2024 CCP Supervisory Stress Test: results report

Results of the Bank of England's 2024 Supervisory Stress Test of Central Counterparties

Content

1: Foreword

Central counterparties (CCPs) sit at the centre of the UK and global financial system and their resilience is important to financial stability in the UK and overseas. Alongside the Bank of England's (the Bank's) other supervisory and regulatory activities, stress testing plays a key role in assessing that resilience, providing transparency and promoting confidence.

This publication marks the Bank's third public UK CCP Supervisory Stress Test (SST), focussed on credit stress testing and CCPs' resilience to the combination of a severe market stress and the default of two or more members. This exercise is exploratory in nature and gives us insights into the resilience of UK CCPs and enables us to identify potential pockets of vulnerability that inform the Bank's ongoing supervisory and regulatory work, both domestically and internationally.

The latest exercise confirms the resilience of each UK CCP to a stress scenario similar to the worst-ever historical stress, combined with the default of the two members that lead to the largest mutualised losses. Compared to the previous stress test, all CCPs are found to experience greater mutualised losses in this exercise. This reflects a combination of the shape of the scenario and the distribution of CCPs' exposures, with shocks beyond the historical worst to some material products. And some CCPs are holding less pre-funded resources as their financial models have adjusted to a period of more benign market conditions, following the market volatility experienced in 2022 prior to the previous stress test. The stress test results do not suggest that this is a cause for concern, but we continue to monitor CCPs' resources through ongoing data collection and supervision. When we extend the stress test to include the cost of liquidating highly concentrated positions and more conservative assumptions, we identify some potential areas of vulnerability, which we will explore with CCPs as part of our ongoing supervision.

Through the Bank's stress testing exercises – including the system-wide exploratory scenario and the desk-based stress test of UK banks – we continue to develop broader insights into the financial system as a whole. And the Bank will continue to invest in its stress-testing capabilities to support its surveillance and risk assessment, including through use of desk-based capabilities to survey a wider range of risks.

Sarah Breeden, Deputy Governor Financial Stability

2: Executive summary

Purpose and design

UK CCPs lie at the heart of the global financial system and are supervised by the Bank of England (the Bank) because of their importance to the smooth functioning of financial markets and the wider economy. As part of this supervision, the Bank conducts regular stress testing of UK CCPs. This report sets out the results of the Bank's third public SST of UK CCPs (the 2024 CCP SST).

The 2024 CCP SST focusses on the credit resilience of the Clearing Services at the three UK CCPs (ICE Clear Europe Limited (ICEU), LCH Limited (LCH), and LME Clear Limited (LMEC)), and whether they have resources to withstand severe market shocks and the default of two or more members, under a range of different assumptions. It is not a pass-fail exercise. Nor is it aimed at checking compliance with regulations or assessing the quality of CCPs' internal stress testing. Rather, it aims to identify any potential vulnerabilities and gaps in CCPs' financial resilience, with the findings used to support and inform the Bank's supervisory and regulatory activities.

Unlike previous exercises, the 2024 CCP SST does not include consideration of CCPs' liquidity resilience or the impact on CCPs' members and clients. We continue to monitor CCPs' liquidity resilience via our ongoing supervisory work, while the interconnectedness of CCPs with the wider financial ecosystem has been explored in the Bank's system-wide exploratory scenario.

The stress test focusses on a Baseline Market Stress Scenario, intended this year to capture market risks arising from escalating geopolitical and trade tensions and a negative shock to growth expectations. This scenario is developed by the Bank and calibrated to be equivalent in severity to the historical worst at each Clearing Service, in terms of the expected profit-and-loss (PnL) impact. While the scenario is grounded in historical stress episodes in order to maintain plausible correlations between risk factors it includes some shocks to individual risk factors that go beyond the historical worst.

Alongside the Baseline Market Stress Scenario, we include additional 'multiplier scenarios' to explore resilience to more extreme scenarios, beyond historical precedents and regulatory requirements. This year's exercise also includes more exploratory desk-based stress testing to survey resilience to a wider range of shocks, including shocks that break historical correlations and that might affect relatively concentrated positions among CCP members.

Results and findings

In the core credit stress test, which does not include the incremental costs of liquidating concentrated positions, we find that all UK CCPs have adequate pre-funded resources to cover a severe stress scenario and the default of the 'Cover-2' members – the two members whose default generates the greatest depletion of mutualised resources at the CCP.

In the 2023 SST we found that the overwhelming majority of losses, and for some Clearing Services all losses, could be absorbed by the defaulters' own resources, reducing the impact on mutualised resources compared to the 2021–22 SST. This was due to CCPs' internal models still putting significant weight on the market volatility experienced in 2022. In this years' exercise, as expected, we find that CCPs are drawing on more of their mutualised resources. As well as changes in CCPs' resources, this also reflects the shape of the scenario, which includes substantial shocks to products with quite large and concentrated positions.

When we extend the analysis to include the cost of liquidating concentrated defaulters' positions, all Clearing Services other than LME Base continue to have sufficient prefunded resources to absorb this impact. We find that LME Base is more vulnerable to the default of two members with large concentrated positions: using the conservative approach to modelling concentration costs taken in previous stress tests LME Base exhaust their default fund and need to draw upon additional resources via powers of assessment. However, this result is sensitive to the assumptions about the costs of liquidation made in our modelling, which is not tailored to the particular markets that LME Base serves. We will explore this further with LMEC to assess whether their approach to estimating concentration costs is appropriate. Results are also sensitive to variations over time in the levels of prefunded resources; for example, the size of the Default Fund at LME has decreased since 2023 (and subsequently increased since the 2024 SST reference date).

We also conduct more exploratory analysis that goes beyond historical precedent and regulatory requirements in order to identify potential pockets of vulnerability at CCPs. In the 2024 exercise, this includes use of a simple desk-based model to estimate the impact of a wider range of scenarios on CCPs' resources, including scenarios that deliberately stretch historical correlations between different products and go beyond historical precedents. This analysis is not as accurate as the core credit stress test, which is based on full scenario revaluations under-taken by CCPs, but it enables us to survey a wider range of potential risks. In most cases, we find UK CCPs have sufficient resources to absorb such scenarios. But we have identified some very extreme but plausible scenarios that may present a risk to CCPs, and we will follow-up with CCPs to probe how they capture the risks identified by these hypothetical scenarios via their own stress testing.

Alongside the specific points identified, the Bank will use the broader findings from the 2024 CCP SST to support and inform its ongoing supervision and regulation of UK CCPs.

3: Introduction

As part of the Bank's ongoing supervision of UK CCPs, the Bank conducts regular supervisory stress testing. The 2024 SST is our third such public exercise. Our stress tests aim to identify potential vulnerabilities and gaps in CCPs' financial resilience, with the findings used to support and inform the Bank's supervisory and regulatory activities. They are not pass-fail exercises, nor aimed at checking compliance with regulations or assessing the quality of CCPs' internal stress testing.

The 2024 CCP SST focusses on the credit resilience of the three UK CCPs. This year's exercise includes exploratory desk-based stress testing in order to estimate the impact of a wider range of scenarios, including scenarios that break historical correlations.

The stress test includes the following components:

- **Credit Stress Test.** Explores the impact of a severe market stress and the default of Clearing Members on the financial resources held by CCPs.[1] As a complement to our core credit stress test, we have also used a more experimental desk-based approach to consider a wider range of scenarios. Further details are provided in Section 5.
- **Credit and Concentration Stress Test:** Extends the Credit Stress Test to include the cost of liquidating concentrated positions held by defaulting members, which may incur an additional discount during a severe market stress. Details are provided in Section 6.
- **Reverse Stress Testing and Sensitivity Testing:** Considers the impact of more conservative assumptions on scenario severity and the number and characteristics of defaulting members. These assumptions deliberately go beyond historical precedents and regulatory requirements in order to identify potential vulnerabilities and test the limits of CCP resilience.[2] Further details of this analysis are provided in Section 7.

All UK CCPs are in the scope of this stress test, as set out in Table A below.

Table A: CCPs in scope of the 2024 CCP SST

CCP	Default Fund/Clearing Service	Key products cleared
ICE Clear Europe Limited (ICEU)	Futures and Options (F&O)	Commodities, equity derivatives, fixed income
LCH Limited (LCH)	SwapClear (a)	Interest rate swaps
	RepoClear	Repos (UK gilts collateral)
	EquityClear	Equities
	ForexClear	Non-deliverable and deliverable FX
LME Clear Limited (LMEC)	LME Base	Commodities (base metals)

(a) The LCH Listed Rates Clearing Service uses the same Default Fund as the LCH SwapClear Clearing Service.

4: Market Stress Scenarios

Core Baseline Scenario

The 2024 CCP SST is centred around a hypothetical market stress scenario developed by the Bank, the Baseline Market Stress Scenario. The Baseline Market Stress Scenario is based on an escalation of geopolitical and trade tensions culminating in an upward shock to commodities markets and the consequent increase in prices for agricultural, gas, oil, power, metals and emissions allowances. Interest rates and government bond yields decrease rapidly across most currencies and maturities caused by a rapid shift in expectations towards faster cuts in rates, while equity prices increase in anticipation of economic stimulus. Currencies appreciate against the US dollar given the uncertainty surrounding the US election.

Overall, the Baseline Market Stress Scenario is calibrated to achieve a target level of severity – in terms of the expected impact on PnL – for each CCP Clearing Service, while maintaining historically plausible correlations between different market prices and rates ('risk factors'). Severity is calibrated at the level of each Clearing Service – rather than for individual risk factors – such that in combination they are broadly equivalent in severity to the worst historical stress experienced, given the volume and mix of products cleared. This is achieved by identifying historical stress periods that align with the stress test scenario narrative for each Clearing Service, and then scaling them to the historical worst expected PnL impact. As such, the design of the Baseline Market Stress Scenario incorporates the most severe historical stresses without replicating any specific event. This ensures that shocks are of consistent severity across services while retaining plausible stressed correlations across products. As an extension, we also test decorrelated scenarios where historic correlations between assets break down via desk-based modelling.

The Bank specified the two-day and five-day shocks for roughly 900 risk factors in the Baseline Market Stress Scenario, published at the launch of the **2024 CCP SST**. To ensure a complete and accurate reflection of the Baseline Market Stress Scenario on UK CCPs, each CCP was required to extrapolate the individual risk factor shocks to all products and exposures within their respective clearing businesses. This extrapolation was undertaken in a manner consistent with the overall scenario narrative and intended severity of the Baseline Market Stress Scenario. The Bank reviewed each CCP's approach to extrapolation.

