

Assessment of ASX Clearing and Settlement Facilities

September 2018

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Executive Summary

Purpose In accordance with its responsibilities under the *Corporations Act 2001*, the Reserve Bank of Australia (the Bank) presents its annual Assessment of the ASX clearing and settlement (CS) facilities. ASX operates four CS facilities: two central counterparties (CCPs) – ASX Clear Pty Limited and ASX Clear (Futures) Pty Limited – and two securities settlement facilities (SSFs) – ASX Settlement Pty Limited and Austraclear Pty Limited. The report details the CCPs' and SSFs' compliance with the Bank's *Financial Stability Standards for Central Counterparties* (CCP Standards) and *Financial Stability Standards for Securities Settlement Facilities* (SSF Standards) (together, the Financial Stability Standards or FSS), respectively, as well as the facilities' more general obligation to do all other things necessary to reduce systemic risk. The assessment is as at the end of June; however, where relevant, developments after this time are discussed.

Conclusion It is the Bank's assessment that the CS facilities 'observed' or 'broadly observed' all relevant requirements under the FSS as at 30 June, with the exception of the Operational Risk Standard (CCP Standard 16, SSF Standard 14), which was rated as 'partly observed' in each facility. On balance, the Bank has concluded that the facilities have conducted their affairs in a way that causes or promotes overall stability in the Australian financial system. However, the CS facilities will need to place a high priority on addressing the recommendations related to operational risk to ensure these issues of concern do not become serious.

Progress towards previous priorities ASX has made material progress against the Bank's regulatory priorities identified in its September 2017 Assessment report:

- *Risk model validation.* ASX has amended its Model Validation Standard to ensure that the frequency of independent validations of the ASX CCPs' credit risk models aligns with the CCP Standards.
- *Analysis of credit stress testing.* The ASX CCPs have implemented a revised monthly reverse stress testing approach.
- *Margining arrangements.* The ASX CCPs have made several changes to their margining practices:
 - *Intraday exposures.* ASX Clear (Futures) has introduced a 2.00 am initial margin call from certain Futures and over-the-counter (OTC) participants, supplemented by a requirement for participants to maintain a margin buffer to cover potential variation margin exposures created in the overnight session. ASX has also made several other changes to bring forward the collateralisation of overnight or late-in-day exposures. ASX Clear (Futures) expects to develop the capability to monitor and manage intraday exposures on a near real-time basis by December 2018.
 - *Margin period of risk (MPOR).* During the assessment period, ASX carried out analysis of the MPOR for all products, concluding that the current assumptions are appropriate, with the exception of electricity derivatives in ASX Clear (Futures) and some cash market products in ASX Clear. In response, ASX has increased the MPOR on energy contracts from two to

three days, and from one to two days for relevant cash market products.

- *Liquidity add-ons.* ASX has conducted a holistic review of its approach to calibrating initial margin for exchange-traded derivatives products at ASX Clear (Futures), resulting in plans to scale up margin requirements for larger portfolios based on estimated liquidation costs.
- *Default broker.* ASX Clear implemented rule changes which allow it to select at least three participants from a pool of eligible default brokers to serve as active default brokers for a two-year period. ASX Clear now has four active default brokers and expects to appoint additional default brokers during the next assessment period.

Other material developments

Other material developments relevant to the supervision of the ASX CS facilities that occurred during the assessment period include:

- *Operational risk review.* ASX has established a program to strengthen its operational risk management and technology governance, to address the findings of an external review carried out at the instigation of the Bank and the Australian Securities and Investments Commission (ASIC). The program also incorporates existing ASX initiatives underway in these areas.
- *Clearing House Electronic Sub-register System (CHES) replacement.* ASX continued its development work on a project to replace CHES, the clearing and settlement system that supports the cash equities market. ASX made the decision to proceed with a solution that utilises distributed ledger technology (DLT) and has consulted on the business requirements for the new system.
- *Stress test exposure limits (STEL) and capital requirements.* Both CCPs reduced STELs to provide an additional buffer of default resources, while ASX Clear introduced additional core capital requirements related to the risk profile and complexity of a participant's business.

Priorities for the next assessment period

The Assessment includes recommendations for the ASX CS facilities to either observe or continue to observe the requirements under particular FSS. These recommendations relate to:

- strengthening governance arrangements
- the management of exposures during the ASX Clear (Futures) Night Session
- aligning financial risk management practices with international guidance on CCP resilience
- the management of liquidity and concentration risk in the CCPs' margin models for exchange-traded derivatives
- implementing plans to strengthen operational risk management arrangements.

The Assessment also identifies areas that will be an important part of the Bank's supervisory engagement with ASX over the next assessment period. These relate to work ASX has underway to strengthen the facilities' risk management arrangements, and include:

- the implementation of longer-term plans to improve risk systems
- the review of liquid resources at both CCPs
- the project to replace CHES
- continued enhancement of the CS facilities' cyber resilience arrangements
- the Bank's planned assessment of the CS facilities' legal basis.

1. Summary of Regulatory Priorities

This section summarises actions taken by the ASX CS facilities during the 12 months to June 2018 (the assessment period) in relation to recommendations identified in the Bank's September 2017 *Assessment of ASX Clearing and Settlement Facilities* (the September 2017 Assessment), and summarises the recommendations identified by the Bank in its September 2018 Assessment of the facilities against the FSS. Further detail is provided in section 2, which describes the material developments in the ASX CS facilities relevant to the FSS; section 3, which discusses findings from an external review of ASX's technology governance and operational risk and control framework; and section 4, which provides the results of a detailed assessment conducted by the Bank of the consistency of the ASX CCPs' risk management arrangements with the CCP Resilience Guidance.

1.1 Progress against 2017 Recommendations

In the Bank's September 2017 Assessment, the ASX CS facilities were rated 'observed' for all FSS, except for ASX Clear (Futures), which was rated 'broadly observed' for Margin (CCP Standard 6). The September 2017 Assessment made a recommendation for steps to be taken by ASX Clear (Futures) in order for it to observe CCP Standard 6, as well as other recommendations in order for the ASX CS facilities to continue to observe various standards. Table 1 summarises actions taken by the ASX CS facilities in relation to these recommendations during the assessment period.

Table 1: Summary of Progress against 2017 Recommendations to Observe or Continue Observing the FSS

Recommendation	Standard	Facility	Actions
Risk model validation. The ASX CCPs should review the frequency of the independent validation of their credit risk models to ensure that they align with the CCP Standards.	CCP Standard 4	Both CCPs	<i>Fully addressed.</i> In February 2018 ASX amended its Model Validation Standard to ensure that the frequency of independent validations of its credit risk models aligns with the CCP Standards.
Analysis of credit stress testing. The ASX CCPs should ensure that they perform comprehensive and thorough analysis of their credit stress test scenarios, models and underlying parameters and assumptions on at least a monthly basis.	CCP Standard 4	Both CCPs	<i>Fully addressed.</i> In July 2017 ASX recommenced monthly reverse stress testing using a modified approach that involves scaling up a selection of existing stress test scenarios, as well as considering the impact of the simultaneous default of its largest three and four participant groups. Combined with monthly review of market conditions this allows for comprehensive and thorough analysis of ASX's credit stress test scenarios, models and underlying parameters and assumptions.

<p>Intraday exposures. By the end of 2017, ASX Clear (Futures) should implement its plans to introduce a scheduled intraday margin call during ASX 24's Night Session to improve its management of intraday exposures created during this session.</p> <p>By 30 June 2020, ASX Clear (Futures) should put in place arrangements to be able to monitor and manage intraday exposures created during ASX 24's Night Session on a near real-time basis, or take other steps to ensure comprehensive management of intraday exposures created during ASX 24's Night Session.</p>	CCP Standard 6	ASX Clear (Futures)	<p><i>Partly addressed.</i></p> <p>ASX Clear (Futures) has mostly addressed the first part of this recommendation by introducing a 2.00 am initial margin call from certain Futures and OTC participants, supplemented by a requirement for participants to maintain a margin buffer to cover potential variation margin exposures created in the overnight session. ASX Clear (Futures) has set out a process for reviewing and resizing the buffer but is yet to implement this.</p> <p>ASX Clear (Futures) has also made progress on developing the capability to monitor and manage intraday exposures (including in the ASX 24 Night Session) in near real time, and is targeting a go-live date for near real-time monitoring capabilities for ASX Clear (Futures) in December 2018.</p>
<p>Margin period of risk. ASX Clear and ASX Clear (Futures) should conduct and document analysis of the MPOR assumptions used in their initial margin models for all products, and review these assumptions in light of this analysis.</p>	CCP Standard 6	Both CCPs	<p><i>Fully addressed.</i></p> <p>The ASX CCPs have conducted and documented analysis of the MPOR assumptions used in their initial margin models for all products. As a result of this analysis, ASX Clear (Futures) has extended the MPOR for electricity derivatives from two days to three days, and ASX Clear is extending the MPOR for certain cash market products from one day to two days.</p>
<p>Liquidity risk. ASX Clear and ASX Clear (Futures) should complete the implementation of add-ons to manage liquidity risk for cash equities and products margined using the Chicago Mercantile Exchange Standard Portfolio Analysis of Risk (CME SPAN) model.</p>	CCP Standard 6	Both CCPs	<p><i>Partly addressed.</i></p> <p>ASX Clear (Futures) completed a holistic review of its approach to calibrating initial margin for products margined using the CME SPAN model, developing plans to scale up margin requirements for larger portfolios based on estimated liquidation costs.</p> <p>The Bank will continue to engage with ASX on the implementation of its amended margining arrangements for products margined using CME SPAN at ASX Clear (Futures), as well as its approach to liquidity add-ons at ASX Clear.</p>
<p>Default broker. ASX Clear should implement its plans to secure an additional default broker.</p>	CCP Standard 12	ASX Clear	<p><i>Fully addressed.</i></p> <p>ASX Clear has implemented rule changes which allow it to select at least three participants from a pool of eligible default brokers to serve as active default brokers for a two-year period. ASX Clear now has four active default brokers and expects to appoint additional default brokers during the next assessment period.</p>

The Bank's September 2017 Assessment also identified a number of areas of supervisory focus for the current assessment period. Material developments in each of these areas are described in sections 2, 3 and 4 (see Appendix A for a mapping of these sections to each area of supervisory focus).

1.2 2018 Assessment and Regulatory Priorities

It is the Bank's assessment that, the CS facilities 'observed' or 'broadly observed' all relevant requirements under the FSS as at 30 June, with the exception of Operational Risk (CCP Standard 16 and SSF Standard 14), which was rated as 'partly observed' in each facility (Table 2).¹ On balance, the Bank has concluded that the facilities have conducted their affairs in a way that causes or promotes overall stability in the Australian financial system.² However, the CS facilities will need to place a high priority on addressing the recommendations related to operational risk to ensure these issues of concern do not become serious. Compared to the September 2017 Assessment, the Bank has lowered each of the CS facilities' ratings for Governance (CCP and SSF Standard 2) to 'broadly observed' and for Operational Risk (CCP Standard 16 and SSF Standard 14) to 'partly observed', reflecting issues identified as part of the Bank's consideration of an external review of ASX's technology governance and operational risk and controls (see section 3). The Bank has also lowered each CCP's ratings for Credit Risk (CCP Standard 4) and Liquidity Risk (CCP Standard 7) reflecting issues identified as part of the Bank's assessment of the ASX CCPs against new international guidance on CCP resilience, which raises the bar in relation to financial risk management at CCPs (see section 4).

Table 2: Ratings of FSS Observance^{(a),(b)}

Standard	ASX Clear	ASX Clear (Futures)	ASX Settlement	Austraclear
CCP and SSF Standard 1: Legal Basis	Observed (→)	Observed (→)	Observed (→)	Observed (→)
CCP and SSF Standard 2: Governance	Broadly observed (↓)	Broadly observed (↓)	Broadly observed (↓)	Broadly observed (↓)
CCP and SSF Standard 3: Framework for the Comprehensive Management of Risks	Observed (→)	Observed (→)	Observed (→)	Observed (→)
CCP and SSF Standard 4: Credit Risk	Broadly observed (↓)	Broadly observed (↓)	N/A	N/A
CCP and SSF Standard 5: Collateral	Observed (→)	Observed (→)	N/A	N/A
CCP Standard 6: Margin	Observed (→)	Broadly observed (→)	---	---
CCP Standard 7 and SSF Standard 6: Liquidity Risk	Broadly observed (↓)	Broadly observed (↓)	Observed (→)	Observed (→)
CCP Standard 8 and SSF Standard 7: Settlement Finality	Observed (→)	Observed (→)	Observed (→)	Observed (→)
CCP Standard 9 and SSF Standard 8: Money Settlements	Observed (→)	Observed (→)	Observed (→)	Observed (→)
SSF Standard 9: Central Securities Depositories	---	---	Observed (→)	Observed (→)
CCP Standard 10: Physical Deliveries	N/A	Observed (→)	---	---
SSF Standard 10: Exchange-of-value Settlement Systems	---	---	Observed (→)	Observed (→)

1 In undertaking its Assessment, the Bank has applied the rating system used in the *Principles for Financial Market Infrastructures: Disclosure Framework and Assessment Methodology* produced by the Committee on Payments and Market Infrastructures and the International Organization of Securities Commissions in December 2012. See Appendix C for more detail on this system.

2 Section 821A(aa) of the Corporations Act requires that a CS facility licensee, to the extent reasonably practicable to do so, comply with the FSS and do all other things necessary to reduce systemic risk.

CCP Standard 11: Exchange-of-value Settlements	Observed (→)	Observed (→)	---	---
CCP Standard 12 and SSF Standard 11: Participant Default Rules and Procedures	Observed (→)	Observed (→)	Observed (→)	Observed (→)
CCP Standard 13: Segregation and Portability	Observed (→)	Observed (→)	---	---
CCP Standard 14 and SSF Standard 12: General Business Risk	Observed (→)	Observed (→)	Observed (→)	Observed (→)
CCP Standard 15 and SSF Standard 13: Custody and Investment Risks	Observed (→)	Observed (→)	N/A	Observed (→)
CCP Standard 16 and SSF Standard 14: Operational Risk	Partly observed (↓↓)	Partly observed (↓↓)	Partly observed (↓↓)	Partly observed (↓↓)
CCP Standard 17 and SSF Standard 15: Access and Participation Requirements	Observed (→)	Observed (→)	Observed (→)	Observed (→)
CCP Standard 18 and SSF Standard 16: Tiered Participation Arrangements	Observed (→)	Observed (→)	Observed (→)	Observed (→)
CCP Standard 19 and SSF Standard 17: FMI Links	Observed (→)	Observed (→)	Observed (→)	Observed (→)
CCP Standard 20 and SSF Standard 18: Disclosure of Rules, Key Policies and Procedures, and Market Data	Observed (→)	Observed (→)	Observed (→)	Observed (→)
CCP Standard 21 and SSF Standard 19: Regulatory Reporting	Observed (→)	Observed (→)	Observed (→)	Observed (→)

- (a) The arrows in brackets indicate the change in ratings from last year: a horizontal arrow indicates no change; a single vertical up arrow indicates a single upgrade (e.g. from 'broadly observed' to 'observed'); a single vertical down arrow indicates a single downgrade (e.g. from 'observed' to 'broadly observed'); and a double vertical down arrow indicates a downgrade by two grades (e.g. from 'observed' to 'partly observed'). Green text is used for upgraded ratings and red text for downgraded ratings.
- (b) 'N/A' means that the Bank has determined that the standard is not applicable to the ASX facility; '---' means that an equivalent standard does not exist for the type of facility (e.g. for CCP Standard 6, there is no equivalent standard for SSFs).

The Bank has made recommendations that the CS facilities should address to observe or continue to observe relevant requirements in the FSS. This includes recommendations to address issues identified in ASX's governance arrangements, operational risk management and consistency with financial risk management practices described in a report of the Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO), *Resilience of central counterparties: Further guidance on the PFMI* (the CCP Resilience Guidance). These recommendations are set out in Table 3 and will be a key part of the Bank's regulatory priorities in the next assessment period.

Table 3: Recommendations to Observe or Continue Observing the FSS

Recommendation	Standard	Facility
<p>Governance. The ASX CS facilities should take the following steps to strengthen their governance arrangements in line with the FSS and consistent with the CCP Resilience Guidance:</p> <ul style="list-style-type: none"> as part of ASX's Building Stronger Foundations program, the facilities should implement plans to more clearly define their risk appetite and embed this in business processes and decision-making throughout the organisation as part of ASX's Building Stronger Foundations program, the facilities should implement plans to clarify responsibilities under ASX's three lines of defence model, improve first line risk ownership and increase resourcing for the second line risk function ASX Clear and ASX Clear (Futures) should ensure that roles and processes in relation to the governance of financial risk management are appropriately formalised and documented in 	CCP and SSF Standard 2	All facilities

order to ensure that the CS Boards have sufficient information to effectively oversee the ASX CCPs

- ASX Clear and ASX Clear (Futures) should ensure that their arrangements for disclosure to, and soliciting feedback from, stakeholders cover all relevant aspects of the CCPs' risk management frameworks, including margin sensitivity analysis, reverse stress testing and management of procyclicality.

For more information, see sections 3 and 4.

Intraday exposures. ASX should introduce a process for ongoing review and resizing of its margin buffer to cover potential variation margin exposures created during ASX 24's Night Session.	CCP Standard 6	ASX Clear (Futures)
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By 30 June 2020, ASX Clear (Futures) should put in place arrangements to be able to monitor and manage intraday exposures created during ASX 24's Night Session on a near real-time basis, or take other steps to ensure comprehensive management of intraday exposures created during ASX 24's Night Session.

For more information, see section 2.1.2.

CCP Resilience Guidance. To align financial risk management practices with the CCP Resilience Guidance the ASX CCPs should implement plans to:	CCP Standards 4 and 7	Both CCPs
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- enhance the comprehensiveness of stress testing to ensure risks are appropriately identified, captured and stressed
- enhance analysis and justification of assumptions used in stress testing models so that risks are adequately captured
- remove assumptions made by ASX Clear that customer positions will be able to be ported and that excess collateral will not be withdrawn or decreased during periods of stress to more accurately reflect the extreme but plausible conditions appropriate for stress testing.

For more information, see section 4.

Liquidity add-ons. ASX Clear and ASX Clear (Futures) should complete the implementation of add-ons to manage liquidity risk for cash market products and products margined using the CME SPAN model.	CCP Standard 6	Both CCPs
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For more information, see section 2.1.2.

Operational risk management. The ASX CS facilities should implement plans under ASX's Building Stronger Foundations program to:	CCP Standard 16, SSF Standard 14	All facilities
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- consolidate and develop a consistent enterprise-wide view of systems, policies, procedures and controls to identify, monitor and manage operational risks
- improve systems and processes supporting change management and incident management
- enhance knowledge management and embed additional resource in order to reduce reliance on key individuals.

For more information, see section 3.

In addition to recommendations to observe or continue to observe the FSS, the Bank has identified several areas that will be an important part of its supervisory engagement with ASX in the next assessment period. These relate to the Bank's planned special topic for the next assessment period, and work ASX has underway to strengthen the facilities' risk management arrangements, and are summarised in Table 4.

