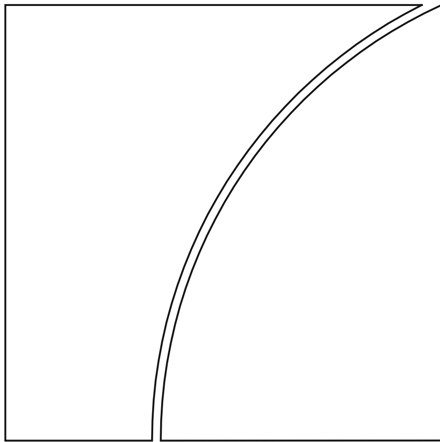
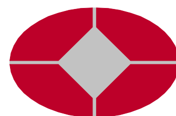
Committee on Payments and Market Infrastructures

Board of the International Organization of Securities Commissions



Implementation monitoring of PFMI: follow-up Level 3 assessment of CCPs' recovery planning, coverage of financial resources and liquidity stress testing

May 2018



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Abbreviations

CCP	central counterparty
CPMI	Committee on Payments and Market Infrastructures
CPSS	Committee on Payment and Settlement Systems
CSD	central securities depository
ETD	exchange-traded derivatives
FMI	financial market infrastructure
IMSG	Implementation Monitoring Standing Group
IOSCO	International Organization of Securities Commissions
IRD	interest rate derivatives
KC	Key Consideration
L1	Level 1
L2	Level 2
L3	Level 3
OTC	over-the-counter
PFMI	*Principles for financial market infrastructures*
SSS	securities settlement systems
VMGH	variation margin gains haircutting

1. Executive summary

In April 2012, the Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) published the *Principles for financial market infrastructures* (PFMI). The PFMI set expectations for the design and operation of financial markets infrastructures (FMIs) to enhance their safety and efficiency and, more broadly, to limit systemic risk and foster transparency and financial stability.

Following the publication of the PFMI, the CPMI and IOSCO agreed to monitor their implementation in 28 CPMI and IOSCO member jurisdictions via a dedicated standing group, the Implementation Monitoring Standing Group (IMSG).[1] The implementation monitoring is being carried out on three levels. Level 3 (L3) peer reviews examine consistency in the outcomes of implementation of the Principles by FMIs and implementation of the Responsibilities by authorities. These assessments are also expected to inform the CPMI and IOSCO about the nature and potential causes of variations in approaches or outcomes, as such variations may be due to challenges and interpretative issues that have emerged in implementing the PFMI. This information may feed into other CPMI and IOSCO work, including the ongoing development of standards and guidance.

This report outlines the findings from a follow-up assessment to the initial L3 assessment *Report on the financial risk management and recovery practices of 10 derivatives CCPs* published by the CPMI and IOSCO in August 2016.[2]

1.1 Scope of the assessment

In this assessment, the IMSG has reviewed CCPs' progress in implementation and the consistency of the CCPs' outcomes of implementation, both with the PFMI and across CCPs, relating to the serious issues of concern identified in the first L3 assessment report in the areas of recovery planning, coverage of financial resources, and liquidity stress testing.

While 10 derivatives CCPs were surveyed in the initial L3 assessment, the current follow-up L3 assessment has expanded the sample to 19 CCPs that provide clearing services to a broader range of product classes, such as clearing services provided in the repo, bond and equity markets, as well as the derivatives markets. The 19 CCPs span 17 jurisdictions and include a mix of globally active and regionally focused entities.

The 19 CCPs participated voluntarily in the exercise, providing responses to a survey covering three topics on recovery planning, coverage of financial resources, and liquidity stress testing. The CCPs also responded to follow-up questions from the IMSG and reviewed the final report for factual accuracy. The IMSG would like to thank the participating CCPs for their cooperation during this exercise. The effective date for the information contained in this report is 1 January 2017.

Importantly, L3 assessments are peer-benchmarking exercises and not supervisory exercises. Accordingly, the focus of the report is on the consistency of outcomes of implementation of the relevant Principles and Key Considerations (KCs) across the group of CCPs as a whole rather than on each individual CCP's specific outcomes of implementation. As noted in Responsibility D of the PFMI, it falls

[1] The 28 jurisdictions that are participating in the PFMI implementation monitoring exercise are Argentina, Australia, Belgium, Brazil, Canada, Chile, China, the European Union, France, Germany, Hong Kong SAR, India, Indonesia, Italy, Japan, Korea, Mexico, the Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

[2] http://www.bis.org/cpmi/publ/d148.htm and https://www.iosco.org/library/pubdocs/pdf/IOSCOPD538.pdf.

within the responsibility of the relevant supervisory authorities to ensure that the Principles are implemented by individual CCPs. Furthermore, the findings in this report are based on the IMSG's review of the 19 CCPs' responses to the survey questionnaire and may not necessarily be representative of all CCPs.

1.2 Key findings of the assessment

Overall, participating CCPs have made progress in implementing arrangements that, collectively, help advance the public policy objectives of the PFMI.[3] In particular areas, as further described below, some CCPs have not implemented practices that are fully consistent with specific standards of the PFMI. These issues were first identified in the August 2016 L3 assessment and, based upon the results of this assessment, remain outstanding in a number of specific instances both for certain derivatives CCPs that participated in the August 2016 L3 assessment (and were urged to remediate such issues by the end of 2016) and for some of the additional nine CCPs that were assessed for the first time under this expanded L3 assessment. The failures of these CCPs to implement practices consistent with specific standards of the PFMI constitute, in certain instances, issues of concern that are serious and warrant immediate attention.[4]

In keeping with their respective responsibilities for regulation, supervision and oversight, authorities are expected to ensure that the PFMI are applied consistently in their respective jurisdictions and implemented by individual CCPs, as noted in Responsibility D of the PFMI. The CPMI and IOSCO have shared the concerns identified in this assessment with the relevant authorities for each particular CCP. While the report focuses on the sample of 19 CCPs that were assessed, other CCPs, as well as their supervisors, regulators and overseers, should also consider any issues of concern identified in this follow-up report if and where relevant and take prompt action to address them. The guidance on resilience[5] and the revised Recovery Report[6] published by the CPMI and IOSCO in July 2017 should be taken into account by the relevant CCPs in making the appropriate enhancements to their practices. The key findings of the exercise are summarised, by topic, below.

1.2.1 Recovery planning

All of the 10 CCPs that were surveyed in the initial L3 assessment have reported changes in their recovery plans in the last 18 months. In particular, the two CCPs that were identified in the previous report as not having any recovery plans in place have made progress in developing their recovery plans but were still in the process of putting in place rules and arrangements to implement the plans as of the effective date of this review.[7] Most of the remaining CCPs made changes to their recovery plans, mainly to their rules and procedures to allocate uncovered credit losses, to re-establish a matched book, to address uncovered liquidity shortfalls and to replenish financial resources following a particular default. CCPs that were not part of the initial L3 assessment have also made changes to their recovery plans, mainly to their rules and procedures to address uncovered credit losses and to re-establish a matched book.

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[3] That is, enhancing safety and efficiency in payment, clearing, settlement and recording arrangements and, more broadly, limiting systemic risk and fostering transparency and financial stability. See paragraph 1.15 of the PFMI.

[4] See sub-sections 1.2.1. Recovery planning and 1.2.3. Liquidity stress testing.

[5] CPMI-IOSCO, *Resilience of central counterparties (CCPs): Further guidance on the PFMI*, July 2017, http://www.bis.org/cpmi/publ/d163.pdf and http://www.iosco.org/library/pubdocs/pdf/IOSCOPD568.pdf.

[6] CPMI-IOSCO, *Recovery of financial market infrastructures – revised report*, July 2017, http://www.bis.org/cpmi/publ/d162.pdf and http://www.iosco.org/library/pubdocs/pdf/IOSCOPD569.pdf.

[7] However, since the effective date of this review, both of these CCPs have submitted proposed rules and arrangements to implement their recovery plans to their regulators for approval.

One of these CCPs was still in the process of putting in place rules and arrangements to implement its recovery plan as of the effective date of this review.

The CPMI and IOSCO reiterate the importance of developing comprehensive and effective recovery plans, consistent with standards in the PFMI and informed by associated guidance in the revised Recovery Report. To that end, if a CCP has not fully implemented a comprehensive and effective recovery plan, this is a serious issue of concern that should be addressed with the highest priority.

Additionally, certain elements of CCPs' recovery plans were highlighted as serious issues of concern in the initial L3 assessment. Many of these elements remain in place as of the effective date of this report, namely:

- Some CCPs employ only one capped tool to address uncovered credit losses. Reliance on this tool alone may be insufficient for a CCP to comprehensively allocate uncovered losses. Other tools may be necessary to achieve the outcome expected in Principle 4.
- Some CCPs do not have mandatory rule-based recovery tools to re-establish a matched book, and it is unclear whether reliance by these CCPs on voluntary, market-based tools alone would effectively restore a matched book. These CCPs should have a range of tools available that are sufficient to ensure that the CCP can re-establish a matched book in recovery.
- Although all CCPs have now identified at least one tool for addressing liquidity shortfalls, certain tools identified in this assessment do not appear consistent with the standards in the PFMI.
- A small number of CCPs lacked rules and procedures that indicate processes to replenish any financial resources employed during a participant default in a manner that allows the CCP to continue to operate in a safe and sound manner. [8]

These CCPs should address these remaining serious issues of concern with the highest priority because the lack of such tools or equivalent measures may undermine a CCP's ability to meet the standards in the PFMI.

