scenario. In the current environment, though, CCPs should also consider the safeguards available in historically unobserved default situations, to cover hypothetical stressed market conditions. The principles in the following pages set out the level of robustness that should be inherent in a CCP's stress testing practices and financial safeguards package.

## **Scenario Standardization and Stress Testing Transparency**

With CCP safety and health being an expected focus as these institutions increase their role in the financial system, it is imperative that incentives for strong risk management are aligned throughout the central clearing ecosystem, from clients to clearing members to CCPs. An appropriately designed CCP financial safeguards package (which is triggered only where the myriad CCP risk mitigation measures do not prevent a default), chiefly the default waterfall, aligns incentives and improves risk management through the concept of loss mutualization. The diversity of the markets CCPs clear and the resulting risk profiles call for strong principles that provide assurance that CCPs are appropriately sizing their financial resources. When sizing financial

resources, CCPs should utilize principles rather than applying standardized scenarios, particularly where those scenarios are designed without the requisite in-depth knowledge of the wide variety and uniqueness of markets CCPs clear. To achieve these goals, the industry must reach a consensus on standardized principles to establish CCP best practices for stress testing. Imposing strict standardization of scenarios presents model risk and increases the likelihood that when an unanticipated stress shock occurs, it will result in a market-wide risk management failure. This scenario standardization approach potentially creates the same risk posed by excessive reliance on the narrow quantitative risk models used in the uncleared markets that failed to anticipate the drivers of the financial crisis, resulting in catastrophic losses among banks and other major financial institutions. Further, scenario standardization at a global level increases the risk that potentially inapplicable stress scenarios will rigidly be used and these will collectively fail to capture the unique risks of the diverse markets cleared by different CCPs, thus exacerbating model risk.

It is worth noting that the Federal Reserve Bank of Atlanta conducted a review of the failures of the stress testing framework for Fannie Mae and Freddie Mac that caused their bail out and found that the obligation to publicly disclose stress testing scenarios applied to the Federal Housing Finance Agency was a key factor in the failure of the agency to appropriately update its framework.<sup>1</sup> Effectively, publishing all details of the framework made it more difficult for the agency to make changes as appropriate due to potential political pressure from the entities (Fannie Mae and Freddie Mac) subject to the stress tests. As risks are dynamic while the tests remain static, the relevance and effectiveness of standardized scenarios are negated. A strong possibility exists that full disclosures of CCP stress testing frameworks, or the creation of standardized stress tests by regulators, will cause them to suffer the same fate: considering the interests of the clearing members subject to stress testing and the financial resources required to be maintained by clearing members in the form of guaranty fund contributions. Publication of stress testing frameworks also risks inordinate focus on the narrow stress techniques subject to public release, which will discourage innovation in risk management and potentially penalize CCPs that have developed enhanced stress testing practices that will likely be discounted in favor of the standardized scenarios.

<sup>1</sup> Federal Reserve Bank of Atlanta, *The Failure of Supervisory Stress Testing: Fannie Mae, Freddie Mac, and OFHEO*. <https://www.frbatlanta.org/research/publications/wp/2015/03.aspx>

In addition to the scenario rigidity risks noted by the Federal Reserve Bank of Atlanta, two scholars from the University of Chicago published a paper expressing concern about the possibility of banks subject to the stress testing framework of the Federal Reserve Bank of New York “gaming” the stress tests if given too much information.<sup>2</sup> In effect, there is significant concern that full transparency could lead to sophisticated market participants attempting to structure portfolios in a way that would be treated favorably under the transparent stress scenarios they are provided. CME believes that these risks are real, could have a significantly adverse

impact on financial stability, and should be taken into account when determining the appropriate level of transparency to provide in relation to CCP stress testing.

<sup>2</sup> Goldstein and Sapra, *Should Banks' Stress Test Results be Disclosed? An Analysis of the Costs and Benefits*. [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2367536&download=yes](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2367536&download=yes)

The appropriate and best approach to stress testing across the wide variety of CCPs throughout the world is the application of principles that can be consistently evaluated by regulators and market participants without creating the model, gaming and rigidity risks outlined above.

## Standardized Stress Testing Scenarios

- Rigidity prevents dynamically adapting to market conditions
- Gives rise to model risk where standardized scenarios fail
- Ineffective for addressing diverse markets

VS.

