



BANK OF ENGLAND

Financial Stability Paper No. 20 – April 2013

Central counterparty loss-allocation rules

David Elliott



BANK OF ENGLAND

Financial Stability Paper No. 20 – April 2013

Central counterparty loss-allocation rules

David Elliott

The author would like to thank Louise Carter, Lucy Chennells, Jeremy Leake, Priyanka Malhotra, Ben Mitchell, David Murphy, Metesh Patel, Amandeep Rehlon, Edwin Schooling Latter and Graham Young for their helpful comments.

david.elliott@bankofengland.co.uk

Financial Stability, Bank of England, Threadneedle Street, London, EC2R 8AH

The views expressed in this paper are those of the authors, and are not necessarily those of the Bank of England. This paper was finalised on 26 April 2013.

© Bank of England 2013

ISSN 1754–4262

Contents

1	Introduction	4
2	The role of a CCP	4
3	CCP risk management	5
4	The case for loss-allocation rules	6
5	Designing loss-allocation rules	7
	Box 1 Potential incentive effects of selective tear-up	9
6	Other considerations	9
	Box 2 The distribution of losses	10
7	Principles to guide the design of loss-allocation rules	11
8	Conclusion	11
	Annex 1: Examples of existing loss-allocation rules	12
	Annex 2: Numerical examples of loss-allocation rules	13
	References	15

Central counterparty loss-allocation rules

David Elliott

Given the increasingly important role of central counterparties (CCPs) in many financial markets, the insolvency of a CCP could be highly disruptive to the financial system if losses fall on participants in an uncertain and disorderly manner. In contrast to most other financial firms, CCPs' obligations to their members, and *vice versa*, are governed by a central rulebook. CCPs have the ability to include in this rulebook rules setting out how losses exceeding the CCP's pre-funded default resources are to be allocated between participants. Indeed, some CCPs have already done so. We term such rules 'loss-allocation rules'. These could have the advantages, relative to the counterfactual of the disorderly insolvency of the CCP, of offering transparency and predictability to participants; providing for a quick and orderly allocation of losses; and potentially allowing the CCP to continue to provide critical services to the market. The detailed design of such rules has important implications for financial stability, as well as for the CCP and its stakeholders. Given these considerations, there is ongoing international work on the design of loss-allocation rules. This paper analyses the options available and offers principles to guide the design of loss-allocation rules.

1 Introduction

Central counterparties (CCPs) play a key role in financial markets by mitigating counterparty credit risk on transactions between market participants. Historically, CCPs have mainly served exchange-traded financial markets. In recent years central clearing has extended to over-the-counter (OTC) derivatives. This part of CCPs' activity will expand further as the G20 objective for all standardised OTC derivatives to be centrally cleared comes into effect.⁽¹⁾

It is therefore imperative to ensure that CCPs are resilient. The updated international *Principles for financial market infrastructures* (PFMI),⁽²⁾ produced jointly by the Basel Committee on Payment and Settlement Systems (CPSS) and the technical committee of the International Organization of Securities Commissions (IOSCO), have strengthened risk management standards for CCPs. But the resources that CCPs hold against loss are necessarily finite, so the question arises of what happens if they are exhausted. If a CCP were to enter a standard insolvency process, losses would be borne mainly by its participants, as the largest creditors of the failed CCP, in a disorderly and most likely lengthy and uncertain process.

One of the key ways in which CCPs are distinguished from most other financial firms is that their obligations to their members, and *vice versa*, are governed by a central rulebook. The CCP's rulebook sets out, among other things, how losses arising from the default of a member are allocated between the CCP's participants, via the application of a 'waterfall' of default resources. The waterfall typically starts with the collateral ('margin') provided by a defaulting member and proceeds to a mutualised default fund. The CCP might also contribute part of its own equity. These (pre-funded) resources are limited. But in principle the rulebook could provide a complete description of how losses would be allocated to participants if the size of the losses exceeded the pre-funded resources. This could have the advantages, relative to the counterfactual of the disorderly insolvency of the CCP, of offering transparency and predictability to participants; providing for a quick and orderly allocation of losses; and potentially allowing the CCP to continue providing critical services to the market. Some CCPs have already introduced such 'loss-allocation' rules⁽³⁾ for certain products, particularly in newer OTC derivative services (see Annex 1).