1.2.2 Coverage of financial resources

Some of the CCPs surveyed in the initial L3 assessment reported that they have taken steps in the last 18 months to strengthen their arrangements for maintaining sufficient financial resources to meet their coverage target. These steps include introducing or lowering early action thresholds to either inform decision-makers or call for additional resources from clearing members when the CCP experiences a narrowing of the gap between stress losses and prefunded resource levels. For the CCPs that were not part of the initial L3 assessment, some reported steps to improve practices for maintaining sufficient financial resources to meet their coverage target.

Although all CCPs have procedures designed to maintain sufficient financial resources, some CCPs nonetheless reported one or more breaches during the review period. The IMSG has also identified procedures that do not achieve outcomes consistent with the PFMI. While automatic and discretionary responses to a breach in coverage are both appropriate as long as they allow for the prompt and full remediation of a breach in coverage, practices that lead to insufficient or protracted responses could cause a CCP to fall short of achieving outcomes consistent with the standards in the PFMI.

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[8] This particular shortcoming is in the process of being resolved as of the issuance of this report.

1.2.3 Liquidity stress testing

While CCPs reported enhancements to several areas of liquidity risk management, limited progress has been made by the participating CCPs over the last 18 months in developing liquidity-specific scenarios in their stress testing framework. Specifically, some participating CCPs do not include in their liquidity stress tests a sufficiently wide range of scenarios that take into account the material liquidity risk posed by the non-performance of entities other than participants (such as settlement banks, nostro agents, custodian banks, liquidity providers, and linked FMIs). The PFMI provide that an FMI should maintain sufficient liquid resources in a wide range of potential stress scenarios. The fact that, following the publication of the initial L3 report, some CCPs continue to lack sufficient liquidity-specific scenarios is a serious issue of concern that should be addressed by the relevant CCPs with the highest priority.

2. Introduction

2.1 Broader context of the Level 3 assessments

In line with the G20's expectations, CPMI and IOSCO members have undertaken to incorporate the Principles and the Responsibilities included in the PFMI in their legal and regulatory frameworks. The CPMI and IOSCO regard full, timely and consistent implementation of the PFMI as fundamental to ensuring the safety and soundness of FMIs and to supporting the resilience of the global financial system.

To that end, the CPMI and IOSCO established a dedicated standing group, the IMSG, to actively monitor the implementation of the PFMI. This work is proceeding according to a monitoring framework that involves three overlapping levels:

(1) Level 1 (L1) to assess whether jurisdictions have completed the process of adopting the legislation, regulations and other policies that will enable them to implement the PFMI;

(2) Level 2 (L2) to assess whether the content of legislation, regulations and policies is complete and consistent with the PFMI; and

(3) Level 3 (L3) to assess whether there is consistency in the outcomes of implementation of the PFMI.

Since the publication of the PFMI, the CPMI and IOSCO have conducted: five rounds of L1 assessments; six L2 assessments; a thematic L3 assessment on the financial risk management and recovery practices of 10 derivatives CCPs; and a combined L2 and L3 assessment of the authorities' implementation of the Responsibilities for authorities in the PFMI.[9] The CPMI and IOSCO will continue to monitor jurisdictions' progress in implementing the PFMI in future assessments.

2.2 Objective of L3 assessments

Assessing the consistency of outcomes involves detailed consideration of the consistency of each participating FMI's outcomes of implementation with the Principles and analysis of the range of outcomes of implementation observed across FMIs in the sample. There are three key inputs to the assessment:

- identification of implementation measures and approaches across FMIs;
- consideration of the consistency of implementation outcomes with the relevant Principles and underlying KCs; and
- comparison of implementation outcomes across FMIs, with attention, where possible, to the drivers, degree and implications of observed variations.

Importantly, L3 assessments are peer-benchmarking exercises and not supervisory exercises. Accordingly, the focus of the reviews is on the consistency of outcomes of implementation of the relevant Principles and KCs across the group of participating FMIs as a whole rather than on each individual FMI's specific outcomes of implementation. As a result, in contrast to other levels of implementation monitoring assessments carried out by the CPMI and IOSCO, L3 reviews do not include formal ratings of observance. Rather, L3 reviews make observations about the broad consistency of outcomes achieved by FMIs, both with the standards under the PFMI and with each other.

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[9] All CPMI-IOSCO implementation monitoring reports are available on the BIS and IOSCO websites.

In addition to monitoring the progress in implementing standards under the PFMI, L3 assessments are expected to inform the CPMI and IOSCO about variations in outcomes that may be due to challenges and interpretative issues. This information can feed into other CPMI and IOSCO work.

2.3 Scope of this review

This review is the second L3 assessment carried out by the CPMI and IOSCO, and it is motivated by the findings of the first L3 assessment.

In 2016, the CPMI and IOSCO published a report on the first L3 assessment.[10] The assessment focused on financial risk management and recovery planning by CCPs and considered outcomes achieved in these areas by assessing the practices of 10 derivatives CCPs that clear both exchange-traded and over-the-counter (OTC) derivatives.[11] As a result of the first L3 assessment, the IMSG identified serious issues of concern in the areas of recovery planning, coverage of financial resources, and liquidity stress testing; and committed to conducting a follow-up targeted review on CCPs' progress in addressing these serious issues of concerns. The report noted:

> "In light of the findings of this review, the IMSG commits to a follow-up review, as set out below:
>
> - In the first half of 2017, the IMSG commits to conducting a follow-up targeted review of CCPs' progress in addressing the most serious issues of concern identified in this review – ie in the areas of recovery planning, coverage of financial resources on an ongoing basis (including responses to breaches of target coverage), and the development of liquidity-specific scenarios in their stress testing frameworks. Where these issues of concern apply, CCPs are expected to make rapid progress in addressing them and are expected to have achieved outcomes of implementation that are consistent with the PFMI by the effective date of this exercise. This will be 31 December 2016. In the case of recovery, the follow-up exercise will be informed by the CPMI-IOSCO report *Recovery of financial market infrastructures* issued in October 2014 (Recovery Report).
>
>   This follow-up review is expected to cover a wider range of CCPs and product classes than have been considered in this exercise."

This second L3 assessment has been structured to follow up on the most serious issues of concern highlighted in the first L3 report, particularly focusing on the progress made in addressing these serious issues of concern and the implementation outcomes, both with the PFMI and across CCPs, in these three areas. The scope of this review has been mapped to specific Principles and KCs, as shown in Table 1. Some topics span multiple KCs in multiple Principles.

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[10] http://www.bis.org/cpmi/publ/d148.htm and http://www.iosco.org/library/pubdocs/pdf/IOSCOPD538.pdf.

[11] The "as-of date" for the first L3 exercise was 30 June 2015 (and 31 March 2015 for the stress testing part).

Mapping of Principles and KCs reviewed by this L3 assessment* — Table 1

	Topics	Principle (KC)
(1)	Recovery planning	3(4), 4(7), 7(10), 15(3)
(2)	Coverage of financial resources	4(4), 4(5)
(3)	Liquidity stress testing	7(9)

* The IMSG also considered the explanatory notes in the PFMI, which provide guidance on how the standards in the Principles and Key Considerations can be implemented.

In this assessment, the IMSG has reviewed practices at 19 CCPs that provide clearing services to a broad range of product classes, such as clearing services provided in the repo, bond and equity markets, and the derivatives markets. These include a mix of globally active and regionally focused CCPs and span 17 jurisdictions. Participation by the CCPs was voluntary.

CCPs were requested to provide responses to a survey covering the areas of recovery planning, coverage of financial resources, and liquidity stress testing. In this survey, CCPs were also asked to provide information on relevant developments subsequent to the effective date of the initial L3 assessment (ie 30 June 2015). The effective date for the information found in this report is 1 January 2017.

This report presents the IMSG's findings from the review of CCPs' responses to the survey and additional follow-up questions with the CCPs. The CCPs were also given the opportunity to review this report for factual accuracy. The discussion of the progress made to address the serious issues of concern, and the variation in CCPs' outcomes of implementation and consistency of outcomes with the PFMI, is anonymised to respect the confidentiality of certain information provided by the CCPs.

Given the breadth and comparative nature of the exercise, and to ensure effective use of resources, the assessment has been carried out as a desktop exercise and did not involve detailed review of source documents beyond the CCPs' responses to the survey and follow-up questions. Also, it has not involved on-site visits to the participating CCPs. As noted in Responsibility D of the PFMI, it falls within the responsibility of the relevant supervisory authorities to ensure that the PFMI are observed by individual CCPs.