Table 4: Supervisory Focus

Development	Standard	Facility
Special topic		
Legal basis special topic. The Bank will carry out a special topic assessment of the ASX CS facilities' legal basis, with a secondary focus on the facilities' arrangements for settlement finality and the ASX CCPs' segregation and portability arrangements.	CCP Standards 1, 8 and 13, SSF Standards 1 and 7	All facilities
Planned work by the ASX CS facilities		
CCP Resilience Guidance. Implementation of ASX's plans to address gaps against the CCP Resilience Guidance that are minor but indicative of good practice in financial risk management, and consideration of how to take into account other minor gaps that ASX does not currently have specific plans to address. For more information, see section 4.	CCP Standards 2, 4, 5, 6, 7 and 15	Both CCPs
Risk system enhancements. The implementation of ASX's longer-term plans to improve its CCP risk systems. For more information, see section 2.1.3.	CCP Standards 4, 5, 6 and 7	Both CCPs
Liquid resources. The review of the adequacy of liquid resources held by the ASX CCPs, as part of the ASX CCPs' annual default fund reviews. For more information, see section 2.1.4.	CCP Standard 7	Both CCPs
CHESS replacement. The development of the new clearing and settlement system for cash market transactions, including how the new system aligns with the requirements in the FSS, and the clarity, effectiveness and documentation of default management processes. For more information, see section 2.3.1.	CCP Standard 14	ASX Clear and ASX Settlement
Cyber resilience. Continued enhancement of ASX's cyber resilience via: <ul style="list-style-type: none"> the implementation of actions identified in ASX's Cyber Strategy roadmap ASX's evaluation of current and emerging technology that could lead to further enhancements to the abilities of ASX to recover from cyber attacks in a timely manner. For more information, see section 2.3.4.	CCP Standard 16, SSF Standard 14	All facilities

In addition to the recommendations and supervisory focus, the Bank expects ASX to work towards continual strengthening of its risk management arrangements. This is in accordance with the general obligation on CS facilities to do all things necessary to reduce systemic risk. ASX recognises this and has governance arrangements in place to motivate and encourage continuous improvement. As part of its ongoing supervisory engagement, the Bank will continue to discuss with ASX areas where there may be opportunities for improvement.

2. Material Developments

This section discusses material developments relevant to the ASX CS facilities that have occurred during 2017/18. Developments between the end of 2017/18 and the finalisation of this report on 28 August are also discussed, where relevant.

To complement this section, background information on activity and participation in the facilities, and governance and risk management in the facilities is set out in Appendix B. A detailed assessment of how the facilities meet each of the FSS (incorporating developments discussed in this section) is presented in Appendix C.

2.1 CCP Risk Management

2.1.1 Credit risk

Changes to Stress Test Exposure Limits

ASX Clear and ASX Clear (Futures) (the ASX CCPs) set STELs for each of their participants based on an internal assessment of creditworthiness. Each CCP automatically calls for collateral known as additional initial margin (AIM) when participants' credit stress test exposures are in excess of their STELs. STEL AIM calls are due before midday on the next business day. The time gap between participants entering into new trades and the payment of any resultant STEL AIM calls means that an increase in a participant's stressed exposures could potentially result in an overnight breach of the relevant CCP's requirement to cover credit losses on the default of its two largest participants and their affiliates with prefunded financial resources ('Cover 2'). During the second half of 2017, ASX Clear (Futures) reported six Cover 2 credit stress test breaches and ASX Clear reported five breaches. Each of these projected shortfalls were covered by AIM collected the next day.

In response to these breaches, and as part of the annual review of the size and composition of the CCPs' default funds undertaken in November 2017, the ASX CCPs decided to lower STELs for all participants to reduce the potential for overnight breaches of the Cover 2 requirement. Before the reduction, STELs for the highest-rated participants were set at half the total default fund of the relevant CCP (i.e. \$125 million at ASX Clear and \$325 million at ASX Clear (Futures)). The reduction means that ASX CCPs will receive STEL AIM before the largest two stress test exposures exceed the size of the relevant default fund, effectively reserving part of the default fund as buffer to address increases in exposures from the previous margin call. ASX has set the minimum buffer at \$80 million at each CCP.³ ASX used the daily changes in the Cover 2 requirement, accounting for STEL AIM held, over the past three years to calibrate these buffers.

In order to help participants manage the transition to the lower STELs, ASX Clear implemented the reduction in two stages, with an initial reduction of \$20 million for the highest-rated participants in

3 This corresponds to a reduction in the maximum STEL in each CCP by half this amount, so that the Cover 2 requirement will be breached only if two participants collectively breach their STELs by \$80 million.

December 2017, and a reduction of a further \$20 million implemented in July 2018. ASX Clear (Futures) implemented the full \$40 million reduction in STELs for the highest-rated participants in December. STELs for lower-rated participants were reduced proportionately in each CCP.

Reverse stress testing

CCP Standard 4.5 requires that, at least on a monthly basis, CCPs should perform comprehensive and thorough analysis of credit stress test scenarios, models and underlying parameters and assumptions to ensure that these are appropriate in light of current and evolving market conditions. ASX addresses this requirement through a combination of:

- routine reverse stress testing, designed to identify scenarios in which the ASX CCPs would exhaust their prefunded financial resources
- running 'for information' stress test scenarios that ASX considers go beyond the 'extreme but plausible' scenarios used in its active stress tests
- reviewing market conditions on a monthly basis to determine whether there is any evidence of emerging stress that would support a change to scenarios.

During the previous assessment period, ASX revised its approach to reverse stress testing, suspending its routine reverse stress testing calculations while developing this modified approach. In response to this, the Bank set a recommendation in its September 2017 Assessment that the ASX CCPs should ensure that they perform comprehensive and thorough analysis of their stress test models on at least a monthly basis.

ASX implemented its modified approach to reverse stress testing in July 2017. Under the new approach, ASX scales up a selection of existing stress test scenarios that typically result in the largest stress test losses for each CCP; the aim is to determine how much more severe these shocks would need to be in order to exhaust prefunded financial resources. ASX also considers the impact of the simultaneous default of its largest three and four participant groups. ASX performs reverse stress testing on a monthly basis.

Model validation

In its September 2017 Assessment, the Bank set a recommendation for the ASX CCPs to review the frequency with which they obtain independent validation of their credit risk models, to ensure that this aligns with minimum frequencies set out in the CCP Standards. At that time, ASX's model validation methodology set the frequency of validation for each of its models based on a risk-based 'score'. ASX's application of this methodology had resulted in a reduction of the frequency of independent validation, in some cases to a frequency below the requirements set out in the CCP Standards.

In February 2018, ASX amended its Model Validation Standard in order to reintroduce a requirement for annual, independent validation of key models used at the ASX CCPs in their credit, collateral, margining and liquidity risk management systems, consistent with requirements set out in the CCP Standards. ASX has engaged an independent third party to conduct annual validations of each of its key clearing risk models over a three-year period, under the oversight of ASX Internal Audit. Under the updated Model Validation Standard, the results and recommendations from each of these validations are reported to the Chief Risk Officer (CRO), internal risk committees and the ASX CS Boards.

2.1.2 Margin

Managing overnight risk in ASX Clear (Futures)

The September 2017 Assessment included recommendations for ASX Clear (Futures) to address the potential for participant exposures to build up during the ASX 24 Night Session, during which time the payments infrastructure for AUD margin payments is closed.⁴ The recommendations were for ASX Clear (Futures) to introduce a scheduled intraday margin call during the Night Session by the end of 2017, and to put in place near real-time monitoring and management of new overnight exposures, or other steps to comprehensively manage these exposures, by 30 June 2020.

In order to address the first of these recommendations, in November 2017 ASX Clear (Futures) introduced a 2.00 am intraday margin call for participants that are most active in the Night Session.⁵ Since the systems used for payment of AUD margin (Austraclear and RITS) are closed overnight, these margin calls are made in USD and settled via the US banking system. A call is made to cover any AUD initial margin shortfall greater than \$3m for house accounts and \$5m for client accounts on AUD futures and OTC products.

To avoid the risk of calling variation margin in USD overnight then having to fund a matching outgoing variation margin payment in AUD the following day, ASX does not typically include variation margin obligations as part of the 2.00 am intraday call. Instead, ASX has introduced a requirement for participants to maintain a margin buffer to cover potential variation margin obligations arising from overnight price moves. The margin buffer is calibrated to cover 80 per cent of variation margin obligations that arise between the last intraday margin calculation of the Day Session (at 1.30 pm) until the 2.00 am intraday call. ASX also has the ability to make additional USD margin calls to cover overnight price movements if it judges this to be necessary. ASX intends to review the size of the margin buffer on a quarterly basis.

ASX has also taken a number of additional steps to enhance its management of risk exposures arising from the ASX 24 Night Session:

- In response to the longer-term recommendation for near real-time risk management of overnight exposures, ASX has acquired data analytics and risk-visualisation software that, once fully implemented, will allow ASX to recalculate exposures at 10-minute intervals. ASX is targeting a 'go-live' date for near real-time monitoring capabilities for ASX Clear (Futures) in December 2018. ASX plans to extend this risk monitoring system to ASX Clear in 2019.
- ASX Clear (Futures) introduced an additional intraday margin call at 8.05 am, prior to the collection of the end-of-day margin call, which applies to all ASX Clear (Futures) clearing participants. This reduces the duration of overnight margin exposures by around two hours for participants not subject to overnight margining. Previously, ASX Clear (Futures) calculated intraday margin obligations at 8.05 am but did not call for intraday margin based on these calculations.

4 The ASX 24 Night Session runs from 5.10 pm to 7 am.

5 11 of the 20 ASX Clear (Futures) participants (together accounting for 96 per cent of total clearing activity) are subject to overnight margining. These participants were identified based on the size of their overnight exposures and level of initial margin.

- ASX Clear (Futures) also halved the previous risk-based erosion thresholds that applied to intraday calls, meaning that a greater proportion of intraday exposures are collateralised in the lead-up to the Night Session.

Recommendation. ASX should introduce a process for ongoing review and resizing of its margin buffer to cover potential variation margin exposures created during ASX 24's Night Session.

By 30 June 2020, ASX Clear (Futures) should put in place arrangements to be able to monitor and manage intraday exposures created during ASX 24's Night Session on a near real-time basis, or take other steps to ensure comprehensive management of intraday exposures created during ASX 24's Night Session.

Monitoring of net settlement positions

In June 2017, ASX Clear reported a breach in its Cover 2 capital requirement which was the result of a large intraday build-up in cash market positions at an individual participant. Since ASX Clear does not perform routine intraday margin calculations for cash market products, it did not call for any collateral against this position until the following morning. At that time, the participant was required to pay STEL AIM resulting from the large increase in its stressed exposures, as well as the increase in initial margin triggered by the trades. In order to provide ASX Clear with more timely notice of a large intraday change in cash market exposures, ASX Clear introduced intraday monitoring and reporting on participants' net settlement positions relative to a \$500 million threshold during the assessment period. Based on the results of the report, ASX management investigate whether further action is required, including calling participants for additional intraday margin, to prevent ASX Clear being exposed to large uncovered positions overnight. ASX has made three such intraday margin calls since the introduction of this enhanced monitoring.

Margin period of risk and liquidity add-ons

The MPOR, or close-out period, is the period during which the CCP is exposed to potential losses on a defaulting participant's portfolio. It is the projected length of time between the receipt of the last margin payment from a defaulting participant, and the point at which all of that participant's positions have been closed out. In the September 2017 Assessment, the Bank made a recommendation for the ASX CCPs to conduct and document analysis of MPOR assumptions used in their initial margin models for all products, and review its assumptions in light of this analysis. Previously, ASX had set its MPORs at one day for cash market products, two days for exchange-traded derivatives, and five days for OTC interest rate derivatives (IRDs). The range of MPORs primarily reflected ASX's assessment of structural market liquidity across these products.

During the assessment period, ASX carried out analysis of the MPOR assumptions used in initial margin models for all products. Based on this analysis, ASX concluded that a two-day MPOR is appropriate for the majority of exchange-traded derivatives products at ASX Clear and ASX Clear (Futures), with the exception of electricity derivatives in ASX Clear (Futures). ASX's analysis revealed that the electricity futures market is less liquid than was implied by its previous MPOR. This is, in part, because the electricity market is primarily used by end users (i.e. energy generators and retailers) for hedging purposes, with the role of clearing participants largely restricted to facilitating client business. The size of individual positions is also typically large relative to average daily trading volumes, making it likely that the close-out period in a default scenario would be longer than for other products.

In response to this analysis, ASX increased the MPOR from two to three days for all AUD energy derivative contracts at ASX Clear (Futures) in January 2018, followed by a similar increase to the MPOR for NZD energy derivative products in May. In addition, ASX adjusted its margin methodology for these products to remove the assumption of a normal distribution of price returns, in order to better reflect the potential for extreme price movements.

ASX's analysis has also led it to consider further changes to improve its ability to manage positions in electricity derivatives in the event of a default. In particular, ASX Clear (Futures) is investigating default management mechanisms that involve end users in the market, the enhanced segregation of accounts and backup clearing arrangements. The MPOR analysis also prompted a review of the appropriate default management approach for exchange-traded derivatives products at ASX Clear, with ASX concluding that a voluntary auction mechanism would provide a more efficient method for closing out a defaulter's portfolio.

ASX's analysis for cash market products at ASX Clear concluded that it should increase the MPOR from one day to two days for products margined using the Historical Simulation Value at Risk (HSVaR) model and for ASX 200 products margined on a flat-rate basis. ASX's analysis concluded that the current two- or three-day MPORs used for remaining flat-rate products was appropriate. ASX uses its OTC default management fire drills to test its MPOR assumptions for OTC products at ASX Clear (Futures). ASX concluded that there was no need to revise the current MPOR for OTC products, set at five days for house positions and seven days for client positions.

While ASX's MPOR analysis is focused on the typical length of time needed to close out a defaulting participant's portfolio, in some cases the portfolio may be unusually large or illiquid and require longer to close out. In order to address this risk, the Bank also made a recommendation in the September 2017 Assessment that ASX should complete the implementation of add-ons to manage liquidity risk for products where a liquidity add-on was not already in place (i.e. cash market products and products margined using the CME SPAN model). During the assessment period, ASX reviewed the use of liquidity add-ons in the context of its overall approach to calibrating initial margin for exchange-traded derivatives at ASX Clear (Futures). The revised margin methodology that ASX has developed as a result of this review would, if implemented as planned, adjust the margin requirement for each portfolio based on the size and underlying liquidity of open positions. ASX is continuing work to develop its approach to liquidity add-ons at ASX Clear.

As part of ASX's review of its margin methodology, ASX increased the frequency with which it recalibrates margin parameters from quarterly to monthly, and extended the historical sample period used to calibrate margin parameters for exchange-traded derivatives at ASX Clear (Futures) from one year to five years. ASX considers that these changes, together with the stronger analytical foundations for MPOR and liquidity add-ons, provide a more robust basis for calibrating margin requirements. As a result, ASX took the decision to reduce the target level of initial margin coverage at ASX Clear (Futures) to a confidence level of 99.5 per cent, from 99.7 per cent previously.

Recommendation. ASX Clear and ASX Clear (Futures) should complete the implementation of add-ons to manage liquidity risk for cash market products and products margined using the CME SPAN model.

Enhancements to backtesting and sensitivity analysis

The CCP Standards require CCPs to analyse and monitor model performance and overall margin coverage through backtesting and sensitivity analysis. Backtesting is a comparison of actual model performance against predicted model outcomes, while sensitivity analysis tests for the responsiveness of initial margin to the underlying parameters and assumptions used to calibrate the initial margin model.

During the second half of 2017, ASX implemented an enhanced approach to both its margin backtesting and sensitivity analysis. ASX's revised backtesting approach incorporates both 'static' and 'point of default' backtests. Static tests (the basis of ASX's previous backtesting approach) are used to assess the statistical performance of the margin model by comparing whether the initial margin requirement for a participant's current portfolio would be adequate to cover historical price movements over the assumed MPOR to the desired confidence level. Point of default tests are used to assess the adequacy of initial margin to cover losses on a participant's portfolio as it would be at the point of a hypothetical default. These tests take into account that initial margin held may have been collected in respect of a participant's positions as they were on the day before default, since the default may occur before the receipt of the previous day's end-of-day margin.

ASX commenced its new approach to sensitivity analysis on its CME SPAN and OTC Filtered Historical Simulation of Value at Risk (FHSVaR) models on a monthly basis from September 2017 and expanded its analysis to cover the cash market margining (CMM) model from December. ASX's analysis covers the sensitivity of ASX's initial margin models to underlying parameters such as MPOR, confidence levels and look-back periods (i.e. the length of price history used to calibrate the model). ASX also conducts 'reverse sensitivity analysis' for CME SPAN margin models, which estimates the length of time over which initial margin would be sufficient to cover losses on participants' current portfolios.

Backtesting results and sensitivity analysis are reported to ASX's Risk Quantification Working Group (RQWG) and the Bank on a monthly basis. The presentation of these results has been refined over time in response to feedback from RQWG.

Consultation on settlement prices during outage

Following an ASX Trade outage in September 2016 and in response to a recommendation from ASIC, ASX reviewed its process for setting the prices used for margining purposes (i.e. settlement prices) in the event of a market disruption. As a result of this review, ASX published a consultation paper in June 2017 to seek feedback from its stakeholders on its processes for determining settlement prices in ASX Clear during a market outage. Following the consultation, ASX Clear decided that it would continue to use its current methodology of using ASX market closing prices to determine settlement prices, except in exceptional circumstances. ASX Clear also decided that participants should be provided with timely communication and transparency on the approach taken to determining settlement prices in the event of a disruption to the ASX market. ASX has published a description of its approach to determining settlement prices on its website.⁶

ASX also intends to provide further guidance to participants on the point of novation in ASX Clear of a trade matched on an Approved Market Operator (AMO) and on its ability to cancel the novation of trades.

⁶ This description is available at <<https://www.asx.com.au/communications/notices/2018/asx-closing-and-settlement-price-determination.pdf>>.

2.1.3 Enhancements to risk systems

During the 2016/17 assessment period, ASX modified and reprioritised certain aspects of its technology transformation program. Instead of developing a new risk management system for the CCPs, ASX planned to make incremental enhancements to the CCPs' existing risk management systems as part of a five-year plan which was to be developed over 2017/18. During the current assessment period, ASX selected and commenced the implementation of a risk-visualisation tool that facilitates a near real-time view of risks, as well as implementing system changes to support the introduction of overnight margining. It has also allocated funding for enhancements to its credit stress testing system that will support implementation of ASX's plans to align with stress testing practices described in the CCP Resilience Guidance (see section 4.3). Further system changes will be required to support the planned introduction of liquidity add-ons at both CCPs.

2.1.4 Liquidity risk

Additional liquidity resources

On a daily basis, the ASX CCPs assess the adequacy of their liquid resources against the objective of covering the largest potential liquidity exposure arising from the default of two participants and their affiliates in stressed market conditions (Cover 2 liquidity requirement). The resources available to the ASX CCPs to meet the Cover 2 liquidity requirement are liquid assets held by the CCPs that derive from the defaulting participants' initial margin as well as each CCPs' default funds, currently sized at \$250 million at ASX Clear and \$650 million at ASX Clear (Futures). ASX Clear also has access to a \$150 million committed liquidity facility from ASX Limited and can supplement its available resources with additional liquidity from offsetting transaction arrangements (OTAs) with participants (see Appendix C.1, CCP Standard 7.3). In addition to its Cover 2 liquidity requirement, ASX Clear has defined a target minimum cash market liquidity buffer of \$100 million, which it would use to meet stressed liquidity exposures arising from cash market transactions before it relied on the use of OTAs.