Additional scenarios and reverse stress testing

Alongside the Baseline Scenario, the 2024 CCP SST also includes three additional 'multiplier' scenarios as part of our reverse stress testing, which explores scenarios and assumptions that deliberately go well beyond historical experience and regulatory requirements. These are constructed by applying linear multipliers (of -1.0x, 1.5x and 2.0x respectively) to each of the individual risk factor shocks in the Baseline Market Stress Scenario.

As an extension compared to previous exercises, the 2024 CCP SST also uses a simple desk-based model to estimate the impact of a wider range of scenarios and 'dark corners' of market movements that could significantly deplete a CCP's Default Fund in the event of a Cover-2 default. These scenarios are generated at CCP service level, using principal component analysis (PCA). This is a statistical method that can identify the key relationships explaining the variance of risk factor movements, including relationships not immediately apparent in historical data, but that could represent potential risks. To give an example, the first principal component might preserve historical relationships between risk factors that are highly correlated and have prices move in parallel. But other principal components could have these risk factors move in opposite directions or change the shape of the maturity curve. Scenarios generated using this approach vary in severity in terms of both their magnitude and the extent to which they preserve correlations.

Reference date

Each of the Baseline Market Stress Scenario and additional alternative scenarios are applied based on the 22 March 2024 reference date, selected to be generally representative[3] of the period since the conclusion of the Bank's previous exercise. This determines the market prices and rates to which the risk factor shocks are applied, as well as CCP exposures and resources. Clearing Member defaults are assumed to occur after the end of day on the reference date, but before markets open the following working day. At this point, the Bank assumes that: (i) no payments are exchanged between CCPs and defaulting Clearing Members; (ii) no position changes are accepted; and (iii) no further payments or margin contributions are made to CCPs.

5: Credit Stress Test

Purpose and objectives

The Credit Stress Test assesses the impact on CCPs' financial resources arising from the default of Clearing Members in a severe market stress scenario. As a starting point, we focus on the two Clearing Member groups whose default generates the largest impact on mutualised resources at each CCP Clearing Service (the 'Cover-2' members).

The test compares these losses to the resources available to the CCP. In the first instance, losses are absorbed by the initial margin and default fund contributions of the defaulters. Any residual losses beyond these resources (Stressed Losses over Member Resources) require the CCP Clearing Service to draw upon other resources under their default waterfalls. These resources are drawn upon in the following order:

- **Skin in the Game (SITG):** CCP's own capital set aside to absorb default losses beyond defaulters' own resources.
- **The mutualised Default Fund (DF):** Contributions of non-defaulting Clearing Members that can be used to absorb default losses beyond SITG and would require replenishing by non-defaulting Clearing Members.
- **Powers of Assessment (PoA):** Additional non-prefunded resources that can be called by the CCP from non-defaulting Clearing Members to cover losses in excess of the mutualised Default Fund.[4]

Results

Chart 1 shows the losses beyond member resources in the Credit Stress Test and the resulting impact on the default waterfall resources of each CCP Clearing Service. Across CCPs, most Clearing Services see significant stressed losses over member resources under a Cover-2 default scenario and all services experience some depletion of their mutualised Default Fund contributions, except for Equity Clear. But all have sufficient pre-funded resources to absorb these losses.

The chart shows the impact of alternative assumptions about the ability of clients of defaulting members to transfer their accounts or 'port' to an alternative member. We show the results under three alternative assumptions: no porting, the porting of segregated client accounts and porting of all client accounts. The results are provided under all three porting assumptions as outlined in Annex A.

Consistent with previous exercises, including alternative porting assumptions has a material impact on the results for LME Base and ICEU F&O. At these services client clearing constitutes a larger portion of clearing activity and so robust procedures for transferring client accounts to other members can significantly reduce the losses faced by the CCP.

Chart 1: Standard Credit Stress Test results

Baseline Market Stress Scenario, CCP Clearing Service Cover-2, all porting assumptions (a) (b) (c) (d) (e)
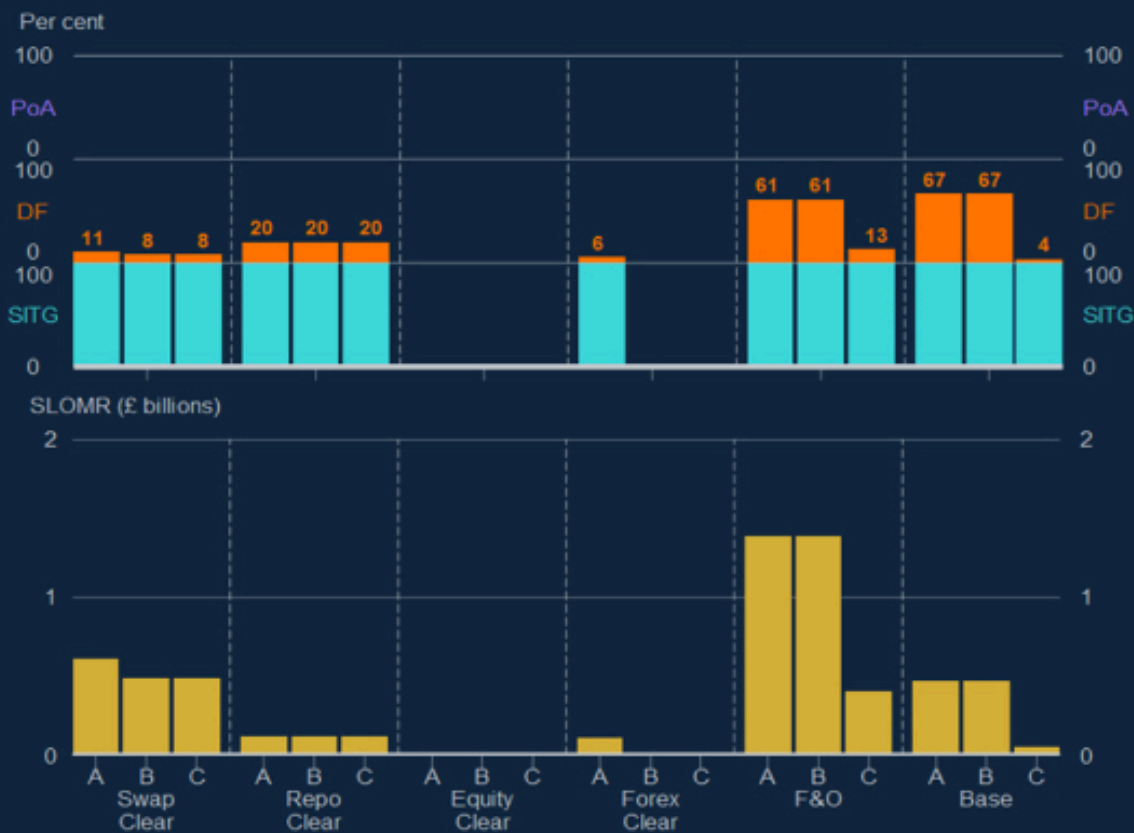
(a) Stressed losses over defaulting members' resources (SLOMR) is the absolute amount (£ millions) by which losses exceed defaulters' resources (Initial Margin and Default Fund contributions).
(b) Percentage usage of dedicated CCP resources (SITG).
(c) Percentage usage of mutualised Default Fund (DF), consisting of non-defaulters' Default Fund contributions.
(d) Percentage usage of Powers of Assessment (PoA). PoA represents the total amount of non-prefunded resources that CCPs can call from non-defaulters.
(e) A = 'No porting', B = 'Segregated client accounts port', and C = 'All client accounts port'.

All services experience greater depletion of mutualised Default Fund contributions compared to the 2023 exercise. And most – with the exception of LCH SwapClear – experience slightly greater resource depletion than in the 2021-22 exercise. To some extent this is to be

expected; most services had elevated levels of resources at the time of the previous stress test, built up in response to the market volatility during 2022. These resources have since partially fallen back, reflecting lower volatility ahead of the March 2024 stress test reference date. And for some services the stress scenario is deliberately calibrated to be more severe in its PnL impact than that used in the 2021-22, since the market volatility of 2022 represented a new historical worst for some Clearing Services.

Overall, the losses for the 2024 CCP SST reflects a combination of two factors: the interaction of the stress scenario with CCPs' exposures, and changes in CCPs' resources.

Stress scenario and CCP exposures

As described above, the scenario is calibrated to be equivalent to the worst PnL impact at the service level. However, the scenario may include shocks to individual products beyond the historical worst and the Bank has deliberately sought to examine different combinations of risk factors and magnitude of shocks across exercises in order to identify potential points of vulnerability. Our analysis indicated that the shape of the scenario combined with concentrated positions in certain products held by the Cover-2 members is the primary driver of the results for most services.

Chart 2 provides the Bank's estimates of the total stressed losses for all Clearing Members in the 2024 CCP SST, compared to the previous year. This shows that the overall magnitude of losses has increased for some services, in particular SwapClear, reflecting a larger shock to the USD Secured Overnight Financing Rate.

For ICEU F&O the absolute size of losses was only slightly higher, but a smaller share of losses was covered by defaulters' initial margin, reflecting a combination of severe shocks – beyond those covered by the initial margin – hitting large positions. Specifically, losses are driven by severe shocks to oil products, particularly at shorter maturities. This is consistent with the scenario narrative of escalating geopolitical risks in the Middle East and the shocks are calibrated to be close to the historical worst in percentage terms. However, this represents shocks that go considerably beyond historical worst in absolute terms, and we therefore take assurance from the fact that ICEU F&O Default Fund can comfortably absorb such shocks.[5]

A similar dynamic is also observed at LME Base, with losses driven by large short positions in copper held by the Cover-2 members. The shocks to copper also go beyond the historical worst (around 20% compared to around 15% historically) motivated by the example of large nickel moves in March 2022. Together with the results of the concentration stress test and our desk-based analysis (described in Box A), this suggests that large positions in copper could be a potentially point of vulnerability at LME Base, which we will explore with the firm.

Changes in CCPs' resources

Changes in results across years also reflect changes in the resources held by CCPs. For example, both Initial Margin and Default Fund size increased after the events of market turmoil in 2022 entered the CCPs' model lookback periods and stress scenario libraries, increasing CCPs' financial resources. This reaction to market volatility was captured by the 2023 CCP SST where the growth in Initial Margin requirements meant that a higher proportion of stressed losses were absorbed by defaulters' own resources, while the increase in Default Fund size meant that a smaller proportion of these resources was used.

Chart 2 also shows the resources used to absorb stressed losses across all Clearing Members. SwapClear has higher available resources in 2024, reducing the impact on mutualised resources. However, LCH RepoClear sees greater mutualised losses from a combination of the scenario and decreases in Initial Margin, following a change in their Initial Margin model. For LME Base, the results reflect a combination of the scenario and a reduction in pre-funded resources; LME Base has subsequently increased the size of its Default Fund.