But this also raises questions. What principles should guide the design of loss-allocation rules to achieve these benefits? How should loss-allocation rules interact with resolution regimes for financial market infrastructures (FMIs)? What is the impact of such rules on clearing members and other participants, including on their incentives to participate in default management processes?

There is ongoing international work on the design of loss-allocation rules. CPSS and IOSCO have published

a consultative report on the *Recovery and resolution of financial market infrastructures*.⁽⁴⁾ This includes a discussion of the characteristics of loss-allocation rules; their role in the recovery of an FMI in financial distress; and some of the issues that arise for CCPs, their members and clients, regulators and resolution authorities. Several CCPs have already introduced loss-allocation rules (see Annex 1), and may be required by regulation to introduce such rules in the future (see Section 4).

In the context of this debate, the purpose of this paper is to analyse in more detail the case for, and possible design of, loss-allocation rules. The paper is structured as follows. Section 2 provides a brief description of the role of CCPs. Section 3 outlines the key risk management practices commonly employed by CCPs. Section 4 sets out the case for loss-allocation rules. Sections 5 and 6 discuss the design of loss-allocation rules and related issues that arise for CCPs, their participants, and authorities. Section 7 suggests principles that could guide the design of loss-allocation rules. The Bank of England has stated that it will have regard to the same set of principles in assessing the suitability of CCPs' loss-allocation rules in its April 2013 publication, *The Bank of England's approach to the supervision of financial market infrastructures*.⁽⁵⁾ Section 8 concludes.

2 The role of a CCP

The key role of a CCP is to mitigate counterparty credit risk. The CCP achieves this by interposing itself between counterparties to contracts traded in financial markets — the counterparties' original bilateral transaction is replaced by new transactions between each counterparty and the CCP in a process known as *novation*. The result is a simplified network of exposures, with the CCP at its centre (**Figure 1**).

The CCP's direct exposures are to its *clearing members* (CMs). CMs may enter into transactions for their own account, and may also guarantee the performance of trades entered into by clients. A large number of financial and non-financial firms may therefore indirectly access the CCP's clearing services (**Figure 2**).⁽⁶⁾

Central clearing mitigates counterparty credit risk in three main ways. First, the concentration of positions with the CCP

(1) See G20 (2009). At the Pittsburgh 2009 Summit, G20 leaders declared that 'all standardized OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties by end-2012 at the latest'. www.g20.utoronto.ca/2009/2009communique0925.html.

(2) CPSS and IOSCO (2012a). www.bis.org/publ/cpss101.htm.

(3) Sometimes referred to as 'end-of-the-waterfall' rules. Such rules may also be referred to as forming part of a CCP's recovery plan in response to a severe financial shock.

(4) CPSS and IOSCO (2012b). www.bis.org/publ/cpss103.htm.

(5) Bank of England (2013), page 9. www.bankofengland.co.uk/financialstability/Documents/fmi/fmisupervision.pdf. Under the United Kingdom's new institutional arrangements for financial regulation, supervision of CCPs has been undertaken by the Bank of England since 1 April 2013.

(6) Some CCPs have relationships with clients as well as CMs; in this paper, we will assume for simplicity that the CCP only has a direct relationship with its CMs.

Figure 1 A complex web of bilateral exposures is reduced to a smaller number of exposures to the CCP