For similar reasons – ie this review has been carried out as a desktop exercise – the IMSG was not able to reach definitive conclusions in certain instances on whether a CCP's practice is consistent with the relevant Principles and underlying KCs or whether the CCP's practice has any implications to the CCP's resilience. For the purpose of transparency, such areas are clearly identified in the report.

The guidance on the *Resilience of central counterparties* and the revised report on *Recovery of financial market infrastructures*, published by the CPMI and IOSCO in July 2017, were not considered by the IMSG in reaching the findings outlined in this report. However, where applicable, the revised report on *Recovery of financial market infrastructures* is referenced in the report (revised Recovery Report).

3. Process and methodology

This L3 assessment proceeded in three main stages over the course of 15 months: (i) setting the jurisdictional and CCP coverage of the exercise; (ii) data collection and analysis by the IMSG; and (iii) review of assessment findings by CCPs, relevant authorities and the CPMI-IOSCO Steering Group.

3.1 Jurisdictional/CCP coverage

This L3 assessment covers CCPs (or relevant clearing services within a CCP) that clear derivative (exchange-traded and/or OTC), repo, bond and/or equity products.

Participating CCPs were selected according to a range of criteria, including that surveyed CCPs in most cases should be domiciled in a jurisdiction in which relevant measures to implement the PFMI for CCPs were assessed to be "fully in force" (ie given a rating of "4") in the June 2016 CPMI-IOSCO L1 assessment for at least one of the authorities with relevant responsibility.[12] Another important factor was a desire to expand the CCP coverage relative to the first L3 assessment, in terms of both jurisdictions and products, in order to allow for a more comprehensive analysis of CCPs' progress in the three topic areas covered by this assessment. Other relevant factors were an attempt to achieve a regional balance in the sample of CCPs, as well as a balance between globally active and more regionally focused CCPs.

Based on these criteria, 19 CCPs were selected to be part of this assessment (Table 2). CCPs' participation in this exercise was voluntary.

[12] See www.bis.org/cpmi/publ/d145.pdf and http://www.iosco.org/library/pubdocs/pdf/IOSCOPD534.pdf.

Table 2: List of CCPs for this follow-up Level 3 assessment (in italics: CCPs added to the list of CCPs covered in the first Level 3 assessment)

CCP	Acronym	Jurisdiction	Products reviewed
ASX Clear (Futures)	ASX	Australia	Exchange-traded derivatives: interest rates, equity indices and commodities OTC derivatives: interest rates
BM&FBovespa[13]	BM&F	Brazil	Exchange-traded derivatives: interest rates, FX and commodities OTC derivatives: interest rates, equities, FX and commodities
Canadian Derivatives Clearing Corporation	*CDCC*	*Canada*	*Exchange-traded derivatives: interest rates, equities, FX and indices* *Repos*
Cassa di Compensazione e Garanzia	*CC&G*	*Italy*	*Bonds and repos*
The Clearing Corporation of India Ltd	CCIL	India	OTC derivatives: FX derivatives
CME Inc	CME	United States	Exchange-traded derivatives: interest rates, equity indexes, FX, commodities and alternative investment products OTC derivatives: interest rates and credit FX
The Depository Trust & Clearing Corporation – National Securities Clearing Corporation	*NSCC*	*United States*	*Equities*
EuroCCP	*ECCP*	*Netherlands*	*Equities*
Eurex Clearing AG	Eurex	Germany	Exchange-traded derivatives: interest rates, equities, equity indices, FX, dividends, volatility indices, exchange-traded funds, commodities and property OTC derivatives: interest rates
Hong Kong Securities Clearing Company Limited	*HKSCC*	*Hong Kong*	*Equities*
ICE Clear Credit	ICC	United States	OTC derivatives: credit
Japan Securities Clearing Corporation	JSCC	Japan	Exchange-traded derivatives: equities, indices, debt (JSCC-ETD) OTC derivatives: interest rates, credit (JSCC-OTCD)
Korea Exchange	*KRX*	*Korea*	*Exchange-traded derivatives: equities, indices, interest rates, currencies, commodities (KRX-ETD)* *OTC derivatives: interest rates (KRX-OTCD)*
LCH.Clearnet SA	LCH SA	France	Exchange-traded derivatives: equities, indices, FX and commodities OTC derivatives: credit
LCH Limited	LCH Ltd	United Kingdom	OTC derivatives: interest rates (SwapClear, LCH Ltd SC) *Repos (RepoClear, LCH Ltd RC)*
Nasdaq Clearing	*NC*	*Sweden*	*Exchange traded derivatives: equities* *OTC derivatives: interest rates*
National Clearing Center	*NCC*	*Russia*	*Exchange traded derivatives*
SIX x-clear	*SXC*	*Switzerland*	*Equities*

[13] On 19 June 2017, it was communicated to the public that "BM&FBOVESPA S.A. – Bolsa de Valores, Mercadorias e Futuros" and "Cetip S.A. – Mercados Organizados" had combined their activities, creating a company with the new corporate name of "B3 S.A. – Brasil, Bolsa, Balcão". For the purposes of this report, the name "BM&FBOVESPA" is used, given that the survey information was provided as of 1 January 2017, ie prior to the change of name.

SGX Derivatives Clearing Limited	SGX	Singapore	Exchange-traded: FX, interest rates, equities and commodities OTC: interest rates, FX and commodities

3.2 Data analysis and review process

A survey covering the areas of recovery planning, coverage of financial resources, and liquidity stress testing was completed by selected CCPs. The survey built on the questions in the PFMI Assessment Methodology mapped to the relevant Principles and KCs set out in Table 1,[14] but with more detailed and granular questions where necessary. Policy, procedural or methodological documents were not requested, although some limited supporting documents were provided where necessary.

The assessment was conducted by IMSG members with support from experts nominated by CPMI and IOSCO member authorities (Annex A). Analysis of the CCPs' survey responses was combined with follow-up questions.

The CCPs and relevant authorities were given an opportunity to provide input on the findings of the review. The final report was approved by the CPMI and IOSCO.

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[14] CPMI-IOSCO, *PFMI – Disclosure framework and assessment methodology*, December 2012, www.bis.org/cpmi/publ/d106.pdf and http://www.iosco.org/library/pubdocs/pdf/IOSCOPD396.pdf.

4. Implementation progress and key findings

4.1 Recovery planning

This section presents the IMSG's findings on the CCPs' progress in implementation and the consistency of the CCPs' outcomes of implementation, both with the PFMI and across CCPs, relating to the serious issues of concern identified in the initial L3 report on recovery planning, which specified that "a number of CCPs have not yet put in place the full set of recovery rules and procedures envisaged in the PFMI". This section considers the expectations for recovery plans in the PFMI relating to:

- uncovered credit losses and re-establishing a matched book;
- replenishment of financial resources;
- uncovered liquidity shortfalls; and
- losses not caused by clearing participant default (ie non-default losses).

In considering the outcomes of implementation with respect to recovery, the IMSG has also been informed by the CPMI-IOSCO report *Recovery of financial market infrastructures* issued in October 2014 (Recovery Report) which was further revised in July 2017 (the revised Recovery Report). Where applicable, the IMSG had made reference to the revised Recovery Report.

4.1.1 Progress made

The characteristics of the CCPs' recovery plans vary considerably. For example, a small number of CCPs have recovery plans which include detailed scenarios (including scenarios for non-default losses), governance processes for escalation and analysis of criticality of their services, while other CCPs are working to implement their recovery plan in their respective rules. The IMSG notes that CCPs' recovery plans will continue to evolve as most CCPs intend to make further enhancements to their recovery plans through internal review and/or consultation with their regulator or participants. When developing the recovery plan, all CCPs reported that they engage with their regulator(s) (either for formal approval or for review). Progress made by CCPs to address in their plans uncovered credit losses, re-establishment of a matched book, liquidity shortfalls, replenishment of financial resources, and non-default losses are further elaborated in the relevant sections below.

4.1.1.1 Progress made by the CCPs that were part of the initial L3 assessment

All CCPs that were surveyed in the initial L3 assessment have reported changes to their recovery plans in the last 18 months, which includes progress made in the development and implementation of new recovery plans or changes to tools and scenarios included in existing recovery plans.

Development and implementation of new recovery plans: The CCPs that were identified in the previous report as not having any recovery plans in place have made progress in developing their recovery plans and are in the process of putting in place rules and arrangements to implement their recovery plans. These CCPs are either in the process of consultation with their participants or in the process of obtaining regulatory approval

Changes to existing recovery plans: Of the remaining CCPs that had recovery plans in place at the time of the initial L3 assessment, most of the CCPs made changes by including additional rules and procedures to allocate uncovered credit losses, to re-establish a matched book, to address uncovered liquidity shortfalls, and to replenish financial resources following a participant default.

