

Sources of Financial Risk for Central Counterparties

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Central counterparties (CCPs) play an important role in managing the risks present in financial markets and in increasing the overall stability of the financial system. This requires CCPs to be sufficiently financially resilient so that they can withstand extreme but plausible events that would pose significant stress. As use of CCPs becomes more widespread, increasing attention is being paid to how CCPs conduct stress tests to evaluate the adequacy of their financial resources. This article describes the sources of, and the circumstances in which CCPs are exposed to, financial risks and how CCPs typically manage these risks.

Introduction

CCPs act as the buyer to every seller and the seller to every buyer through a process known as 'novation'. By substituting the numerous bilateral exposures of a clearing participant with a single multilateral net exposure to a CCP, central clearing simplifies the network of interconnections between financial institutions and reduces total exposure. These arrangements provide substantial benefits to participants in terms of counterparty risk management.

Four CCPs are currently licensed to operate in Australia and are therefore subject to joint supervision and oversight by the Reserve Bank and the Australian Securities and Investments Commission. Two of these CCPs are domestically incorporated subsidiaries of ASX Limited.

- ASX Clear Pty Limited clears ASX-quoted cash equities, debt products and warrants traded on the Australian Securities Exchange and Chi-X Australia markets, and equity-related derivatives traded on the ASX market.

- ASX Clear (Futures) Pty Limited clears futures and options on interest rate, equity, energy and commodity products, as well as Australian dollar-denominated over-the-counter (OTC) interest rate derivatives (IRD).

The other two CCPs – LCH.Clearnet Limited and Chicago Mercantile Exchange Inc. – are overseas CCPs whose operations in Australia primarily involve clearing OTC IRD.

As part of their response to the global financial crisis, in 2009 the G20 Leaders committed to ensuring that all standardised OTC derivatives contracts are cleared through CCPs (G20 2009). Increased use of CCPs is intended to enhance financial stability, but this relies on CCPs being sufficiently financially resilient so that they can withstand even extreme stresses. Consequently, both regulators and market participants are paying increasing attention to how CCPs conduct stress tests to evaluate the adequacy of their financial resources (for example, JPMorgan Chase 2014; FSB *et al* 2015; ISDA 2015). A key part of evaluating the stress testing policies and practices of CCPs is understanding the sources of financial risk they face. This article discusses the sources of financial risk that CCPs are exposed to, including the

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circumstances in which these risks arise and how they are typically managed.

Financial Risks and Risk Management

The main financial risks faced by CCPs are related to credit and liquidity:

- *Credit risk* is the risk that the CCP will be unable to fully meet its financial obligations when required.
- *Liquidity risk* is the risk that the CCP will have insufficient funds to meet its financial obligations as and when expected – even though it may be able to do so in the future.¹

The international standards for CCPs, the *Principles for Financial Market Infrastructures* (PFMI) (CPSS-IOSCO 2012), set out how CCPs are expected to manage credit and liquidity risks.² The PFMI require that a CCP maintain sufficient resources to cover the credit and liquidity exposures in a wide range of potential scenarios, including the default of the participant (and its affiliates) that the CCP has the largest potential exposure to in extreme but plausible scenarios.^{3,4} To test the sufficiency of its resources, CCPs are required to conduct rigorous daily stress tests. In doing so, CCPs are expected to consider exposures to both clearing participants and other entities, such as investment counterparties and liquidity providers.

A CCP's financial resources are typically sourced from margin and the default fund contributions of

participants or the CCP's own assets (referred to as 'skin in the game').⁵ There are two main types of margin that a CCP typically collects:

- *Initial margin* is collected from participants to cover potential future exposures to a participant as a result of adverse changes in the value of the portfolio.
- *Variation margin* is designed to settle the mark-to-market changes in the value of participant's portfolios. It is paid by participants that have made a mark-to-market loss and (often) paid to participants that have made a mark-to-market gain.