This view of the drivers of the results is supported by further desk-based analysis that we have conducted as an extension to this year's stress test (see Box A). This more experimental work involves using a simple model to estimate the impact of a wider range of scenarios, including shocks that stretch historical correlations. When we focus on scenarios that are comparable to the Baseline Market Stress Scenario in magnitude and plausibility, we find that CCPs' prefunded resources can comfortably absorb the vast majority of such scenarios. This suggests that the results of Baseline Market Stress Scenario reflect particularly adverse combinations of shocks and positions. The results therefore give us confidence in the overall resilience of UK CCPs, while identifying risk factors that may be a potential source of vulnerability, and which we will explore further with CCPs.

Chart 2: Standard Credit Stress Test results

Aggregate stressed losses, Baseline Market Stress Scenario (a)
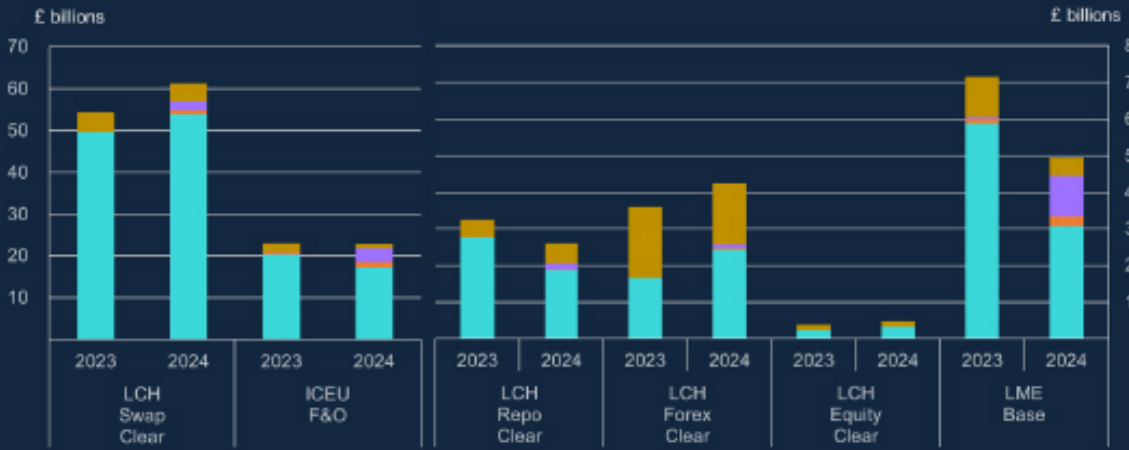
(a) Stressed losses are aggregated across all Clearing Members in the 2023 CCP SST and 2024 CCP SST respectively. The Bank's measure of aggregate stressed losses is an estimate calculated under simplifying assumptions.

Box A: Desk-based analysis of alternative scenarios

Last year, the Bank highlighted the use of an experimental desk-based model to explore CCP resilience under bespoke market stress scenarios. That work focussed on the 'Single Product Reverse Stress Test' which identified the shocks to individual risk factors that would be required to deplete DF, based on simple linear modelling of the impact of different risk factor moves on PnL.

As an extension to that exploratory work, this year the Bank has used that modelling capability to explore a wider range of stress scenarios. Unlike the Baseline Market Stress Scenario – in which moves across different risk factors are grounded in historical correlations – these scenarios are intended to break these correlations in order to identify potential pockets of risk.

For each CCP Clearing Service we have generated and explored the impact of a range of scenarios generated using Principal Component Analysis. This is a statistical method that can be used to identify the key relationships that explain the variance of the original data set, in this case historical price returns. This methodology has the benefit of enabling us to generate a wide range of scenarios from the set of all possible combinations in a way that is consistent and unbiased across services.

We use these components to generate a wide range of alternative scenarios, based on a series of positive and negative multiples of each principal component. This is done at the service level – for example, for LMEC this could include some scenarios that move all metal prices in the same direction, and others that move different metals in different directions, or include larger price moves at shorter maturities. We then use our desktop model to assess the impact of each of these scenarios on UK CCPs, with the aim of identifying scenarios that would significantly deplete the default fund in the event of a Cover-2 default.

The results are summarised in Chart A, where each dot shows resource depletion and relative plausibility for one of the scenarios tested at each service. Here plausibility is defined in terms of the Mahalanobis distance, a statistical measure of the distance between a specific shock and the historical distribution. This captures both the size of the shock compared to historical market moves and also the extent to which it preserves or breaks historical correlations between risk factors.

Overall, across the Clearing Services we find a limited number of scenarios that deplete the default fund, while CCPs are also resilient to many shocks more extreme than the historical worse. This supports our view that UK Clearing Services are

generally resilient and that this year's baseline stress scenario uncovered certain pockets of risk. But it has also identified additional scenarios that appear to be plausible (albeit very extreme) based on the historic distribution of shocks and that could potentially pose a risk to UK CCPs.

Given that this analysis is more experimental, we are doing further analysis of the plausibility of these scenarios and are probing these results with the relevant Clearing Services. The Mahalanobis distance is a purely statistical measure that cannot capture the specifics of different markets. So, while some of these scenarios sit within the historic distribution of the Mahalanobis distance (in the top 1% or 0.1%) they can still include prices moves in specific products that go well beyond the scenarios that CCPs would be expected to consider when sizing their resources.

Chart A: Desk-based estimation of the impact of alternative scenarios
Anonymised CCP Clearing Service Cover-2, no porting (a)
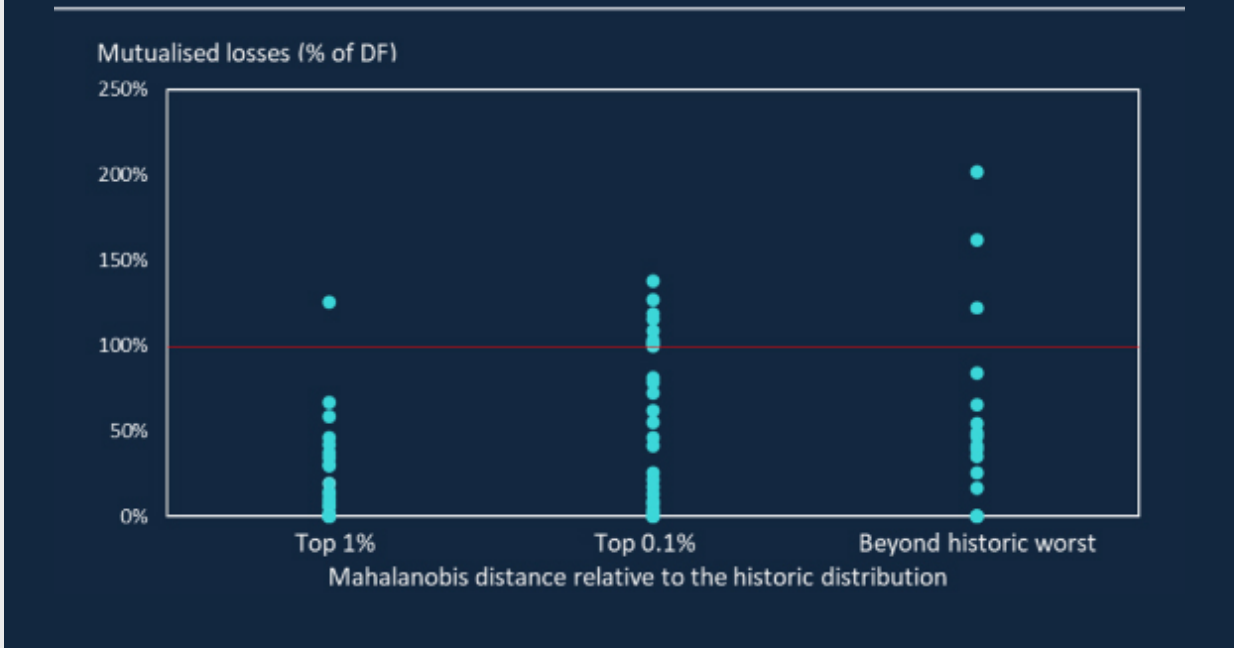
(a) Each dot shows resource depletion (axis Y) and relative severity (axis X) for one of the scenarios tested at each anonymised service. Severity buckets are determined in terms of the Mahalanobis distance, representing scenarios within the historical distribution of Mahalanobis distance values (top 1% and top 0.1%) and scenarios going beyond the largest historic value.

6: Credit and Concentration Stress Test

Purpose and objectives

The Credit and Concentration Stress Test extends the Credit Stress Test to also account for the potential costs of liquidating concentrated positions held by defaulters. If the Cover-2 members together hold a position in certain products that is large relative to the depth of the market, then the CCP might incur additional costs when liquidating these positions.

By including concentration costs, the Credit Stress Test methodology aims to provide a more complete and realistic view of the impact of the combined market stress scenario and default of Clearing Members on CCPs.

Whereas the impact of the core Credit Stress Test can be calculated precisely using the data submitted by CCPs, the costs of liquidating concentrated positions cannot be observed or calculated precisely, but must be modelled and are subject to considerable uncertainty. And so, a range of different approaches are taken by CCPs and regulators, reflecting the specific characteristics of different markets and products.

The Bank's methodology assumes that concentration costs reflect the additional market risk that defaulters' positions would be exposed to if, instead of being liquidated all at once and potentially moving the market, they were instead liquidated gradually, without affecting market prices. This approach necessarily requires making assumptions about the capacity of the market. This year, we have used a suite of approaches, alongside the approach that we have taken in previous years that uses average daily volume traded in each maturity as a proxy for market depth. This includes:

- using open interest as a measure of market depth, which may better capture products that are traded less frequently but still have deep markets underlying them. We calibrate the open interest metric to be equivalent to the metric used in previous stress tests of 25% of average daily volumes in the most frequently traded maturities; and
- allowing Clearing Services to hedge across maturities – with less frequently-traded maturities being hedged in the 'main', most frequently-traded maturity. This effectively allows for some transference of liquidity across maturities and better captures the approach that some CCPs take in practice.

This gives us additional insights into CCPs' resilience and also allows for the fact that a single methodology may not be equally appropriate for all markets. Box B includes additional details on the methodologies used.

Results

Chart 3 shows the results of the Credit & Concentration Stress Test, incorporating the Bank's estimates of concentration costs. As noted above, we show a range of impacts to reflect the uncertainty in the approach to estimating market depth, where the upper end of the range denotes the approach taken in previous stress tests, which was explicitly conservative.[6]

As the chart shows, the inclusion of concentration costs can have material impact on resource depletion, substantially increasing the stressed losses over member resources of the Cover-2 population compared to the Credit Stress Test.