- Two CCPs introduced variation margin gains haircutting (VMGH) as a tool to allocate uncovered credit losses. One CCP that had indicated in the initial L3 assessment that it was considering whether to use VMGH has decided not to adopt this tool.
- Two CCPs that were considering the use of initial margin gains haircutting as a tool to allocate uncovered credit losses decided not to use this tool in their recovery plan.
- For re-establishing a matched book, one CCP introduced the ability to force the allocation of remaining positions of the defaulters' portfolio to non-defaulting clearing participants, and one CCP removed this tool. Two CCPs introduced the ability to tear up a subset of contracts.
- One CCP made enhancements to replenish its financial resources through a recapitalisation plan with its parent.
- One CCP established a liquidity line with its parent to address uncovered liquidity shortfalls.

4.1.1.2 Changes made by the new CCPs

Of the CCPs not covered by the initial L3 report, most made changes to their recovery plan between 30 June 2015 and 1 January 2017. Similarly to the 10 derivatives CCPs that were surveyed in the initial L3 assessment, the CCPs made changes mainly by including additional rules and procedures to address uncovered credit losses and to re-establish a matched book.[15] Other areas in which changes were reported include development of governance processes for escalation, updating of stress scenarios (splitting default and non-default scenarios), and insurance coverage for non-default loss scenarios (eg cyber-risk). One CCP, however, is still in the process of finalising its recovery plan and relevant rules.

4.1.2 Allocation of potentially uncovered credit losses caused by a participant default

Principle 4, KC 7, states that an "FMI should establish explicit rules and procedures that address fully any credit losses it may face as a result of any individual or combined default among its participants [...]. These rules and procedures should address how potentially uncovered credit losses would be allocated, including the repayment of any funds an FMI may borrow from liquidity providers".

All CCPs have tools to allocate uncovered credit losses, and all but one CCP have assessment powers. Some CCPs have the power to perform VMGH[16] [17] and some CCPs will allocate their own funds to cover losses from a participant default that are still uncovered after all other prefunded resources are exhausted.[18]

Of the CCPs that identified assessment powers as a tool to address uncovered credit losses, the size of the assessment is based on the amount of risk the participant poses to the CCP. These powers are generally subject to an outright cap on the maximum amount that may be assessed, ranging from 50% to 550% of a participant's default fund contribution. Some CCPs provide for a limitation on the maximum amount that a participant is liable for should it choose to resign its participation in the CCP.

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[15] Based on their responses to the survey and various follow-up questions, it appears that CCPs considered a variety of tools to be relevant to re-establishing a matched book, and, correspondingly, to liquidating or otherwise managing the position of a defaulted clearing member. Such tools (or combination thereof) can include, but are not limited to: trading out of a position either on-market or off-market (eg through an auction); settlement (cash or otherwise); tear-up; and forced allocation. The tool or tools available will depend on the individual CCP's rulebook and other arrangements.

[16] Two additional CCPs are seeking approval for the implementation of VMGH.

[17] One CCP is seeking approval for the implementation of VMGH.

[18] CCP responses included in this category of "own funds" are CCPs' own resources, additional skin-in-the game, resources from a parent company and/or "letter of comfort" from a parent to address uncovered credit losses.

Further, of the CCPs that use VMGH as a loss allocation tool, five CCPs impose a cap on the VMGH. Two CCPs cap VMGH at a fixed amount or at the level of the participant's default fund contribution (whichever is higher), with the ability to increase the cap with the approval of all non-defaulting participants. Two other CCPs cap their VMGH tool in terms of time (ie five days). One CCP caps its VMGH tool in terms of both timing and amount. The remaining CCPs stated that they have no cap on their VMGH tool.

4.1.2.1 Comprehensiveness of CCPs' rules and procedures to address uncovered credit losses fully

Some CCPs rely on only one type of loss allocation tool. Of these CCPs, all but one employ assessment powers which are either subject to an outright cap on the maximum amount that may be assessed or are subject to a limitation triggered if a member chooses to resign from the CCP.

The initial L3 assessment identified a key finding that "for the CCPs that do not have an uncapped loss allocation tool in place […] it is unclear whether their plans would comprehensively address uncovered credit losses". However, the initial L3 assessment also noted that some CCPs stated that placing caps ensures the transparency, measurability, manageability and controllability of the tools. The initial L3 assessment noted that CCPs that have no uncapped tools were considering additional credit loss allocation tools.

As of this assessment, some CCPs employ only one capped tool to address uncovered credit losses. It is a serious issue of concern that reliance on this tool alone may be insufficient for a CCP to comprehensively allocate these uncovered losses. Other tools may be necessary to achieve the outcome expected in Principle 4.

4.1.3 Re-establishing a matched book following participant default

Principle 4, KC7, states that "an FMI should have explicit rules and procedures that address fully any credit losses it may face as a result of any individual or combined default amongst its participants". As paragraph 4.5.1 of the revised Recovery Report explains, in order to fully address such losses "after a participant defaults, a CCP will need to re-establish a matched book of obligations, stemming further losses". This could be done by using either voluntary, market-based tools (eg auction or buy-in) or a mandatory, rule-based arrangement (eg tear-ups or forced allocation). Paragraph 4.5.2 of the revised Recovery Report notes that while the "use of voluntary, market-based tools is likely to lead to a better outcome than any mandatory, rule-based arrangement", mandatory tools are still necessary: "to address the likelihood that voluntary methods might prove insufficient to re-establish a matched book, a CCP will need to have a mandatory, ex ante agreed mechanism to do so, such as forced allocation or termination of contracts".

4.1.3.1 Use of voluntary and/or mandatory tools to re-establish matched book

All CCPs have tools to re-establish a matched book following from a participant default, including the use of voluntary tools (eg auction or buy-in) which could be employed during the default management process. In addition, most CCPs have mandatory rule-based tools to re-establish a matched book for their products, including the use of partial tear-ups, full tear-ups and/or forced allocation. A small number of CCPs can employ forced allocation, some CCPs have partial tear-up as a tool, and some CCPs can employ full tear-ups. Of the CCPs that employ full tear-up to re-establish a matched book, a small number employ full service tear-up as their only rule-based tool. While some CCPs do not have any mandatory rule-based tools for their derivative products, these CCPs would rely on voluntary market-based tools.

The most substantial difference in observed practice across the CCPs surveyed was between CCPs that cleared different classes of products. In particular, there appears to be a difference in practices

(or characterisation of practices) to re-establish a matched book between CCPs that clear derivative products and CCPs that clear cash products. Most of the CCPs identified above as having clearly established mandatory rule-based tools provide clearing for derivative products. These mandatory tools are used typically when voluntary market-based tools are not successful.

By contrast, most cash CCPs characterised or otherwise described the tools they have available to re-establish a matched book as voluntary, market-based tools to re-establish a matched book.[19] Only one cash CCP's service stated that it employs a service tear-up, which in practice means that the CCP will liquidate the defaulting clearing member's portfolio position by selling the position in the open market. However, the characterisation of tools by the other cash CCPs is less clear. A small number of cash CCPs indicated that they will cash-settle[20] if the defaulted contract cannot be delivered due to the lack of market liquidity. Other cash CCPs did not provide sufficient information for the IMSG to determine the process that would apply if voluntary measures were unsuccessful or otherwise not available.

The initial L3 assessment of derivatives CCPs identified a key finding that it was unclear whether a CCP's recovery plan would re-establish a matched book if it did not have a mandatory tool for liquidating the positions of the defaulter, such as tear-up or forced allocation measures. Based on the results of this follow-up assessment, it appears that some derivatives CCPs and most cash CCPs continue to lack mandatory rule-based recovery tools to re-establish a matched book (or to otherwise close out a defaulter's outstanding obligation) and rely only on voluntary, market-based tools. [21] However, this conclusion is subject to the observation that there is a misunderstanding or misinterpretation regarding the question of whether their matched book tools operated on a mandatory or voluntary basis, which may be based on a definitional ambiguity of the terms "mandatory tool" and "voluntary tool" in the cash CCP context. In addition, the lack of clarity regarding which matched book tools are voluntary and which are mandatory in the cash CCP context may have led to disparate findings between derivatives CCPs and cash CCPs. However, some CCPs do not have mandatory rule-based tools to re-establish a matched book, and it is a serious issue of concern that it is unclear whether reliance by those CCPs on voluntary, market-based tools alone would effectively restore a matched book. These CCPs should have a range of tools available that are sufficient to ensure that the CCP can re-establish a matched book in recovery.

4.1.4 Replenishment of financial resources

Principle 4, KC 7, states that an FMI's rules and procedures should "indicate the FMI's process to replenish any financial resources that the FMI may employ during a stress event, so that the FMI can continue to operate in a safe and sound manner".

All CCPs have responded that they have requirements to replenish the prefunded financial resources that have been used in the event of a participant default. CCPs have in place varying practices for replenishment, including differences in the timing, amounts of replenishment and use of caps on the amounts they may call for replenishment.

With respect to timing of replenishment, some CCPs require default fund resources to be replenished within one business day after default fund resources have been utilised. Some other CCPs require their participants to meet replenishment obligations within one business day after the CCP issues a replenishment notice, but issuance of such notice is at the CCP's discretion.

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[19] Generally, cash CCPs have obligations to take delivery of securities from sellers at the price the trades were executed at, which are matched by obligations to deliver the same securities to the buyers for the same price.