To the extent that variation margin is paid to participants that have made a mark-to-market gain it is no longer part of the CCP's available financial resources.

The PFMI restrict CCPs to accepting collateral with low credit, market and liquidity risks to ensure that these assets maintain their value and are readily convertible to cash to cover losses when required. CCPs typically apply 'haircuts' to the value of non-cash collateral that is provided by participants to reflect the potential for changes in the value of collateral between the time that it was last marked to market and the time it may take the CCP to liquidate it following a default.⁶ The PFMI also require that CCPs limit their investments to instruments with minimal credit, market and liquidity risks. These restrictions are important as a participant default is likely to coincide with stressed market conditions when the CCP is likely to need to liquidate collateral or investments.

When assessing the sufficiency of its resources to meet liquidity risks, the PFMI limit the 'qualifying liquid resources' to:

- cash (that is, at-call deposits) at the central bank of issue;
- cash at a creditworthy commercial bank;

1 Although CCPs are exposed to other types of risk, such as business and legal risks, they are beyond the scope of this article.

2 The relevant standard-setting bodies (the Committee on Payments and Market Infrastructures (CPMI), formerly the Committee on Payments and Settlement Systems (CPSS), and the International Organization of Securities Commissions (IOSCO)) recently released for consultation guidance intended to provide further clarity and granularity on aspects of the PFMI related to a CCP's financial resilience.

3 A CCP that is involved in activities with a more complex risk profile or that is systemically important in multiple jurisdictions is expected to maintain sufficient resources to cover the default of the two participants and their affiliates that would potentially cause the largest aggregate credit exposure to the CCP in extreme, but plausible, market conditions.

4 If a CCP's available financial resources are insufficient to absorb the loss, the CCP is expected to have tools to fully allocate the loss. For further discussion of these tools, see Gibson (2013).

5 For more information on these financial resources, see Carter and Garner (2015).

6 Participants lodging cash collateral typically do not face haircuts.

- committed lines of credit;
- committed foreign exchange swaps;
- committed repurchase agreements;
- highly marketable collateral that is readily available and convertible into cash with prearranged and highly reliable funding arrangements, even in extreme but plausible market conditions; or
- collateral that is eligible for pledging to (or for conducting other appropriate forms of transactions with) the relevant central bank, but only to the extent that the CCP has access to routine, and non-discretionary, credit at that central bank.

This definition is more restrictive than the requirements around collateral and investments, which means that not all available financial resources will necessarily be considered sufficiently liquid to be considered when assessing a CCP's management of liquidity risks.

Day-to-day Risks

In the absence of a counterparty default, a CCP's financial obligations are balanced. This is because its positions are created through novation, so for each long (buy) position there is a matching short (sell) position. Similarly, a CCP's financial obligations in relation to the collateral it has received from participants are typically matched by the assets it holds. However, a CCP needs to manage the liquidity risks that arise in its day-to-day operations, as well as in the event of default. A CCP's day-to-day liquidity requirements arise from timing mismatches including, but not limited to, a need to:

- Return initial margin – either following the closing out of positions or a request to withdraw excess collateral – that was provided as cash and has been reinvested in another asset^{7,8}
- Pay out variation margin before all variation margin has been received from participants
- Fund the initial settlement of deliverable instruments (such as securities) where settlement occurs on an individual gross basis (known as delivery-versus-payment model 1, DvP 1).⁹ The proceeds of that settlement can then be used to settle further obligations, with the CCP, in normal circumstances, ending the day with the same assets with which it started.

The last two of these requirements can be minimised or eliminated through the design of the CCP's operations. For example, if a CCP pays out variation margin only after it has received it from participants, there will be no net liquidity need. Similarly, if the securities settlement system used by the CCP settles obligations on a simultaneous net basis (known as delivery-versus-payment model 3, DvP 3), the CCP's obligations for both securities and cash will net to zero and there will be no net liquidity need. Even where the securities settlement system is on a DvP 1 basis, the amount of liquidity required can be minimised by 'shaping' settlement obligations (that is, splitting large settlement obligations into smaller parcels that can be settled sequentially).