For LCH services this impact is generally limited; EquityClear does not present stressed losses over member resources, being able to absorb the losses via Initial Margin. While the estimate of Cover-2 concentration costs at SwapClear is material, the bulk of it arises from Clearing Members that are part of one of the defaulting groups (and therefore are also assumed to default) but in fact have surplus resources to absorb these concentration costs.

However, for ICEU F&O and LME Base we observe a significant impact of including concentration costs, which is also more sensitive to alternative assumptions made on market depth. At ICEU F&O the inclusion of concentration costs increases Default Fund utilisation from 61% to between 72% and 76%, depending on assumptions around market depth estimation. Similarly to LCH SwapClear, a material proportion of these concentration costs come from members of the defaulting group that have a surplus to absorb these costs, limiting the impact on mutualised resources.

LMEC is most impacted by the inclusion of concentration costs. Under the approach to modelling concentration costs used in previous stress tests, this results in full depletion of the mutualised Default Fund and 18% consumption of LMEC's Powers of Assessment (non pre-funded resources that can be called from non-defaulting members). This is driven by large and concentrated positions held by the Cover-2 population. However, results are sensitive to the assumptions made on market capacity. When we use a measure of market depth based on open interest the estimated concentration costs drop significantly. This reflects the particular nature of trading practices in LMEC, where maturities other than the most-traded maturity are typically traded around certain prompt dates (in particular the three-month prompt date), suppressing average daily volumes even where there is significant open interest (see Box B).

We are probing these results further with LMEC to assess the robustness of their current approach to modelling concentration costs.

Chart 3: Credit & Concentration Stress Test results

Baseline Market Stress Scenario, CCP Clearing Service Cover-2, no porting (a) (b) (c) (d) (e)

(a) Stressed losses over defaulting members' resources (SLOMR) is the absolute amount (£ millions) by which losses exceed defaulters' resources (Initial Margin and Default Fund contributions).

(b) Percentage usage of dedicated CCP resources (SITG).

(c) Percentage usage of mutualised Default Fund (DF), consisting of non-defaulters' Default Fund contributions.

(d) Percentage usage of Powers of Assessment (PoA). PoA represents the total amount of non-prefunded resources that CCPs can call from non-defaulters.

(e) Results are shown as a range – indicated by the hashed areas on the chart – based on alternative approaches to defining market depth.

Box B: Modelling the costs of liquidating concentrated positions

Concentration costs are the costs over and above the impact of the market stress that CCPs would face when liquidating (through auction or hedging) concentrated positions of defaulting Clearing Members. Where these positions are material, it is likely that CCPs would need to take a discount on their market value in order to liquidate them.

Unlike the impact of the prescribed market stress scenario, which for a given portfolio can be calculated with precision, concentration costs are not observable and cannot be calculated precisely, but need to be modelled or estimated.

In practice, CCPs and regulators use a range of different approaches to achieve this, all of which require calibration and are subject to uncertainty. For example, concentration costs may be estimated using theoretical models to estimate the market risk or by drawing on surveys of market participants and dealers. The latter approach can be effective as it draws on views of market experts, however the quality relies on collecting a large number of granular responses.

For stress-testing purposes, the Bank uses an in-house methodology to estimate concentration costs, rather than seeking to replicate the concentration add-on calibration used by CCPs. The Bank's methodology follows the logic that the concentration costs demanded by the market can be inferred from the additional market risk these positions would be exposed to if liquidated gradually over a period of time, such that liquidation itself would not lead to a material change in price. This involves the following steps:

1. Aggregate positions of defaulting Clearing Members at a granular product level, including conservative offsetting of long and short positions on highly correlated products.[7] This ensures that the calculation is based on the actual aggregated positions in every product that a CCP would have to liquidate.
2. Estimate concentration costs based on the implied market risk exposure:
   a. calculate the size of the positions relative to the depth in the market. In previous stress tests, average daily volumes traded have been used as the measure of market depth; in this stress test we also consider a measure of market depth based on open interest;
   b. estimate how long it would take to liquidate these positions gradually, based on an assumed limit on how much of the position can be liquidated each day without

moving market prices (our standard approach assumes 25% of average daily volumes);

c. calculate the market risk the position could potentially be exposed to over this liquidation period; and

d. Estimate the price the market will demand for taking on this risk exposure, assuming that market participants seek a certain probability of profit.

3. Allocate estimated concentration costs for each product back to the accounts of defaulting Clearing Members, in proportion to the positions held in each account.

In applying this methodology we make several assumptions, each of which is calibrated to be conservative:

- we assume the market depth (the amount the CCP could liquidate in a day without materially moving the market price) is 25% of average daily volume traded in each product;

- we consider liquidation costs for each granular product separately. In practice, CCPs would create hedged portfolios which would attract lower concentration costs than fragmented positions; and

- we assume that the market would demand a premium resulting in at least 90% probability of profit (based on historical distributions). In practice, liquidation would be subject to competitive bidding and CCPs have control over the auction process and can protect themselves from extreme outcomes. And some market participants may have relevant economic interests in the portfolio, for example for hedging purposes.

Applying a single, common methodology has the advantage of consistency across services. However, products cleared by UK CCPs are characterised by different market conventions, trading patterns and risk profiles. Therefore, certain assumptions and calibration choices could impact different services disproportionally. This year we have therefore undertaken additional sensitivity analysis to test the impact of these assumptions, focussing on those where the impact is likely to be disproportionate across services.

The focus of this sensitivity analysis has been on how we define market depth. Proxying market depth by daily average volume may underestimate the amounts that could be liquidated in markets characterised by infrequent or cyclical trading. Where we observe a 'main', most traded maturity (eg in some futures markets), most daily activity occurs in that maturity, meaning other maturities experience limited or no activity day-to-day and reducing daily average volumes calculated for those maturities. However, significant trading is seen in those maturities on an infrequent basis, without

significant moves in price. We therefore test a measure of market depth based on open interest as an alternative. We find that this has a material impact on concentration costs at ICEU and LMEC – reducing costs by as much as 55%. These services clear more products with infrequent trading patterns.

An alternative approach is to consider liquidity across the curve, as significant liquidity in one maturity may support liquidity in other maturities. We also note that CCPs may manage the costs of large positions in products that are traded infrequently by hedging all or part of these positions in other maturities. We find that at the individual member level, the ability to pool liquidity across maturities may have a material impact on concentration costs. However, for the Cover-2 population, with the largest positions, the hedge itself may move the market and incur additional costs and therefore adjusting these assumptions has a smaller impact.

We will continue to explore and develop this aspect of the stress test methodology.

7: Reverse stress testing and sensitivity testing

Purpose and objectives

Alongside the core stress test we use additional sensitivity testing and reverse stress testing to better understand CCPs' resilience to combinations of increasingly severe assumptions. This includes consideration of more severe 'multiplier' scenarios and looking at larger groups of defaulters.

For this year's exercise this includes the following elements:

- **Cover-X analysis:** this extends the baseline Credit Stress Test to consider the impact of the default of a customised selection of Clearing Member groups (rather than the Cover-2 population). The purpose of this analysis is to examine whether resources sized against the Cover-2 standard are sufficient to cover the default of other combinations of Clearing Members, for example non-bank financial institutions or entities with a higher probability of default.

- **Opposite Direction Scenario analysis:** this examines the impact of a -1.0x multiplier of the Baseline Market Stress Scenario, that is, reversing the direction of all shocks. Together with the Credit Stress Test, this gives us a broader view of CCP resilience by encompassing shocks in both directions. But we note that this scenario should be considered as exploratory as it has not been calibrated against historical data. This also means that the scenario is not consistent in severity across Clearing Services, so results should not be regarded as comparable across services.

- **Reverse Stress Test:** as in previous years, this subjects CCPs to increasingly severe assumptions that go well beyond historical precedents and regulatory requirements.

- **Market Stress Scenario severity:** 1.5x and 2.0x multipliers of the Baseline Market Stress Scenario. This year, the Reverse Stress Test also includes identification of the precise multiples of scenario severity that would fully exhaust default fund at each Clearing Service.

- **Number of defaulting Clearing Member groups:** increasing numbers of defaulting Clearing Members groups (the 'Cover-N' population) from one to five.

- **Concentration cost calculation:** alternative assumptions on the modelling of concentration costs.

The following sections set out further details and results for each of these elements.

Cover-X analysis

To complement the analysis of results under a Cover-2 default, the Bank uses 'Cover-X' analysis to explore the impact of a wider range of defaulter combinations and identify potential risks to CCPs that might not be captured when focussing on the Cover-2 members.

Chart 4 illustrates the results of Credit Stress Test in the Baseline Market Stress Scenario under four alternative defaulter combinations – not including concentration costs – in addition to results under a Cover-2 default:

- **Probability of Default Cover-X:** default of all Clearing Member groups with a one-year estimated probability of default greater than 0.2%.[8]
- **System-wide Cover-2:** default of the two Clearing Member groups whose default generates the largest impact on mutualised resources across all CCP Clearing Services in aggregate under the Baseline Market Stress Scenario.
- **Non-financial Cover-X:** default of all Clearing Members groups defined as non-financial entities, such as industrial or manufacturing entities active in commodities markets.
- Non-bank Cover-X: default of all Clearing Member groups defined as non-bank entities, such as commodities brokers or pension funds.

For LCH services, we do not identify any alternative combinations of defaulters that have a greater impact than the default of the Cover-2 population. In contrast, at ICEU F&O and LME Base the default of all non-bank entities is estimated to result in losses beyond those generated by a Cover-2 default. However, this scenario should be considered implausible, as it implies the default of over a third of membership at either CCP.

In our view, this result reflects the markets served by different CCP Clearing Services, rather than differences in their risk management. In particular, both ICEU F&O and LME Base have a higher proportion of non-bank and non-financial entities in their membership compared to LCH Clearing Services, which significantly influences their default loss. For both services the set of non-bank defaulters also includes a Cover-2 member.