[20] Cash settlement is where the CCP does not deliver the securities but instead transfers the associated cash position.

[21] At least one CCP may be able to withstand protracted losses during the closeout period using an uncapped loss allocation tool.

A small number of other CCPs issue notices for replenishment, which specifies payment deadlines that are imposed on their participants. These deadlines range from a potential request for "immediate payment" to up to 10 business days.

A CCP having rules and procedures that do not indicate processes to replenish any financial resources employed during a participant default in a manner that allows the FMI to continue to operate in a safe and sound manner is a serious issue of concern.

4.1.5 Addressing uncovered liquidity shortfalls

Principle 7, KC 10, states that an "FMI should establish explicit rules and procedures that enable the FMI to effect […] payment obligations on time following any individual or combined default among its clearing participants. These rules and procedures should address unforeseen and potentially uncovered liquidity shortfalls and should aim to avoid unwinding, revoking, or delaying the same-day settlement of payment obligations".

The initial L3 assessment stated that arrangements for the allocation of liquidity shortfalls are among the least developed elements of recovery plans and that relatively few CCPs had arrangements in place to cover liquidity shortfalls with specific liquid resources, liquidity arrangements or liquidity generated by credit loss allocation tools. The IMSG observes that while all CCPs have identified tools to address uncovered liquidity shortfall, these tools continue to be less developed than for credit losses.

As set out in Section 4.3 of the revised Recovery Report, tools for addressing liquidity shortfalls can broadly be characterised as those that obtain liquidity from third-party institutions, from participants that are owed funds, and from all participants. Some have the ability to obtain resources from third-party institutions and also from either all participants or participants that are owed funds; a small number of CCPs have tools that fall into all three categories; a small number of CCPs can obtain resources only from third-party institutions; and a small number of CCPs can obtain resources only from participants.[22]

Some CCPs identify a last-resort tool, including payment deferral (discussed in Section 4.1.5.2 below). Other than this, a small number of CCPs specifically noted that they retain at least some discretion over the sequencing of tools for addressing liquidity shortfalls.

4.1.5.1 Use of qualifying liquid resources to address uncovered liquidity shortfalls

Most CCPs identified cash deposited with central or commercial banks, prearranged committed credit lines with parent companies or external liquidity providers, and their own funds held on hand as tools to address uncovered liquidity shortfalls. Of these CCPs, a small number specified that they hold an amount of qualifying liquid resources that exceed the minimum in KC 4 (ie their coverage target of "cover n"). The responses of some other CCPs suggest that they also hold more qualifying liquidity resources than required to satisfy their liquidity coverage target with the excess available to address additional liquidity shortfalls. However, one CCP that identified types of qualifying liquid resources as tools to address uncovered liquidity shortfalls reported no additional types of tools to address scenarios in which the CCP's payment obligations exceed the amount of its prefunded or prearranged liquidity resources. This practice of maintaining only a finite amount of resources is not consistent with the expectations to address potentially *unforeseen and uncovered* liquidity shortfalls as described under KC 10.

[22] Some CCPs identified the ability to access liquidity from parent companies to address a liquidity shortfall. For simplicity, the IMSG included this type of liquidity as resources from "third-party institutions".

4.1.5.2 Payment deferral as a tool to address uncovered liquidity shortfalls

Among the tools that CCPs have identified to address uncovered liquidity shortfalls, some CCPs identified the power to postpone payments. One CCP specified that the delay can be intraday or beyond, and another capped the deferral to a period of 30 days for a subset of its products. A small number of CCPs specified that this tool is meant to be a last resort to be used after exhausting all other liquidity measures. Reliance on a rule or procedure that allows a CCP to postpone payments is not consistent with Principle 7, KC10, of the PFMI, which states that CCPs should "aim to avoid delaying the same-day settlement of payment obligations".

4.1.5.3 Other tools to address uncovered liquidity shortfalls

In addition to other liquidity shortfall tools mentioned above, a small number of CCPs also identified payment-in-kind as a tool to address uncovered liquidity shortfalls. These payments-in-kind could include payments in another currency or securities of the defaulter. CCPs with this tool have specified that it is meant to be a last resort to be used after exhausting all other liquidity measures.

A small number of CCPs referred to being able to use their tools for meeting uncovered credit losses to address an uncovered liquidity shortfall. Another CCP has specifically identified VMGH or tools that seem similar in concept to VMGH for this purpose, even though it did not identify such a tool as a means to address uncovered credit losses. The revised Recovery Report acknowledges that there is significant interaction and interdependency between credit and liquidity risk. Further, paragraph 3.2.3 notes that FMIs may be exposed to liquidity risk even when there is no default of a participant and that the resources the FMI maintains to address credit risk may be insufficiently liquid to enable the FMI to meet its own payment obligations to other participants when due, which could put the FMI's viability at risk. Therefore, it is a serious issue of concern that some CCPs, in addressing uncovered liquidity shortfalls, rely exclusively on tools designed to address uncovered credit losses. This does not appear to be consistent with the standards in the PFMI.

4.1.5.4 Replenishment of liquid resources

Principle 7, KC 10, further states that an FMI's "rules and procedures should also indicate the FMI's process to replenish any liquidity resources it may employ during a stress event, so that it can continue to operate in a safe and sound manner". Most CCPs refer to replenishment of liquidity resources via the use of default management proceeds, tools to address potentially uncovered credit losses (ie assessment powers), and liquidity generated by replenishment of prefunded financial resources in the default waterfall. Further, some CCPs indicate that they have discretion to determine the timing of liquidity replenishment and the sequencing of tools to replenish liquidity resources. Similar to the observations in Section 4.1.5.3, CCPs appeared to identify tools to replenish liquidity resources only in the event of a participant default and not other types of liquidity stress events.

4.1.6 Addressing losses not caused by participant default

Principle 3, KC 4 states: "An FMI should identify scenarios that may potentially prevent it from being able to provide its critical operations and services as a going concern and assess the effectiveness of a full range of options for recovery or orderly wind-down." In identifying the non-default scenarios, the revised Recovery Report (paragraph 2.4.5) states that "these scenarios may include, but are not limited to […] a wide range of general business losses or liquidity shortfalls, or the realisation of investment losses or liquidity shortfalls (for example, from financial assets that FMI holds at third parties)". The initial L3 report noted that a number of CCPs planned to develop their recovery plans further to more comprehensively address non-default losses.

4.1.6.1 Range of scenarios identified for non-default risks

All CCPs in the sample stated that they have identified general business non-default risk scenarios in their recovery plans. These scenarios include: (i) custody and investment risk; (ii) fraud/crime or management incidents; (iii) operational failure, including cyber-incidents; (iv) legal problems; (v) operational failure of a linked FMI; and (vi) failure of third-party service providers.

Operational risk and custody and investment risk are the scenarios most commonly considered by CCPs in relation to general business risk. As regards custody and investment risk, some CCPs have assessed that such risks would not disrupt their critical functions and therefore did not include such scenarios in their recovery plans. Their reasons include the following: (i) collateral could be held in a central securities depository (CSD) owned by the CCP's parent entity, or at the central bank; (ii) limits are placed on the amount or type of permitted investments; and (iii) the CCP is not empowered to invest members' collateral. In some of these cases, it appears that custody and investment risks are reduced rather than eliminated. Accordingly, CCPs should continue to evaluate these non-default loss scenarios to assess whether they could potentially prevent them from being able to provide their critical operations and services as a going concern.

4.1.6.2 Tools to address losses from non-default risks

All CCPs have liquid net assets funded by equity to implement their plans to recover from general business losses.

Recapitalisation, insurance agreements and other tools

To address losses exceeding the amount of prefunded liquid net assets funded by equity, all CCPs but one have tools to address losses not caused by a clearing participant default. Most of them have plans to raise new equity capital or preserve existing capital. Specifically, most CCPs have plans to generate new equity capital through capital injection from holding companies or shareholders. One CCP plans to choose one or a combination of the two channels in consultation with relevant stakeholders. A small number of CCPs, in conjunction with recapitalisation plans based on commitment from parent companies, have capital conservation measures composed of reduction in dividends or suspension of variable remuneration. Further, most CCPs have insurance arrangements for certain non-default losses. Some CCPs have other tools such as sale of assets; cost reduction measures; and restructuring plans. The absence of tools at one CCP to address losses not caused by a clearing participant default is a serious issue of concern for that CCP.

Arrangements to allocate losses from custody and investment risk to participants' assets

Among the CCPs that consider including custody and investment risk scenarios with respect to participants' assets in their recovery plans, a small number of CCPs have tools to allocate investment losses above a predefined threshold to participants. Losses are first absorbed by the CCP up to this threshold and then allocated to participants pro rata. This practice is consistent with paragraph 4.6.2 of the revised Recovery Report and Sections 6.2.3 and 6.2.4 of the guidance on *The resilience of central counterparties*, which state that an FMI should consider exposing its owners to a share of losses arising from custody and investment risk to participants' assets, even if the FMI and its participants decide it is appropriate for participants to share in the losses as well.