Both CCPs hold additional liquidity resources that could be used for the purposes of meeting liquidity needs in stressed conditions; these include STEL AIM and intraday margin held as well as the overnight margin buffer at ASX Clear (Futures) and offsetting cash market inflows at ASX Clear. During the assessment period, there were 20 instances at ASX Clear and 155 instances at ASX Clear (Futures) in which there was a projected shortfall in resources available to meet the Cover 2 requirement, or the minimum cash market liquidity buffer in the case of ASX Clear, under stressed market conditions. However, in all but seven of these instances at ASX Clear and two at ASX Clear (Futures), the projected shortfall would have been covered had the additional liquidity resources that were available been taken into account.

In June 2018, ASX updated its Liquidity Risk Policy, and Liquidity Stress Testing and Liquidity Requirement Standard to formally reflect the use of these additional liquid resources to meet the CCPs' liquidity requirements. Prior to this, ASX had been reporting its liquidity stress test results for both CCPs with adjustments to include the additional liquidity resources, which was not consistent with its formally approved liquidity stress testing approach. This reliance on informal and ad hoc processes to correct an identified gap in the previous liquidity stress test model is reflective of similar findings that were identified by the Bank in its assessment of ASX's governance arrangements against the CCP Resilience Guidance (see section 4.1).

ASX will consider the smaller number of instances where there was a projected stressed shortfall in the CCPs' liquid resources as part of the annual review of the CCPs' default funds, which is expected in the second half of 2018. This review will consider whether there is a need for ASX to increase the size of the CCPs' default funds or take other steps in order to ensure the ongoing sufficiency of its liquid resources.

2.1.5 Membership requirements

Minimum core capital requirements

Clearing participants at ASX Clear are subject to base core capital requirements of \$5 million for direct participants, or between \$5 million and \$20 million for general participants.⁷ In December 2017, ASX Clear introduced additional core capital requirements in order to more adequately reflect the risk profile and complexity of a participant's business. This additional requirement is based on the extent to which the participant undertakes the following types of activity: clearing of written options on behalf of clients; proprietary trading activity; and non-ASX client activity.⁸ ASX classifies each of these activities as either *de minimis*, material, or neither *de minimis* nor material, and imposes additional core capital requirements as follows:

- *de minimis* – no additional requirement
- neither *de minimis* nor material – additional requirement of \$2.5 million
- material – additional requirement of \$5 million.

In determining the materiality of the participant's relevant activities, ASX takes into consideration factors such as initial margin held, products traded, size and utilisation of the participant's risk limits, historic and forecast revenues generated by the activity, the number of additional activities undertaken by the participant, and the relative significance of the activity to the participant's overall risk profile.

ASX has allowed a transitional period until 1 January 2019 to allow participants to meet any initial increase in core capital requirements. Going forward, ASX will review core capital requirements on a quarterly basis, providing participants with at least six months to meet any increase in requirements.

Risk-based capital requirements

In November 2017, ASX Clear implemented changes to the types of assets eligible to meet core and liquid capital requirements.

- *Subordinated debt*. In November, ASX Clear removed a participant's ability to use approved subordinated debt to meet its core capital requirement. Under ASX Clear's previous rules, a participant was allowed to satisfy a portion of its core capital requirement using approved subordinated debt if it did not hold sufficient other assets to meet its core capital requirements. The exception was originally introduced to assist participants with the transition to higher minimum core capital requirements in 2009 and was subject to the prior approval of ASX Clear,

7 'Core capital' is defined by ASX as the sum of: all paid-up ordinary share capital; all non-cumulative preference shares; qualifying reserves; and opening retained profits/losses, adjusted for current year movements.

8 Non-ASX client activity includes activity that is undertaken by a participant on behalf of a client in products that are not cleared by ASX Clear or ASX Clear (Futures).

and certain other conditions and limitations. At the time of the change, no participants had approval from ASX Clear to use subordinated debt for this purpose.

- *Liquid assets.* In November, ASX Clear amended the definition of 'liquid' in its rules to include assets that may be realisable or convertible to cash in 31 days (previously 30 days). This change was made in response to the implementation of the Australian Prudential Regulation Authority's (APRA's) Liquidity Coverage Ratio requirements, which resulted in some authorised deposit-taking institutions (ADIs) changing their notice period for early withdrawal of term deposits to 30 days. As a result, a term deposit with a maturity of more than 30 days would no longer have been treated as liquid by ASX Clear, and could therefore not be used to meet the minimum liquid capital requirement.

2.2 Default Management and Recovery

2.2.1 Default management

The Bank's September 2017 Assessment acknowledged the significant progress ASX had made in responding to the Bank's recommendations to enhance its default management arrangements. However, the Bank set one recommendation relating to default management and one area of supervisory focus for ASX in the September 2017 Assessment, to address remaining plans for ASX to enhance its default management arrangements.

Additional default brokers

In order to manage exposures and restore a matched book following a default event, default brokers execute close-out and hedging trades in exchange-traded products on behalf of ASX Clear. During 2016/17, one of ASX Clear's two default brokers had resigned, taking the number of brokers below the minimum of two set out in ASX's internal Default Management Standard. In response, the Bank made a recommendation in the September 2017 Assessment for ASX to implement plans to secure an additional default broker.

During the assessment period, ASX Clear implemented rule changes which allow it to require a participant to enter into a default broker agreement with ASX Clear, making the participant an eligible default broker. Under the new rules, ASX Clear selects at least three participants from the pool of eligible default brokers to serve as active default brokers for a two-year period. ASX Clear currently has four active default brokers and expects to appoint additional default brokers during the next assessment period. ASX Clear (Futures) also engaged a third default broker during the assessment period.

Default management fire drills

The other area of supervisory focus on default management for the Bank has been in monitoring the ASX CS facilities' plans to enhance their default management fire drills, including their testing of arrangements to deal with the default of a settlement participant. ASX conducted a SSF-specific fire drill in August 2017, which focused on the default of a participant at ASX Settlement. Going forward, ASX has expanded the scope and complexity of its CCP fire drills to consider interactions between clearing and settlement participants within the one scenario. For example, the ASX Clear fire drill considered the flow-on effects of an Austraclear participant default on other participants in ASX Clear. In this way ASX will test the default procedures of the two ASX SSFs alongside those of the CCPs. ASX

also broadened the scope of its OTC fire drill at ASX Clear (Futures) to test the governance and execution of its hedging strategy.

2.2.2 CPMI-IOSCO recovery guidance

The revised report of CPMI and IOSCO, *Recovery of Financial Market Infrastructures* (the Recovery Guidance), was adopted by the Bank as guidance to the interpretation of the FSS upon publication in July 2017.⁹ The Recovery Guidance is an update of guidance that was initially published in October 2014 and contains minor clarifications in response to comments that were received during a CPMI-IOSCO consultation in 2016. The Bank had taken account of the previous version of the guidance when assessing the ASX CS facilities' recovery plans as part of the September 2015 Assessment, setting a number of recommendations that were subsequently addressed by ASX. During the assessment period the Bank assessed the ASX CS facilities against the updated Recovery Guidance, concluding that their practices are consistent with the guidance. Nevertheless, ASX has identified potential improvements to its disclosures and reporting relating to recovery tools. In November 2017 it ran educational sessions on recovery tools with both ASX Clear and ASX Clear (Futures) participants. ASX also plans to publish additional materials to support the market's understanding of the recovery tools that ASX has at its disposal in the first half of 2019.

2.3 Operations and Technology

2.3.1 CHES replacement

ASX is in the process of replacing CHES, its core system for clearing, settlement and other post-trade services for the Australian cash equity market. In December 2017, the ASX Board selected Digital Asset (DA), a New York-based technology company, as the vendor platform that will replace CHES. The new platform will be built incorporating DLT. The announcement in December followed a long period of joint development by ASX and DA to ensure that a DLT-based system could meet all of the necessary functional and non-functional requirements. In April 2018, ASX publicly released its consultation paper on the CHES functionality it intended to offer, both on Day 1 and in the longer term.¹⁰ The consultation paper brought together two work streams that had been occurring separately – work on the DLT prototype, and the determination of proposed business requirements developed by stakeholder working groups. ASX plans to release a paper in September 2018 that provides a summary of its consultation feedback, the Day 1 functionality, implementation timelines and how it intends to engage further with stakeholders on key issues.

The Bank has continued to engage with ASX on its proposed business requirements for the CHES replacement system, with a focus on understanding how these align with the requirements in the FSS and can support ASX's risk management capabilities. For example, ASX had confirmed through this engagement that the CHES replacement system will have functionality that can be configured to support segregation between a participant's clients' positions and collateral from the participant's own positions and collateral, although ASX would seek further feedback from its participants before activating this functionality. ASX Clear currently does not offer this type of segregation for cash market transactions; instead it has implemented materially equivalent protections for client collateral

⁹ This report is available at <<https://www.bis.org/cpmi/publ/d162.pdf>>.

¹⁰ The consultation document is available at <<https://www.asx.com.au/documents/public-consultations/ches-replacement-new-scope-and-implementation-plan.pdf>>.

and positions that are designed to minimise the risk of loss of principal to the client throughout the pre-settlement period (see Appendix C.1, CCP Standard 13.2).

DLT architecture and message interface

Although ASX plans to apply DLT to support its post-trade functions, its application of DLT differs significantly from the arrangements of other systems that use DLT such as Bitcoin and other cryptocurrencies. ASX is proposing to use a private, permissioned network application of DLT. Under this approach, ASX would operate, and control access to, the network according to ASX rules, creating a trusted network of nodes. The distributed ledger would provide the single source of truth regarding transactions on the market, with ASX providing access to users allowing each to see elements of the ledger relevant to them. Users would have a choice of connecting using a DLT node or by using a messaging solution based on the XML ISO 20022 format, which will replace the proprietary CHES message protocol that is used in the current system.

Access by non-ASX trading, clearing and settlement entities

ASX has committed to providing access to its clearing and settlement infrastructure on transparent and non-discriminatory terms. ASX currently provides several non-ASX markets with access to its clearing and/or settlement services and will continue providing this access. Consistent with the *Regulatory Expectations for Conduct in Operating Cash Equity Clearing and Settlement Services in Australia* set out by the Council of Financial Regulators (CFR) and Australian Competition and Consumer Commission, ASX has also specifically committed to ensure that its new platforms and technology will not be designed in such a way as to raise barriers to access to operators of other markets, or to any competing CS facilities that might emerge in the future.¹¹

2.3.2 Enterprise Risk Management

In November 2017, the ASX Limited Board approved a three-year enterprise risk management (ERM) plan to refresh its risk management framework, and address gaps in ASX's ERM approach that had been identified in a January 2016 review. This review concluded that ERM practices in the broader financial services industry had developed rapidly in the preceding five years, resulting in a gap between ASX's ERM approach and better industry practices. These findings also prompted ASX to review the resourcing of its ERM function, resulting in the recruitment of a new CRO with a greater focus on ERM, as well as a new General Manager responsible for ERM across ASX. This ERM plan was further updated to align with the findings identified in an external review of ASX's technology governance and operational risk and control framework carried out in late 2017 (see section 3). The broader program to implement key elements of the ERM plan and address other findings of the external review is expected to run until December 2020.

2.3.3 Secondary data centre

During the assessment period, ASX progressed work to replace its current secondary data centre with a new site. ASX has identified a suitable site following a request for proposal process and has commenced detailed specification of hardware requirements. In selecting a new site for its secondary data centre, ASX considered a range of factors including:

¹¹ The CFR policy statement is available at: <<https://www.cfr.gov.au/publications/cfr-publications/2016/regulatory-expectations-policy-statement/>>.

- the redundancy of critical infrastructure (e.g. utilities and telecommunications)
- physical security standards
- geographical location relative to ASX's existing operations
- the scalability of the facility, to allow for future growth in required capacity.

ASX has entered into a contract with the data centre provider and plans to commence the build of the new site later this year with a phased migration to follow.

2.3.4 Cyber resilience

CPMI and IOSCO published *Guidance on Cyber Resilience for Financial Market Infrastructures* in June 2016 (the Cyber Resilience Guidance). During the assessment period, the Bank assessed ASX against the Cyber Resilience Guidance, drawing on a self-assessment by ASX against the guidance and an external assessment of ASX against industry standards, and shared the results of this assessment with ASX. The assessment concluded that ASX's practices are consistent or broadly consistent with the guidance, apart from in relation to the expectation that ASX is able to recover critical operations safely within two hours following an extreme cyber attack. The Cyber Resilience Guidance recognises that it may take time for financial market infrastructures (FMIs) to meet this expectation. The Bank plans to maintain a focus on cyber resilience in its ongoing supervision of the ASX CS facilities, and in particular will be monitoring:

- the implementation of actions identified in ASX's Cyber Strategy roadmap
- ASX's evaluation of current and emerging technology that could lead to further enhancements to the abilities of ASX to recover from cyber attacks in a timely manner.

2.4 Governance

2.4.1 Management changes

Over the past 18 months, ASX has experienced significant change in its senior management team. In particular, there have been new appointments to the roles of Chief Executive Officer (CEO), CRO, Chief Information Officer (CIO), and Group General Counsel and Company Secretary. ASX has also created a new Chief Operating Officer (COO) role to provide a more holistic view of operations and technology within ASX. The refresh of the senior executive team of ASX was completed during the assessment period with the appointment of the new CIO in September 2017 and the new Group General Counsel in October 2017.¹²

The Bank has engaged closely with the new management team to understand how they intend to implement the strategy set out by the ASX Board and, in particular, the significant change program that is underway. This includes the 'Building Stronger Foundations' program to enhance ASX's technology governance and operational risk management (see section 3) as well as significant technology projects, such as CHES replacement.

12 Information on ASX executives is available at <<http://www.asx.com.au/about/executive-team.htm>>.

2.4.2 Committee structure

During the assessment period, ASX conducted a review of its management committee structure. The review found that there were opportunities to rationalise the number of committees operating within ASX, as well as to clarify the role of committees in decision making. In response, ASX has consolidated those committees with a direct role in supporting executive decision making, and recharacterised committees with a focus on information sharing or ideas generation as working groups.

ASX has three main management committees following this reorganisation:

- The Risk Committee, which is responsible for advising the CRO on risk management decisions in the exercise of his delegated authority from the CEO. The Risk Committee replaces two previous committees – the Enterprise Risk Management Committee and the Capital and Liquidity Committee (CALCO).
- The Regulatory Committee, which is responsible for ASX policies related to the conduct and operations of the licensed entities in the ASX Group, including the CS facilities. The committee is chaired by the ASX Group General Counsel and Company Secretary.
- The Technology, Operations and Security Committee, which is responsible for advising the COO in the oversight of ASX's technology, operations and security strategies, and the investments that support these strategies.

The consolidation of these committees is intended by ASX to provide greater clarity on decision-making responsibilities, streamline reporting and support an organisation-wide approach to key issues.

The management committee restructuring has also allowed ASX to streamline reporting to the ASX Limited and CS Boards, by providing a clearer link between the relevant committee and decisions on the coverage, agenda and topics that will be presented at various board meetings. ASX has also made changes to better coordinate the timing of meetings of the ASX Limited and CS Boards.

2.5 International Initiatives, New Products and Services

2.5.1 New Zealand

NZD OTC derivatives

In November 2017, ASX Clear (Futures) expanded its OTC Service to clear NZD OTC derivatives. The products eligible for clearing include interest rate swaps referencing the NZ bank bill benchmark (BKBM) and NZ overnight index swaps (OIS), to a maximum maturity of 15 years and two years respectively. ASX Clear (Futures) has extended its OTC FHSV_aR model, used to calculate initial margin for existing AUD OTC products, to also cover the new NZD products. OTC initial margin requirements are now calculated in AUD on a combined AUD and NZD OTC portfolio. However, variation margin on NZD products is payable in NZD.

To support the introduction of the NZD OTC clearing service, ASX Clear (Futures) implemented additional NZD stress testing scenarios involving shocks to NZD rates. Currently, these additional scenarios build on the stress scenarios applied to AUD OTC derivatives. ASX intends to add NZD-specific scenarios following the annual review of stress test scenarios, which took place in August 2018. In the interim, ASX has included conservative shocks to the assumed correlation between AUD

and NZD rates and has not recognised any offsets between AUD and NZD OTC exposures in its estimation of stress testing exposures.

As part of the changes, ASX Clear (Futures) made amendments to its rules to facilitate access to the NZD OTC clearing service by institutions domiciled in New Zealand. In addition, ASX Clear (Futures) expanded the range of products available to hedge the portfolio of a defaulting participant that contains NZD OTC IRD to include NZD ETD listed on the ASX 24 market.

The Bank will continue to monitor ASX's risk management arrangements for NZD OTC IRD, including the inclusion of NZD-specific stress testing scenarios in the next assessment period.

NZD payment arrangements

ASX Clear (Futures) currently settles its NZD obligations, including variation margin for NZ OTC and exchange-traded derivatives, via an arrangement with ASX Clearing Corporation Limited (ASXCC). ASXCC settles these obligations across its exchange settlement account with the Reserve Bank of New Zealand (RBNZ), with payments initiated in the RBNZ's Exchange Settlement Account System (ESAS) via the RBNZ's central securities depository, NZClear. This follows the operationalisation of ASXCC's ESAS account in June 2017; previously, NZD payments were settled across the ESAS account of ASXCC's commercial settlement bank.

The RBNZ plans to decommission NZClear's payment functionality during the current year as part of a broader refresh of the NZClear system. ASX is therefore in the process of setting up a new payments solution to settle NZD payments directly across ASXCC's ESAS account using SWIFT messaging. In order to implement this new approach, ASXCC has obtained a SWIFT bank identification code and is seeking membership of the High Value Clearing System managed by Payments NZ.

2.5.2 Overseas recognition

In December 2017, the Bank of England (BoE) announced guidance on its approach to recognising non-UK CCPs that provide services in the UK, so that these CCPs can continue operating on the same basis following the UK's withdrawal from the EU.¹³ The BoE wrote to relevant non-UK CCPs, including ASX Clear and ASX Clear (Futures) outlining the circumstances in which they would need to be recognised by UK authorities, and the approach to recognition that the BoE expects to take to the recognition process. The BoE advised that, at the point of exit, UK authorities would apply the recognition regime currently in force in the EU, under which both ASX CCPs are currently recognised. In March 2018, the BoE further clarified that non-UK CCPs would not be expected to require full recognition until the end of 2020.¹⁴ ASX currently intends to apply for recognition for both ASX CCPs.

2.5.3 Other new products and services

During the assessment period, ASX introduced rule changes to support a new gold futures contract that will be traded on the ASX 24 derivatives market and centrally cleared by ASX Clear (Futures). The contract will be quoted in USD, consistent with most major international gold contracts, and will have

13 The BoE's statement is available at <<https://www.bankofengland.co.uk/news/2017/december/approach-to-authorisation-and-supervision-of-international-banks-insurers-central-counterparties>>.

14 The BoE's letter clarifying the timeline for recognition is available at <<https://www.bankofengland.co.uk/letter/2018/ccps-preparation-for-the-uk-withdrawal-from-the-eu-update-march-2018>>.

a monthly expiry. The contract is deliverable (rather than cash-settled), with delivery occurring in the Perth Mint. ASX plans to launch the contract for live trading in the first half of 2019.