Chart 4: Cover-X Stress Test resultsBaseline Market Stress Scenario, Cover-X combinations, No porting (a) (b) (c) (d)
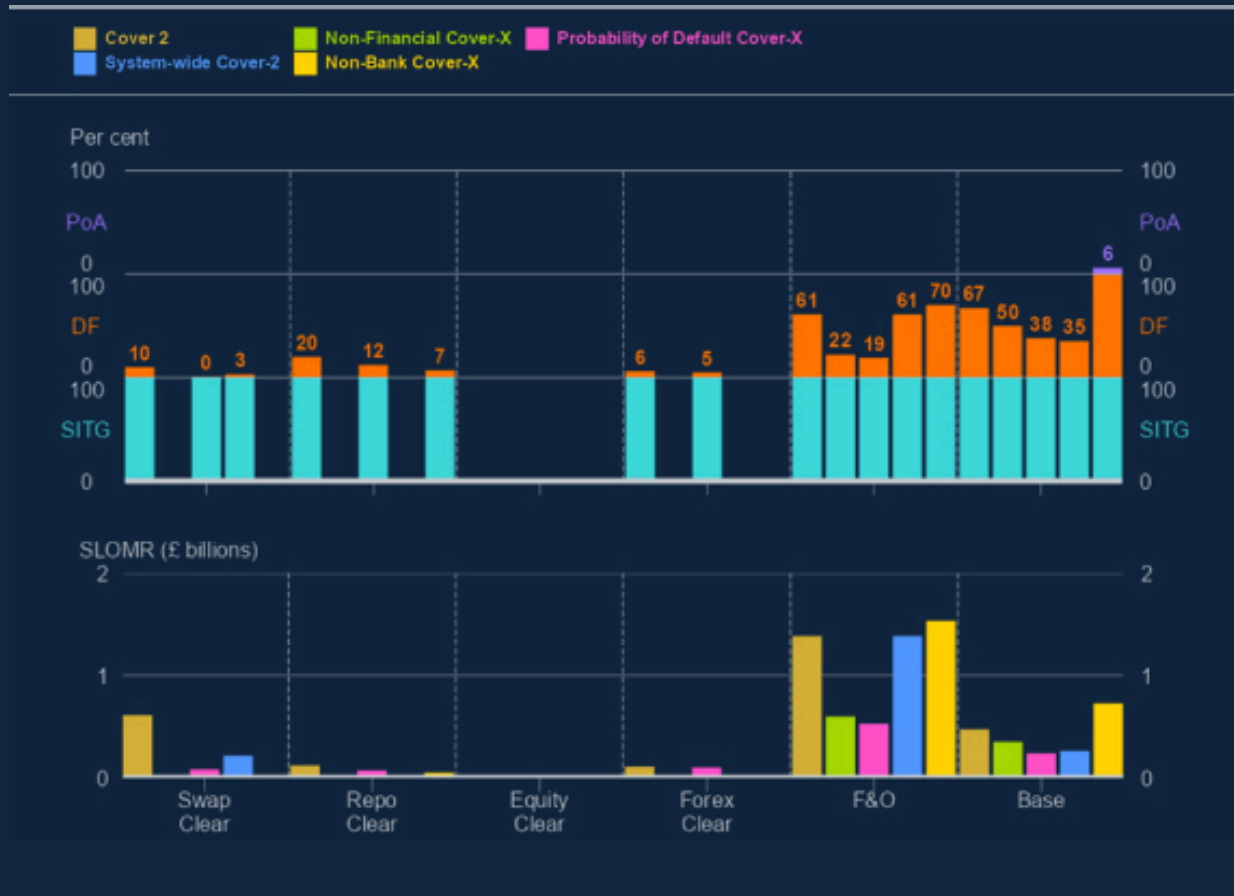
(a) Stressed losses over defaulting members' resources (SLOMR) is the absolute amount (£ millions) by which losses exceed defaulters' resources (Initial Margin and Default Fund contributions).
(b) Percentage usage of dedicated CCP resources (SITG).
(c) Percentage usage of mutualised Default Fund (DF), consisting of non-defaulters' Default Fund contributions.
(d) Percentage usage of Powers of Assessment (PoA). PoA represents the total amount of non-prefunded resources that CCPs can call from non-defaulters.

Opposite Direction Scenario analysis

The Opposite Direction Scenario analysis subjects CCPs to an 'opposite direction' Market Stress Scenario, in which the direction of all shocks (except volatility shocks) in the Baseline Market Stress Scenario are reversed. This analysis can identify whether CCPs are resilient to shocks very different in nature from the baseline scenario and recent market experience, providing us with additional insights.

However, as the Opposite Direction Scenario is simply the inversion of the Baseline Scenario, it has not been calibrated to a specific level of plausibility and consistency in severity across all CCPs. While the shocks to each risk factor have the same magnitude as in the Baseline Scenario, for some products the reversed shocks are further into, or beyond, the extremes of

historical distribution. This is especially the case for ICEU F&O. As described in Section 5, the Baseline Scenario includes shocks to oil that go slightly beyond the historical worst in percentage terms at the short end of the curve. When reversed, these shocks go well beyond the historical worst and so we consider this scenario more implausible.

As shown in Chart 5, SwapClear, LME Base and ICEU F&O all experience greater losses under the Opposite Direction scenario. This increase is most material at ICEU F&O, where losses would require calling additional resources via its Powers of Assessment. As noted above, we consider that this scenario goes well beyond regulatory requirements, but the results also reflect the distribution of long oil positions at ICEU F&O.

Chart 5: Credit Stress Test

-1.0x Baseline Market Stress Scenario, CCP Clearing Service Cover-2, No porting (a) (b) (c) (d)
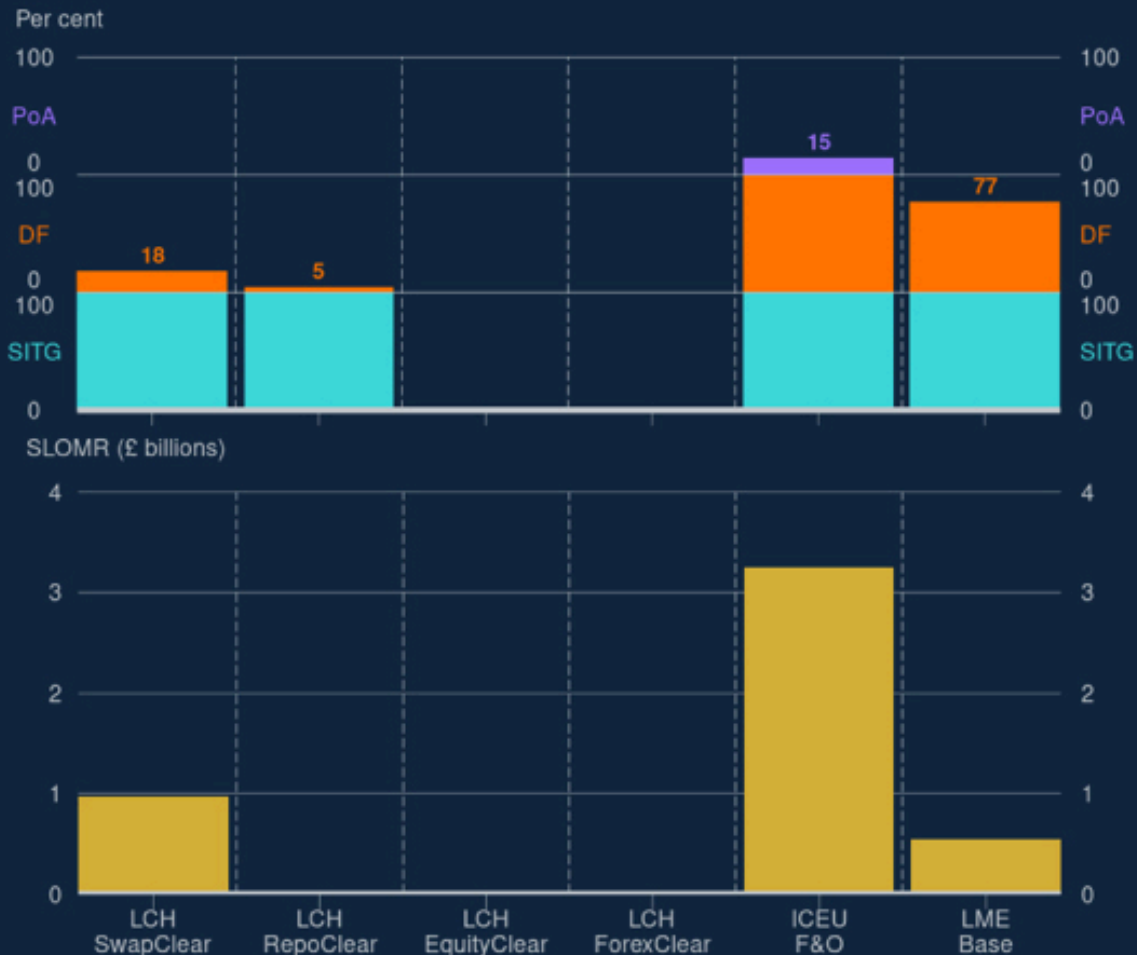
(a) Stressed losses over defaulting members' resources (SLOMR) is the absolute amount (£ billions) by which losses exceed defaulters' resources (Initial Margin and Default Fund contributions).

(b) Percentage usage of dedicated CCP resources (SITG).

(c) Percentage usage of mutualised Default Fund (DF), consisting of non-defaulters' Default Fund contributions.

(d) Percentage usage of Powers of Assessment (PoA). PoA represents the total amount of non-prefunded resources that CCPs can call from non-defaulters.

Reverse Credit Stress Test

The Reverse Credit Stress Test systematically subjects CCPs to increasingly severe assumptions on scenario severity, the number of defaulters and the calculation of concentration costs. Each of these assumptions is adjusted to levels of severity that intentionally go well beyond historical precedents and regulatory requirements and in combination are very extreme.

The aim of this analysis is to identify the combinations of assumptions that might fully deplete both pre-funded and non-prefunded resources at each Clearing Service. We do this by asking CCPs to submit data on the impact of specific 'multiplier' scenarios and this year we have extended the Reverse Stress Test by interpolating and extrapolating from these submissions to identify precise scenario multipliers that exhaust resources.