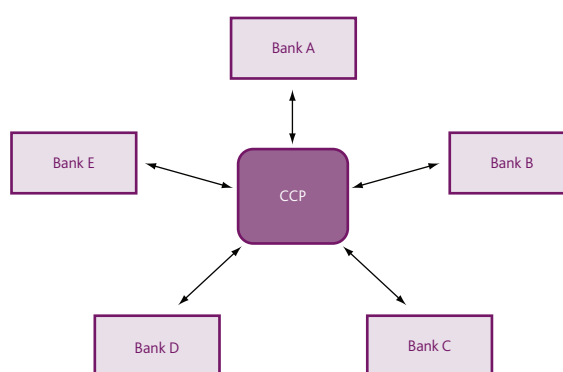
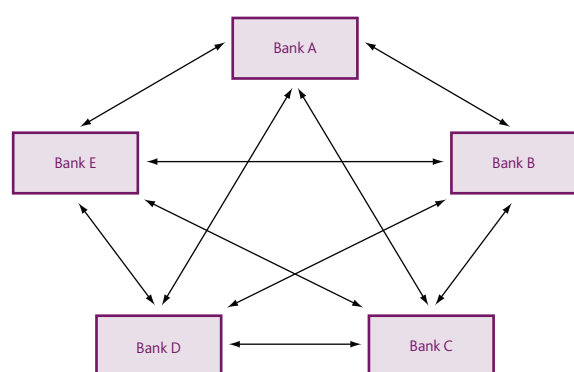
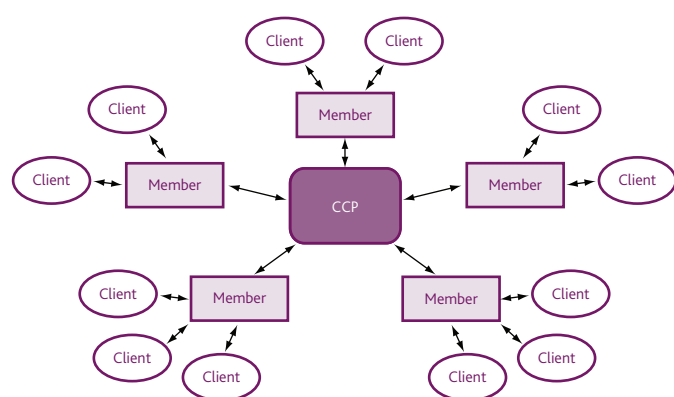


Figure 2 Clearing members and clients served by the CCP



allows it to net down those positions. This ‘multilateral netting’ significantly reduces the total size of exposures.⁽¹⁾ Second, the CCP establishes strong risk mitigants, by calling for collateral from both parties to cleared transactions (see Section 3). Third, the CCP acts as a means to *mutualise* losses that exceed the defaulter’s margin, notably by establishing a ‘default fund’ (or ‘guarantee fund’) to which CMs contribute, which may be called upon to meet such losses (see Section 3).

3 CCP risk management

Since a CCP interposes itself between the two sides of a bilateral transaction, unless a CM defaults the CCP is not exposed to market risk on the cleared positions: any decrease in the value of its claim on one CM is matched exactly by an increase in the value of its claim on another CM. Hence the CCP has a ‘matched book’.

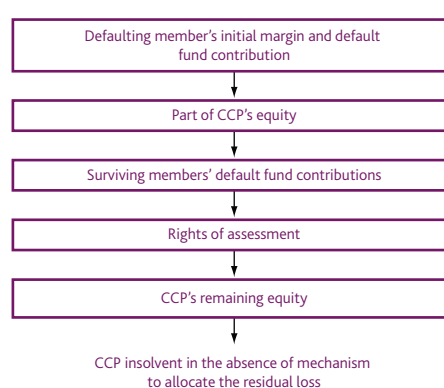
In order to minimise the exposure that the CCP would have in the event that a CM defaults, changes in the value of cleared positions are recognised through regular payments of *variation margin*: a CM whose net position has fallen in value pays to the CCP the value of this decrease; this variation margin is ordinarily then paid by the CCP to CMs whose net positions have increased in value.

The CCP is, however, exposed to market risk if a CM defaults and so ceases to pay variation margin. In that case the CCP will no longer have a matched book and will be exposed to changes in the market value of its unmatched positions. In order to return to a matched book, the CCP will need to close out its unmatched positions, for example by entering into offsetting/hedging transactions and/or by auctioning the positions to non-defaulting CMs. If market prices move against the CCP during this process, it may incur losses.

The CCP’s primary protection against this contingent market risk is *initial margin* that it collects from CMs. The size of the initial margin requirement is set with the aim of ensuring that it is large enough to meet the loss that the CCP may incur between the point that a CM defaults (and so ceases to provide variation margin) and the point at which the CCP successfully hedges or auctions the defaulting CM’s position and returns to a matched book.

In case the margin that the CCP holds from the defaulter is not sufficient to meet the loss, the CCP maintains a *default waterfall* of further resources that can be called upon in the order set out in its rulebook (Figure 3 illustrates a common default waterfall structure).

Figure 3 A typical CCP default waterfall in the absence of a loss-allocation rule



(1) For a fuller explanation see IMF (2010).

An important component of the default waterfall is ordinarily a pre-funded *default fund* (or *guarantee fund*) to which all CMs are required to contribute, normally in approximate relation to the amount of risk that each brings to the CCP. This serves to mutualise the residual loss among the surviving CMs. The CCP may itself make a contribution to the default waterfall from its own capital which is called upon before the default fund.⁽¹⁾ If these pre-funded resources are entirely exhausted, many CCPs may call on non-defaulting CMs to contribute a further amount, usually up to a pre-determined limit. This is sometimes termed *rights of assessment*. In the absence of a mechanism to allocate any further losses among CMs, the *CCP's remaining equity* is thereafter the only remaining resource to absorb losses. If losses exceed this remaining equity, the CCP becomes insolvent.