Both initial and variation margin for the contract will be called in USD, consistent with the quoted currency of the contract. The notification of USD margin requirements will occur around 6.00 am, in line with other products cleared by ASX Clear (Futures), but there will be a later cut-off time for participants to settle their USD margin calls to align with operating hours of the US banking system. These calls must be settled by 12.00 pm AEST (2.00 pm AEDT). This is one hour after the re-opening of Fedwire, the US real-time gross settlement funds transfer system.

3. Review of ASX's Technology Governance and Operational Risk and Control Framework

3.1 Background and Overview

During the previous assessment period, ASX experienced two significant operational disruptions. On 19 September 2016, there was a major disruption to the operation of ASX's equity trading system (ASX Trade), which prevented trades from being executed for most of the day. The second incident, following a power outage on 15 February 2017, resulted in the unavailability of Austraclear for around half an hour and impacted ASX's ability to recover its CHES system for several weeks if there had been a disruption to its primary site. ASX also experienced a series of other less significant operational incidents across its trading and CS facilities during that period. Although the Bank does not play a direct role in the regulation of ASX's trading facilities, ASX manages operational risk on a whole of group basis.

Following these operational disruptions, ASX commissioned an independent external review of ASX's technology governance, and operational risk and control framework (the Review) at the instigation of the Bank and ASIC, covering ASX's licensed markets and CS facilities. Its scope covered ASX's technology governance, and operational risk practices and control mechanisms, with an objective to identify any gaps compared to global better practice and recommend how these be addressed. The Review was conducted by KPMG, utilising consultants with expertise in operational risk management and governance. The Review involved a detailed examination of documentation, supplemented by interviews with a number of ASX staff.

Both the Bank and ASIC engaged closely with both ASX and KPMG throughout the Review process, and continue to engage with ASX in its response to the Review findings. This reflects the critical importance of governance and operational risk management in the two agencies' respective mandates: the Bank's focus has been on the implications for systemic risk arising from the ASX CS facilities' operations; ASIC's focus has been on the implications for the fair and effective provision of services by the CS facilities and the fair, orderly and transparent operation of ASX's licensed markets. ASIC plans to publish a report on ASX's technology governance and operational risk management standards, building on the findings of the Review.

The Review identified 36 recommendations to address gaps identified in ASX's risk management and technology strategy, governance practices, risk measurement and monitoring, knowledge management and resource management. These findings are described in more detail in section 3.2. 21 of the Review's recommendations were classified as 'strategic' recommendations that would be more resource-intensive and take longer to fully address.

ASX has been supportive of the Review and has accepted all 36 recommendations. In response, ASX has developed a three-year program to address findings from the Review: 'Building Stronger Foundations in Risk, Technology and Incident Management' (Building Stronger Foundations). The Building Stronger Foundations program also incorporates existing ASX initiatives and projects that had

been identified by ASX prior to the Review. The key elements of the Building Stronger Foundations program relevant to each of the Review findings are discussed in section 3.2, and further details on the governance and operationalisation of the program are set out in section 3.3. At the end of the assessment period ASX had completed implementation of one of the Review recommendations and had addressed 29 per cent of the underlying deliverables in the broader Building Stronger Foundations program.

3.2 Key Review Findings

The Review benchmarked ASX's technology governance and operational risk management practices against industry standards and better practice among peer FMIs and the broader financial services industry. The Review was completed in December 2017 and its findings highlighted a number of shortcomings that are relevant to the Bank's assessment of the ASX CS facilities observance of the FSS, in particular standards relating to Governance (CCP and SSF Standard 2) and Operational Risk (CCP Standard 16 and SSF Standard 14). These shortcomings relate to ASX's risk management and technology strategy, governance practices, operational risk measurement and monitoring, knowledge management and resource management. The Review also acknowledged that ASX management had already identified some of the issues set out in the findings, particularly ones relating to governance and ERM, and had already commenced initiatives to address the findings. Where relevant, these are noted below.

The Bank has closely examined the findings of the Review to understand the extent of any areas in which the ASX CS facilities fall short of the very high expectations for governance and operational risk management set out in the FSS. The high standard to which ASX is held reflects the key role that its CS facilities play in managing systemic risk in the Australian financial system. The Bank has concluded that there are a number of findings highlighted in the Review that ASX must address in order to fully observe the FSS relating to governance and operational risk; these findings are noted below and reflected in the recommendations set out in section 3.3. The Bank acknowledges that ASX has engaged constructively with the Review process and has accepted all of the recommendations set out in the report.

Strategy and culture

The Review noted that ASX had not kept pace with a step change in the role of ERM across the industry in recent years. This had been identified by ASX prior to the Review, and had led to the recruitment of a new CRO with a greater focus on ERM. Under the new CRO, ASX had developed a three-year plan to strengthen its ERM capabilities which was finalised shortly before the Review was completed (see section 2.3.2). While the Review acknowledged that progress had been made, its findings emphasised that ASX's risk management and IT strategies need to be set out in greater detail and more thoroughly embedded in ASX's culture. As an example, the Review found that ASX's risk appetite statement required additional detail on risk tolerance levels in order for management to effectively implement consideration of the risk appetite into day-to-day operations. Addressing weaknesses in ASX's risk appetite framework was also identified as a key element of its three-year ERM plan.

The Review also found a lack of evidence of formal consideration of risk in the strategy setting process, recommending that ASX formally consider risk in key processes such as strategic planning and performance management. ASX has included actions in the Building Stronger Foundations program that address each of these findings, including to develop a more detailed risk appetite

statement, to embed the inclusion of ERM goals in individual performance management processes, and develop a communication plan to emphasise the importance of risk management across the organisation. The last of these steps was implemented before the end of the assessment period, with work underway to address other actions.

The Review found that ASX's three lines of defence model for risk management and, in particular, the risk management and compliance functions for operations and technology had been under-resourced and lacked clarity regarding roles and responsibilities for risk activities across the organisation.¹⁵ ASX has commenced work, also identified in its three-year ERM plan, to strengthen and mature its first and second line risk management, securing Board funding approval for additional head count and commencing recruitment for these roles. While a number of additional roles have already been filled (particularly in the first line), additional hiring and training of staff is likely to continue through to 2019 as the first and second line risk management functions are further developed and new risk management processes are embedded by ASX.

ASX's IT strategy was another area for improvement identified by the Review. Historically, the focus of the IT strategy has been on individual projects rather than an overarching vision of the IT function that identifies the business objectives it is designed to address and the capability needed to meet those objectives. In part, this is related to the lack of a true end-to-end view of ASX's IT architecture (i.e. its enterprise architecture). Consequently, the Review recommended that ASX define a technology strategy and roadmap, and clarify the role of enterprise architecture within strategic planning. The previous IT strategy was already under review by ASX's new CIO, who had joined in September 2017. The ASX Limited Board approved an updated IT strategy and five-year plan in June 2018, and is continuing work to implement this strategy and develop its enterprise architecture approach.

While the Bank views ASX's work to address each of the above findings as significant in bringing ASX in line with better practice, there are two areas in particular in which further progress is required to bring ASX into full observance with the FSS:

- more clearly defining ASX's risk appetite and embed this in business processes and decision-making throughout the organisation (CCP and SSF Standard 2.6)
- clarifying responsibilities under ASX's three lines of defence model, improving first line risk ownership and increasing resourcing for the second line risk function (CCP and SSF Standard 2.2).

Governance

A key finding of the Review with respect to governance of technology and operational risk was that information provided to executive and board forums was typically at a summarised level that did not always provide the Board or executives with the information required to make strategic or risk management decisions, or to oversee delegated decision-making. The Review also found that there was limited formal sharing of risk information across relevant boards and committees; instead ASX relied on common membership across these forums. The risk of this approach is that it creates reliance on key individuals and undermines the role of the committees themselves in the decision-making process. The Review acknowledged that ASX had already taken steps to address some of these

¹⁵ Under the three lines of defence model, the first line is risk management within the business functions themselves; the second line is an independent risk management and compliance function that develops risk management policy and oversees risk management in the first line; and the third line is independent assurance (i.e. internal and external audit).

concerns, in particular through its restructure of management committees (see section 2.4.2). Management have also developed education modules and a communication strategy to improve staff awareness of the appropriate level and governance forums for decision making.

In addition to steps already underway, as part of the Building Stronger Foundations program, ASX has undertaken to enhance key governance reports with greater detail, continue its review of governance structures, and provide appropriate governance to support new initiatives introduced as part of the broader program – for example, establishing a design authority to govern the new enterprise architecture when this has been developed.

The Bank views effective governance arrangements as critical in ensuring that appropriate decisions are made in ASX's technology investments and operational risk management, and will closely monitor ASX's plans to enhance its governance arrangements to understand whether these will deliver outcomes consistent with the expectations set out in the FSS.

Operational risk measurement and monitoring

The Review indicated that one of the reasons for the limited analysis of information provided to executive and board forums was the limitations of ASX's systems to measure and monitor operational risks. These limitations impeded the aggregation of risk information, and led to inconsistencies in the monitoring of risk across the organisation. Constraints on ASX's ability to capture a full range of data and a lack of forward-looking key risk indicators also limited ASX's ability to generate strategic insights for more effective risk management.

In response, ASX has committed to substantially improving risk measurement and monitoring through the implementation of new systems and functionality. A key element of this will be the implementation of a Governance, Risk and Compliance system, which will enable ASX to capture and consolidate risk data for reporting. ASX also plans to upgrade its IT service management tools to better support incident, change and problem management functionality in line with industry best practice, as well as to implement a communications tool to support crisis management. A vendor selection process is underway for these systems. Collectively, the new systems will allow ASX to generate greater strategic insights through the ability to analyse data more effectively, support the business in its risk, regulatory, audit and assurance tasks, and improve incident management and crisis management communication. ASX will also be reviewing the way in which it presents risk and compliance data, in particular through enhancing its key risk indicators, and developing a risk assurance monitoring and reporting 'dashboard'.

The Bank views a frequent and accurate process to measure and monitor key risks as essential for a CS facility to ensure that its risk profile remains within its risk appetite and consistent with the standards established under the FSS. In order to fully observe these standards, it is important that ASX implement its plans to:

- consolidate and develop a consistent enterprise-wide view of systems, policies, procedures and controls to identify, monitor and manage operational risks (CCP Standard 16.1 and SSF Standard 14.1)
- improve systems and processes supporting change management and incident management (CCP Standard 16.2 and SSF Standard 14.2).

Knowledge management

The Review observed that there is heavy reliance on expert individuals within ASX, which has the potential to impede effective response to incidents, efficient IT operations and change management. This was attributed to knowledge repositories and tools that were not structured to support efficient IT operations and changes, as well as an inconsistent approach to the documentation of processes, procedures and controls. In response, ASX will undertake an exercise to create a holistic view of all policies, processes, procedures and controls to enable more effective assessment and management of risk, and include knowledge management functionality within its upgraded IT service management tool. This will also support the establishment of a formal technology risk and controls register, and in turn will establish a single source of truth resulting in improved information management and reduced key person risk.

An effective knowledge management process is important for sustainably managing risks and responding to incidents as an institution, even if key individuals are unavailable. In order for ASX to fully observe the FSS, the Bank notes that ASX should enhance knowledge management and embed additional resource in order to reduce reliance on key individuals (CCP Standard 16.4 and SSF Standard 14.4).

Resource management

The Review also found that ASX's tendency to manage projects and operations within silos affects its ability to manage its resources effectively. This was compounded by a lack of clarity regarding the delineation of responsibilities within IT. In response, ASX is carrying out a review of the organisational structure of IT, which is intended to clarify roles and responsibilities and develop stable teams across key operations domains. The Bank views this as particularly important given the central role of technology to the operations of the ASX CS facilities, as well as the number of significant projects currently underway (including the replacements of CHES and ASX's CORE database).

3.3 Conclusions, Recommendations and Next Steps

In light of the findings discussed in section 3.2, the Bank's assessment is that each of the ASX CS facilities broadly observes the standard on Governance (CCP and SSF Standard 2) and partly observes the standard on Operational Risk (CCP Standard 16 and SSF Standard 14). This assessment takes into account that ASX has already implemented a number of significant steps to improve its governance arrangements, in particular the restructuring of its management committees (section 2.4.2). While ASX has made some progress in addressing areas for improvement in its operational risk management identified in the Review or as part of its own three-year ERM plan, fully addressing the areas in which the Bank has identified less than full observance of the FSS is reliant on longer-term initiatives. These include investment in new systems and the embedding of structural and cultural change.

Recommendation. The ASX CS facilities should implement plans under ASX's Building Stronger Foundations program to:

- more clearly define their risk appetite and embed this in business processes and decision-making throughout the organisation
- clarify responsibilities under ASX's three lines of defence model, improve first line risk ownership and increase resourcing for the second line risk function
- consolidate and develop a consistent enterprise-wide view of systems, policies, procedures and controls to identify, monitor and manage operational risks
- improve systems and processes supporting change management and incident management
- enhance knowledge management and embed additional resource in order to reduce reliance on key individuals.

Next steps

Ultimate responsibility for the delivery of the Building Stronger Foundations program lies with the ASX Limited Board, which has delegated day-to-day oversight of the program to an Executive Steering Group (ESG). The ESG is chaired by the CRO and is comprised of other key executives across the group, including the CEO, COO and CIO. The ESG meets monthly to monitor the implementation of the program and the Board, and Audit and Risk Committee receive progress updates at each of their meetings. The Building Stronger Foundations program involves significant investment in new systems and staff, which the Board has committed to prioritising in funding decisions. The resourcing requirements of the program are also on the standing agenda for the ESG, which is seeking to quarantine program resources from demand from other high priority projects within ASX. ASX has also reviewed the level of general business risk capital at the CS facilities, to ensure that this provides appropriate cover for operational risks while the Review findings are being addressed.

Both the Bank and ASIC will receive regular updates following each ESG meeting, and will have additional engagement with members of the Board to understand how the Board is overseeing the implementation of the program. ASX has also engaged KPMG to verify the progress made in implementing actions in June and December 2018 and June 2019. The first of these progress reviews confirmed that ASX had met its closure criteria on one recommendation and 29 per cent of underlying deliverables.

4. Special Topic – CCP Resilience Guidance

In July 2017 CPMI-IOSCO published the report *Resilience of central counterparties: Further guidance on the PFMI*.¹⁶ The CCP Resilience Guidance builds on work conducted by CPMI and IOSCO member jurisdictions to examine the degree of consistency in the outcome of the implementation of the *Principles for Financial Market Infrastructures* (PFMI) by FMIs, including a review of selected major CCPs' implementation of Principles relating to financial risk management and recovery practices published in August 2016.¹⁷ This review found that CCPs have made important and meaningful progress in implementing these Principles, but identified some gaps and shortcomings, as well as a number of other differences in the outcomes of implementation across CCPs. A follow-up review, published in May 2018, found that CCPs covered by the review had made further progress in implementing arrangements consistent with the PFMI, although remaining gaps were identified for some CCPs in the areas of risk management and recovery planning.¹⁸

The CCP Resilience Guidance provides further guidance on the Principles and Key Considerations in the PFMI regarding financial risk management by CCPs, but it does not create additional standards beyond those already set out in the PFMI. Instead, it aims to improve the financial resilience of CCPs by providing clarity on an acceptable way of observing the PFMI. The guidance focuses on five key elements of a CCP's financial risk management framework:

- governance of financial risk management
- stress testing for both credit and liquidity exposures
- coverage of financial resources
- margin
- the contribution made by a CCP to financial resources available to absorb losses ('skin in the game').

Although no additional standards are imposed by the CCP Resilience Guidance, it was expected that it would prompt enhancements to risk management practices at many CCPs. CCPs were expected to identify and implement any necessary changes to ensure consistency with the guidance by the end of 2017.

At the time that the CCP Resilience Guidance was published, the Bank noted that it would take this guidance into account in its interpretation of the FSS. The Bank applies the CCP Resilience Guidance in its interpretation of the following CCP Standards within the FSS: Governance (CCP Standard 2);

16 The CCP Resilience Guidance is available at <<https://www.bis.org/cpmi/publ/d163.pdf>>.

17 For more information, see 'Implementation monitoring of PFMI: Level 3 assessment – Report on the financial risk management and recovery practices of 10 derivatives CCPs', available at <<https://www.bis.org/cpmi/publ/d148.pdf>>.

18 For more information, see 'Implementation monitoring of PFMI: follow-up Level 3 assessment of CCPs' recovery planning, coverage of financial resources and liquidity stress testing', available at <<https://www.bis.org/cpmi/publ/d177.pdf>>.

Framework for the Comprehensive Management of Risks (CCP Standard 3); Credit Risk (CCP Standard 4); Collateral (CCP Standard 5); Margin (CCP Standard 6); Liquidity Risk (CCP Standard 7); and General Business Risk (CCP Standard 14).

This section provides an overview of the results of the Bank's assessment of the ASX CCPs against the CCP Resilience Guidance. As this is an assessment against guidance, rather than against the FSS, the Bank reviewed the consistency of ASX practices against the guidance and judged the overall seriousness of any gaps against the extent to which ASX addresses the minimum headline standard in the FSS.

In preparation for the Bank's assessment, ASX conducted a self-assessment in the second half of 2017, which identified several of the gaps identified below. On the basis of this self-assessment, ASX developed a work plan to address these gaps. ASX began to implement this plan in late 2017, but judged that it was not feasible to also complete the plan within this timeframe. In some cases ASX identified the need for system changes or additional analytical work that would require additional time. In June, ASX updated its plan to include actions to address all gaps of potential concern identified in the Bank's assessment (i.e. gaps that could affect the CCPs' observance of the headline standard in the FSS). The assessment presented in this section takes into account actions that had been completed as at the end of June.

In most cases, the practices described in the CCP Resilience Guidance were already part of ASX's risk management framework and are set out in detail in relevant sections of Appendix C.1. This section therefore focuses on identified gaps between the ASX CCPs' practices and the more granular expectations for financial risk management set out in the guidance. It provides only an overview of the majority of areas in which the ASX CCPs were already consistent with the CCP Resilience Guidance. It is split into five parts: governance, margin, stress testing, adequacy of coverage and skin in the game.

4.1 Governance

CCP Standard 2 sets out requirements for the governance of a CCP. The Standard states that a CCP should have clear and transparent governance arrangements, which promote the safety of the CCP and support the broader financial system, other public interest considerations and the objectives of stakeholders. It details the roles and responsibilities of the CCP's board, including the ultimate responsibility of the board to establish a clear, documented risk management framework. The CCP Resilience Guidance expands on these requirements and provides more granular detail on the ways in which the board is expected to carry out its responsibilities.

The CCP Resilience Guidance sets out that the board should have the ultimate responsibility for ensuring that the CCP's margin system and stress testing framework are appropriately designed to set and maintain the CCP's required level of resources. The guidance clarifies that the board is expected to carefully oversee management's implementation of the risk management framework, as well as any tasks delegated to a committee. This requires the board to receive an appropriate flow of information from management. The board is also expected to establish a comprehensive disclosure and stakeholder feedback mechanism to inform the board's decision-making regarding the CCP's risk management framework.