The Credit Reverse Stress Test uses the same calculation methodology as the Credit Stress Test (Annex A), with adjustments to the following input assumptions:

- **Market Stress Scenario severity:** the impact of -1.0x, 1.5x and 2.0x multipliers of the Baseline Market Stress Scenario detailed in Section 4.
- **Number of defaulting Clearing Member groups:** increasing the number of defaulting Clearing Members groups (the 'Cover-N' population) from one to five.
- **Concentration cost calculation:** increasingly severe assumptions used to model concentration costs. Specifically, the volume of defaulting Clearing Members' positions that we assume can be liquidated each day before giving rise to concentration premiums is limited from 25% down to 15% and 10% of market depth. For the purposes of this analysis, market depth is defined as average daily volumes. As described above, we consider this to be a conservative way of defining market depth, especially for ICEU and LMEC, so these additional assumptions should be considered very conservative.
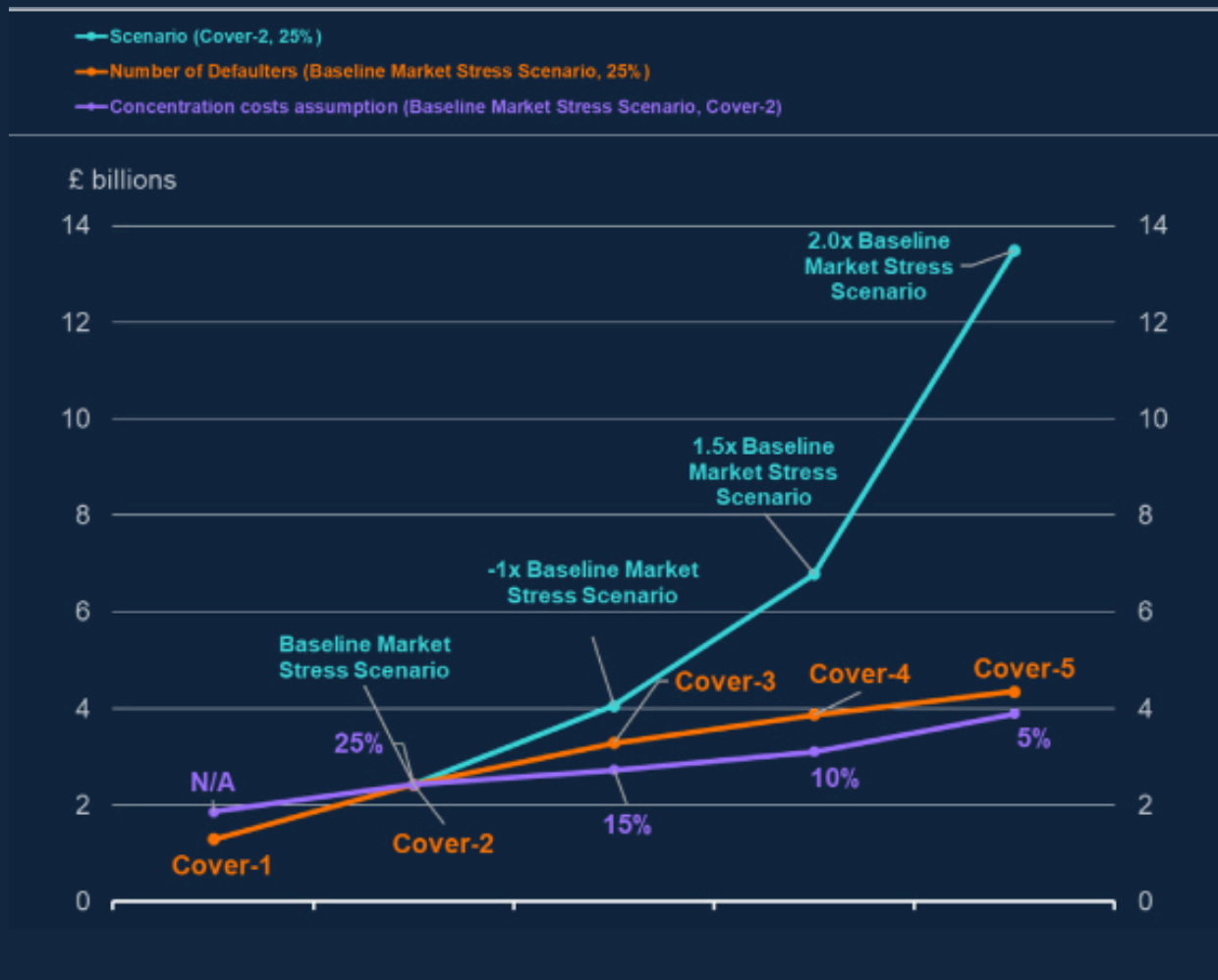
We start by considering the impact of changing these assumptions one at a time. We then extend our analysis to identify the scenario severity that exhausts default fund under different numbers of defaulters. Finally, we consider all three dimensions together.

One-dimensional Reverse Credit Stress Test

Chart 6 presents aggregate stressed losses over member resources across all CCP Clearing Services as the severity of each Credit Reverse Stress Test assumption is adjusted individually and considers concentration costs calculated only based on Daily Average Volume. In isolation, increasing the severity of the Market Stress Scenario has the greatest impact on stressed losses over member resources, compared to increasing the number of defaulting Clearing Member groups or increasing the severity of the Bank's concentration cost assumptions.

Chart 6: Credit Reverse Stress Test results

Aggregate SLOMR across all CCP Clearing Services (a) (b) (c)

Legend:
- Scenario (Cover-2, 25%)
- Number of Defaulters (Baseline Market Stress Scenario, 25%)
- Concentration costs assumption (Baseline Market Stress Scenario, Cover-2)

(a) Each line illustrates the impact of increasing the severity of one assumption while holding all other assumptions constant. Where the number of defaulting Clearing Member groups is held constant, the identity of the Clearing Member groups can change according to the dynamic Cover-2 methodology.

(b) Stressed losses over members' resources (SLOMR) is the absolute amount (£ billions) by which losses exceed defaulters' resources (Initial Margin and Default Fund contributions).

(c) '25%', '15%', and '10%' represent the percentage of daily average volume traded for each product assumed can be liquidated daily without a price impact. A lower liquidation rate implies a reduction in the market's ability to absorb CCP positions before giving rise to concentration costs. N/A represents exclusion of concentration costs.

Two-dimensional Reverse Credit Stress Test

As an extension to previous stress tests, this year we have interpolated between and extrapolated from the scenarios shown in Chart 6 above to identify the precise point that would deplete each CCP's mutualised Default Fund.

This is done by interpolating between CCPs' estimates of losses under the -1.0x, 1.0x, 1.5x and 2.0x scenarios, and then extrapolating the losses to severities of -3.0x and 6.0x. We then compare the estimates of losses against available pre-funded resources, given the set of defaulters that generate the largest losses.

Chart 7 shows the scenario multiplier required to completely deplete pre-funded resources under a specific number of defaulters. Overall, all CCPs show a continuous decline in their ability to withstand higher severity scenarios as the defaulting population increases and the largest decrease in resilience levels happens when we move from one to two defaulters. Beyond that, additional defaults have a more limited impact as the defaulters will tend to be smaller entities and may have offsetting positions with other defaulters in the Cover-N set.

LCH services, particularly LCH ForexClear and LCH RepoClear, can comfortably withstand scenarios of severity exceeding the standard stress test. LCH SwapClear is also in a position able to absorb the increase in severity and would require five defaulters and close to double the severity of the Baseline Scenario to deplete its mutualised Default Fund.

Under Cover-2 LMEC and ICEU exhaust their prefunded resources around the 1.2x severity level. This represents a scenario well beyond the historical worst – including shocks to key products of over 130% of the historical worst – and beyond regulatory requirements.

Chart 7: Scenarios that deplete CCP pre-funded resources

CCP Clearing Service, No porting, No Concentration Costs calculation
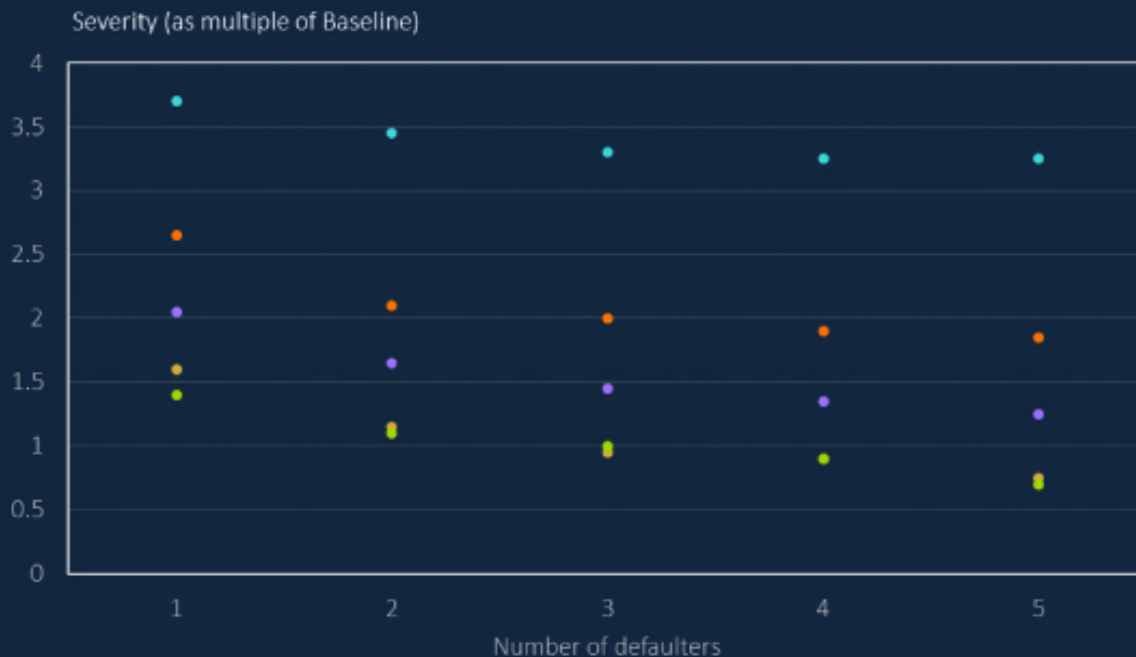
Three-dimensional Reverse Credit Stress Test

Chart 8 presents the results of the Credit Reverse Stress Test when combining changes in all three input assumptions simultaneously. The chart illustrates which layers of each CCP Clearing Service's default waterfall experience depletion under each combination of assumptions and considering only the average daily volume as a measure of market depth. Shading indicates the proportion of each layer depleted.

As expected, as we apply more extreme and conservative assumptions – that go well beyond regulatory requirements – we start to see losses that exceed CCPs' default funds.

- For LME Base, in the absence of concentration costs losses may exceed Default Fund under the Baseline scenario under the default of four or more members, or for the 1.5x scenario under a Cover-2 default. Once conservative assumptions on concentration costs are included, losses may exceed Powers of Assessment under the 1.5x and 2.0x Baseline scenarios and a Cover-2 default.
- ICEU F&O is also estimated to experience full depletion of its Default Fund under the 1.5x and 2.0x multiplier scenarios and a Cover-2 default. As with LME, including concentration

costs increases these losses and under more conservative metrics leads to depletion of Powers of Assessment.

- Consistent with the results of the Credit Stress Test, LCH services are generally more able to absorb losses. However, the default of three or more members under the 1.5x Baseline or two or more members under the 2.0x Baseline would deplete Default Fund at LCH SwapClear. Other LCH services are more sensitive to the assumptions made on concentration costs; for ForexClear this reflects conservative assumptions that do not allow offsets across currency pairs.