## Principles for Stress Testing

- Flexibility allows frameworks to consider changing market conditions
- Encourages CCP risk management innovation in line with strong principles based practices
- Effectively addresses the diverse markets cleared by CCPs

## II. PRINCIPLES FOR STRESS TESTING

CME Clearing advocates for the standardization and disclosure of stress testing principles to benefit clearing members and their clients, as well as financial regulators. Principles also serve to enhance financial market stability by giving market participants comfort in knowing the CCPs they face use robust stress tests when sizing financial and liquidity resources. These principles are as follows:

### **Principle 1** Dynamic Monitoring of Clearing Member and Client Portfolios

The monitoring and mitigation of risk is the principal role of a CCP, which is achieved through frequent risk monitoring and review. CCP risk management teams should perform comprehensive daily stress testing to identify clearing member or client accounts that individually represent significant exposures.

### **Principle 2** Conservative Safeguards Sizing and the Waterfall Structure

Stress testing allows CCPs to size both the financial safeguards package to address potential clearing member defaults and the necessary liquidity resources to meet potential payment obligations. These tools must ensure that a CCP has adequate financial and liquidity resources available and the flexibility to take action to prevent shortfalls in times of crisis.

### **Principle 3** Comprehensive Scenario Construction

CCPs should construct historical and hypothetical stress testing scenarios aligned with their unique product offerings and risk profile to meet 'extreme but plausible' standards. These scenarios must be dynamic enough to adapt to evolving market conditions, product launches, and clearing member concentrations and should be updated, or new scenarios developed, as market conditions change.

### **Principle 4** Thorough Review to Identify Model Limitations

Reverse stress testing assists a CCP in identifying the potential enhancements to financial resource sizing through the application of extreme but implausible scenarios unique to the markets they clear. Stress tests should also be validated by an independent party to ensure the framework is sufficiently robust, and take action to address these exposures.

## Principle 5

### Maintaining a Robust Governance Structure

To ensure the adequacy of its stress testing framework, CCPs must maintain a robust governance structure which includes CCP staff, senior management, risk committees, the board of directors, and regulators.

## Principle 6

### Transparent Application of Stress Testing Principles and Practices

CCPs should provide transparency into their stress testing practices. These disclosures give market participants greater insight into the risk management regimes of the CCPs they face and their ability to provide financial stability during stress market events.

## Principle 1: Dynamic Monitoring of Clearing Member and Client Portfolios

Risk exposures are dynamic and change with market conditions and positions of participants. It is thus critical that CCPs perform daily stress testing of clearing member and client portfolios. Monitoring and mitigation of risk is the principal role of a CCP. This is accomplished through a variety of risk management techniques in addition to the default waterfall structure. CCP risk management teams should perform daily stress testing and review the results to ensure that clearing member or customer exposures remain manageable within the financial resources of the clearing member and that current guaranty fund requirements and liquidity resources are sufficient to cover such exposures. CCPs must retain the right to perform interim guaranty fund or liquidity resources resizing by calling for additional resources from members to prevent a shortfall. Shocks and scenarios should be regularly reviewed and evaluated against current market conditions to determine relevance and sufficiency in resource sizing and stressed portfolio assessments.

Standardized scenarios, as stated previously in this publication, run the risk of being inflexible, stale, and irrelevant, and assessment against such standards will not definitively prove that a CCP maintains an adequate

or inadequate financial safeguards package. For example, the Swiss Franc depegging from the Euro in January of this year resulted in significant volatility increases in the foreign exchange market. CCPs successfully dealt with the depegging and were then able to immediately incorporate these moves into their margin and stress testing models. In contrast, standardized scenarios designed by regulators and standard setters would likely be less flexible as noted by the Federal Reserve Bank of Atlanta resulting in stale or inappropriate stress testing frameworks.

## Practice 1

### Preventing Potential Guaranty Fund Shortfalls

CCP Risk Management should maintain the right to resize the guaranty fund or liquidity resources as needed through the CCP rulebook.

The size of financial resources should be evaluated on a daily basis and CCP Risk Management must have the ability to resize these resources as needed during the normal course of their risk management. This prevents potential shortfalls in CCP resources relative to exposures.

## Practice 2

### Dynamic Assessment of Liquidity Needs and Resources

Stressed potential payment obligations should be reviewed against qualifying liquidity resources on a daily basis to determine whether liquidity resources need to be resized.