The Bank's assessment is that the roles and responsibilities of the CS Boards at ASX are consistent with the CCP Resilience Guidance. The CS Boards review key policies under ASX's Clearing Risk Policy Framework, such as the Margin Policy, Margin Standard, stress testing standards, and investment

mandates. The CS Boards receive detailed quarterly reporting on the operation of the CCPs and their compliance with risk management policies and standards. These policies and standards are set to align with the FSS, and the CS Boards have a statutory obligation to ensure that the CCPs comply with the FSS. The ASX CCPs' objectives recognise the public interest, including overseeing conduct consistent with public policy objectives directed at financial market and payments system integrity.

However, there are some instances where the desired outcome of the CCP Resilience Guidance is achieved via informal or ad hoc means, rather than via a documented requirement. For example, following a breach in financial resources, there should be an immediate review of relevant aspects of a CCP's risk management framework. The process for review at ASX is less formal and is not documented: if there is a breach there is a discussion at management level on the underlying cause of the breach and the CRO may elect to carry out a review of the risk management framework. Other gaps relate to: documentation of processes to ensure that changes to the legal framework for collateral are reflected in model assumptions; identification of actions arising from monthly analysis of stress testing and model assumptions; the CS Boards' oversight of the sizing of the ASX CCPs' general business risk capital; independent review of the ASX CCPs' model validation processes; and annual review and approval by the CS Boards of ASX's Model Validation Standard and the CCPs' response to findings from model validations. The Bank views these gaps as minor in nature, but expects ASX to take steps to ensure that roles and processes in the governance of financial risk management are appropriately formalised and documented.

Both ASX CCPs have established Risk Consultative Committees as a forum for stakeholders to provide feedback on risk management matters. However, there are minor gaps in the scope of the ASX CCPs' disclosures, relating to matters such as the provision of information on ASX's sensitivity analysis, reverse stress testing and management of procyclicality. ASX plans to implement changes to its disclosures to address these gaps by the end of 2018.

4.2 Margin

A CCP's margining system is a fundamental part of its risk management framework. Margin is the first layer of protection against losses incurred in the event of the default of a clearing participant. CCP Standard 6 sets out requirements for a CCP to cover its credit exposures to its participants for all products through an effective margin system that is risk based and regularly reviewed. The CCP Resilience Guidance provides additional detail to assist CCPs in developing and maintaining a margining system that is effective in addressing the relevant risks.

The ASX CCPs use a range of different margin models for the products they clear. Table 5 summarises the margin model used for each product class. Further detail on the key margin models used by the ASX CCPs is available in the special topic on ASX's margining arrangements in section 3 of the Bank's September 2017 Assessment.¹⁹

19 The September 2017 Assessment is available at <<https://www.rba.gov.au/payments-and-infrastructure/financial-market-infrastructure/clearing-and-settlement-facilities/assessments/2016-2017/>>.

Table 5: ASX CCP Initial Margin Models

Product	CCP	Model
Exchange-traded derivatives	Both	CME SPAN
OTC IRDs	ASX Clear (Futures)	Filtered historical simulation value at risk
Cash market products	ASX Clear	Historical simulation value at risk (for equities in the All Ordinaries Index with at least two years of price history)
		Flat rates (for all other products)

Margin system design and margin period of risk

The CCP Resilience Guidance provides detail on the elements a CCP should consider when designing a margin system. One important element is the assumed MPOR in a CCP's margin model. As part of the special topic on ASX's margining arrangements in its September 2017 Assessment, the Bank recommended that ASX conduct and document analysis of the MPOR assumptions used in its initial margin models for all products, and review these assumptions in light of this analysis. ASX completed this analysis for ASX Clear (Futures) in December 2017 and identified that its margining arrangements for electricity futures did not reflect the idiosyncrasies of that market. ASX Clear (Futures) adjusted its margining approach to address this finding (see section 2.1.2). ASX completed its MPOR analysis for all products cleared by ASX Clear in June 2018, identifying that the MPOR should be increased from one to two days for products margined using HSVaR and for ASX 200 products margined using a flat rate. ASX expects to implement these changes in the coming assessment period.

The guidance clarifies that a CCP's assumed MPOR should explicitly incorporate the maximum possible time between the point at which the CCP last collected margin from the defaulting participant and the point at which the market risk on the defaulter's portfolio has been extinguished. During the assessment period ASX amended its backtesting approach to include an assumption that the point of default occurs before the collection of margin (see section 2.1.2). However ASX does not have an equivalent assumption in place for stress testing at ASX Clear and ASX Clear (Futures). ASX plans to address this gap of potential concern by determining and implementing an approach to incorporating an assumption of default prior to the receipt of variation margin in the CCPs' stress tests in 2019.

Pricing data are another important element of a CCP's margin system. The ASX CCPs source price data for cash market products and exchange-traded derivatives from the ASX Trade and ASX Trade 24 markets. OTC IRDs and some settlement prices for commodity derivatives are priced using third-party data sources. ASX runs a set of checks and validations for its price data each day to ensure they are correct, and independently validates models that calculate prices for exchange-traded options (ETOs) and OTC IRDs as part of its regular model validation process. The CCP Resilience Guidance sets out that, when using historical prices to calibrate its margin model, a CCP should carefully evaluate the appropriate historical sample period. ASX completed analysis to determine and justify historical sample periods for ASX Clear (Futures) in December 2017 (see section 2.1.2). The equivalent analysis has not yet been carried out for ASX Clear, which is a gap of potential concern. ASX plans to conduct analysis for ASX Clear during the next assessment period.

More broadly, the CCP Resilience Guidance states that a CCP should have processes to identify, clarify and evaluate the choices and trade-offs being made in the design of its margin system. As part of this, a CCP should evaluate which models and approaches are most appropriate for the products it clears.

These processes should support the board's ultimate responsibility for the design of the overall risk management framework of the CCP. ASX has conducted a one-off benchmarking exercise against parameter choices and models used by peer CCPs, which it intends to repeat alongside a formal consideration of alternative models as part of its model validation process going forward. However, this is not explicitly captured in its Model Validation Standard and the CS Boards are not given the ultimate responsibility for approving the outcome of any validation. While the Bank views this gap as minor, it expects the gap to be addressed in response to the recommendation that ASX should take steps to ensure that roles and processes are appropriately formalised.

The CCP Resilience Guidance provides examples of the types of wrong-way risk that CCPs could be exposed to (i.e. the risk that a CCP's exposure to a counterparty is correlated with the creditworthiness of that counterparty), and requires that CCPs have in place a holistic framework to identify, monitor and manage wrong-way risks. Although ASX identifies specific sources of wrong-way risk and addresses them in a number of ways, ASX lacks a formal wrong-way risk framework. This is a minor gap that ASX intends to address by developing a formal framework by the end of 2018.

Backtesting and sensitivity analysis

CCP Standard 6.6 requires CCPs to analyse and monitor model performance and overall margin coverage through backtesting and sensitivity analysis. The CCP Resilience Guidance describes steps that a CCP should take when performing backtesting to assess whether it has collected sufficient margin to meet its coverage requirement. ASX conducts backtesting at the portfolio level for each of its margin models and also tests key margin parameters. In 2017, ASX implemented new backtests that take into account the potential composition of a defaulting participant's portfolio at the point of default, as well as enhancing statistical tests of backtesting results (see section 2.1.2).

ASX has also refined its approach to sensitivity analysis to assess the sensitivity of margin requirements to changes in key margin parameters such as MPOR, look-back period and confidence interval. ASX's revised sensitivity analysis is consistent with the CCP Resilience Guidance.

ASX intends to update its backtesting and sensitivity analysis documentation to reflect enhancements in its approach in the second half of the year.

Procyclicality

A margin model may be procyclical if it is calibrated in a way that is likely to cause or exacerbate financial instability.²⁰ The FSS set high-level requirements for CCPs to limit the procyclicality of their margin models, but they are not prescriptive in how these requirements should be achieved. In the September 2017 Assessment, the Bank concluded that the ASX CCPs' practices were consistent with these high-level requirements. The CCP Resilience Guidance provides more detailed guidance on how CCPs can manage procyclicality. In particular, it states that a CCP should evaluate the appropriateness of procyclicality-limiting tools in its margin models and develop clearly articulated frameworks for assessing, disclosing and addressing procyclicality-related risks. ASX established a procyclicality framework in May, which sets out the approaches ASX takes to address procyclicality. However, ASX's procyclicality framework lacks an explicit framework for evaluating the extent to which ASX's margin models are procyclical and the effectiveness of ASX's procyclicality mitigating tools. To close this

²⁰ For example, a margin model might respond to heightened volatility by increasing margin requirements in a way that places significant liquidity demands on participants, in turn exacerbating the volatility in the market.

minor gap, the Bank expects ASX to update its procyclicality risk framework and related documentation and processes to include a framework for evaluating the extent to which ASX's margin models are procyclical and the effectiveness of ASX's procyclicality mitigating tools. ASX should consider the use of quantitative metrics set out in the CCP Resilience Guidance, as well as any other metrics it considers appropriate.

Portfolio margining

CCP Standard 6.5 limits the use of portfolio margining to products that have significantly and reliably correlated risk profiles. The CCP Resilience Guidance further explains that CCPs should identify, document and apply clear criteria when determining which products are correlated in this way. Almost all of ASX's margin models permit some form of offset, with the exception of flat rates applied to less-liquid cash market products. Margin calculations in ASX's Value-at-Risk (VaR)-based models implicitly recognise offsets based on historically observed price correlations between products. This includes offsets between interest rate futures and OTC derivatives positions where the futures have been allocated for portfolio margining using a VaR model. ASX's use of an extended look-back period (with a fixed start date in 2008) helps to validate the reliability of historical correlations in ASX's model for OTC derivatives. For exchange-traded derivatives, correlations observed across related contracts are explicitly incorporated through SPAN parameters, which are only applied where correlation measures exceed predefined thresholds.

4.3 Stress Testing

Stress testing is a core part of the risk management framework of a CCP. It is used to verify the sufficiency of a CCP's financial resources, even in a range of extreme but plausible scenarios. The CCP Resilience Guidance sets clear expectations on the rigour of credit and liquidity stress testing at CCPs by providing clarity on the key matters that should be taken into account when a CCP establishes its stress testing framework. It provides further guidance on the identification of risks, the development of extreme but plausible scenarios, the calculation and aggregation of stress test results, and the analysis of stress test scenarios, models, and underlying parameters and assumptions.

Structure of stress testing frameworks

The CCP Resilience Guidance clarifies the commonalities and differences between credit and liquidity stress testing. For example, it notes that a default can create a liquidity exposure in excess of, or even in the absence of, any credit exposure. This may occur if the CCP is required to convert eligible collateral (including cash in currencies other than the currency of settlement) into the currency required to meet its payment obligations when due. Consequently, CCPs are expected to maintain sufficient liquid resources, and stress test these resources, in each and every currency in which they have payment obligations. ASX Clear (Futures) has payment obligations in currencies other than AUD (i.e. NZD, euro, Japanese yen, USD and British pound). Obligations in NZD arise from clearing NZD OTC derivatives (see section 2.5.1). Payment obligations in the remaining currencies are limited to the return of margin posted in those currencies, which it holds on deposit at commercial banks or invests in overnight reverse repurchase agreements collateralised with government bonds denominated in the same currency. Consequently, ASX Clear (Futures) would face a liquidity exposure if a commercial bank holding a deposit failed or ASX was unable to liquidate its investments in a timely manner. ASX limits the size of this potential liquidity exposure by imposing limits on the amount invested with any

one counterparty and the amount of non-AUD collateral it will accept. ASX also monitors whether it has sufficient liquid assets in all relevant currencies against a liquidity requirement.

Previously, the Ordinary Liquidity Requirement (OLR) and Additional Liquidity Requirement (ALR) for all currencies was set using historical outflows in ASXCC's AUD portfolio rather than observed outflows in the relevant currency. In June 2018, ASX updated its Liquidity Stress Testing and Liquidity Requirement Standard which set out a revised approach to setting liquidity requirements for non-AUD currencies in which ASX Clear (Futures) has payment obligations. To better reflect the risks posed by NZD, OLR and ALR rates under the revised approach are based on historic outflows in ASXCC's NZD portfolio. ASX also set a floor for OLR rates for both AUD and NZD at 10 per cent. In addition, the OLR rate for 'non-matched currencies' (i.e. non-AUD and non-NZD currencies in which cash collateral is received in a different currency to the margin requirement) is set at 100 per cent, to reflect the assumption that cash collateral in these currencies could be withdrawn by participants at any time with a one-day notice period.

However, ASX does not currently have liquidity-specific scenarios covering the NZD obligations of ASX Clear (Futures) that would further test the sufficiency of these liquidity requirements. In order to address this gap of potential concern, ASX plans to develop liquidity-specific scenarios for NZD obligations in relation to ASX Clear (Futures) by the end of the year.

Identification of risks

The CCP Resilience Guidance elaborates on the full range of risks that should be considered in stress testing. It clarifies that a CCP should identify all sources of credit and liquidity risk that it could be exposed to in extreme but plausible market conditions. In doing so, a CCP is expected to identify risks related to both exposures and the resources designed to absorb those exposures.

While ASX identifies a wide range of risks that are then incorporated in its stress tests, there are some risks that it does not fully capture. For example, ASX does not identify and subsequently capture risk factors that cannot be easily measured (such as stressed bid-ask spreads). If these risks are to be incorporated in stress tests they may need to be estimated or modelled. Other gaps of potential concern identified relate to: comprehensively identifying potential sources of liquidity risk from entities other than participants; modelling liquidity exposures that cannot be directly measured; including all sources of liquidity risk in forward-looking stress scenarios; and identifying all events that could affect the CCPs' ability to make intraday payments. ASX has plans to address these gaps over 2018/19, as well as to make more general enhancements to its identification of risks. For example, ASX has plans to establish internal monitoring and reporting of intraday stress test exposures. If this monitoring and reporting identifies shortfalls in the coverage of intraday stressed exposures, ASX intends to operationalise full intraday stress testing recalculation.

Other, minor, gaps were also identified in relation to consistently and accurately identifying and accounting for risk factors that affect both exposures and resources, and incorporating unobserved costs (such as transaction costs or bid-ask spreads) when estimating the cost of liquidating or hedging a portfolio in extreme but plausible scenarios.

Development of extreme but plausible scenarios

The CCP Resilience Guidance provides further guidance on constructing comprehensive scenarios for stress testing. It states that a CCP should model extreme but plausible market conditions in a manner that adequately captures all of the risks identified, using a mixture of historical and forward-looking

scenarios. ASX uses both historical and forward-looking scenarios for its stress testing, which incorporate peak intraday and intra-period price moves as well as end-of-day price movements. However, there are a number of gaps of potential concern which could lead to the scenarios ASX uses in its stress tests not being sufficiently comprehensive:

- *Review of historical scenarios.* The guidance clarifies that a CCP is expected to include all of the most extreme scenarios observed unless the CCP determines, based on a comprehensive, rigorous analysis, that it is implausible that a particular historical scenario can reoccur. ASX applies a wide range of historical scenarios based on 20 years of historical data in its stress testing approach. This means that, as time passes, historical stress events will drop out of the 20-year look-back period. ASX has no formal process to review whether stresses that were observed more than 20 years ago continue to be plausible and therefore should remain part of its stress tests. The changes required to close this gap will be implemented as part of the annual review of ASX Clear (Futures)' stress testing framework in 2018 and the review of ASX Clear's framework in 2019.
- *Trading strategies.* The guidance clarifies that a CCP should ensure its stress test scenarios adequately reflect the trading strategies employed by, and different portfolios of, its direct and indirect participants are adequately reflected. ASX plans to conduct analysis to justify that the design of its stress testing framework captures these risks in August 2018 and September 2019 for ASX Clear (Futures) and ASX Clear, respectively.
- *Liquid resources.* ASX currently applies stresses to its potential liquidity exposures but does not apply stresses to available liquid resources as part of its forward-looking liquidity-specific stress scenarios. ASX plans to extend these scenarios to apply stress to liquid resources during the next assessment period.
- *Alignment of liquidity and credit stress scenarios.* The CCP Resilience Guidance sets out that the extreme but plausible scenarios used in liquidity stress tests should at least include all scenarios used for credit stress testing. In 2019, ASX plans to commence work to ensure that all extreme but plausible scenarios used ASX Clear's credit stress test are incorporated in its liquidity stress test. The Bank expects this work to include ensuring that all enhancements to credit stress test scenarios made as a result of gaps identified in this assessment are subsequently captured in corresponding liquidity stress test scenarios.

The scenarios used by ASX capture most of the risks it has identified but exclude some sources of risk that ASX considers to be immaterial. For example, ASX does not model liquidity risks from the non-performance of settlement banks due to the limited role that these play in its settlement and investment activities. The guidance acknowledges that the set of risk factors used in constructing stress test scenarios only needs to include those to which the CCP is most exposed, but this is expected to be justified on an ongoing basis using a combination of expert judgement and reliable statistical techniques. The Bank considers the absence of a process at ASX to ensure that an appropriate justification is provided for the exclusion of any risk factors from stress test scenarios, and that this justification is reviewed on a periodic basis, to be a minor gap. Similarly, while ASX considers its CCP's stress test scenarios to be sufficiently extreme to incorporate second-order effects resulting from the default of a clearing participant, ASX has not justified this analytically. The Bank also considers this gap to be minor in nature.

Calculation and aggregation of stress test results

The CCP Resilience Guidance sets out expectations regarding valuation models used in stress testing, how results are aggregated and how client exposures should be treated. ASX uses valuation models to measure the impact of assumed stressed market conditions on the value of positions, collateral and investments. Some of these valuation models are described in ASX's margining and stress testing standards, but other methodologies are set out less formally in ASX's internal procedural documents. ASX plans to address this minor gap by documenting all of its relevant valuation models more comprehensively by the end of the year.

Another key parameter in valuing exposures is the length of time it is assumed to take ASX to close out a position in stressed market conditions. The guidance clarifies that this 'stressed period of risk' (SPOR) should be at least as long as the MPOR, and that the SPOR should take into account the specific characteristics of the products and markets cleared in extreme but plausible conditions. ASX has defined and set a SPOR higher than MPOR in some products (e.g. exchange-traded derivatives and cash market products), but is still in the process of conducting comprehensive analysis to define, justify and document SPORs for all products. This is a gap of potential concern. Once this analysis is done, ASX will implement necessary system changes over the course of the next two years.

When it comes to aggregating results, the guidance clarifies that CCPs are expected to incorporate the stressed value of collateral (including cash collateral that the CCP has invested) into stress tests. The collateral haircuts applicable to participant non-cash and cross-currency collateral is based on the fifth-worst price move over a 20-year look-back period. This is not consistent with the level of stress ASX considers to be extreme but plausible. ASX Clear addresses this by applying stress to the value of collateral in its stress tests, but ASX Clear (Futures) does not. ASX Clear (Futures) plans to implement changes to address this minor gap by September 2019. As part of this work, ASX should ensure that its stress testing for collateral is consistent with its default management procedures by stressing collateral and cleared positions jointly only where they will be liquidated as a portfolio. While neither CCP incorporates the stressed value of cash collateral that ASX has invested into its stress tests, ASX has separate business risk capital set aside to absorb such losses.

ASX Clear's stress tests assume that it will be able to port client accounts. This is a gap of potential concern which, in order to more accurately reflect the extreme but plausible market conditions appropriate for stress testing, requires CCPs to assume that they will be unable to port client positions. ASX removed the porting assumption from its credit stress tests for ASX Clear in July 2018.