The trade-offs involved in the design of a CCP's default waterfall are modelled in Nahai-Williamson *et al* (2013).

4 The case for loss-allocation rules

Initial margin and the default fund should be determined so as to provide a high level of confidence that CCPs will be able to absorb losses resulting from the default of one or more CMs. In light of their systemic significance, CCPs are subject to regulation, including on the adequacy of their initial margin and other default resources. For example, the CPSS-IOSCO PFMI require that CCPs that are involved in activities with more complex risk profiles, or that are systemically important in multiple jurisdictions, should maintain financial resources sufficient to cover the simultaneous default of their two largest participants.⁽²⁾ In past instances of member failure, margin has usually been sufficient to cover CCP losses, and calls on the mutualised default fund have been rare, although not unknown.⁽³⁾

But the default waterfall of resources upon which most CCPs can call is limited. So in certain extreme scenarios the default waterfall and the CCP's capital could be exhausted. Without a mechanism to allocate losses which exceed these resources, the CCP would then become insolvent.

The failure of a CCP could be very disruptive. In the absence of an appropriate resolution regime, the CCP would have to stop trading and enter liquidation. CMs would not receive payments due from the CCP and might not be able to access their margin and any remaining default fund contributions for some time. There could be uncertainty over the status of open cleared contracts. The final determination of losses could take a considerable period of time. And trading would be disrupted in the markets that the CCP clears: for example, after the Hong Kong Futures Guarantee Corporation failed in 1987, the futures exchange and the stock exchange suspended trading for the rest of the week.⁽⁴⁾ These consequences could have severe financial stability implications. These concerns are growing in importance as CCPs become more systemically

significant following the G20 objective for all standardised OTC derivatives to be centrally cleared.

CCPs are in principle able to address these concerns by writing *loss-allocation rules* which allocate among surviving CMs any losses which exceed the default fund, thereby preserving the CCP's solvency and potentially allowing it to continue to operate.⁽⁵⁾ That is, the CCP's rulebook can be written to provide a complete description of how any losses will be allocated, rather than a partial description that ends once the default fund or limited rights of assessment are exhausted. It may well be that CMs would consider it in their interest to contribute voluntarily further resources to meet the loss. But this cannot be relied upon; and there may be co-ordination problems or practical difficulties in arranging this within a short period of time.

Of course, the losses are not eliminated by loss-allocation rules. And whether a CCP has a loss-allocation rule or not, the losses are likely ultimately to fall on CMs. But in contrast to CCP insolvency, loss-allocation rules have two key benefits. First, when losses occur they are allocated in a comparatively quick, orderly and transparent manner determined *ex ante* by the CCP and its CMs. As well as providing greater certainty of outcome to market participants, this should better incentivise CMs to monitor the CCP's risk management since it will be clear to CMs that they will bear the loss if that risk management fails. Second, the CCP would be able to continue operating or to wind down its clearing activities in an orderly manner, reducing disruption to the markets that it clears.

Authorities have recognised the importance of loss-allocation rules. The PFMI state that an infrastructure's rules and procedures 'should address how potentially uncovered credit losses would be allocated ...[and] should also indicate the FMI's process to replenish any financial resources that the FMI may employ during a stress event, so that the FMI can continue to operate in a safe and sound manner'.⁽⁶⁾ This is developed further in the CPSS and IOSCO (2012b) consultative report on the *Recovery and resolution of financial market infrastructures* in its discussion of recovery actions that can be taken by an FMI. The consultative report notes the value of the ability to mutualise loss allocation across an FMI's participants and the importance of the need for a CCP to return to a matched book. CPSS and IOSCO are expected

(1) In Europe this is a requirement under Article 45(4) of the Regulation on OTC derivatives, central counterparties and trade repositories (commonly known as the European Market Infrastructure Regulation, or EMIR).

(2) CPSS and IOSCO (2012a), Principle 4.

(3) For example, Hong Kong Securities Clearing Company drew on its guarantee fund to meet losses incurred from the default of Lehman Brothers Securities Asia. See Hong Kong Exchanges and Clearing Ltd (2008), page 155.