Qualifying liquidity resources are derived from a variety of sources. CCPs should monitor each clearing member's liquidity resources daily ensuring adequacy under stressed market conditions. The CCP should evaluate the clearing members' exposures and the funding available to determine whether these exposures must be reduced or additional liquidity resources obtained.

### Practice 3

#### Identification of Large Individual Exposures

CCPs must identify and stress clearing member and client accounts that may individually maintain large exposures to properly mitigate or reduce the consequent risks.

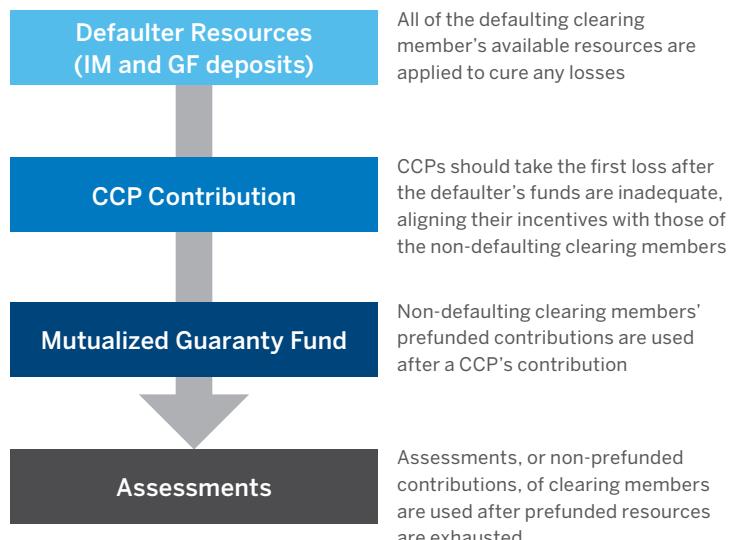
Client accounts with concentrated or highly directional positions, or those of a magnitude that pose material risk relative to the capital of the clearing member, must be stress tested to assess the impact of extreme but plausible market events on their individual exposures and the resulting impact on the CCP's financial resources. These results should be measured against a number of metrics, including but not limited to: historical maximum stress losses, clearing member capital, and clearing member financial resources.

Further, CCPs should maintain the ability to view the results of these stress tests by product, tenor, account, and client to monitor risk posed by a specific product or account. Shocks and scenarios used to identify accounts with large exposures should align with those employed in guaranty fund sizing stress tests. This practice allows CCPs to monitor and mitigate the risk posed by large clients to their clearing member and potentially the market as a whole.

### Principle 2: Conservative Safeguards Sizing and the Waterfall Structure

#### Financial Safeguards Sizing

CCPs globally have broadly similar protections in their financial safeguards packages: clearing member defaulter resources, CCP contributions, the mutualized guaranty fund, and assessments. Importantly, the sizing of each layer and the order in which they are applied determines the robustness of the safeguards. CME Clearing advocates for CCPs to take a "defaulter pays" approach, using the defaulter's resources to meet their obligations, while maintaining a mutualized layer of protection to address stress events and ensure appropriate risk management incentives, and for the CCP to take the first loss before mutualization via the CCP's contribution.



The optimal waterfall structure is detailed above. In addition, CCPs must have a recovery and resolution plan detailing the tools available in the event that losses extend beyond the end of the waterfall.

CCPs size initial margin, the primary component of available collateral, using the relevant margin model for the given asset class using at least a 99% confidence interval. CCPs size guaranty fund to cover a stress shortfall. The CCP contribution is a resource set aside by the CCP to further align incentives across the clearing ecosystem. This resource should take the "first loss" in the case of a default, prior to using the guaranty fund contributions of non-defaulting members, and should be sized to represent a meaningful contribution by the CCP relative to the contribution made by clearing members to the financial safeguards package.

These layers should be sized in consideration of the appropriate balance between the likelihood of a systemic event, the costs of participation, and the benefits of clearing member diversification, as well as to promote strong incentives to participate in default management. CME Clearing is concerned that some participants may advocate for increased prefunded resources, through member guaranty fund contributions, as a method to limit clearing membership by increasing barriers to entry or shifting costs between various market participants. Limiting clearing membership reduces the benefits of diversification while cost shifting may reduce incentives to conduct appropriate risk management. At all times, the goal of a CCP should be to provide financial stability through the creation of a default waterfall that aligns risk management incentives at all points in the clearing ecosystem. When sizing the guaranty fund,

systemically important CCPs are required to cover the two largest stress shortfalls driven by their clearing members (a “cover 2” standard). CME Clearing is concerned that increasing the number of clearing members covered by guaranty fund will reduce clearing membership without any attendant risk benefits. The cover 2 standard currently in place is designed to conservatively size financial resources while striking a balance with clearing member participation costs stemming from prefunding default fund contributions.