Overall, each CCP Clearing Service is less resilient to more severe combinations of assumptions than in the Bank's previous CCP SST exercise. Consistent with the Credit Stress Test, this is a consequence of the shape of the Baseline Market Stress Scenario as well as certain assumptions and calibration choices for the concentration cost calculation.

Chart 8: Credit Reverse Stress Test results

CCP Clearing Service Cover-N, No porting (a) (b) (c) (d) (e) (f)
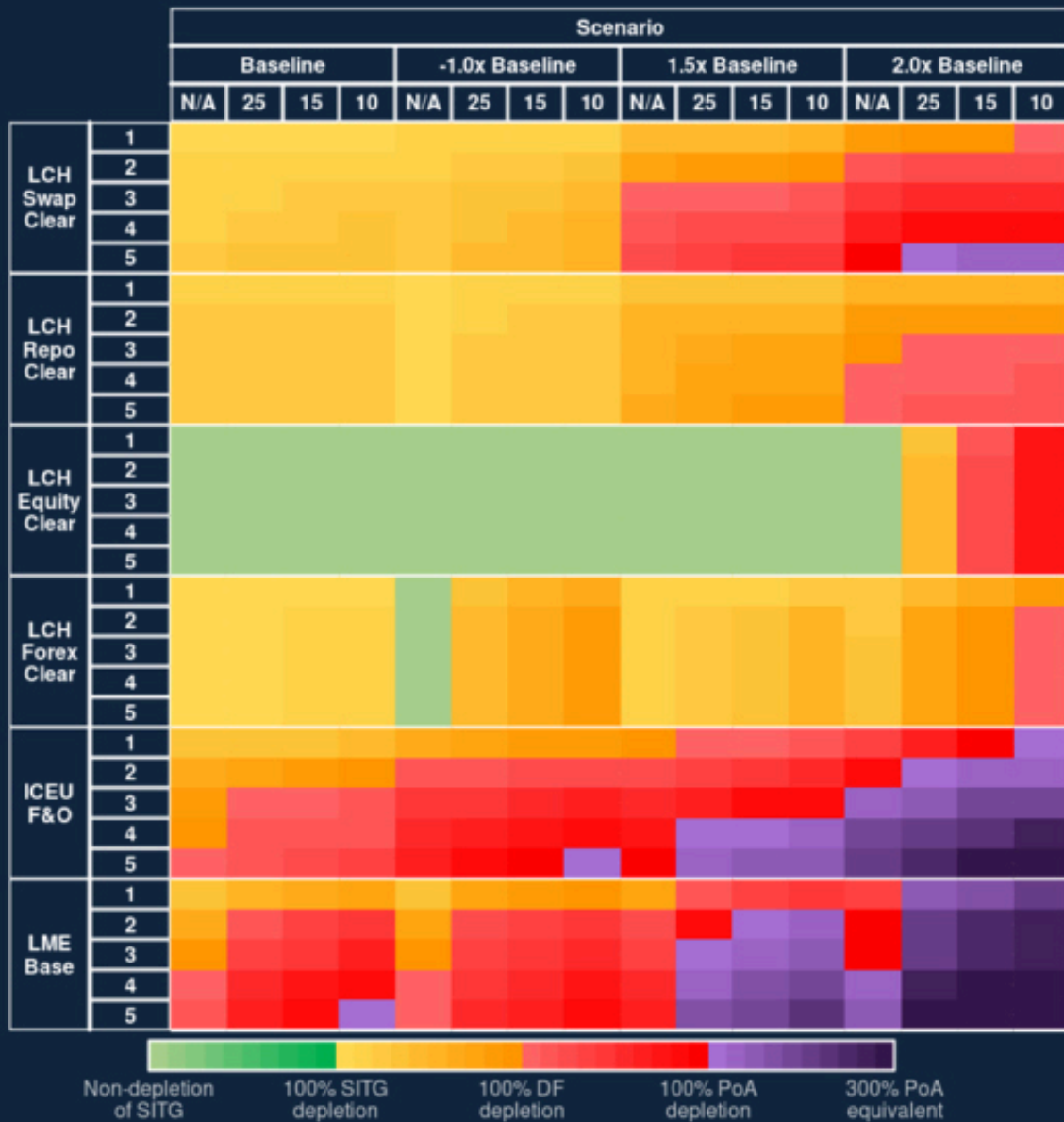
(a) Percentage usage of dedicated CCP resources (SITG).

(b) Percentage usage of mutualised Default Fund (DF), consisting of non-defaulters' Default Fund contributions.

(c) Percentage usage of Powers of Assessment (PoA). PoA represents the total amount of non-prefunded resources that CCPs can call from non-defaulters. PoA are assumed to be equal to the minimum of non-defaulting Clearing Member groups' Default Fund contributions multiplied by three, or the non-defaulting Clearing Member groups' Default Fund contributions multiplied by the number of individual defaulting Clearing Members.

(d) Losses beyond PoA, presented with reference to the size of PoA. For example, 100% PoA equivalent where losses beyond PoA are of the same magnitude as PoA.

(e) '25', '15', and '10' represent the percentage of daily average volume traded for each product assumed can be liquidated daily without a price impact. A lower liquidation rate implies a reduction in the market's ability to absorb CCP positions before giving rise to concentration costs. N/A represents exclusion of concentration costs.

(f) Numbers on the y-axis represent the number of Clearing Member groups assumed to default.

8: Overall conclusions and next steps

Overall, the results of the Credit Stress Test show that all UK CCP Clearing Services are resilient to the default of their Cover-2 population under the Baseline Market Stress Scenario excluding the costs of liquidating concentrated positions. Under this assumption, all UK CCP Clearing Services can absorb default losses within their prefunded resources.

UK CCP Clearing Services generally experience greater depletion of mutualised Default Fund contributions than in previous exercises. This reflects the shape of the Baseline Market Stress Scenario. While it is calibrated to be broadly equivalent in overall severity to the worst historical stress for each UK CCP Clearing Service, the Scenario includes shocks to some material products that go beyond the historical worst. These shocks impact large positions held in these products by the Cover-2 members, leading to losses beyond IM. The results are also driven by CCPs unwinding prefunded resources – that had increased following the market volatility in 2022 – between the reference dates for the 2023 and 2024 CCP SST.

When estimates of concentration costs are included this increases the use of prefunded resources and for LME Base results in losses in excess of their default fund. This result is sensitive to the specific assumptions made in our modelling, some of which may not fully reflect the dynamic in LMEC's markets, and under some still conservative assumptions the losses are contained with the default fund. However, the impact is also driven by large directional positions. We will probe this further with LMEC to assess the robustness of their approach to accounting for concentration costs.

Consistent with the exploratory aims of the CCP SST, the exercise also includes sensitivity testing and reverse stress testing that goes beyond regulatory requirements. This aims to identify potential pockets of vulnerability that may exist outside the Cover-2 population or under shocks that go beyond 'extreme but plausible'.

- The 'Cover X' analysis tests resilience to alternative groups of defaulters, in order to uncover potential vulnerabilities that may not be captured when focussing on the Cover-2 population. We find that the default of all non-bank members could pose a greater risk to both LME Base and ICEU F&O than a Cover-2 default. But this represents a very extreme scenario – the default of around 20 or more members – and reflects the markets that these Clearing Services serve.
- The Opposite Direction scenario reverses the direction of the baseline scenario in order to survey a wider range of shocks, including some going well beyond what we would regard as plausible based on historical experience. We find larger losses at some services under this scenario, driven by shocks to some products going disproportionally beyond historical extremes, notably the shorter maturities for oil.

- In the Credit Reverse Stress Test, CCPs are tested against different combinations of Market Stress Scenarios and assumptions on the number of defaulters that go beyond historical precedents, as well as the inclusion of more conservative estimates of concentration costs. Consistent with the results of the Credit Stress Test, each CCP Clearing Service experiences more depletion of its resources under these severe combinations of assumptions than in previous exercises.

As an extension to this year's stress test, we have also used a simple desk-based model to estimate the impact of a wider range of scenarios on CCPs' resources, including scenarios that deliberately stretch historical correlations between different products and go beyond historical precedents. This analysis is not as accurate as the core credit stress test, which is based on full scenario revaluations under-taken by CCPs, but it enables us to survey a wider range of potential risks. In most cases, we find UK CCPs have sufficient resources to absorb such scenarios. But we have identified some very severe but plausible scenarios that may present a risk to CCPs as they affect relatively large or concentrated positions held by Clearing Members. We will follow-up with CCPs to probe how they capture the risks identified via their own stress testing.

The Bank will use the findings from the 2024 CCP SST to support and inform its ongoing supervision and regulation of UK CCPs. We plan to follow-up with the three CCPs in scope regarding the approach to concentration risk and other pockets of risk we have identified. We will also share relevant results with other regulators and authorities.

Annexes

Annex A: Credit Stress Test methodology

Methodology

The Credit Stress Test methodology aims to reflect the processes and mechanics of a Clearing Member default scenario, based as closely as possible on the applicable regulations and CCPs' rulebooks.

The Bank collects data from CCPs on financial resources held (including margin requirements and margin collateral, Default Fund contributions, and CCPs' own capital),[9] Clearing Member and client positions, and on the impact of each of the Market Stress Scenarios on Clearing Members' and clients' profit and losses. The Bank relies on CCPs' models to revalue collateral and positions given the complexity of some of the products cleared by UK CCPs. The Bank validates the data submitted by CCPs against other information sources available.

Using this input data, the Bank assesses the impact on individual CCP Clearing Services' financial resources under the applicable Market Stress Scenario and default assumptions, following the steps below. Where additional modelling assumptions are required – for example in the estimation of concentration costs – the Bank applies its own bespoke and conservative models.

Step 1 – Calculation of surplus or deficit of resources at the individual account level.

The Bank first calculates the surplus or deficit of resources for each individual Clearing Member house account and client account. This is determined by comparing the PnL impact of the relevant Market Stress Scenario, estimated concentration costs where applicable (see Box B for further details), and the applicable account-level prefunded resources. These calculations are based on margin requirements, rather than total margin collateral, to reflect the possibility that Clearing Members may withdraw excess collateral from CCPs in the run-up to a default event.

Step 2 – Calculation of surplus or deficit of resources at the Clearing Member level

Next, the overall impact for each individual Clearing Member is determined based on the surplus or deficit of resources at each of its accounts, and the relevant account segregation rules. Surpluses and deficits on house accounts are generally aggregated, as CCP rules allow any surplus on Clearing Members' house accounts to be used to offset any deficits on their client accounts. Balances at client accounts are only aggregated where: (i) those accounts have a deficit; and (ii) those accounts are not assumed to be ported (ie transferred) to other (non-defaulting) Clearing Members. This reflects CCP rules which stipulate that any surplus on clients' accounts must be returned to those respective clients and cannot be used to offset deficits elsewhere.