Analysis of parameters and assumptions

CCP Standard 4.5 states that a CCP should, '[o]n at least a monthly basis ... perform a comprehensive and thorough analysis of stress testing scenarios, models, and underlying parameters and assumptions used to ensure they are appropriate for determining the CCP's required level of default protection in light of current and evolving market conditions'. The CCP Resilience Guidance explains that a CCP should consider using a combination of three techniques for conducting that analysis, which ASX incorporates into its stress testing approach as follows:

- *For-information scenarios*, which are scenarios that ASX considers to be beyond extreme but plausible, are run on a daily basis, with the results of these tests reviewed and presented to the CS Boards on a semi-annual basis.
- *Sensitivity analysis* is carried out on a monthly basis. ASX management reviews daily changes in price and implied volatility for the month to determine whether there is any evidence of stress that would support a change to scenarios.

- *Reverse stress testing* is conducted monthly to determine the shock that would be required to exhaust ASX's financial resources.

The CCP Resilience Guidance provides examples of factors that CCPs could consider as part of their reverse stress testing analysis, including changes in the size and composition of cleared portfolios, or the number of simultaneous defaults. ASX's reverse stress testing approach captures some but not all of the factors identified in the guidance, which is a gap of potential concern. From November 2018, ASX plans to also model changes in the size and composition of participant portfolios as part of its annual default fund reviews.

4.4 Adequacy of Coverage

The CCP Resilience Guidance clarifies that Cover 1 or Cover 2 are minimum standards for credit or liquidity risk, and that a CCP should consider its risk profile when determining the amount of any resources that it should maintain above these minima.²¹ The ASX CCPs meet their minimum Cover 2 standard for both credit and liquidity; however, ASX considers coverage beyond this, for example to cover three or more participant defaults, to be beyond extreme but plausible, since there is no historical precedent for this. ASX has not conducted analysis to justify the appropriateness of its coverage requirements, which takes into account the specific risk profile of its participants, including the composition and concentration of stress test losses across participants. The Bank considers this to be a minor gap.

The CCP Resilience Guidance also clarifies that CCPs should ignore any excess contributions from participants when assessing the sufficiency of its financial resources in credit and liquidity stress testing, since excess contributions from participants are voluntary and could be withdrawn or decreased during times of stress. This is consistent with the practice of ASX Clear (Futures); however, ASX Clear assumes that excess collateral lodged by participants and their clients (for equity derivatives) would be available to cover their stressed exposures, which is a gap of potential concern. While ASX has the ability to assess the sensitivity of stress test exposures to varying this excess collateral assumption in ASX Clear, this assessment is not conducted on a regular basis. ASX Clear plans to explicitly exclude excess collateral from its stress testing by early 2020.

4.5 Skin in the Game and Business Risk Capital

CCP Standards 4 and 14 require a CCP to maintain financial resources to cover losses resulting from clearing participant default and general business losses, respectively. These resources may come from participants or from the CCP. The guidance sets out the expectation that a CCP should contribute its own resources to address losses from both a participant default and a custody/investment loss, to increase the confidence of participants and other stakeholders that their exposure to these sources of risk are reflected in the CCP's risk management practices. The CCP Resilience Guidance also provides guidance on the form and seniority of CCP contributions to prefunded financial resources and custody and investment losses.

ASX contributes a significant portion of its own resources to address losses from a participant default. ASX Clear's \$250 million default fund comprises \$178.5 million of own equity and \$71.5 million paid into a restricted capital reserve from the National Guarantee Fund in 2005. ASX Clear (Futures)' \$650

21 In some cases, CCP Standards 4 and 7 require that, at a minimum, stress scenarios include the default of only a single participant and its affiliates; however, the higher 'Cover 2' standard applies to both of the ASX CCPs.

million default fund includes \$450 million of own equity and \$200 million of contributions from participants. ASX engages with the participants regularly with respect to the size and composition of its default funds. This is done during ASX's annual review of its default funds, when the results of the review are reported to the participants through the ASX CCPs' Risk Consultative Committees. Both CCPs' default waterfalls are consistent with the guidance in that a portion of a CCP's own capital is used to absorb losses before contributions from non-defaulting participants.²² ASX's contributions to the default funds are held in trust by ASXCC for the benefit of the two CCPs, and can only be used to address losses from a participant default.

To cover losses associated with custody and investment risks, ASX set aside \$75 million as business risk capital – \$35 million for ASX Clear and \$40 million for ASX Clear (Futures). However, this capital was also available to meet other general business and operational losses, contrary to the expectation in the CCP Resilience Guidance that these funds should not be available for other purposes. To address this minor gap, in July 2018 ASX set aside an additional \$71 million in capital to cover general business risk, while maintaining \$75 million as a separate pool of capital to cover custody and investment risk.

4.6 Conclusions and Recommendations

The CCP Resilience Guidance raises the standards expected of a CCP's financial risk management framework across a broad range of topics by providing a more granular description of what are acceptable practices in observing the requirements of the CCP Standards. The Bank's assessment is that the ASX CCPs' practices are consistent or broadly consistent with the CCP Resilience Guidance. Although the ASX CCPs' practices are consistent with the majority of the guidance, the Bank has identified a number of gaps, some of which the Bank views as potentially of sufficient concern to affect the CCPs' observance of the CCP Standards.

The gaps of potential concern relate to the standards on Credit Risk (CCP Standard 4) and Liquidity Risk (CCP Standard 7). The Bank's assessment is that these gaps are issues of concern that should be addressed by the ASX CCPs in a defined timeline. As a result, the Bank has concluded that the ASX CCPs broadly observe these two standards. The gaps identified in relation to the standard on Governance (CCP Standard 2) were more minor, but ASX should address these gaps in order to observe this standard on a continuing basis.

ASX has plans in place to address the gaps of potential concern identified in this assessment. The Bank has set a recommendation for ASX to implement these plans in order to more fully align its practices with the CCP Resilience Guidance and fully observe the standards established under the FSS. The Bank has also set a recommendation that ASX address the minor gaps related to the governance of financial risk management. This recommendation forms part of a broader recommendation that seeks to address other governance-related shortcomings at ASX identified as part of the Review (see Section 3).

22 In the case of ASX Clear, the default fund does not include participant contributions.

Recommendation. To align financial risk management practices with the CCP Resilience Guidance the ASX CCPs should implement plans to:

- Enhance the comprehensiveness of stress testing to ensure risks are appropriately identified, captured and stressed.
- Enhance analysis and justification of assumptions used stress testing models to that risks are adequately captured.
- Remove assumptions made by ASX Clear that customer positions will be able to be ported and that excess collateral will not be withdrawn or decreased during periods of stress to more accurately reflect the extreme but plausible conditions appropriate for stress testing.

Recommendation. The ASX CCPs should take the following steps to strengthen their governance arrangements consistent with the CCP Resilience Guidance:

- Ensure that roles and processes in relation to the governance of financial risk management are appropriately formalised and documented in order to ensure that the CS Boards have sufficient information to effectively oversee the ASX CCPs.
- Ensure that the ASX CCPs' arrangements for disclosure to, and soliciting feedback from, stakeholders cover all relevant aspects of the CCPs' risk management frameworks, including margin sensitivity analysis, reverse stress testing and management of procyclicality.

ASX has also set out plans to address a number of gaps that the Bank views as minor but indicative of good practice in financial risk management. The Bank will continue to engage with ASX on these plans as part of its ongoing supervision of the ASX CCPs. Where there are minor gaps that ASX does not currently have specific plans to address, the Bank will engage with ASX over the coming assessment period as it considers how best to take into account the guidance in this area.

Appendix A: 2017 Areas of Supervisory Focus

Table 6: Summary of Progress against 2017 Areas of Supervisory Focus

Development	Standard	Facility	Actions
<i>Developments in International Standards</i>			
CCP Resilience Guidance. The alignment of the CCPs' risk management arrangements with the new CPMI-IOSCO Resilience Guidance.	CCP Standards 2, 3, 4, 5, 6, 7 and 14	Both CCPs	The Bank performed an assessment of the ASX CCPs against the Resilience Guidance, which forms the special topic of this assessment. For more information, see section 4.
Updated FMI Recovery Report. The alignment of the facilities' recovery planning arrangements with the revised CPMI-IOSCO guidance on recovery.	CCP Standards 3, 4, 7 and 14, SSF Standards 3, 4, 6 and 12	All facilities	The Bank performed an assessment of the ASX CCPs against the updated elements of the guidance on recovery. For more information, see section 2.2.2.
Cyber resilience. The CS facilities' self-assessment against the CPMI-IOSCO Cyber Guidance and the implementation of the facilities' concrete plans to improve their capabilities to recover from a cyber attack.	CCP Standard 16, SSF Standard 14	All facilities	The Bank has assessed ASX against the Cyber Resilience Guidance, drawing on a self-assessment by ASX against the guidance and an external assessment of ASX against industry standards. For more information, see section 2.3.4.
<i>Review of Planned Work</i>			
Risk system enhancements. The ASX CCPs' progress in developing and implementing their short-term risk system enhancements over the next assessment period, as well as the development of ASX's five-year plan to improve its risk systems.	CCP Standards 4, 5, 6 and 7	Both CCPs	ASX has continued to make incremental enhancements to its risk management systems as part of a longer-term plan to improve its risk systems. For more information, see section 2.1.3.
Settlement prices. The ASX CCPs' consultation with their participants on the determination of settlement prices during an outage of ASX Trade and ASX 24.	CCP Standard 6	Both CCPs	ASX completed its consultation in respect of ASX Clear, and concluded that it would continue to use its current methodology in both CCPs, supported by improved documentation of procedures and greater transparency on how it would determine prices in the event of a market disruption. For more information, see section 2.1.2.
Margin model sensitivity analysis. The implementation of the CCPs' new sensitivity analysis framework, and the expansion of the product scope covered by the analysis.	CCP Standard 6	Both CCPs	ASX implemented its new sensitivity analysis framework in September 2017 for exchange-traded and OTC derivatives, and December 2017 for cash market products. For more information, see section 2.1.2.
Default management. The CS facilities' plans to enhance their default management fire drills, including the introduction of SSF-specific fire drills.	CCP Standard 12, SSF Standard 11	All facilities	ASX conducted a SSF-specific fire drill, and made enhancements to broaden the scope and increase the complexity of its CCP fire drills to test the flow-on effects of a participant default. For more information, see section 2.2.1.

<p>Operational risk review. The external review of the CS facilities' operational risk management arrangements and ASX's response to the findings of the review.</p>	<p>CCP Standard 16, SSF Standard 14</p>	<p>All facilities</p>	<p>ASX has commissioned a multi-year project to address the findings of KPMG's external review of ASX's technology governance and operational risk frameworks. The Bank and ASIC have engaged with both ASX and KPMG on the review findings and ASX's response. For more information, see section 3.</p>
<p>CHESS replacement. The development of the new clearing and settlement system for cash securities transactions, including: how the new system aligns with the requirements in the FSS; the clarity, effectiveness and documentation of the default management processes; contingency plans regarding the replacement of CHESS should the decision be taken not to proceed with a DLT solution.</p>	<p>CCP Standard 14</p>	<p>ASX Clear and ASX Settlement</p>	<p>The Bank has continued engagement with ASX on its CHESS replacement project. ASX has confirmed that it will proceed with a DLT-based platform to replace CHESS, and has conducted a consultation on the business requirements for the new platform. For more information, see section 2.3.1.</p>

Appendix B: Background Information

B.1 ASX Group Structure and Governance

There are two types of CS facilities operated by the ASX Group:

- *CCPs*. A CCP acts as the buyer to every seller, and the seller to every buyer in a market. It does so by interposing itself as the legal counterparty to all purchases and sales via a process known as novation. These arrangements provide substantial benefits to participants in terms of counterparty risk management as well as greater opportunities for netting of obligations. At the same time, however, they result in a significant concentration of risk in the CCP. This risk can crystallise if a participant defaults on its obligations to the CCP, since the CCP must continue to meet its obligations to all of the non-defaulting participants. The ASX CCPs manage this risk in a number of ways, including through participation requirements, margin collection, the maintenance of pooled resources and loss allocation arrangements (see Appendix B.3).
- *SSFs*. An SSF provides for the final settlement of securities transactions. Settlement involves transfer of the title to the security, as well as the transfer of cash. These functions are linked via appropriate delivery-versus-payment (DvP) arrangements incorporated within the settlement process.

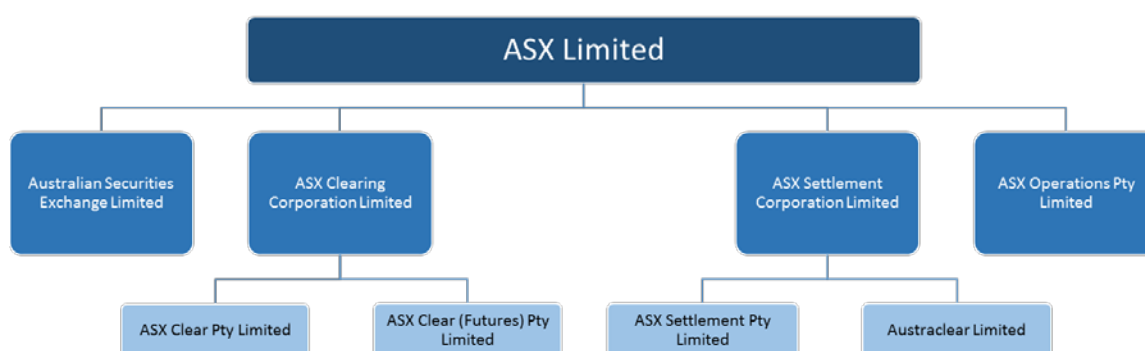
The ASX Group operates two CCPs and two SSFs:

- *ASX Clear* provides CCP services for ASX-quoted cash equities, debt products and warrants traded on the ASX and Chi-X Australia Pty Ltd (Chi-X) markets, equity-related derivatives traded on the ASX market and Chi-X-quoted warrants traded on Chi-X. The provision of CCP services for Chi-X is provided under the Trade Acceptance Service (TAS), which allows ASX Clear to act as a CCP for trades executed on AMO platforms in accordance with the ASX Clear Operating Rules and Procedures.
- *ASX Clear (Futures)* provides CCP services for futures and options on interest rate, equity, energy and commodity products traded on the ASX 24 market, as well as AUD and NZD-denominated OTC IRD.
- *ASX Settlement* provides SSF services for ASX-listed cash equities, debt products and warrants traded on the ASX and Chi-X markets. The provision of SSF services for Chi-X is provided under the TAS. Under the Settlement Facilitation Service, ASX Settlement provides DvP settlement services for transactions in non-ASX-listed securities undertaken on trading platforms operated by Approved Listing Market Operators (ALMOs); these include the National Stock Exchange of Australia (NSX) and the Sydney Stock Exchange Limited (SSX). ASX Settlement also provides for subscriptions and redemptions in unlisted managed funds through the mFund Settlement Service.
- *Austraclear* provides settlement and depository services for debt securities, including government bonds. It also provides settlement services for derivatives traded on the ASX 24 market and for margin payments in ASX Clear and ASX Clear (Futures).

Each of the ASX facilities holds a CS facility licence, and each CCP and SSF is required under the Corporations Act to comply with the relevant FSS determined by the Bank (i.e. the CCP Standards and SSF Standards, respectively) and to do all other things necessary to reduce systemic risk (see Appendix B.2).

ASX Limited is the ultimate parent company of the four CS facilities (Figure 1) and is listed on the ASX market. The ASX Limited Board is responsible for overseeing the processes for identifying significant risks to ASX and ensuring that appropriate policies, as well as adequate control, monitoring and reporting mechanisms, are in place. In addition, the ASX Limited Board assigns certain responsibilities to subsidiaries within the group, including the boards of the four CS facilities (the CS Boards). The CS Boards are responsible for managing the particular clearing and settlement risks faced by each respective CS facility, including through compliance with the FSS. The CS Boards are subject to common governance arrangements with high-level objectives set out in the CS Boards’ Charter. There are five directors that serve on all four CS Boards; one additional director serves on both the ASX Clear and ASX Settlement Boards and three additional directors serve on both the ASX Clear (Futures) and Austraclear Boards.

Figure 1: ASX Group Structure



In the ASX corporate structure, the two CCPs – ASX Clear and ASX Clear (Futures) – are subsidiaries of ASXCC. ASXCC is the holding company for, and manages the financial resources of, the two CCPs. It invests these resources according to a treasury investment policy and investment mandate approved by the CS Boards. The two SSFs – ASX Settlement and Austraclear – are subsidiaries of ASX Settlement Corporation Limited. ASXCC and ASX Settlement Corporation Limited are in turn subsidiaries of the ASX Group’s parent entity, ASX Limited. ASX Limited is the licensed operator of the ASX market, which provides a trading platform for ASX-quoted securities and equity derivatives. Another subsidiary, Australian Securities Exchange Limited, is the licensed operator of the ASX 24 market, an exchange for futures products.

In delivering their services, the CS facilities rely on group-wide operational and compliance resources that reside in ASX Operations Pty Limited (ASX Operations), a wholly owned subsidiary of ASX Limited. ASX Operations provides most operational resources required by the CS facilities.

ASX has adopted a group-wide organisational structure to manage the business operations of its various entities, including the CS facilities. Its business units are organised into nine main groups:

- Office of the CEO
- Risk

- Operations
- Technology
- Business Development
- ASX Compliance
- Office of General Counsel and Company Secretariat, and Regulatory Policy
- Finance
- Human Resources.

The CRO, who heads the Risk group, is responsible for providing executive oversight of ASX's Clearing Risk Policy Framework and Settlement Risk Policy Framework, which document the formal structure for the development, governance and review of policy and standards for the CCPs and SSFs.

The COO who heads the Operations and Technology groups, is responsible for providing executive oversight of the frontline management of risks under ASX's Settlement Risk Policy Framework. The COO is also responsible for the delivery of overall operations of the ASX Group and reports directly to the CEO, as does the CRO. Both COO and CRO have a direct reporting line to the CS Boards and are able to attend CS Board meetings.

The Risk and Operations groups contain a number of departments that play key roles in the management of risks faced by the CS facilities:

- Clearing Risk Quantification and Development (CRQD) is responsible for the development of clearing risk management systems, maintaining and validating CCP risk and pricing models and the implementation of CCP policies and standards.
- Clearing Risk Policy and Management (CRPM) develops and maintains CCP and SSF policies and standards.
- Post Trade Operations implements SSF policies and standards, and maintains effective procedures for carrying out those policies and standards.
- Enterprise Risk is responsible for enterprise-wide risk management, including general business risk.
- Regulatory Assurance oversees CS facility compliance obligations, including providing compliance training for business areas, undertaking compliance reviews, and coordinating reporting to regulators.
- Internal Audit conducts risk-based reviews of internal controls and procedures across ASX. Internal Audit reports to the Audit and Risk Committee and the Managing Director and CEO for audit purposes and to the CRO for administrative purposes only.

Following a restructuring of its management committees during the assessment period (discussed in section 2.4.2), ASX now has three main executive-level committees that support decisions related to the risk management of the CS facilities:

- The Risk Committee is responsible for advising the CRO on risk management decisions in the exercise of his delegated authority from the CEO. The Risk Committee replaces two previous committees – the Enterprise Risk Management Committee and CALCO.