The following practices should be included in CCP guaranty fund sizing to ensure that it maintains a conservative financial safeguards package that accounts for changing market conditions and the costs associated with a potential default.

## Practice 1 Post-Haircut Collateral Valuation

Available collateral should be applied to stress losses at a post-haircut value.

Many types of collateral experience value fluctuations that impact the ability of a given asset to fully meet the margin requirements for the exposures it is intended to cover. CCPs should apply appropriate haircuts to the collateral they accept to prevent unanticipated reductions in collateral value due to price volatility in a given security or currency. These haircuts should be periodically stress tested to account for the impact of severe market conditions on the value and liquidity of the collateral.

## Practice 2 Conservative Guaranty Fund Sizing

CCPs should apply a buffer on top of their guaranty fund requirement.

The buffer will reduce the likelihood of a guaranty fund shortfall and should be sized by taking into account the growth trend in the size of clearing member and customer exposures in the relevant asset class, as well as the historical size of the guaranty fund. This additional layer of protection reduces the likelihood of procyclical guaranty fund calls.

## Practice 3 Consideration of Portfolio Liquidation Costs

CCPs should incorporate the observed cost of portfolio liquidation into guaranty fund sizing during regular default management drills to ensure the financial resources are sufficient to meet costs of liquidation during a stress event.

CCPs benefit from a post-mortem analysis of the costs and ease of liquidation observed during regular default drills. This exercise better prepares them for liquidating a diverse set of portfolios during a real default, in terms of both the cost to the CCP as well as the ability of surviving clearing members to take on the defaulter's positions.

### Liquidity Resource Sizing

As with financial resource sizing, extreme but plausible scenarios are applied to determine the level of liquidity resources necessary to make payments over a defined period following a clearing member default. Liquidity resources must be large enough to cover the largest potential payment obligation under stressed market conditions in its membership base, across all waterfalls. CCPs should also consider additional payment obligations stemming from a payment failure by the second largest firm.

## Practice 1 Point in Time Versus Period of Time

CCPs should measure liquidity resources to ensure they can meet all payment obligations during a settlement cycle.

A clearing member default and subsequent payment obligations pose direct liquidity risks to CCPs. Contrary to financial resources, which cover potential losses over a period-of-time, i.e. over the course of 5 days in the case of OTC instruments such as IRS, CDS or OTC FX, and support position-related risk, liquidity resources must be adequate to cover the CCP's payment obligations at a specific point-in-time, i.e. a settlement cycle. CCPs should use liquidity stress testing to measure potential payment obligations under stressed market conditions against the available qualifying liquidity resources.

## Practice 2

### Assessment of Collateral Liquidity

CCPs should use independent parties to test collateral liquidity under stressed conditions to reaffirm the liquidation assumptions the CCP uses in stress testing.

CCPs should bolster their understanding of collateral liquidity by testing their ability to liquidate the collateral they accept on a routine basis, both to ensure that their assumptions are correct as well as to ensure that liquidity backstops would perform sufficiently under severe market stress.

## Practice 3

### Collateral and Liquidity Diversity

CCPs should ensure that they have a diverse array of collateral and liquidity sources available to them during both normal and stressed market conditions.

The collateral liquidity assessment detailed above confirms the appropriateness of the collateral a CCP currently accepts and indicates the ability of CCPs to liquidate different collateral types in a timely manner. It is prudent for CCPs to have multiple options for obtaining liquidity during stress conditions which may include: direct liquidation of collateral, rule based liquidity resources, committed liquidity facilities, uncommitted repurchase agreements and flexibility to perform payment in kind on a limited basis during stress market conditions.

## Principle 3: Comprehensive Scenario Construction

CCPs construct 'extreme but plausible' stress testing scenarios aligned with their asset classes and risk profile to most appropriately size potential losses under a stressed environment. Scenarios must be continuously assessed and dynamic enough to adapt to evolving market conditions, new products, and clearing member concentrations. To allow for the necessary flexibility to address their exposures, as well as to avoid confinement to static stress shocks, CCPs should adhere to a principles-based framework for scenario construction.