The Bank considers alternative assumptions regarding CCPs' ability to successfully port client accounts (detailed in Table 1.A) to assess the impact of successful porting on CCPs' resilience. Where porting of client accounts is assumed, ported accounts would be moved across to a new Clearing Member with all their positions and resources and so are excluded from the rest of the calculation process.

Table 1.A: Credit Stress Test alternative porting assumptions

Porting assumption	Description
No porting	No client accounts port from defaulting Clearing Members to non-defaulting Clearing Members. This is the most conservative porting assumption in the Credit Stress Test.
Segregated client accounts port	Client accounts that are individually segregated (ISEG) or legally segregated operationally comingled (LSOC) are assumed to successfully port from defaulting Clearing Members to non-defaulting Clearing Members. Omnibus accounts do not port from defaulting Clearing Members to non-defaulting Clearing Members.
All client accounts port	All client accounts are assumed to successfully port from defaulting Clearing Members, including ISEG, LSOC, and omnibus accounts.

Step 3 – Calculation of surplus or deficit of resources at the Clearing Member group level

Clearing Members are then grouped together into Clearing Member groups when they are under the same corporate/legal structure and/or have particularly close economic relationships. This reflects the likelihood that all Clearing Members within a Clearing Member group would default together when a default occurs.

The surplus or deficit of resources for each Clearing Member group is then calculated based on the net surplus/deficit of each individual Clearing Member within that Clearing Member group. Under CCPs' rules, defaulting Clearing Members are resolved separately, even if they are part of the same corporate group. For Clearing Members with a surplus, this surplus therefore cannot be used to offset losses elsewhere in the Clearing Member group. For Clearing Members with a deficit over their margin resources, this deficit is compared against their own Default Fund resources and then aggregated to calculate stressed losses over defaulting members' resources at the Clearing Member group level.[10]

Step 4 – Default of selected Clearing Member groups

The Credit Stress Test methodology can test any combination of defaulting Clearing Member groups. The initial focus is on the default of the Cover-2 population, which is determined algorithmically for each CCP Clearing Service by calculating losses for every potential pair of defaulting Clearing Member groups.[11]

This is complemented by the Cover-X Analysis, which considers the default of customised populations of Clearing Member groups. This includes an analysis of the system-wide Cover-2 population, defined as the two Clearing Member groups whose default leads to the greatest aggregate stressed losses over defaulting members' resources across all CCP Clearing Services. It also includes populations of Clearing Member groups based on common characteristics, such as entity type or industry, and based on Clearing Members' probability of default.

Step 5 – Calculation of depletion of financial resources held under CCPs' default waterfalls

After selecting the defaulting Clearing Member groups, the resulting stressed losses over defaulting members' resources are compared to the other resources available to each CCP Clearing Service under their default waterfalls. These resources are drawn upon in the following order: Skin in the Game (SITG), the mutualised Default Fund and Power of Assessment.

Annex B: Glossary

Baseline Market Stress Scenario – A hypothetical market stress scenario designed by the Bank of England. It represents an escalation of geopolitical and trade tensions culminating in an upward shock to commodities markets. Interest rates and government bond yields decrease rapidly, while equity prices increase. Currencies appreciate against the USD dollar. It is modelled to shock CCP Clearing Services to a level of severity equivalent to the worst historical stress scenario.

CCP (Central Counterparties) – Financial Market Infrastructures sitting between the buyer and seller of a trade, guaranteeing the obligations under the contract agreed between the two counterparties. If one counterparty fails, the other is protected via the default management procedures and resources of the CCP.

CCP Clearing Service – A distinct part of a CCP offering clearing for certain financial markets and types of products. Typically, each CCP Clearing Service maps directly to a single Default Fund.

CCP Skin in the Game – A tranche of the CCP's own capital that is utilised directly after the defaulter's resources have been used to cover losses, but before any resources from non-defaulted members can be utilised.

Clearing Member – A direct member of the CCP that submits trades either on their own behalf or on behalf of clients. The Clearing Member is financially responsible for the trade's obligations, such as posting initial margin and variation margin, including on behalf of its clients.

Clearing Member group – A group of entities, at least one of which is a Clearing Member, that form part of a legal entity or are closely economically integrated.

Client – Counterparties that clear trades indirectly via a Clearing Member. These entities do not make contributions to CCPs' Default Funds.

Concentration costs – Additional costs that CCPs may face when they liquidate (through hedging or auction) large or concentrated positions of defaulters.

Cover-2 – The two Clearing Member groups whose default generates the largest impact on resources/worst liquidity balance at each CCP Clearing Service/CCP under the relevant market stress scenario.

Cover-X – An alternative (ie not Cover-2) defaulter population at each CCP Clearing Service.

Default Fund – CCPs' prefunded mutualised resources contributed by Clearing Members. These resources are called upon after the defaulters' own resources and the CCP's own capital have been depleted.

Defaulters' own resources – The prefunded resources, consisting of Initial Margin and Default Fund contributions, which a defaulting Clearing Member has posted to the CCP as collateral. These form the first layer of each CCP's default waterfall.

Default waterfall – The resources that a CCP can access to satisfy defaulting Clearing Members' obligations, drawn in the following order: (i) defaulting Clearing Members' prefunded resources (Initial Margin and Default Fund contributions); (ii) CCP Skin in the Game (CCPs' own capital set aside to absorb default losses); (iii) mutualised Default Fund contributions (prefunded contributions of non-defaulting Clearing Members); and (iv) Powers of Assessment (non-prefunded resources CCPs can call from non-defaulting Clearing Members).

Initial Margin – Resources posted by a Clearing Member to cover the potential losses that could arise from that Clearing Member's positions in the event of a default. A CCP will call upon the defaulting Clearing Member's Initial Margin contributions before other resources within the default waterfall sequence to meet the obligations of a defaulting Clearing Member.

Losses beyond Powers of Assessment – Outstanding losses after all previous layers of the default waterfall have been depleted, including Powers of Assessment. CCPs may use tools such as cash calls, Variation Margin gains haircutting and contract tear-ups where they experience losses beyond Powers of Assessment.

Mutualised Default Fund contributions – Clearing Members' contributions to a CCP's Default Fund which can be used to absorb default losses beyond defaulters' own resources and CCPs' SITG. Utilised contributions require replenishing by non-defaulting Clearing Members.

Non-bank Clearing Member group – Group that is not classified as a bank entity or another CCP.

Non-financial Clearing Member group – Group that does not conduct banking activities or other financial activities.

Non-prefunded resources – Additional financial resources that CCPs have the power to call from non-defaulting Clearing Members via Powers of Assessment.

Omnibus client account – An account maintained by a Clearing Member at a CCP that contains more than one customer of the Clearing Member.

Opposite Direction Scenario – A market stress scenario in which the direction of all shocks (except volatility shocks) is reversed relative to the Baseline Market Stress Scenario.

Porting – Refers to the ability of CCPs to successfully transfer client accounts at defaulting Clearing Members to non-defaulting Clearing Members.

Powers of Assessment – The non-prefunded resources a CCP can request from its Clearing Members in the event of a Clearing Member default. This can occur after the depletion of the Defaulter's prefunded resources, the CCP's Skin in the Game and the Default Fund.

Prefunded resources – The total of all collateral held by CCPs that is available at the time of a potential default. This includes Initial Margin and Default Fund contributions of any defaulted Clearing Members, and Default Fund contributions of non-defaulting Clearing Members.

Probability of default – The modelled probability that a chosen entity will default on its obligations over a specified period.

PnL (profit-and-loss) – The observed increase/decrease in the value of a portfolio when this is priced at current market prices.

Reference date – The start date for the CCP supervisory stress test. The reference date determines the market prices to which shocks are applied, as well as CCP exposures and resources.

Risk factors – The individual market prices and rates to which shocks are applied in the Bank's market stress scenarios.

Segregated client accounts (ISEG, LSOC) – A type of account that only holds positions and collateral associated with a single client in individually segregated accounts (ISEG), or multiple clients in legally segregated, operationally commingled accounts (LSOC). These types of accounts are assumed to be easier to port than non-segregated (omnibus) accounts.

Sensitivity testing – The process of individually and jointly changing core assumptions underlying the stress test. Combining multiple sensitivities often represents a more severe test that goes beyond regulatory requirements and historical precedents.

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1. A CCP's default waterfall stipulates the sequence of financial resources that a CCP can draw upon to cover stressed losses over defaulting Clearing Member resources. Beyond defaulting Clearing Member's Initial Margin and Default Fund contributions, the default waterfall includes CCP Skin in the Game (SITG) (the CCP's own capital which can be used to cover credit losses), non-defaulter's Default Fund contributions, and Powers of Assessment (additional non-prefunded resources that CCPs can call from non-defaulting Clearing Members).

2. For example, Market Stress Scenarios beyond the 'extreme but plausible' definition, and the default of a greater number of defaults than the two Clearing Member groups whose default generates the largest exposures (Cover-2 population).

3. The 22 March 2024 reference date was selected as CCP resources, CCP exposures and market prices on this date were within one standard deviation of the average over the period since the conclusion of the Bank's previous CCP SST exercise.

4. Powers of Assessment are calculated to be equal to the minimum of non-defaulting Clearing Member groups' Default Fund contributions multiplied by three, or the non-defaulting Clearing Member groups' Default Fund contributions multiplied by the number of individual defaulting Clearing Members. This reflects UK CCPs' rulebooks allowing a maximum of three Powers of Assessment calls in a six-month period.

5. Our scenario generation methodology allows for shocks to individual risk factors to reach up to 110% of the historical worst in percentage terms. And so, for example the 42% increase in one-month Brent goes beyond the historical worst of 38%. However, given a higher starting price, this represents an absolute shock of about twice the historical worst.

6. As noted in previous stress test reports, the calculation of concentration costs incorporates conservative assumptions and is done at the granular product level, an inherently conservative approach as in practice auction portfolios would likely benefit from diversification and could attract lower concentration premia.

7. These offsets relate to calendar spreads or basis exposures in related products for which there are high levels of historically observed correlations in price moves. We quantify these correlations conservatively using periods of stress, when typical correlations between products may break down.

8. The classifications for 'Probability of Default Cover-X' are applied using Bloomberg's one-year market-implied probability of default measure.

9. CCPs provide both pre-stress and stressed collateral values for each Market Stress Scenario.

10. Where CCPs have rules in place that allow a surplus of a given Clearing Member in one Clearing Service to offset a deficit of that same Clearing Member in another Clearing Service, these offsets are applied in the calculation.

11. The Cover-2 population is defined at the CCP Clearing Service level as UK CCPs maintain segregated Default Funds for different asset classes.