Further, one CCP has tools to allocate both custody and investment losses to its participants, while another CCP has responded that it has similar tools in place but did not specify whether they are aimed at either custody or investment risk, or both. The remaining CCPs that consider custody and investment risk scenarios in their recovery plans did not report specific loss allocation tools dedicated to addressing custody and investment losses.

4.2 Maintaining coverage of financial resources on an ongoing basis

This section presents the IMSG's findings on the CCPs' progress in implementation and the consistency of CCPs' outcomes of implementation, both with the PFMI and across CCPs, with respect to the matters identified as "serious issues of concern" in the initial L3 report regarding coverage of financial resources which were specified as:

- "*Maintaining coverage on an ongoing basis*. The quantitative data suggest that in practice a small number of CCPs' prefunded financial resources may not be sized to meet the relevant target coverage on an ongoing basis. Furthermore, some CCPs do not have clear processes in place to promptly address any breach of target coverage."

Some of the CCPs surveyed in the initial L3 assessment reported that they have taken steps in the last 18 months to strengthen their arrangements for maintaining sufficient financial resources to meet their coverage target. These steps include introducing or lowering early action thresholds to either inform decision-makers or call for additional resources from clearing members when the CCP experiences a narrowing of the gap between stress losses and prefunded resource levels. For the CCPs that were not part of the initial L3 assessment, some reported steps to improve procedures for maintaining sufficient financial resources to meet their coverage target.

Although all CCPs have procedures designed to maintain sufficient financial resources, some CCPs nonetheless reported one or more breaches during the review period. The IMSG has also identified procedures that do not achieve outcomes consistent with the PFMI. While automatic and discretionary responses to a breach in coverage are both appropriate as long as they allow for the prompt and full remediation of a breach in coverage, practices that lead to insufficient or protracted responses could cause a CCP to fall short of achieving outcomes consistent with the standards in the PFMI.

It is important to note that this assessment reviewed whether CCPs met their coverage target[23] and whether CCPs had processes in place for responding to a breach. Other aspects of Principle 4 – for example, the specification of the stress testing framework – were not assessed.

4.2.1 Progress made

Progress and changes made by the CCPs that were part of the initial L3 assessment

- One CCP changed its procedures to respond to a breach in coverage by calling additional resources on any day where a breach is identified rather than at the next scheduled monthly resizing.
- Two CCPs introduced early intervention thresholds where additional resources are called when the highest stress loss exceeds a predetermined percentage of prefunded resources at the CCP, while another lowered the threshold at which internal decision-makers are notified.

[23] CCPs reported that they pursue a broad range of coverage targets based on various combinations of participant defaults. Most CCPs have a coverage target that is consistent with maintaining sufficient prefunded financial resources to cover the default of the two participants and their affiliates that would potentially cause the largest aggregate credit exposure to the CCP in extreme but plausible market conditions. However, there are four instances of CCPs targeting to cover the default of the single participant and its affiliates that would potentially cause the largest aggregate credit exposure to the CCP in extreme but plausible market conditions. There are also one CCP with a Cover 4 target and three CCPs that target the largest participant plus a combination of other participants.

- One CCP decreased the payment window for contributions to the default fund for one of its service lines from five to two days, while also increasing the frequency of the scheduled resizing of the default fund for that same service from quarterly to monthly.
- A small number of CCPs made other relevant adjustments to their stress testing or sizing of default funds. One CCP increased the frequency of the stress testing of its total financial resources from monthly to daily. Another CCP increased the length of its lookback period.

Changes made by the new CCPs

- Few CCPs not covered by the initial L3 assessment have taken steps since 30 June 2015 to improve procedures for meeting their coverage target on an ongoing basis.
- One CCP took steps to reduce the likelihood of experiencing a breach in coverage by lowering the trigger for reviewing the sufficiency of prefunded resources and by increasing the magnitude of the buffer above the largest stress loss that is used to set the default fund.
- One CCP introduced an additional margin requirement to cover excess risk not covered by initial margin.

4.2.2 Key findings related to the serious issues of concern

Principle 4, KC 4, states: "A CCP should cover its current and potential future exposures to each participant fully with a high degree of confidence using margin and other prefunded financial resources […] All other CCPs should maintain additional financial resources sufficient to cover a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliates that would potentially cause the largest aggregate credit exposure for the CCP in extreme but plausible market conditions […]"; and Principle 4, KC 5, states: "A CCP should determine the amount and regularly test the sufficiency of its total financial resources available in the event of a default or multiple defaults in extreme but plausible market conditions through rigorous stress testing. A CCP should have clear procedures to report the results of its stress tests to appropriate decision makers at the CCP and to use these results to evaluate the adequacy of and adjust its total financial resources."

The IMSG has observed that CCPs employ a variety of practices that are designed to ensure they maintain total prefunded financial resources to meet their coverage target on an ongoing basis and to address a breach of target coverage. All CCPs that participated in the follow-up L3 assessment conduct stress testing on a daily basis and report the results of their stress tests to appropriate decision-makers at the CCP, which is consistent with certain expectations under Principle 4, KC 5.

4.2.2.1 Breaches of coverage

Although all CCPs report that they target a level of coverage consistent with the standards in Principle 4, KC 4, the quantitative data[24] received from them suggest that some failed to meet the relevant target coverage[25] on at least one day during 2016.

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[24] As part of the IMSG's survey, CCPs were asked to provide data on the dates of all breaches that occurred in 2016 and, for each date with a breach, the size of the breach in nominal terms (ie dollar value) and as a proportion of total prefunded resources held on that date. The surveyed CCPs were requested to calculate breaches without taking into account "any voluntary, excess contributions from participants". However, CCPs may have included such excess contributions or required prefunded resources that have been called but not yet paid in their calculations.

[25] For the purpose of this assessment, a "breach" refers to an instance where, on any particular day, a CCP's total prefunded financial resources that it is entitled to use for these purposes are insufficient to cover the largest aggregate credit exposure to the CCP from the default of the number of clearing participants specified in its coverage target (eg Cover 1 = the largest exposure, including affiliates; Cover 2 = the two largest exposures, including affiliates; or other) in extreme but plausible market conditions. In cases where a CCP has elected a more conservative coverage target than the minimum from KC4, breaches were calculated against that more conservative target.

The breaches reported must be interpreted cautiously, as some CCPs had different interpretations of "prefunded" resources. Specifically, some CCPs included participant collateral in excess of their requirements, while others included financial resources called for but not yet received. These practices have the potential to understate the number of breaches reported by CCPs. Section 4.2.2.3 below discusses the implications of treating such collateral as prefunded resources when assessing whether the CCP is meeting its coverage target.

- One CCP had breaches on a large number of days (142 days for exchange-traded derivatives and 88 days for OTC derivatives). This suggests a significant shortcoming in the CCP's ability to address a breach.
- Two CCPs had a few breaches on consecutive or near-consecutive days, which also suggests a shortcoming in addressing breaches. In response to consecutive breaches, one of these CCPs made changes in its processes to respond more quickly to a breach in its coverage target. The other has increased the size of the default fund.
- One CCP had breaches on five non-consecutive days.
- One CCP had breaches on three non-consecutive days.[26]
- One CCP had a breach on one day only.

Two of the CCPs reporting a breach in this follow-up assessment had also reported a breach on at least one day in the initial L3 assessment, which covered the 12-month period ending 30 June 2015.[27]

Consistent with findings from the first L3 assessment, the approaches taken by CCPs to maintain target levels of coverage on an ongoing basis continue to vary across CCPs. Many CCPs have precautionary procedures intended to increase the likelihood that they will meet their coverage target:

- Some CCPs size their default fund at a level above the stress test credit exposure consistent with their coverage target by applying a prespecified "buffer" to the relevant coverage target when sizing total financial resources.
- Most CCPs have procedures to call for additional resources in the absence of a breach when stressed losses are equal to a predetermined proportion of prefunded resources.

All else being equal, these conservative practices improve a CCP's resilience.

4.2.2.2 Processes to promptly address any breach of target coverage

One of the serious issues of concern from the initial L3 assessment in the area of coverage of financial resources was the failure of some CCPs to have clear policies and procedures in place to promptly address any breach of target coverage. Around half of the CCPs surveyed in this follow-up exercise have fully automated procedures (that is, with no discretion for decision-makers) for returning the CCP to the specified coverage level within a specified amount of time. The remaining CCPs have frameworks in which decision-makers have elements of discretion in determining the CCP's response to a breach.

While automatic and discretionary responses to a breach in coverage are both appropriate as long as they allow for the prompt and full remediation of a breach in coverage, practices that lead to insufficient or protracted responses could cause a CCP to fall short of achieving outcomes consistent with the standards in the PFMI.

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[26] The parent of one of these CCPs has set aside funds to strengthen the risk management of that CCP and two others. In the event that losses related to a participant default exceeded prefunded financial resources, these funds would be available.

[27] The third CCP reporting a breach in the initial assessment did not report any in the follow-up assessment.