(4) See Hay Davison (1988). Norman (2011) discusses further examples of CCP failure.

(5) See Box 2 for discussion of how loss-allocation rules might affect clients, in addition to CMs.

(6) Principle 4 (key consideration 7). Further commentary is provided in footnote 61 on page 45: 'For instance, an FMI's rules and procedures might provide the possibility to allocate uncovered credit losses by writing down potentially unrealised gains by non-defaulting participants and the possibility of calling for additional contributions from participants based on the relative size and risk of their positions.'

to publish further guidance on CCP recovery arrangements this year. In the United Kingdom, the Bank of England's Financial Policy Committee has encouraged the development of loss-allocation rules⁽¹⁾ and HM Treasury has consulted on a proposed change to the Recognition Requirements for UK CCPs to require them to have such rules in place.

5 Designing loss-allocation rules

Loss-allocation rules need to be able to ensure that as the CCP returns to a matched book (in order to eliminate the source of the loss), it can maintain solvency. The broad options that have been followed by some CCPs to achieve this are to:

- call additional financial resources from CMs; and/or
- reduce ('haircut') the claims of CMs on the CCP.

These approaches are not mutually exclusive; indeed, existing examples of loss-allocation rules often apply them both (sequentially).

The following subsections explain the options in more detail and consider the advantages, disadvantages and limitations of different approaches. Annex 1 summarises some existing loss-allocation rules. Annex 2 provides numerical examples of some of the different approaches.

5.1 Calling additional financial resources from CMs

As explained in Section 3, many CCPs have rights of assessment as part of their default waterfalls, under which they can call upon CMs to contribute further financial resources if the default fund is exhausted. In most cases, these are subject to an upper limit or cap. Some CCPs have loss-allocation rules which allow them to call for financial resources from their CMs without limit if losses exhaust the default fund: we term these *uncapped cash calls*.

Loss-allocation rules involving uncapped cash calls on CMs provide CCPs with the most flexibility in deciding how to distribute a loss among its membership. For example, uncapped cash calls can be used to extend the 'mutuality principle' — that the CMs should collectively bear losses according to some reasonable distribution — beyond the default fund to a loss of any size.

But most existing loss-allocation rules do not allow for uncapped cash calls. This reflects two concerns relative to some other loss-allocation tools:

- First, cash calls rely on members actively to pay in funds. If members delay in meeting the call then the CCP could face liquidity difficulties. The CCP may also be forced to place further members into default.
- Second, the ability of the CCP to make uncapped calls on members introduces an unlimited (contingent) exposure for

the CMs in respect of the CCP. This introduces a risk to CMs which they are unable to control, and which may conflict with legislative or regulatory requirements for CMs' liabilities to CCPs to be limited.⁽²⁾ Unlimited exposures may also have implications for bank capital requirements. This in turn may disincentivise membership of CCPs.

5.2 Variation margin haircutting

A feature of loss-allocation rules recently introduced by a number of CCPs for certain products ('clearing services') is *variation margin haircutting*. Under this approach, if the default fund and capped rights of assessment are insufficient, the CCP reduces ('haircuts') *pro rata* across CMs the variation margin payments that it is due to make to CMs whose positions (in the relevant clearing services) have increased in value since the default. Meanwhile, CMs whose positions have decreased in value are still required to pay variation margin in full.

If all positions are valued consistently at a mid-price and the CCP can close out the defaulter's positions at close to that mid-price, then variation margin haircutting should almost always be able to cover the loss that the CCP sustains on the defaulter's positions.⁽³⁾ This is because, as explained in Section 3, the CCP has a matched book, so any losses on the defaulter's positions must be associated with equivalent increases in the value of the positions of non-defaulters.

An advantage of variation margin haircutting over an uncapped cash call is that it does not create an unlimited contingent exposure from a CM to the CCP; instead, losses are applied to CMs' claims on the CCP. This means that a CM can lose no more than the amount by which its position has gained in value since the default, ie its loss is limited to the extent of its in-the-money claim. And individual CMs can in principle model the size of their own in-the-money claims on the CCP, and manage and control these claims by trading with other CMs to reduce their position at the CCP.⁽⁴⁾ Indeed, such trading by CMs may also aid the CCP in closing out the defaulter's positions by providing liquidity in the affected contracts.