**Extreme:** Representative of observed market movements or synthetic shocks that are sufficiently outside of normal market conditions. CCPs should employ a dynamic threshold above expected price and volatility movements to determine conditions reflective of a stressed environment. Historical stress shocks should be normalized so as to be relevant in current market conditions. Alterations or breaks to observed correlations should also be considered. Floors should be applied to shocks to ensure that risk factors are not normalized to reflect current market conditions to a point where they may no longer be considered extreme.

**Plausible:** Scenarios used to size financial and liquidity resources should represent realistic market movements and resulting participant losses, based on current market conditions, whether the scenarios are historical or hypothetical. Scenarios should be continually reviewed and modified as appropriate to ensure plausibility in light of current market conditions. By way of example, it is not plausible to employ a 250 basis point shock to 3-month LIBOR, where the current rate is 30 bps but such a shock would be more plausible if the rate were 400 bps.

## Practice 1

### Confidence Interval

CCPs should employ at least a 99.9% confidence interval across all asset classes to ensure adequate coverage of stress shortfalls.

The confidence interval used in the stress model must be above that used for the respective margin model to capture tail risks only observed under stressed market conditions. A 99.9% confidence interval is sufficient to cover extreme but plausible price or volatility moves across all products. While a 100% confidence interval would cover the worst loss, it may not be appropriate for every stress testing model and could impose costs without any attendant benefits due to its lack of relevance. For example, a CCP clearing only one asset class may benefit from applying a worst-loss methodology in some circumstances. However, a CCP clearing several uncorrelated asset classes may not benefit from utilizing a worst-loss methodology across all asset classes as it will result in extreme, but implausible stress shocks that are not appropriate for guaranty fund sizing. It is highly unlikely that a single market event would result in the worst loss

in agriculture, energy, interest rate, equities, and metals simultaneously. Additionally, the stresses applied to products with substantial historical data availability must be evaluated on the basis of whether a historical worst loss remains relevant given current market conditions and market structure. These shocks should then be normalized to current market conditions to ensure that they remain extreme but plausible.

## Practice 2

### Stressed Liquidation Period

The liquidation period should be at least equal to the margin period of risk ("MPOR").

MPOR and confidence level alone are not sufficient to properly monitor the adequacy of the financial resources relative to potential stress shortfalls. CCPs must consider both a forward-looking and a results-based approach to evaluating liquidation period in a stressed market environment.

## Practice 3

### Coverage Level

CCPs should assess the coverage level of their stress testing framework to ensure that all stress testing model parameters are taken into account.

In conjunction with the confidence interval and liquidation period, a multitude of factors may be included in a given asset class stress model which may be evaluated through an assessment of the coverage level, or the adequacy of the size of the guaranty fund relative to the stressed exposures it is intended to cover. These factors may include liquidity, concentration, or idiosyncratic risk and are addressed separately from confidence interval, which is primarily focused on market risk. Extremeness and plausibility of shocks can also be verified through the assessment of coverage level. High or low utilization ratios of stress shortfall to the current size of the guaranty fund can act as indicators of appropriateness of the financial resources. To ensure that the coverage level statistic is accurate and meaningful, CCPs must use a substantial look-back period of at least ten years (where available), noting some asset classes may not have such extensive data histories.

## Practice 4

### Customer Default Assumptions

CCPs should define a plausible and measurable standard for determining the number of customer defaults to include in stress testing and guaranty fund sizing.

Under stressed market conditions, it is prudent to assume customer defaults may contribute to the loss of a clearing member. CCPs must determine a plausible number of customer defaults to include in financial resource sizing. There are multiple factors to consider when making this determination.

For instance, under a gross margining regime, it is highly unlikely that all of a clearing member's customers would default considering the improbability that the customer accounts would all be inadequately margined and thus unable to be ported. Therefore, a CCP should be prepared to cover the losses incurred by a certain number of a clearing member's largest customers failing to meet their obligations, as they pose the greatest risk to that clearing member under a stress scenario. However, the likelihood of widespread customer defaults greatly increases when customer accounts are netted in an omnibus structure (not permitted under the CFTC regulatory regime), as the amount of margin posted by a single customer is likely insufficient to cover its exposure without utilizing other customers' margin in the net pool. To quickly port to surviving clearing members, it is likely that customers may need to be transferred separately to multiple clearing members from those customers whose positions were netted against their own at the defaulted clearing member, as experienced during MF Global. This would result in the customer accounts being insufficiently margined, complicating or potentially preventing porting. Under stressed market conditions, collateral availability may be constrained, restricting the ability of otherwise healthy customers to obtain collateral to top up their margin requirement at a customer's new clearing member, potentially creating an unnecessary cascade of customer defaults.