- The Regulatory Committee is responsible for ASX policies related to the conduct and operations of the licensed entities in the ASX Group, including the CS facilities.
- The Technology, Operations and Security Committee is responsible for advising the COO in the oversight of ASX's technology, operations and security strategies, and the investments that support these strategies. A sub-group of the committee meets as the Portfolio Governance Group, providing oversight of significant projects within the ASX Group.

ASX also operates a number of other internal forums that bring together experts from departments across the group for the review or oversight of risk management at the CS facilities:

- Risk Quantification Working Group (RQWG) is responsible for quantitative risk management matters, such as the review and application of quantitative risk policies and standards and the Model Validation Framework, including oversight of model governance and the outcomes and recommendations of regular reviews of margining and stress test outcomes and recommendations. The RQWG is chaired by the General Manager, CRQD.
- Default Management and Recovery Steering Group (DMRSG) provides oversight of the CCP's Default Management and Recovery Framework (DMRF). The DMRSG is chaired by the CRO.
- Participant Incident Response Group (PIRG) is responsible for monitoring and managing material participant incidents, including any non-compliance with participant obligations, settlement default, operational failure or an event which might result in the participant becoming an externally administered body corporate or an insolvent under administration and, in the case of a clearing participant, escalating potential default events to the Default Management Committee (DMC).

In addition to the internal forums that ASX operates, the views of participants and other stakeholders are sought through external standing forums:

- An ASX Clear (Futures) Default Management Group (DMG) which is comprised of OTC participants and is consulted on aspects of the default management process.
- Risk Consultative Committees for both ASX Clear and ASX Clear (Futures), comprising participants from each CCP. The committees are consulted on material changes to default management processes, the margining methodology, the default fund, position and liquidity limits, participation criteria, and other changes affecting risk management practices or related rules.
- A Business Committee which acts as a stakeholder advisory body for ASX's cash market clearing and settlement services. The Committee is comprised of representatives of clearing participants, settlement participants, AMOs and the Stockbrokers and Financial Advisors Association.
- Advisory user groups for particular products and services (i.e. ETOs, rates and Austraclear), which are forums for participants to provide feedback on those products and services.

B.2 Regulatory Environment

The Corporations Act establishes conditions for the licensing and operation of CS facilities in Australia and gives ASIC and the Bank powers and responsibilities relating to these facilities. These powers are exercised under the governance of ASIC's Commission and the Bank's Payments System Board, respectively. The regulators' respective roles are defined in the Corporations Act.

- The Bank is responsible for determining standards (the FSS) for the purposes of ensuring that CS facility licensees conduct their affairs in a way that causes or promotes overall stability in the Australian financial system, and for assessing how well a licensee is complying with its obligation under the Corporations Act, to the extent that it is reasonably practicable to do so, to comply with these standards and do all other things necessary to reduce systemic risk.
- ASIC is responsible for assessing the extent to which CS facility licensees comply with all other obligations of a CS facility licensee arising under the Corporations Act, including notably the obligation, to the extent that it is reasonably practicable, to do all things necessary to ensure that the CS facility's services are provided in a fair and effective way.

The Bank has determined two sets of FSS relevant to its oversight of CS facilities: the CCP Standards and SSF Standards.

As licensees, the ASX CS facilities are required to provide the Bank with timely information on any material developments relevant to the services provided under its CS facility licence and its compliance with the FSS. The Bank also gathers information on the facilities through an open and ongoing dialogue with ASX staff, including through scheduled periodic meetings and ad hoc targeted meetings on specific topics.²³ Based on the information gathered, the Bank undertakes annual assessments of the ASX CS facilities.²⁴

The ASX CCPs are recognised by the European Securities and Markets Authority (ESMA) as 'third-country CCPs'. This allows the ASX CCPs to continue to provide clearing services to participants established in the European Union. ASX Clear (Futures) was also granted an exemption from registration as a Derivatives Clearing Organization (DCO) in the US. This exemption allows ASX Clear (Futures) to provide clearing services to US banks with respect to 'proprietary' swaps. The Bank and ASIC have established a memorandum of understanding (MoU) with each of ESMA and US Commodity and Futures Trading Commission (CFTC) which, among other things, supports cross-border cooperation and information sharing. The Bank has also issued a supplementary interpretation of CCP Standards to facilitate the ASX CCPs' recognition in the EU (see Appendix C).

The Bank has an MoU with the RBNZ which establishes cooperation arrangements relevant to ASX Clear (Futures)' existing activities in NZD-denominated products. RBNZ has also stated that ASX Clear (Futures) may be of systemic importance in New Zealand and may therefore be designated for oversight as an offshore FMI under the RBNZ's proposed new oversight regime for FMIs.²⁵

B.3 Risk Management in the ASX Central Counterparties

CCPs are exposed to both credit and liquidity risks, primarily following the default of one or more participants. Credit risk is the risk that one or more counterparties will not fulfil their obligations to

23 For more information see *the Reserve Bank's Approach to Assessing Clearing and Settlement Facility Licensees*, available at <<https://www.rba.gov.au/payments-and-infrastructure/financial-market-infrastructure/clearing-and-settlement-facilities/standards/assess-csf-licensees.html>>.

24 The Bank's intention to carry out annual assessments of the ASX CS facilities is set out in the *Frequency and Scope of Regulatory Assessments of Licensed Clearing and Settlement Facilities*, available at <<https://www.rba.gov.au/payments-and-infrastructure/payments-system-regulation/frequency-of-assessments.html>>.

25 For more information, see 'An Enhanced Oversight Framework for Financial Market Infrastructures', available at <<http://www.rbnz.govt.nz/-/media/ReserveBank/Files/regulation-and-supervision/financial-market-infrastructure-oversight/regulatory%20developments/FMIs-Cabinet-paper.pdf?la=en>>.

the CCP, resulting in a financial loss, while liquidity risk arises where the CCP is unable to meet its payments obligations at the time that they are due, even if it has the ability to do so in the future. ASX Clear and ASX Clear (Futures) manage the risks arising from a potential default in a number of ways, including through participation requirements, margin collection, the maintenance of prefunded pooled financial resources, recovery tools, and risk monitoring and compliance activities.

Participation requirements

Participants in each CCP must meet minimum capital requirements. While capital is only a proxy for the overall financial standing of a participant, minimum capital requirements offer comfort that a participant has adequate resources to withstand an unexpected shock, for example, arising from operational or risk-control failings.

- ASX Clear requires direct participants that clear cash market products or derivatives to maintain at least \$5 million in capital. ‘General participants’, which are able to clear on behalf of third-party participants, are subject to tiered capital requirements. A general participant must maintain \$5 million in capital to support its own clearing activity and \$5 million to support each third-party clearing relationship, up to a maximum of \$20 million. As discussed in section 2.1.5, after December 2018 participants will also be subject to additional core capital requirements based on the risk profile and complexity of their business.
- ASX Clear (Futures) requires participants that clear futures only to hold at least \$5 million in net tangible assets (NTA). Participants using the OTC derivatives clearing service must meet a higher minimum NTA (or Tier 1 Capital) requirement of \$50 million.

The CCPs also impose capital-based position limits (CBPLs) on participants’ activity. Specifically, the ratio of initial margin requirements to liquid capital, NTA or Tier 1 Capital for participants is subject to an upper limit of three for both CCPs. Under certain conditions, banks and subsidiaries of banks or bank holding companies are not subject to a ratio-based capital position limit. Rather, these institutions’ initial margin liabilities are subject to a fixed \$1.5 billion aggregate limit. ASX Clear also places requirements on participants to establish a formal liquidity risk management framework and prepare an annual liquidity plan.

Prefunded financial resources

The CCPs cover their credit and liquidity exposures to their participants by collecting margin and maintaining a fixed quantity of prefunded pooled resources. The CCPs collect several types of margin.

- *Variation margin.* Variation (or ‘mark-to-market’) margin is collected at least daily from participants with mark-to-market losses and, in the case of futures and OTC derivatives, paid out to the participants with mark-to-market gains.
- *Initial margin.* Both CCPs routinely collect initial margin from participants to mitigate credit risk arising from potential changes in the market value of a defaulting participant’s open positions between the last settlement of variation margin and the close-out of these positions by the CCP. The CCPs use statistical models to calculate initial margin, which vary by product type. To validate the adequacy of their initial margin models, the CCPs perform regular backtesting and sensitivity analysis.
- *AIM.* The CCPs may also make calls for AIM when exceptionally large or concentrated exposures are identified, including through stress tests, or when predefined position limits are exceeded.

In addition to end-of-day margin calls, the CCPs call margin on an intraday basis when exposures due to changes in market value and the opening of new positions exceed predefined limits. Intraday margin calls for both CCPs would equal the total shortfall in initial margin, variation margin and AIM if triggered.

ASX requires that variation margin is posted in cash, while initial margin may be posted in the form of cash or securities that ASX would be able to rapidly and reliably liquidate in the event of the participant's default. Specifically, ASX Clear accepts certain equity securities and exchange-traded funds as collateral, while ASX Clear (Futures) accepts certain Australian and US government securities, as well as foreign currency denominated in EUR, GBP, JPY, NZD or USD. ASX applies haircuts to non-cash and foreign currency collateral to cover market risk on the liquidation of those assets.

An average of 34 per cent of margin requirements in ASX Clear and 95 per cent of AUD-denominated margin requirements in ASX Clear (Futures) were met in cash during the assessment period. In ASX Clear, equity securities comprise the remaining collateral. In ASX Clear (Futures), approximately 5 per cent was held in foreign currency on average in 2017/18, while 5 per cent was Australian government and semi-government bonds. Some clients of participants in ASX Clear commonly post non-cash collateral in excess of margin requirements for equity derivatives. In 2017/18, on average, 83 per cent of the value of non-cash collateral posted against derivatives positions in ASX Clear was in excess of margin obligations.

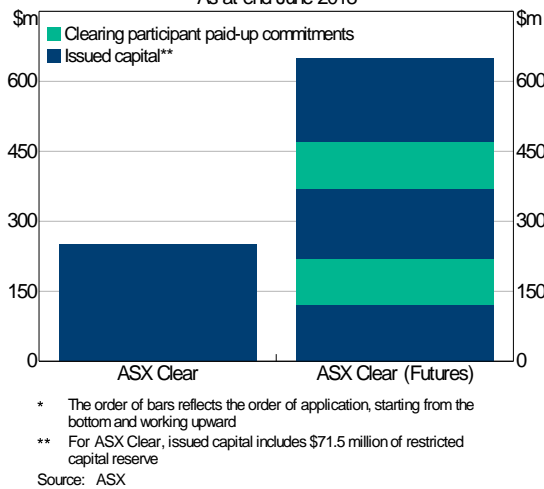
The margin and other collateral posted by a participant would be drawn on first in the event of that participant's default.²⁶ Should this prove insufficient to meet the CCP's obligations, the CCP may draw on a fixed quantity of prefunded pooled financial resources (referred to as the CCP's 'default fund'; Graph 1).

- ASX Clear's default fund was \$250 million over the assessment period. This comprised \$178.5 million of own equity and \$71.5 million paid into a restricted capital reserve from the National Guarantee Fund in 2005.
- ASX Clear (Futures)' default fund was \$650 million over the assessment period. This included \$450 million of ASX's own equity and \$200 million of contributions from participants.

There were no changes to either CCP's default fund over 2017/18.

²⁶ For ASX Clear (Futures) the other collateral would include the defaulted participant's contributions to the CCP's prefunded pooled financial resources.

Graph 1
Prefunded Pooled Financial Resources*
 As at end June 2018



Credit stress tests

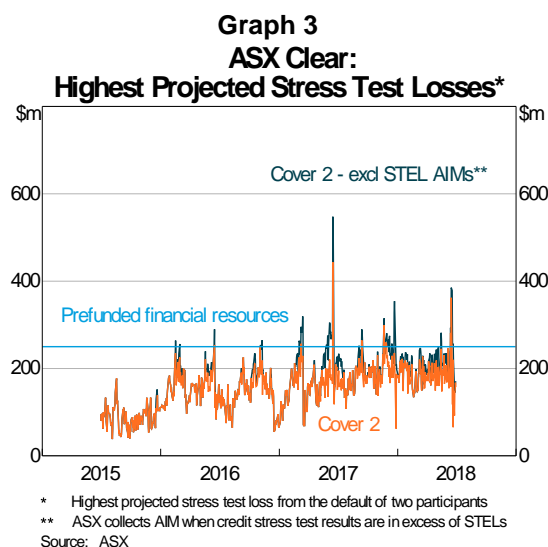
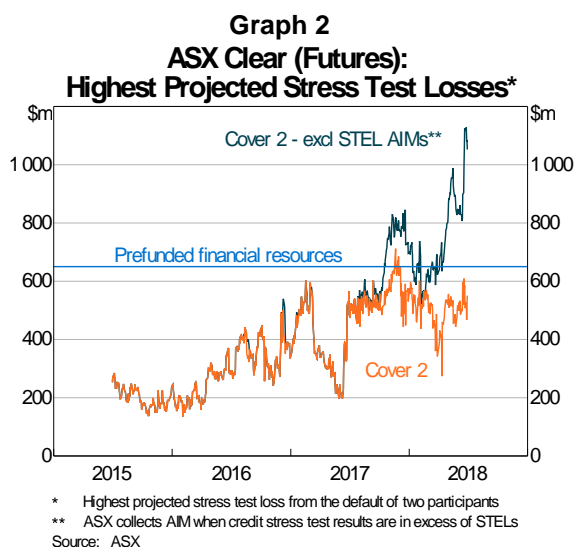
In order to assess the adequacy of its financial resources to cover its current and potential future credit exposures, the CCPs perform daily credit stress tests.²⁷ These tests compare each CCP's available prefunded resources against the largest potential loss in the event of the joint default of two participants and their affiliates under a range of extreme but plausible scenarios (i.e. the Cover 2 requirement). The requirement for the ASX CCPs to have sufficient prefunded resources to meet Cover 2 reflects the Bank's supplementary interpretation of the FSS, under which both CCPs are deemed to be systemically important in multiple jurisdictions (see Appendix C.1, CCP Standard 4.4).

Both ASX CCPs experienced days on which their respective Cover 2 requirement exceeded their prefunded financial resources in 2017/18. At ASX Clear (Futures), the Cover 2 requirement exceeded its prefunded financial resources on six days, with the largest shortfall being \$62 million (Graph 2). ASX Clear's Cover 2 requirement exceeded its prefunded financial resources on seven days in the year, with a largest shortfall of \$112 million (Graph 3). These projected shortfalls were covered by AIM the next day.

The ASX CCPs automatically call AIM, to be paid before midday the next day, when credit stress test results are in excess of STELs. The STELs are based on ASX's Internal Credit Ratings (ICRs) of participants, with all STELs set at less than half of the total default fund of the relevant CCP. Not all of these STEL AIM calls are related to shortfalls in the Cover 2 requirement. During the assessment period, ASX Clear made STEL AIM calls on 162 days against nine participants in total, with the largest totalling \$130 million. ASX Clear (Futures) made STEL AIM calls on 226 days against nine participants in total, with the largest call totalling \$435 million.

After investigating the reasons for breaches of the Cover 2 requirement experienced in each CCP, ASX determined that it was appropriate to lower participant STELs in order to provide a greater buffer of prefunded financial resources to cover intraday changes in stressed exposures (see section 2.1.1).

²⁷ For more detail on the CCPs' credit stress test framework see section 4.3.



Liquidity risk management

Credit exposures faced by the CCPs from a participant default would also create liquidity exposures. The CCPs may also face default liquidity exposures in excess of their credit exposures. These additional exposures may be particularly large for ASX Clear, given that it novates equity trades with delivery obligations. For example, if a participant with net equity delivery obligations were to default, ASX Clear’s liquidity exposure would include the cost of purchasing the securities to meet the delivery obligations of the defaulted participant. By contrast, the CCP’s credit exposure would be limited to the change in price in the securities between the defaulting participant’s last variation margin payment and the time the CCP executes an offsetting securities trade. ASX Clear also faces liquidity exposures from its acceptance of equity collateral against derivatives positions. Specifically, if ASX Clear were to liquidate its equity collateral, it would likely have to wait two days to receive the proceeds of the sale.

The ASX CCPs perform daily liquidity stress tests to assess the adequacy of the CCPs’ available liquid resources to cover the largest potential liquidity exposure arising from the joint default of two participants and their affiliates under a range of extreme but plausible scenarios (Cover 2 liquidity target). The CCPs’ liquidity stress test framework utilises the same market stress scenarios as the corresponding credit stress tests, but also takes into account additional, liquidity-specific risks.

While ASX Clear manages liquidity across both its cash market and derivatives products, it has defined a target minimum cash market liquidity ‘buffer’ of \$100 million (see Appendix C.1, CCP Standard 7.8). Cover 2 cash market liquidity exposures regularly exceeded the buffer over 2017/18, in which case ASX Clear would have had to rely on OTAs (which are essentially liquidity commitments from its participants) to settle any exposures above the buffer (see Appendix C.1, CCP Standard 7.3). The buffer also implicitly defines the liquidity threshold for ASX Clear’s derivatives-market exposures. During the assessment period, ASX Clear’s derivatives-market liquidity exposures exceeded this threshold on 20 occasions. ASX Clear (Futures) exceeded its prefunded liquid resources on 155 occasions. Most of the breaches of the Cover 2 liquidity target observed at both CCPs during the year would have been covered had additional liquid resources held by each CCP been taken into account. ASX updated its Liquidity Risk Standard in July 2018 to reflect the availability of these resources (see section 2.1.4).

If a liquidity stress test breach occurs at either CCP, it is reported to the CRO and Chief Financial Officer. ASX would also review the circumstances and nature of the breach, the size of the breach and

possible mitigants. Breaches are also reported on a quarterly basis to the Risk Committee. In addition, if there were three breaches in a quarter, this would require an emergency meeting of the Risk Committee, which would decide on the response. Potential responses to a breach could be to increase the CCPs' prefunded resources, or establish or increase the size of committed liquidity facilities.

Both ASX Clear and ASX Clear (Futures) also face liquidity risk from the reinvestment of pooled prefunded resources and the portion of margin posted by participants in the form of cash. These assets are reinvested and held by ASXCC, the holding company for the two CCPs, according to a defined investment policy and investment mandate. Liquidity risk arises since ASXCC would have to convert its assets into cash to meet any obligations arising from a participant default or for day-to-day liquidity requirements, such as the return of cash margin to participants. To mitigate investment liquidity risk, ASXCC's investment policy requires that a minimum portion of ASXCC's investments must be in liquid assets to meet its minimum liquidity requirements (see Appendix C.1, CCP Standard 7.3).

Recovery tools

In a highly unlikely scenario that involves more than two large participant defaults or market conditions that are beyond 'extreme but plausible', it is possible that prefunded or other liquid financial resources could be insufficient to fully absorb default-related losses or meet payment obligations. In such circumstances, the CCP may be left with an uncovered credit loss or liquidity shortfall. Each CCP's approach for allocating an uncovered credit loss or liquidity shortfall following a participant default relies on a number of tools:

- *Recovery Assessments.* The power to call for additional cash contributions from participants to meet uncovered losses and fund payment obligations, in proportion to each participant's exposures at the CCP prior to the default. Recovery Assessments are capped at \$300 million in ASX Clear and \$600 million in ASX Clear (Futures) (or \$200 million for a single default).
- *Variation margin gains haircutting.* A tool, available to ASX Clear (Futures) only, allowing the CCP to reduce (haircut) outgoing variation margin payments to participants in order to allocate losses or a liquidity shortfall arising from a defaulting participant's portfolio. There is no cap on the use of this tool.
- *Settlement payment haircutting.* A reserve power that could be used in the context of complete termination to allocate losses or a liquidity shortfall if the above tools were insufficient. Complete termination would involve tearing up all open contracts at the CCP and settling them at their current market value. Any residual losses or liquidity obligations of the CCP could be allocated by haircutting settlement payments to participants. Use of this tool would have a highly disruptive effect on the markets served by the CCP, so would be considered only as a last resort.