Risks from a Clearing Participant Default

A CCP's credit and liquidity risks crystallise following the default of one or more clearing participants as the CCP's obligations are then no longer balanced. Until the defaulting participant's positions can be replaced, the CCP is exposed to changes in the value of the defaulter's portfolio as the CCP must

7 It is assumed that non-cash margin posted by participants is not re-used or 'rehypothecated' by the CCP.

8 While a CCP will also need liquidity to return clearing participant contributions to mutualised default resources (typically referred to as the default fund or clearing fund) if that clearing participant resigns, there is typically sufficient delay between the notice of resignation and when the funds are due to be returned, which should allow the CCP to liquidate the investment prior to fulfilling this obligation.

9 For more information on DvP models, see BIS (1992).

guarantee the equivalent financial obligations to other clearing participants until its exposure can be closed out.¹⁰ This close-out period is expected to be short – typically between two and five days.¹¹

Cash-settled instruments

The main source of risk for cash-settled instruments, such as many derivatives, is variation margin. During the close-out period, the CCP must meet variation margin obligations to the non-defaulting participants. This may involve a payment or a receipt, depending on the direction of the position and the daily price movements. When the CCP closes out the exposure, it will also need to pay for the offsetting position, which will be equivalent to the mark-to-market change in the price of the position. Over the close-out period, the obligations may offset, in which case the credit exposure will be less than the liquidity exposure, as the liquidity requirement is driven by the peak financial obligation at any point in time. The net credit exposure will be a function of the cumulative variation margin plus the cost of closing out the position.

Deliverable instruments

Often CCPs that clear deliverable instruments do not pay out variation margin to participants with a net mark-to-market gain; instead the CCP holds these funds until settlement, so they do not face this source of risk. However, a CCP that clears deliverable instruments will need to take on the defaulter's obligation to purchase the instruments delivered to the CCP by the defaulter's counterparties. The CCP is required to fulfil this obligation as and when the instruments are due to be delivered. To close out its exposure, the CCP will then resell these instruments, with the difference between the sale and the purchase price, less any net variation

margin received on the position, representing the credit exposure. However, since the resale of the instrument occurs after the purchase, this creates a liquidity need in excess of the credit exposure due to the need to fund the purchase over that period. The liquidity need will evolve over time until all the deliverable instruments purchased by the CCP have been successfully resold (see 'Box A: Liquidity Exposures from Securities Settlement').

CCPs that clear deliverable instruments will also have an obligation to deliver instruments that the defaulter had sold but was yet to settle.¹² As is the case with purchase obligations, this exposes the CCP to the cost of replacing the position, since the cost of purchasing the instruments following the default of a clearing participant may be higher than the originally contracted sale price plus any variation margin received from the defaulter for this position. The liquidity exposure from this delivery obligation depends on whether there is a timing difference between the settlement of the purchase and sale of the instruments. Since the CCP cannot deliver an instrument until after it has been purchased, this timing difference is likely to be much shorter than when a CCP is closing out a defaulter's obligation to purchase a deliverable instrument. Indeed, if transactions are settled on a simultaneous net basis (DvP 3), the CCP only has to fund the net difference between the sale and purchase prices (that is, the liquidity exposure equals the credit exposure). Even under DvP 1 settlement, in which transactions are settled individually, the CCP can often 'shape' the settlements so that only part of the purchase is required to be funded before some funds are received from the settlement of the instruments due to be sold by the defaulting clearing participant.

¹⁰ This is typically done either by entering into an offsetting position on exchange or through an auction process with the surviving clearing participants for OTC products.

¹¹ Close-out times will vary depending on product type; liquid exchange-traded products would generally take less time to close out than less liquid OTC products.

¹² This exposure may be mitigated by the extent to which the defaulting participant had pre-positions on some (or all) of the securities due to be delivered into their settlement account, which are available to settle the defaulter's obligation.