Where clients are margined on a gross basis, the likelihood of portability significantly increases, further reducing the likelihood of multiple client defaults.

## Practice 5

### Historical Scenarios

Historical scenarios should be selected using large observed market movements in the available time period and applied to portfolios as appropriate given current market conditions.

## Practice 7

### Segregation of Stress Shocks

Product groups should be shocked independently of one another, with such shocks being used to test the appropriateness of the correlations employed in sizing financial resources.

Stress testing shocks should be considered on a product group basis (i.e. equities, interest rates, commodities, etc.), as to be properly tailored to their asset class and avoid failing to capture product-specific risks through oversimplification. Some market events used in scenario construction may include the bankruptcy of Lehman Brothers, the 1987 crash, and the events of September 11, 2001. Historical market events should be evaluated and normalized to reflect current market conditions, as appropriate.

## Practice 6

### Hypothetical Scenarios

Hypothetical scenarios should be constructed to represent augmented historical movements, potential macroeconomic events, and statistical scenarios.

Historical events may be appropriately extended by assuming increased volatility, changes to correlation assumptions or correlation breakdowns. Statistically designed scenarios are predicated upon assumptions related to the distribution of profit and loss movements given current market conditions, and are primarily advantageous for products lacking rich data history or extreme moves in the available historical time series, as well as designing forward-looking scenarios for all products. Macroeconomic events represent shocks that may impact multiple asset classes and are reflective of potential future stress events. CCPs should consider past events, such as the Swiss Franc depegging or Eurozone debt crises, when assessing the probability of future market conditions used to create their hypothetical stress scenarios.

Correlations between different categories of products must be tested to determine whether they are appropriate and stable in times of stress. Observing the behavior of these correlations under stressed conditions will indicate the plausibility of applying them during normal market conditions, as well their suitability as a constant assumption. CCPs should shock products independently to prevent gains in one asset class from offsetting losses incurred in another, as this may or may not occur under stressed conditions. Indiscriminately applying all assumptions present under normal market conditions, such as correlations between different product groups, in a stress scenario is imprudent and may lead to shortfalls.

## Practice 8

### Comprehensive Shocks to Affiliate Clearing Members

CCPs should take clearing member affiliations into consideration during stress testing. Affiliates should be stressed together and separately, with the larger of the two stress shortfalls being used to size financial resources.

CCPs should determine whether stress testing affiliates together masks or exposes the risks they bring to the market. This can be done by stress testing affiliated entities separately as well as together even where offsets between affiliates would be permitted. Affiliates may trade in offsetting asset classes, which necessitates combined and individual shocks to ensure all exposures are adequately covered by the available resources. Therefore, to be more conservative, CCPs should evaluate the combined and separate shocks and take the larger of the two stressed losses.

**Practice 9****Incorporation of Market Structure and Safeguards into Stress Shocks**

CCPs should consider market structure and safeguards when determining the size of stress shocks. This may include, but is not limited to, account segregation, execution model, and settlement regularity.

Account segregation may vary from omnibus to LSOC to individual segregation, impacting the risk that one individual client account can pose to another, which should affect a CCP's decisions regarding how conservative it may need to be when conducting stress testing. Models such as customer net omnibus may need to be more conservative than customer gross omnibus given the increased fellow customer exposure inherent in such a structure relative to gross margining regimes. Under the net regime, stress losses may be exacerbated due to reduced collateral on deposit and cumbersome portability, as customers may need to be ported to multiple clearing members rather than a single clearing member. In addition, the execution model is an indicator of ease of liquidation; selling a portfolio through a central limit order book provides access to a broader, centrally located group of potential bidders, whereas a bilateral sale may involve fewer bidders. Further, the settlement cycles of a particular market dictate how often portfolios are marked-to-market, removing risk from the system. More frequent settlement cycles, such as the intraday and end-of-day cycles used by derivatives CCPs, limit the accumulation of debt obligations to a shorter period of time than where settlement occurs on a longer time horizon, thus calling for shocks consistent with the time period between settlement cycles. In comparison, the stress shocks applied to uncleared portfolios that may be marked-to-market on a quarterly or even annual basis, and may not require margin collection, warrant much larger stress shocks than a cleared portfolio that is marked-to-market during a daily, if not twice daily, settlement cycle.