Variation margin haircutting is, though, subject to some practical limitations:

- First, it is theoretically possible, although unlikely, that even if the entire flow of variation margin owed to in-the-money CMs were subject to a full haircut, this would be insufficient

(1) Bank of England (2011), page 53. 'The FPC welcomed ongoing work to ensure that UK CCPs have robust arrangements to manage potential losses, which should include rules for allocating amongst their participants, and therefore absorbing, losses that are not covered by margin, default fund and other financial resources.'

(2) For example, Article 43(3) of EMIR requires that 'the clearing members of a CCP shall have limited exposures toward the CCP'.

(3) At least on derivatives products; for cash products it may also be necessary to haircut the settlement price as discussed on page 8.

(4) Although it must remain true that the claims of surviving CMs collectively match the loss incurred on the defaulter's positions.

to cover the cost of returning to a matched book. This could arise if the CCP had to pay a significant premium over the mid-price of the defaulter's positions in an auction of those positions (ie if the bid-offer spread on those positions was very large).

- Second, while variation margin haircutting has been adopted for derivatives clearing services, complications arise in services which do not involve daily exchange of variation margin, or where there is physical settlement of transactions, eg repo transactions. In such cases, haircutting the claims of surviving CMs whose positions have gained in value may need to involve adjusting those settlement prices. This introduces practical problems, such as the interaction with settlement systems; and what to do in respect of transactions that settle during the period following a CM default but before the final extent of the loss is known.

A further consideration is whether or not there should be a cap to limit the size of the haircut. In some cases, the extent of variation margin haircutting is capped. Once such a cap is reached, a complete loss-allocation rule needs to allocate any further losses in another way, for example by cancelling ('tearing up') contracts in the affected service with a final round of haircutting to allocate the residual loss (see Section 5.4). On the one hand, capping variation margin haircutting and moving to contract tear-up crystallises the loss for CMs, providing them with certainty over their exposure to the CCP. On the other hand, CMs whose positions had been torn up may need to replace these positions, either bilaterally or with another CCP. Replacing these positions in stressed market conditions could be highly disruptive and expensive and could redistribute losses between CMs in an unpredictable way. Such a process could be more disruptive and costly than orderly allocation of losses and continuation of positions via further variation margin haircutting, provided that there remains a realistic prospect of the CCP being able to hedge or auction the positions successfully in order to return to a matched book.

5.3 Initial margin haircutting

Haircutting of the initial margin provided by non-defaulting CMs is not a feature of existing loss-allocation rules. This may be because if initial margin were haircut then it would need to be replaced by members, in order to ensure that the CCP maintains adequate financial resources to protect against further member defaults. As with a cash call, if members delay in replacing initial margin, then the CCP may be underprotected and may also need to place further members into default.⁽¹⁾ In some jurisdictions, such as the EU, there are also regulatory restrictions.⁽²⁾

However, particularly where initial margin is provided in a form such that it would not be protected from the insolvency of the CCP, economically there is an argument that it could be subject to haircutting in the same way as variation margin claims on the CCP.

5.4 Termination of open contracts

As described in Section 3, in the period following a default the CCP will be attempting to return to a matched book by entering into offsetting transactions and/or by holding an auction of the defaulter's positions. It is conceivable that the CCP's attempts to return to a matched book may fail, for example if members are unwilling to participate in an auction for the defaulter's positions at any acceptable price. But if the CCP is unable to return to a matched book then the loss may continue to increase; returning to a matched book is crucial to cap the loss. One way to return to a matched book in such extreme scenarios is to *tear up* open contracts, ie to cash settle and cancel (without reopening) those contracts. The cash settlement prices could be based on, for example, the price at which the most recent variation margin requirements had been calculated. If the CCP is unable to pay the cash settlement prices in full, these are haircut *pro rata* across CMs due payment from the CCP. Tearing up contracts caps the loss by limiting the gains otherwise payable by the CCP to CMs with positions opposite to those of the defaulter.

Several existing loss-allocation rules involve *complete tear-up*, whereby there is provision ultimately for all open contracts in the affected clearing service to be cash settled and closed.

This is clearly a drastic approach which should only be contemplated in circumstances where the only alternative was disorderly insolvency of the CCP. A complete tear-up of positions in a clearing service could have serious implications for financial stability as members' and clients' hedged positions become unhedged and participants attempt to replace many positions in a short space of time. This may be particularly damaging to end-users who clear directional positions through the CCP in order to hedge particular risks.