Box A

Liquidity Exposures from Securities Settlement

Consider the example of a defaulter that had agreed to purchase securities two days prior to and the day before its default (Table A1).¹ For simplicity, assume that the CCP only clears one type of security (S) and that no variation margin is collected or paid.² On the day of the default (t), the CCP is required to finalise the purchase of S_{t-2} securities at the price agreed on two days prior, p_{t-2} , resulting in a liquidity requirement of $S_{t-2}p_{t-2}$. The CCP can contract to sell these securities at the current market price (p_t) with settlement occurring in two days. Similarly, on the following day, the CCP is required to finalise the

purchase of S_{t-1} securities at price p_{t-1} and agrees to sell them at the new price p_{t+1} . The cumulative liquidity requirement on the day following the default is then $S_{t-2}p_{t-2} + S_{t-1}p_{t-1}$. The sales of securities occur over the next two days, allowing the CCP to recoup the funds outlaid for their purchase and reducing the outstanding use of liquid funds to the final level: $S_{t-2}(p_{t-2} - p_t) + S_{t-1}(p_{t-1} - p_{t+1})$; this represents the credit exposure from these positions. The liquidity need is determined by the peak cumulative liquidity requirement, which, in this example, occurs on day $t + 1$.

Table A1: Hypothetical Liquidity Exposures for a Securities CCP
Following the default of a clearing participant with obligations to buy securities

Day	Event	Daily liquidity requirement	Cumulative liquidity requirement
t	Clearing participant defaults CCP settles purchase of securities bought by defaulter on $t - 2$ CCP contracts to sell securities on $t + 2$		$S_{t-2}p_{t-2}$
$t + 1$	CCP settles purchase of securities bought by defaulter on $t - 1$ CCP contracts to sell securities on $t + 3$	$S_{t-1}p_{t-1}$	$S_{t-2}p_{t-2} + S_{t-1}p_{t-1}$
$t + 2$	CCP settles sale of securities purchased on t	$-S_{t-2}p_t$	$S_{t-2}(p_{t-2} - p_t) + S_{t-1}p_{t-1}$
$t + 3$	CCP settles sale of securities purchased on $t + 1$	$-S_{t-1}p_{t+1}$	$S_{t-2}(p_{t-2} - p_t) + S_{t-1}(p_{t-1} - p_{t+1})$

Source: RBA

- 1 The timeline in this example is consistent with the cash equities market in Australia, where trades are settled on a $t + 2$ basis, where the actual transfer of cash for equity ownership (settlement) occurs two days after the trade is contracted.
- 2 If variation margin was collected on a next day basis then by day t the CCP would have received $S_{t-2}(p_{t-2} - p_t)$. If the CCP does not pay out variation margin then it would be holding these funds and could use them to fund the obligations in Table A1. If the CCP pays out variation margin then the cost of the securities the defaulter had contracted to purchase on day $t - 2$ would be $S_{t-2}p_{t-1}$.

Consider a further example where the defaulter had contracted to sell S'_{t-2} securities at price p'_{t-2} and S'_{t-1} securities at price p'_{t-1} . Again, assume that the CCP only clears one type of security with a two-day settlement cycle and that no variation margin is exchanged.³ If the clearing participant defaults prior to the delivery of the securities at time t , the CCP must fulfil the defaulter's obligation to deliver the securities. To do so, it must first purchase S'_{t-2} and

S'_{t-1} securities at the current market price p'_t . If p'_t is greater than p'_{t-2} and p'_{t-1} , the CCP incurs a loss of $S'_{t-2}(p'_t - p'_{t-2}) + S'_{t-1}(p'_t - p'_{t-1})$, which represents the CCP's credit exposure. As noted above, the liquidity requirement would depend on whether there is a timing difference between the settlement of the purchase and sale of the securities.