**Principle 4: Thorough Review to Identify Model Limitations****Practice 1****Evaluation of Reverse Stress Testing Scenarios and Results**

CCPs should utilize reverse stress testing scenarios, those which are deemed extreme but implausible as a mechanism to test the appropriateness and robustness of their stress testing framework.

Reverse stress testing focuses on severe, but implausible market conditions that would entirely deplete the financial safeguards package, and may consequently result in the recovery or resolution of the CCP. The scenarios included in reverse stress testing may be constructed similarly to those used in guaranty fund sizing, but to a greater degree of severity which falls outside the domain of plausibility. The ongoing evaluation of these scenarios in light of current market conditions will ensure that the stress testing frameworks of CCPs continue to evolve as market conditions change and assumptions surrounding the definition of extreme but plausible are tested on a regular basis. Reverse stress testing scenarios may include, but are not limited to, augmented historical market movements, historical but implausible shocks, hypothetical scenarios, inversion of correlations, numerous simultaneous clearing member defaults, and various degrees of correlation breaks.

**Practice 2****Employing Independent Model Validation**

CCPs should have stress testing models independently validated to ensure robustness and adequacy.

Independent model validation is integral to ensuring that a model is robust, achieves planned objectives and performs appropriately. Validation of the stress testing model, in conjunction with the risk management framework as a whole, should be performed by an independent market expert on an annual routine basis to provide further assurance of its appropriateness, in adherence with CPMI-IOSCO principles. Independent model validation teams should be isolated from the developers of the stress testing methodology to provide

unbiased assessment of the model. In line with regulatory requirements, independent validation teams should ensure the methodologies employed for each asset class include stress scenarios that are both extreme and plausible, whether historical or hypothetical.

The independent validator should perform sensitivity analysis to test the framework. Sensitivity analysis is used to identify parameters to which minor changes could have a disproportionate impact on stressed exposures. Stress shortfalls, being determined based on the stress loss and collateral on hand, are impacted by these parameters and should be accounted for accordingly.

## **Principle 5: Maintaining a Robust Governance Structure**

A robust governance structure is integral to ensuring that CCP risk management practices provide safety and soundness. The structure is dependent upon multiple layers of governance, both internal and external, to provide such assurances. The ideal structure is as follows:



### **Practice 1** Designing a Comprehensive Internal Governance Structure

CCPs should employ a robust internal governance structure responsible for establishing an appropriate stress testing framework.

CCP Risk Management is responsible for determining what action should be taken to ensure market stability. Furthermore, CCP Risk Management serves as a key component of the internal governance structure of the CCP and is typically responsible for selecting stress scenarios and setting stress testing parameters, and making any changes. The Risk Management team, through daily stress testing, determines when the guaranty fund may potentially be inadequate to cover stressed exposures. CCPs should maintain strict escalation procedures that determine when these results must be presented to Senior Risk Management

in determining whether further action, such as resizing the guaranty fund, is necessary, as well as maintaining proper records detailing approving officers and actions. The Risk Management team is additionally responsible for identifying significant exposures and keeping Senior Risk Management apprised of the risks involved, i.e. a large or concentrated customer being spread across multiple clearing members.

### **Practice 2** Engaging Expert Market Participants Through Risk Committees

Risk Committee members provide market expertise in assessing the risk profile of the CCP and the risk methodologies it employs.

Risk Committee(s) must be comprised of individuals from clearing members, independent market participants, and industry experts, each of whom is well versed in financial markets risk management (including stress testing) and committed solely to preserving the soundness of the CCP in their capacity as Risk Committee members. Risk Committee members are consulted regarding substantial changes to the design and implementation of the stress testing framework and periodically review stress testing results.

### **Practice 3** Robust Regulatory Oversight

Regulators with the appropriate expertise in the relevant markets should conduct annual, in-depth evaluations of CCP risk management practices, including those for stress testing.