A less disruptive approach may be *selective tear-up*, whereby a subset of contracts — rather than all open contracts — is cash settled.

The subset selected for tear-up could be the smallest subset of contracts that will return the CCP to a matched book. In this case, the subset could be the original opposing trades to the defaulter's (if these are still open and identifiable); or a matching set of trades drawn from across all CMs holding positions in the same class as those of the defaulter, whether or not their original trades were with the defaulter.⁽³⁾

(1) Such an issue may also arise with variation margin haircutting, if a haircut on gains one day leaves a member unable to pay variation margin on losses on a later date.

(2) EMIR Article 45(4) states that 'A CCP shall not use the margins posted by non-defaulting members to cover the losses resulting from the default of another clearing member.'

(3) The latter option has some similarities to proposals in Hull (2012). Hull's proposal differs from the options considered in this paper in several other respects. In particular, Hull suggests that CCPs should selectively tear up contracts opposite to those of the defaulter in the case of *any* default (rather than only those defaults where the CCP is unable to return to a matched book without incurring costs exceeding initial margin, default fund etc), and that CCPs should not mutualise among their members losses in excess of initial margin.

Box 1

Potential incentive effects of selective tear-up

In an illiquid or volatile market, it may be difficult to determine the appropriate compensation to pay to members who have had contracts torn up, and even if appropriate compensation can be determined, the amount may be too large to be funded by variation margin haircutting.

Suppose that the CCP attempts to auction the defaulter's portfolio to non-defaulting CMs and that if the auction fails, the CCP will employ its selective tear-up rule. Having observed the portfolio put up for auction, CMs will be able to estimate the probability that their own positions will be subject to a selective tear-up. If a CM believes that its

positions are not at risk of being selected for tear-up, so that it will not face the cost of replacing them, then it may be less incentivised to participate competitively in the auction. Whereas if the loss-allocation rule ends with complete tear-up, all CMs may be incentivised to participate in the auction since all would face the cost of replacing positions if the auction were to fail.

A similar argument suggests that CMs holding positions that are unlikely to be torn up will be less incentivised to make voluntary payments to the CCP.

In general, the design of loss-allocation rules must be sensitive to effects on members' incentives at all stages of the default management process.

Alternatively, a wider set of contracts in the affected products could be selected for tear-up.

Members who have had contracts selectively torn up may face a greater loss than those subject only to variation margin haircuts, since the replacement cost of the affected positions may be greater than the cash settlement price, especially if the latter is haircut. Compensation for this cost could in principle be funded from a deeper variation margin haircut on the other members in order to distribute the loss more widely among the CCP's membership, in line with the CCP's role of mutualising tail risk.

The motivation for a selective tear-up approach is to minimise the disruption from tear-up while mutualising the loss across the CCP's membership. There are, though, concerns about selective tear-up:

- The asymmetric treatment of clearing members may have adverse effects on the incentives of some members at earlier stages of the default management process (see Box 1).
- Selective tear-up may interfere with netting, which could have implications for bank capital requirements.

These concerns must be weighed against the market disruption that would result from a complete tear-up of all contracts in the cleared market.

6 Other considerations

The introduction and detailed design of loss-allocation rules raise other issues for CCPs, their shareholders, members, clients, regulators and resolution authorities.

6.1 The position of shareholders

If an insolvent CCP were to be wound up, the CCP's shareholders would be at the bottom of the creditor hierarchy⁽¹⁾ and would be unlikely to receive any value for

their stake. A loss-allocation rule that avoids CCP insolvency and does not penalise shareholders may therefore exacerbate principal-agent problems, for example by reducing the incentives for the CCP's owners to invest in risk management. There may therefore be benefits to loss-allocation rules that seek to address this. One means of doing so would be to provide for a further contribution of the CCP's capital to the waterfall at the point that the loss-allocation rule is implemented. However, if the CCP is to continue operating it must remain sufficiently well-capitalised to be viable, including meeting regulatory capital requirements. Transferring equity from existing shareholders to the CMs who have borne losses may therefore be preferable in principle, if this can be achieved within the rulebook. Such compensation for CMs may also incentivise them to participate effectively in auctions, since they stand to gain from preservation of the franchise value of the CCP. To the extent that CCPs are owned by their CMs, the principal-agent concern is mitigated.