3 If variation margin was collected on a next day basis then the CCP would either have $S'_{t-2}(p'_{t-2} - p'_{t-1})$ or its obligation would be reduced by this amount.

Risks from the Default of Other Entities

As well as exposures to clearing participants, CCPs also face risks from the default of other entities that may affect the CCP's ability to meet its financial obligations as and when they fall due. These include risks related to:

- *Investment counterparties.* The default of an investment counterparty will result in a (potentially significant) reduction in the CCP's financial resources where the value received from the liquidator is less than the CCP's exposure to that counterparty (taking into account collateral held by the CCP where it exists). These risks can be managed by ensuring that counterparties are of high credit quality, minimising the size of unsecured exposures to any single counterparty and investing on a secured basis where possible. It is also likely that there will be delays in receiving funds from the liquidator, creating an additional liquidity exposure for the CCP.
- *Collateral issuers.* The default of a collateral issuer will create an obligation for the participant (or investment counterparty) to replace the

collateral it provided, which it is usually required to do by the following business day. However, until this occurs the CCP faces a temporary decline in its financial resources.

- *Liquidity providers.* CCPs may use committed liquidity facilities with other institutions as a source of qualifying liquid resources. However, the default of a liquidity provider means that the CCP may be unable to convert its collateral into liquid resources when necessary. As CCPs typically hold sufficient liquid assets to meet their day-to-day liquidity requirements, in the absence of the default of a participant or an investment counterparty the CCP may not have an immediate need for these liquid assets.
- *Settlement banks, custodian banks, securities settlement systems and central securities depositories.* A problem at (including the default of) one of these entities may impede a CCP's access to the CCP's financial resources. For example, a problem at a securities settlement system, central securities depository or custodian may temporarily prevent a CCP from accessing collateral held at that entity, making it temporarily unavailable to access liquidity

to meet payments as and when they fall due. Similarly, a problem at a settlement bank could delay the receipt of payments due to the CCP that it may require to fund outgoing payments. However, as with the case of liquidity providers, a CCP may not have an immediate need for these liquid assets.

Conclusion

Understanding the sources of financial risk that CCPs face is a key part of evaluating the stress testing policies and practices of CCPs. The main financial risks faced by CCPs are related to credit and liquidity. Although CCPs will typically be exposed to liquidity risks in their day-to-day operations, following the default of a participant or other counterparty the CCP will face both credit and liquidity exposures. The sources of financial risk that a CCP faces in a default scenario will vary depending on the type of counterparty and, for clearing participant defaults, the type of instrument being cleared. To ensure that they have sufficient resources to cover the credit and liquidity exposures in a wide range of scenarios, CCPs need to consider all relevant sources of financial risk in their stress testing. ✎

References

- BIS (Bank for International Settlements) (1992)**, *Delivery Versus Payment in Securities Settlement Systems*, Bank for International Settlements, Basel.
- Carter L and M Garner (2015)**, 'Skin in the Game – Central Counterparty Risk Controls and Incentives', *RBA Bulletin*, June, pp 79–88.
- CPSS-IOSCO (Committee on Payment and Settlement Systems and Technical Committee of IOSCO) (2012)**, *Principles for Financial Market Infrastructures*, Bank for International Settlements, Basel.
- FSB (Financial Stability Board), BCBS (Basel Committee on Banking Supervision), CPMI (Committee on Payments and Market Infrastructures) and IOSCO (International Organization of Securities Commissions) (2015)**, 'CCP Workplan', April.
- G20 (Group of Twenty) (2009)**, 'Leaders' Statement: The Pittsburgh Summit', 24–25 September.
- Gibson M (2013)**, 'Recovery and Resolution of Central Counterparties', *RBA Bulletin*, December, pp 39–48.
- ISDA (International Swaps and Derivatives Association) (2015)**, 'CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework', Risk Management Position Paper, January.
- JPMorgan Chase (2014)**, 'What is the Resolution Plan for CCPs?', *Perspectives*, September.