Automatic approach

Around half of the surveyed CCPs automatically call for additional financial resources from clearing members when stress test losses exceed a pre-established proportion of prefunded resources. Generally, these automatic processes occur on either the same or the next day after a breach in target coverage occurs. At slightly more than half of the CCPs with an automatic approach, the trigger for calling for additional resources takes the form of a limit on the largest stress test loss arising from any given clearing member relative to the total size of the default fund. At other CCPs with an automatic approach, the limit is based on a combined limit that is related to coverage target.

As discussed above, a CCP is expected to have procedures that support the prompt re-establishment of coverage in the event of a breach. There are a variety of practices with respect to the timing of when CCPs that have automatic calls require their members to comply with the call for additional financial resources. Most CCPs with an automatic approach require members to provide resources on the same day or the next day after they are requested. However, one CCP collects additional resources two days after they are requested.

Discretionary approach

The remaining CCPs apply elements of discretion in responding to a breach in coverage, based on a review of the circumstances of the breach.

Although having discretion over *how* breaches are addressed may result in a tailored response that achieves the maintenance of coverage targets, processes that do not result in the CCP addressing a breach fully or in a timely manner result in outcomes that are not consistent with the PFMI.

Some CCPs noted that a decision-maker might have enough discretion to disregard a breach in specific circumstances (for example, when the recalculated coverage was close to the current level; when there was no deterioration of clearing member credit quality; or when the calculation of a breach did not take into account excess collateral that would, under a different calculation process, cover the target amount).

Information on the timeliness of CCPs' response to a breach also suggests that not all CCPs have procedures that support the prompt re-establishment of financial resources.

- Two CCPs did not specify any time frame in which they would act to respond to a breach. Nor did they indicate a time frame in which their members must comply.
- Two CCPs indicated they would wait until the next scheduled resizing. One of these CCPs resizes its default fund quarterly and allows two days for participants to provide resources in one product class and 20 days in another. The other resizes its default fund weekly, and additional resources are called from participants up to seven days later, with participants required to post additional margin the same day.
- One CCP would act within seven days.
- One CCP would act "within a few" days. This CCP requires its members to provide initial margin by the next day, additional margin on the same day, and additional contributions to the default fund within twenty days.
- One CCP indicated that while it has automatic processes to call for additional financial resources if breaches occur on two consecutive days, it would have discretion to respond or not to a breach on the first day. If losses related to a participant default exceeded prefunded financial resources, that CCP would have access to funds set aside by its parent to strengthen its risk management.
- One CCP that indicated it would respond on the same day allows its members up to three days to provide additional initial margin and ten business days for them to provide additional default fund contributions while allowing itself up to three days to provide its own additional capital.

4.2.2.3 Other collateral used by CCPs

Some CCPs include excess collateral or margin called for but not yet received when determining the adequacy of their total prefunded financial resources.

A small number of CCPs reported that they take into account excess collateral from participants when determining the adequacy of their total prefunded financial resources. Two of these CCPs noted that they retain discretion over whether to release excess collateral to pledging clearing members in order to prevent the withdrawal of excess collateral that could cause a breach in coverage. The other two CCPs do not.

A small number of CCPs also include margin called for but not yet received when assessing the adequacy of their total prefunded financial resources (four CCPs did not answer the question). Some of these CCPs reported that this calculation was appropriate because they can directly debit the bank accounts of clearing members or have the margin call filled automatically by the clearing member (or its settlement bank) within a short time frame (within an hour of the call or by 9 am on the next business day). However, resources are unavailable to the CCP until the CCP obtains both ownership and control of the margin. The unavailability of these resources at the time they are needed to address an actual default loss would have a negative impact on the CCP's resilience.

4.3 Liquidity stress testing

This section presents the IMSG's findings on the CCPs' progress in implementation and consistency of implementation outcomes, both with the PFMI and across CCPs, relating to the serious issue of concern identified in the initial L3 report, which stated the following:

> "*Liquidity-specific stress testing scenarios.* Some CCPs did not identify liquidity exposures that could arise independently of a credit exposure in their liquidity stress testing scenarios; and, as in the case of credit stress testing, some CCPs did not appear to adequately supplement the stress testing of their liquidity exposures with stress testing of their liquid resources."

As described in more detail in Section 4.3.1 below, while CCPs reported enhancements to several areas of liquidity risk management, the IMSG observed that limited progress has been made by the participating CCPs over the last 18 months in developing liquidity-specific scenarios in their stress testing framework. Furthermore, as noted in Section 4.3.2 below, current implementation outcomes reported by the total group of CCPs show that not all CCPs include sufficient liquidity-specific scenarios in their liquidity stress tests. Specifically, some CCPs do not include a sufficiently wide range of scenarios that take into account the material liquidity risk posed to the CCP by the non-performance of entities other than participants (such as settlement banks, nostro agents, custodian banks and liquidity providers). The PFMI provide that an FMI should maintain sufficient liquid resources in a wide range of potential stress scenarios, and the fact that, following the publication of the initial L3 report, some CCPs continue to lack sufficient liquidity-specific scenarios is a serious issue of concern that should be addressed by the relevant CCPs with the highest priority.

The IMSG also identified, as an additional issue of concern noted in Section 4.3.3 below, that some CCPs exclude certain liquidity exposures that they consider "immaterial" or "negligible" from their liquidity stress tests. Omitting these types of liquidity exposures from their liquidity stress tests could have resilience implications for the CCP.

4.3.1 Progress made

Progress made by the CCPs that were part of the initial L3 assessment

Little progress has been made since the effective date of the initial L3 assessment (30 June 2015). Only one of the 10 derivatives CCPs in the original set reported progress in developing liquidity-specific stress testing scenarios that could arise independently of a credit scenario. This CCP now includes scenarios that account for the outflow of participant cash margin that could result in the absence of a participant default (eg an outflow of cash caused by the substitution of cash margin held at the CCP for non-cash collateral). One other CCP reported that it now includes a hypothetical scenario which assumes that, in conjunction with the simultaneous clearing member default, the service provider group (which includes settlement banks, custodian banks and investment counterparties) holding the largest amount of clearing member resources is unavailable to the CCP.

Most of the remaining CCPs did not report any progress in developing liquidity-specific stress testing scenarios.[28] Some of these CCPs nonetheless reported enhancements to other areas of their liquidity risk management framework which fall outside the scope of this targeted assessment.[29]

Changes made by the new CCPs

None of the new CCPs reported changes to or the development of liquidity-specific stress testing scenarios since the effective date of the initial L3 assessment (30 June 2015). Four of these CCPs, however, reported changes to other areas of their liquidity risk management framework which fall outside the scope of this targeted assessment.[30]

4.3.2 Key findings related to the serious issue of concern

As noted above, the IMSG previously raised as a serious issue of concern in the initial L3 assessment that some CCPs did not include liquidity-specific scenarios in their stress tests. KC9 of Principle 7 states that "scenarios should take into account the design and operation of the FMI, include all entities that might pose material liquidity risks to the FMI (such as settlement banks, nostro agents, custodian banks, liquidity providers, and linked FMIs) […]".

For this assessment, it remains a serious issue of concern that, following the publication of the initial L3 report, some participating CCPs continue to lack sufficient liquidity-specific scenarios in their stress tests that take into account all entities that might pose material liquidity risk to the CCP.

Included below are more detailed findings regarding the extent to which a CCP's stress testing framework takes into account the liquidity risk posed to the CCP by commercial settlement banks and/or nostro agents, linked CSDs or securities settlement systems (SSS), commercial custodian banks, and private sector liquidity providers:

- <u>Commercial settlement banks and/or nostro agents</u>: Only one CCP of the seventeen CCPs that rely on commercial settlement banks and/or nostro agents to collect and disburse payments related to CCP clearing and settlement processes reported that it includes, or considered including, liquidity-specific scenarios that take into account the non-performance of these entities. A small number of these CCPs noted that they do not consider this liquidity risk since the amount of payment flows through their commercial settlement banks is "non-material" compared with the payment flows through their accounts at the relevant central bank of issue.

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[28] One of these CCPs reported that it already includes some liquidity-specific scenarios as part of its liquidity stress tests and therefore did not make any changes to its liquidity stress tests as of the cutoff date.

[29] Given the targeted scope of this assessment, the IMSG did not include a comprehensive list of these changes in this report. Nevertheless, CCPs are encouraged to continue making enhancements to their liquidity risk management practices consistent with the PFMI.

[30] Ibid.

Six CCPs reported that they have backup arrangements in place that can be used to help address this type of scenario.[31] Three of these CCPs and two others also noted that they evaluate the concentration risk posed to the CCP by their commercial settlement banks and place limits on their exposures to these entities.

The remaining six CCPs did not provide information in their responses that would explain how their liquidity risk management framework takes into account the potential non-performance of these entities.

- Linked CSDs/SSS: None of the thirteen CCPs in the sample that rely on linked CSDs/SSS reported that they include, or considered including, liquidity-specific scenarios that account for the non-performance of these entities. Only one of these CCPs noted that it has backup arrangements in place to help address this type of scenario.[32] The remaining twelve CCPs did not provide information in their responses that would explain how their liquidity risk management framework takes into account the potential non-performance of these entities.