CPMI-IOSCO, in conjunction with industry groups and global regulatory bodies, has published both qualitative principles and quantitative disclosures for CCPs. CCPs should be regulated in jurisdictions that have adopted these principles, referred to as the PFMIs to ensure compliance with a globally consistent regulatory framework. Each regulator should monitor the compliance of the CCPs in their jurisdictions with the PFMIs, performing onsite exams of each topic as appropriate allowing them to review a CCP's risk management (including stress testing) practices in great detail. Regulators may request stress testing scenarios, liquidation period and confidence interval parameters, information on coverage

level and guaranty fund adequacy, as well as the stress losses and shortfalls resulting from the CCP's stress testing methodology. Given the significant amount of data provided through these requests, regulators are well-equipped to evaluate the sufficiency of a CCP's stress testing model and financial safeguards package, and may require increased stringency where necessary.

## Principle 6: Transparent Application of Stress Testing Principles and Practices

### CCP Disclosures

The PFMI qualitative and quantitative standards include the components of stress testing that should be disclosed publicly. This effort provides a standard template for transparency and guidelines for periodic public reporting of information for CCPs in jurisdictions that have officially adopted CPMI-IOSCO's practices or intend to do so.

### Practice 1 Participating in the Quantitative Disclosures

CPMI-IOSCO has published the public quantitative disclosure standards for central counterparties and CCPs should participate in the disclosure regardless of PFMI implementation in their jurisdiction.

CPMI-IOSCO has made great strides in improving and standardizing transparency into CCP stress testing through its public quantitative disclosure standards for central counterparties publication. This includes items such as amount and type of default resources available, cover 1 and cover 2 stress loss amounts, contribution of large members to the default fund, and liquidation period assumptions. These disclosures will strengthen market participants' ability to understand their exposures to central counterparties and their approach to sizing financial resources.

### Practice 2

#### Principles of CCP Risk Management Disclosures

CCPs should provide public disclosures to demonstrate their compliance with the stress testing principles and practices included in this publication and further assist market participants in evaluating counterparty exposures.

As a proponent of transparency, CME Clearing supports further disclosure regarding CCP risk management practices. Quantitative disclosure alone is insufficient to demonstrate a robust risk management framework and should be published in conjunction with information aligned to the principles and practices outlined in this paper. Given that some components of CCP risk methodologies may differ between asset classes, the CCP should provide transparency into the practices employed for each financial safeguards waterfall. Consequently, CME Clearing advocates for an annual disclosure by all CCPs regarding stress testing to illustrate compliance with these principles and practices.

### Clearing Member Disclosures

Because risk management is critical at all layers of the financial system, we support and encourage clearing members to disclose information consistent with the practices enumerated above to their clients and CCPs. This initiative would promote further transparency in the financial markets and strengthen relationships between clearing members and their customers. While this would be a significant improvement in risk management transparency in the clearing industry, it does not encompass all clearing member risks.

To the extent that clearing members are impacted by risk through other business lines, it is critical that sufficient transparency is provided to CCPs and their customers in relation to those risks, since they may impact the clearing member's ability to perform on obligations to their customers and CCPs.

## III. CONCLUSION

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Substantial changes in the regulatory landscape and overall structure of the financial markets have increased momentum towards greater transparency into the risk management practices of systemically important financial institutions. CME Clearing supports the efforts of regulatory bodies and industry groups to define the principles and practices that must be disclosed among participants to ascertain the safety and soundness of a CCP. To improve transparency, CME

Clearing proposes that all CCPs adhere to the principles and practices outlined in this paper, which illustrate the symbiotic relationship between prudent risk management practices and adequacy of the financial safeguards package. CCPs should take care to strike a balance between the benefits and risks of increased disclosure in their demonstration of compliance with such practices to maintain the flexibility, relevance, and robustness of their methodologies.



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**CME GROUP HEADQUARTERS**

20 South Wacker Drive  
Chicago, Illinois 60606  
[cmegroup.com](http://cmegroup.com)

**CME GROUP GLOBAL OFFICES**

**Chicago**  
+1 312 930 1000

**Singapore**  
+65 6593 5555

**Houston**  
+1 713 658 9292

**Tokyo**  
+81 3 3242 6233

**New York**  
+1 212 299 2000

**Calgary**  
+1 403 444 6876

**São Paulo**  
+55 11 2565 5999

**Washington D.C.**  
+1 202 638 3838

**London**  
+44 20 3379 3700

**Hong Kong**  
+852 2582 2200

**Seoul**  
+82 2 6336 6722