In addition, ASX Clear can address a liquidity shortfall relating to the settlement of securities transactions via the use of OTAs with participants due to receive funds in the settlement batch. Both CCPs also have the power to restore a matched book via partial or complete termination of contracts at their current market value if normal close-out processes cannot be carried out.

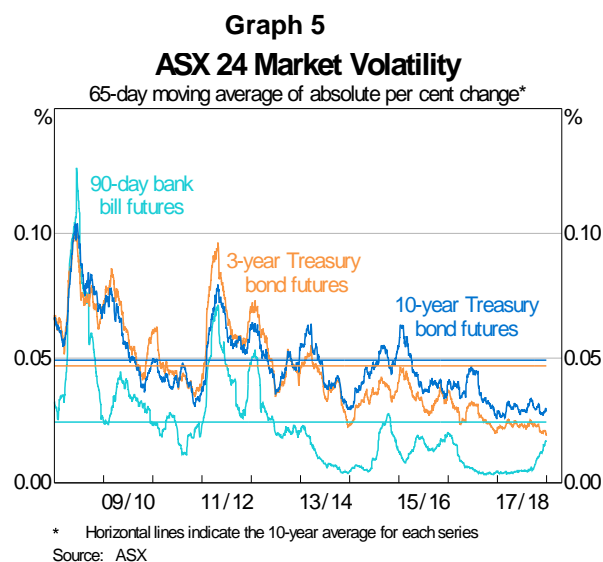
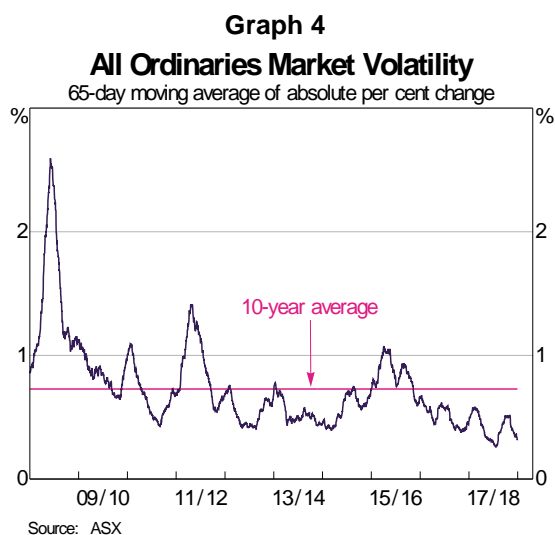
ASX has established a staged process for replenishment of the CCPs' default funds in the event that these were exhausted or partially drawn down following a participant default. At the end of a 22-business-day 'cooling-off period' following the management of a default, ASX Clear and ASX Clear

(Futures)' default funds would be fully replenished up to \$150 million and \$400 million, respectively (see Appendix C.1, CCP Standard 4.8).

B.4 Activity and Participation

Central counterparties

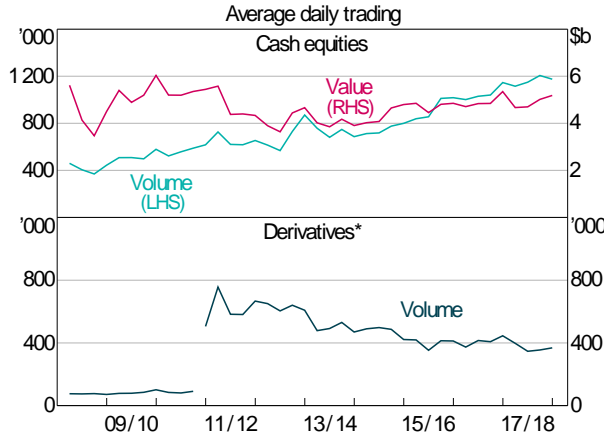
Market conditions were generally benign during the assessment period, with the average volatility in products cleared by the ASX CCPs remaining below their 10-year averages. Average volatility in equity prices (as measured by the 65-day moving average of daily absolute percentage changes in the S&P ASX All Ordinaries Index) fell by around 10 basis points to 0.39 per cent when compared to the previous year (Graph 4). Volatility in the prices of 90-day bank bill futures increased towards the end of the year, although remained below long-term average levels, while price volatility remained broadly stable for government bond futures (Graph 5).



Trading activity in ETOs declined over 2017/18, consistent with the long-term trend (Graph 6). The volume on the cash equities market increased, but the average value traded was broadly unchanged.²⁸ Exposures in ASX Clear continued to fall over 2017/18. As measured by initial margin, ASX Clear's exposures in ETOs fell by 14 per cent to an average of \$910 million over 2017/18 compared with 2016/17, while exposures to cash equities trades fell by 5 per cent to an average of \$148 million (Graph 7). ASX Clear's exposures to the cash equities market are much lower than for ETOs primarily because of the short duration of cash market trades at two days.

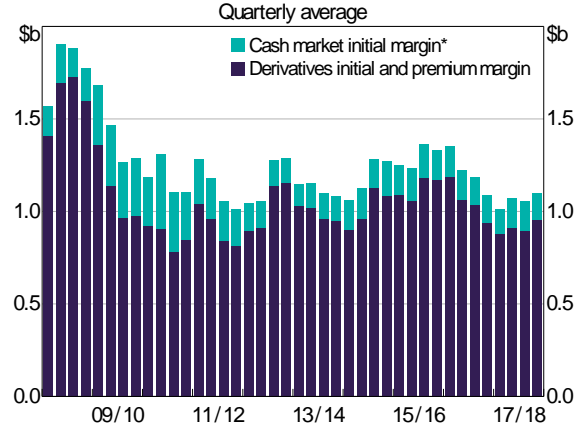
28 Exposures to cash equity transactions in ASX Clear are correlated more with value traded than volume.

Graph 6
ASX Market Trades



* In May 2011, ASX changed its standard contract size for single stock options to 100 shares per contract from 1 000 shares per contract.
Source: ASX

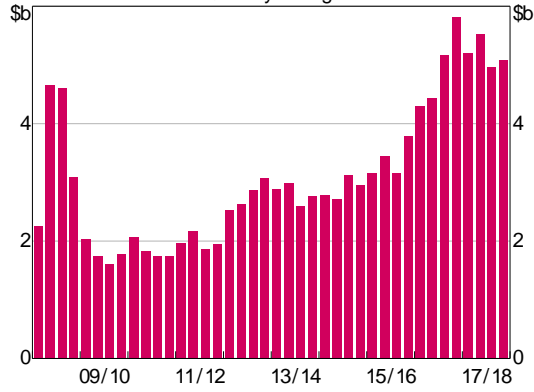
Graph 7
ASX Clear Margin



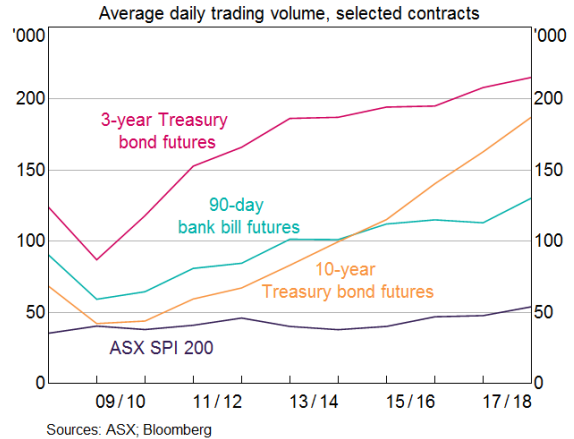
* Notional amount until 7 June 2013; Real Risk methodology used until 18 July 2012, Cash Market Margining used thereafter
Source: ASX

Exposures at ASX Clear (Futures) grew by 6 per cent to \$5.2 billion on average, as measured by margin held (Graph 8). These exposures primarily arise from the four major contracts cleared – the SPI 200 equity index future, the 3-year and 10-year Treasury bond futures and 90-day bank bill swap future – which accounted for around 96 per cent of total transactions cleared at ASX Clear (Futures) in 2017/18. Transaction volumes increased across each of the four most actively traded contracts on ASX 24, with the 10-year Treasury bond futures and 90-day bank bill futures contracts experiencing the strongest growth in 2017/2018 (Graph 9).

Graph 8
ASX Clear (Futures) Initial Margin



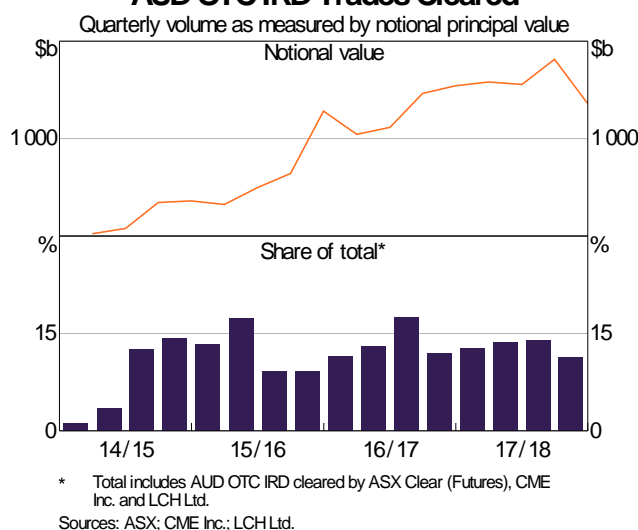
Graph 9
ASX 24 Derivatives Trades



The average daily value of AUD OTC IRDs cleared by ASX Clear (Futures) continued to grow, although at a slower rate when compared to previous years (Graph 10). The share of these products cleared by ASX Clear (Futures) compared with the other CCPs clearing the product (LCH Ltd and CME Inc.) remained steady at an average 13 per cent over the year.

ASX Clear had 35 direct participants as at 30 June 2018. There were 20 direct clearing participants in ASX Clear (Futures).

Graph 10
ASX Clear (Futures):
AUD OTC IRD Trades Cleared



Securities settlement facilities

The daily average value of cash equity settlements in ASX Settlement remain unchanged at approximately \$9.5 billion in 2017/18. This is consistent with subdued growth in trading activity in the ASX market, albeit trends in net settlement values can deviate from trends in gross trading values, since the latter do not include non-market transactions and netting efficiency can change over time.

In 2017/18, the average daily value of debt securities settled in Austraclear increased by 4 per cent, to \$48 billion. This includes the value of securities settled under repurchase agreements (other than intraday repurchase agreements with the Bank).

B.5 Operational Performance

ASX manages its operational risks in the context of its group-wide ERM Framework, applying consistent operational risk controls across all of its CS facilities. Key operational objectives are minimum availability of 99.8 per cent (99.9 per cent for Austraclear) and peak capacity utilisation of 50 per cent or less. These objectives were met during the assessment period (Table 7). System availability was above target availability for all systems, while peak usage was below the limit of 50 per cent for all systems.

Table 7: ASX CS Facility System Availability and Usage Statistics for 2017/18

Facility	Core system	Availability (per cent)	Peak usage (per cent)	Average usage (per cent)
ASX Clear	Derivatives Clearing System	100	18	7
ASX Clear / ASX Settlement	CHESS	99.99	39	24
ASX Clear (Futures)	Genium	100	27	9
ASX Clear (Futures)	Calypso	100	49	44
Austraclear	EXIGO	99.98	45	28

There were two incidents during the assessment period that impacted availability of CS facility systems. CHESs availability was impacted by an incident that occurred in February 2018 that affected the processing of CHESs messages. All CHESs processing was stopped for approximately 23 minutes while remedial action was carried out. Austraclear's core system, EXIGO, experienced two incidents during the assessment period that affected availability. Both of these incidents resulted in a delay to settlement processing, lasting a total of 42 minutes across both incidents. ASX also experienced an incident affecting its primary data centre on 4 June that did not affect the availability of its CS facility systems, but did have an impact on the connectivity of some participants to trading systems.

Appendix C: Detailed Assessment against the Financial Stability Standards

Introduction

This Appendix sets out the Reserve Bank's assessment of how well ASX Clear and ASX Clear (Futures) have observed the CCP Standards, and how well ASX Settlement and Austraclear have observed the SSF Standards as at 30 June 2018.²⁹ In setting out its assessment, the Bank has applied the rating system used in CPMI and IOSCO's *Principles for Financial Market Infrastructures: Disclosure Framework and Assessment Methodology*.³⁰ Under this framework, the Bank has assessed each of the ASX CS facilities' observance of the requirements of each of the applicable FSS as being:

- *Observed* – Any identified gaps and shortcomings are not issues of concern and are minor, manageable and of a nature that the facility could consider taking them up in the normal course of its business.
- *Broadly observed* – The assessment has identified one or more issues of concern that the facility should address and follow up on in a defined timeline.
- *Partly observed* – The assessment has identified one or more issues of concern that could become serious if not addressed promptly. The facility should accord a high priority to addressing these issues.
- *Not observed* – The assessment has identified one or more serious issues of concern that warrant immediate action. Therefore, the facility should accord the highest priority to addressing these issues.
- *Not applicable* – The standard does not apply to the type of facility being assessed because of the particular legal, institutional, structural or other characteristics of the facility.

Section 821A(aa) of the Corporations Act requires that a CS facility licensee, to the extent reasonably practicable to do so, comply with the FSS and do all other things necessary to reduce systemic risk. In assessing how well a CS facility complies with a CCP or SSF Standard, the Bank has assessed how well the facility complies with the headline standard and each of the 'sub-standards' listed under the headline standard. A single overall rating is applied to each CCP or SSF Standard, reflecting this assessment.

The Bank's ratings of each of the CS facilities against relevant FSS are supplemented by detailed information under each sub-standard that is relevant to the Bank's assessment. The Bank gathered this information through its regular liaison with ASX staff, the supply of regular data and reports by

29 The full text of the detailed assessments of each of these CS facilities is available at <<https://www.rba.gov.au/payments-and-infrastructure/financial-market-infrastructure/clearing-and-settlement-facilities/assessments/2017-18/>>.

30 Available at <<http://www.bis.org/cpmi/publ/d106.htm>>.

ASX, and a series of specific information requests and meetings with ASX during and immediately following the assessment period to gather information relevant to assessing compliance with the FSS. Arrangements for regular liaison and the supply of data and reports by ASX are described in further detail under the detailed assessments of CCP Standard 21 and SSF Standard 19.

Supplementary interpretation of CCP Standards

In assessing how well ASX Clear and ASX Clear (Futures) have observed certain sub-standards of the CCP Standards, the Bank has applied the supplementary interpretation of these sub-standards issued by way of an exchange of letters with ASX in October 2014.³¹ This supplementary interpretation supersedes the Bank's previous supplementary interpretation of the CCP Standards issued in August 2013. The supplementary interpretation of the CCP Standards applies to any domestically licensed derivatives CCP that provides services to participants that are either established in the EU or subject to EU bank capital regulations, and affects CCP Standards 2.6, 4.2, 4.4, 6.3, 7.3, 13.2, 13.3, 15.4 and 21.

³¹ This letter is available at <<https://www.rba.gov.au/payments-and-infrastructure/financial-market-infrastructure/clearing-and-settlement-facilities/pdf/supplementary-guidance-domestic-derivatives-ccps.pdf>>.

Abbreviations

ADI	authorised deposit-taking institution	CMM	cash market margining
AFR	available financial resources	COO	Chief Operating Officer
AIM	additional initial margin	CPMI	Committee on Payments and Market Infrastructures
ALMO	Approved Listing Market Operator	CPSS	Committee on Payment and Settlement Systems
ALR	additional liquidity requirement	CS	clearing and settlement
AMO	Approved Market Operator	CRA	Counterparty Risk Assessment
AONIA	Australian overnight index average	CRO	Chief Risk Officer
APRA	Australian Prudential Regulation Authority	CRPM	Clearing Risk Policy and Management
ASIC	Australian Securities and Investments Commission	CRQD	Clearing Risk Quantification and Development
AusPayNet	Australian Payments Network Limited	DA	Digital Asset
ASXCC	ASX Clearing Corporation	DBOR	Daily Beneficial Ownership Report
BBSW	bank bill swap rate	DCO	Derivatives Clearing Organization
BCL	Banque Centrale du Luxembourg	DCS	Derivatives Clearing System
BKBM	NZ bank bill benchmark	DLR	default liquidity requirement
BoE	Bank of England	DLT	distributed ledger technology
CALCO	Capital and Liquidity Committee	DMC	Default Management Committee
CBPL	capital-based position limit	DMRF	Default Management and Recovery Framework
CCMS	centralised collateral management service	DMG	Default Management Group
CCP	central counterparty	DMRSG	Default Management and Recovery Steering Group
CDI	CHESS Depository Interest	DPS	Derivatives Pricing System
CEO	Chief Executive Officer	DvD	delivery-versus-delivery
CFO	Chief Financial Officer	DvP	delivery-versus-payment
CFTC	US Commodity Futures Trading Commission	ESA	Exchange Settlement Account
CFR	Council of Financial Regulators	ESAS	Exchange Settlement Account System
CHESS	Clearing House Electronic Sub-register System	ESG	Executive Steering Group
CIO	Chief Information Officer	ESMA	European Securities and Markets Authority
CLR	core liquidity requirement	ERM	enterprise risk management
CMaX	Collateral Management Exchange	ETO	exchange-traded option
CME	Chicago Mercantile Exchange	FHSVaR	filtered historical simulation of value at risk

FMI	financial market infrastructure	PIRG	Participant Incident Response Group
FSS	Financial Stability Standard(s)	PSNA	<i>Payment Systems and Netting Act 1998</i>
HLE	High-level Expectations	PSR	price scanning range
HSVaR	Historical Simulation of Value at Risk	PvP	payment versus payment
ICC	inter-commodity spread concession	RBNZ	Reserve Bank of New Zealand
ICR	Internal Credit Rating	RCC	Risk Consultative Committee
IOSCO	International Organization of Securities Commissions	RITS	Reserve Bank Information and Transfer System
IRD	interest rate derivatives	RQWG	Risk Quantification Working Group
MoU	memorandum of understanding	RTGS	real-time gross settlement
MPOR	margin period of risk	SOF	SWIFT Oversight Forum
NSX	National Stock Exchange of Australia	SPAN	Standard Portfolio Analysis of Risk
NTA	net tangible assets	SPOR	stressed period of risk
NZONIA	New Zealand Overnight Index Average	SSF	securities settlement facility
OIS	overnight index swap	SSX	Sydney Stock Exchange
OLR	ordinary liquidity requirement	STEL	stress test exposure limit
OTA	offsetting transaction arrangement	SWIFT	Society for Worldwide Interbank Financial Telecommunication
OTC	over-the-counter	TAS	Trade Acceptance Service
PFMI	<i>Principles for Financial Market Infrastructures</i>	VaR	value at risk
PGG	Portfolio Governance Group	VSR	volatility scanning range
PID	participant identifier		