- Commercial custodian banks: Only one CCP of the seven CCPs that hold non-cash collateral at commercial custodian banks reported that it includes, or considered including, liquidity-specific scenarios that take into account the non-performance of these entities. One other CCP reported that it has backup arrangements in place to address the non-performance of its commercial custodian banks. The remaining five did not provide information in their responses that would explain how their liquidity stress testing framework takes into account the non-performance of these entities.[33] In fact, three of these CCPs reported that any non-cash collateral held at their custodian banks will always be available to them, even in the event the custodian bank defaults.

- Clearing member liquidity providers: Twelve of the fifteen CCPs that rely on their clearing members as liquidity providers report that if a liquidity provider was among the largest one or two defaulting participants (as applicable given the CCP's liquidity coverage target), the CCP would assume in a stress testing scenario that it could not access the liquid resources that would otherwise have been contributed by that liquidity provider.[34]

  Of the remaining three CCPs, two reported that they account for the non-performance of their clearing member liquidity providers by sizing their liquid resources to assume that their largest liquidity provider is unavailable, regardless of whether it is a clearing member or a non-clearing member entity.

  The other CCP does not account for the failure of any of its liquidity providers and assumes that both its clearing member and its non-clearing member providers are always available to provide liquidity since they are subject to prudential supervision.

- Liquidity providers that are not clearing members:[35] Of the sixteen CCPs that rely on external (non-clearing member) liquidity providers to meet their qualifying liquid resource requirement, only one reported that it includes, or considered including, liquidity-specific scenarios that take into account the non-performance of these entities. Two other CCPs, as noted above, reported that they take into account the non-performance of these entities by sizing their liquid

[31] It should be noted that the IMSG did not review the effectiveness or reliability of the CCPs' backup arrangements.

[32] Ibid.

[33] Ibid.

[34] Two of the fifteen CCPs also each noted that any of its liquidity providers that is an affiliate of a clearing member is also assumed to be unavailable if the clearing-member entity defaults. It should be noted that the IMSG did not collect this information from all CCPs to make a determination on whether the other CCPs also make this assumption.

[35] It should be noted that these findings apply to private sector liquidity providers only (including liquidity arrangements with CSDs) and do not apply to any credit arrangements the CCPs may have with central banks.

resources to assume that their largest liquidity provider is unavailable to lend, regardless of whether it is a clearing member or a non-clearing member entity. One other CCP reported that it takes into account the failure of its non-clearing member liquidity providers by adding a buffer amount to their liquid resources which is sized to address the failure of one of its non-clearing member providers in addition to the assumption that the largest one or two defaulting clearing members are unable to lend.

The remaining twelve CCPs did not provide information in their responses that would explain how their liquidity stress testing framework takes into account the non-performance of non-clearing member liquidity providers.

Consistent with KC 9 of Principle 7, CCPs should, when conducting liquidity stress testing, consider a wide range of relevant scenarios that take into account the design and operation of the CCP. Where a CCP is materially reliant on liquidity providers and other entities (such as settlement banks, nostro agents, custodian banks and linked FMIs) and does not include the risk of non-performance by such entities in its liquidity stress test scenarios, it may not be adequately considering the liquidity risk posed to itself.

4.3.3 Additional findings

In addition to the serious issue of concern detailed above, the IMSG observed that some CCPs exclude from their stress tests payment obligations for certain product types and for certain currencies that they consider to be "immaterial" or "negligible".

- Payment obligations excluded from stress testing: Four CCPs that clear physical commodities exclude the payment obligations associated with these physical deliveries.

  One CCP that clears both derivative transactions and securities transactions excludes payment obligations associated with cleared derivative transactions.

- Currencies excluded from stress testing: Similarly, some CCPs which clear products in more than one currency exclude payment obligations associated with certain currencies from their liquidity stress tests.

KC 4 of Principle 7 states that CCPs "should maintain sufficient liquid resources in all relevant currencies to settle securities-related payments, make required variation margin payments, and meet other payment obligations on time with a high degree of confidence under a wide range of potential stress scenarios […]". Therefore, omitting payment obligations from liquidity stress tests could leave the CCP unable to identify potentially important exposures, which could result in resilience implications for those CCPs.

4.3.4 Other observations

Finally, the IMSG observed variations in CCPs' implementation outcomes that are worth noting below:

- Changes to collateral value (eg the value of liquid resources): All CCPs reported that they use the post-haircut value of collateral to determine the amount of liquid resources available in stressed market conditions. These CCPs, nonetheless, appear to apply different methodologies and assumptions to calibrate their collateral haircuts.

  For example, there is a degree of variation across the sample of CCPs in the lookback periods used to calibrate collateral haircuts. One CCP uses a 20-year lookback period to calibrate its haircuts; two other CCPs use a shorter lookback period of 10 years; and another uses lookback periods ranging from seven days to one year, depending on the collateral type posted by participants. While variations in how CCPs calibrate collateral haircuts may exist for a variety of reasons, it is unclear from their responses whether the collateral haircuts applied by some of them take sufficient account of extreme but plausible market conditions.

- Calculation of future variation margin payments: The group of CCPs that clear derivative transactions reported different methodologies used to calculate the potential variation margin payments on the defaulter's portfolio over the assumed liquidation period.

  A small number of the derivatives CCPs reported in their survey response that they run their credit stress testing scenarios on cleared portfolios to calculate the size of the daily variation margin payments. Other CCPs use their initial margin requirements as a proxy to size their future variation margin payments.

  Given the targeted scope of this assessment, the IMSG did not collect information on the parameters and assumptions used by the latter group of CCPs to calculate their initial margin requirements. Nevertheless, CCPs that use initial margin parameters that meet the minimum standard under the Principle 6 (eg single-tailed confidence level of at least 99%) as a proxy to size future variation margin payments could potentially underestimate the size of the variation margin payment obligations in extreme but plausible market conditions.

- Adequacy of liquid resources for payment against delivery: Four of the cash CCPs that clear security transactions reported that they determine the size of their liquid resources by adding a buffer amount to the historical settlement activity observed at the CCP. These CCPs, however, reported different lookback periods and buffer amounts in their calculation methodology.

  Regarding the lookback period, one CCP uses a period of 12 months of historical settlement activity, and another uses a longer lookback period of approximately five years. Regarding buffer amounts, these CCPs size the buffer amounts using different percentages above the historical settlement activity, with one CCP sizing the buffer as 15% above the historical settlement activity and the other two using 25%. The cash CCPs' responses, however, did not clarify how they derived those lookback periods and buffers, and whether those choices are sufficiently conservative to calculate the liquid resources necessary for future settlement obligations in extreme but plausible market conditions.

Annex A: Members of the CPMI-IOSCO Implementation Monitoring Standing Group (IMSG) and assessment teams

Members who led a topic sub-team have an asterisk next to their name.

IMSG co-chairs	
Bank of France	Emmanuelle Assouan
Bundesanstalt für Finanzdienstleistungsaufsicht (Bafin), Germany	Thomas Eufinger (until June 2017)
Securities and Exchange Commission, US	Christian Sabella (from September 2017)
Members	
Reserve Bank of Australia	Jennifer Hancock Matthew Boswell
Central Bank of Brazil	Daniel Tavares de Castro
Brazilian Securities and Exchange Commission (CVM)	Sergio Ricardo Silva Schreiner
Bank of Canada	Eric Chouinard*
Bank of France	Maud Abdeli
Bundesanstalt für Finanzdienstleistungsaufsicht (Bafin), Germany	Edip Acat
European Central Bank	Tom Kokkola Pierre Marmara
European Securities and Markets Authority (ESMA)	Maud Timon
Hong Kong Monetary Authority	Stephen Pang
Reserve Bank of India	Nilima Ramteke
Securities and Exchange Board of India	Sanjay C Purao
Bank of Japan	Takashi Hamano Takahiro Ebisawa
Financial Services Agency, Japan	Kazunari Mochizuki
Bank of Korea	Young-Seok Kim
Netherlands Bank	Jeannette Capel
Central Bank of the Russian Federation	Andrey Krylov
Monetary Authority of Singapore	Ken Nagatsuka* Tze Hon Lau Jonathan Tan
Sveriges Riksbank	Johanna Stenkula von Rosen
Capital Markets Board of Turkey	Nalan Sahin Urkan
Bank of England	Graham Young (until June 2017) Barry King (from July 2017) Julian Schelle
Board of Governors of the Federal Reserve System	Emily Caron Trevor Petrellese Kathy Wang

	Brendan Rowan
Federal Reserve Bank of New York	John Rutigliano* Joey Patel
Commodity Futures Trading Commission, US	Robert Wasserman
Securities and Exchange Commission, US	Stephanie Kim Park Claire Noakes
IOSCO Assessment Committee	Amarjeet Singh
IOSCO Secretariat	Manabu Kishimoto (until June 2017) Josafat De Luna Martínez (from June 2017) Tajinder Singh
CPMI Secretariat	Philippe Troussard Umar Faruqui