6.2 Member discretion in loss-allocation rules

Certain existing loss-allocation rules give members the opportunity to limit their exposure to loss allocation by providing them with *resignation options*. Resignation options provide flexibility to members to cap their exposure to the CCP. But if some members resign, the remaining loss will be concentrated on a smaller number of remaining members, potentially with negative financial stability effects. This could result in a destabilising 'prisoner's dilemma' whereby it is in the interest of each individual member to resign but collectively damaging for them to do so.

Additional flexibility in the allocation of losses can be achieved if there is a process for members to make *voluntary payments* to the CCP to cover the loss. Members may decide

(1) Noting that if the loss was caused by CM default, the default fund contributions of the non-defaulting CMs would be used before the CCP's equity is extinguished.

Box 2

The distribution of losses

Different approaches to loss allocation may result in quite different distributions of losses between CMs. For example, a cash call may be designed to allocate losses in proportion to CMs' default fund contributions; whereas variation margin haircutting allocates losses in proportion to the amount by which CMs' positions with the CCP have moved into the money since the failure of the defaulting CM. As discussed in Section 5.1, the former approach could be viewed as an extension of the 'mutuality principle'. The latter may be closer to the distribution of losses that would have occurred had the CCP entered insolvency. Several of the existing loss-allocation rules first prescribe capped rights of assessment, then later move to variation margin haircutting as insolvency looms larger.

We write in this paper of the allocation of losses *to* CMs, rather than to the *clients* of CMs who also access CCP services. This

is because, in the United Kingdom at least, CCPs' contractual relationships are in general with CMs rather than with the clients of CMs, and the CCPs' rulebooks impose obligations on CMs rather than on clients. However, the CMs' relationships with their clients will also be governed by a set of legal terms, and these may specify how any losses that the CCP imposes on CMs under a loss-allocation rule are passed on to the CMs' clients. In particular it may be that approaches that haircut claims (eg for variation margin or for the return of initial margin) are passed on by CMs to clients, since it should be possible to link these directly to client positions or margin posted. Clients may therefore also bear losses.

A possible concern with variation margin haircutting rules is that if CMs do pass on to their clients the haircut on those clients' positions, it may be that clients are bearing a significant proportion of the ongoing loss, whereas it is only CMs who are entitled to participate in the auction. This could influence the incentives of CMs to bid and/or the level of their bid.

to do so if, for example, they would prefer to conclude the default management process quickly rather than wait for the loss-allocation rule to run its course; or as an alternative to the potential disruption that might be caused by complete tear-up options.

6.3 Isolation of losses within a clearing service

Many CCPs offer clearing services across different instrument classes. Several existing loss-allocation rules allocate a loss only to members operating within the particular clearing service in which that loss occurs.

Isolating losses within a clearing service has several advantages. It better enables CMs to manage their exposure to the CCP. For example, a member who only trades liquid exchange-traded products might not have the risk-management capability to manage an exposure to the tail risk of more illiquid OTC derivatives. This may partly explain why some CCPs have introduced loss-allocation rules to their OTC derivatives clearing services before their exchange-traded services.

Further, if a CCP is able to insulate one clearing service from a CM default in another service, the possibility that contagion may spread between clearing services and lead to the insolvency of the entire CCP is reduced. And in loss-allocation rules which involve tear-up, only one market, rather than several, will be disrupted in this way.

6.4 Losses other than from a CM default

This paper has considered losses that a CCP might face as a result of the default of a CM. But CCPs face potential losses

from other sources. For example, some CCPs reinvest as principal the cash margin and default fund contributions that they receive, and so take on credit and potentially market risk; a payment or settlement bank might default; or the CCP could suffer a fraud or operational error. In general, the full default waterfall is not available to cover such losses; rather, the CCP must rely on its own capital. The failure of a CCP following such losses would affect CMs in much the same way as a failure following a CM default, so CMs have an interest in ensuring that CCPs are not vulnerable to these losses. In the case of investment risk, this may be achieved by loss-allocation arrangements that ensure participants bear the risk and return on this investment activity.

6.5 The interaction of loss-allocation rules with resolution regimes

This paper has considered loss-allocation rules within a CCP's own rulebook as part of its recovery arrangements. Given the serious systemic consequences of the failure of a large CCP, authorities internationally are also considering the application of statutory resolution regimes to CCPs.⁽¹⁾ These could provide powers for a resolution authority to stabilise a failing CCP, for example by transferring its ownership and/or its positions to another company.⁽²⁾ Where a resolution authority needs to intervene to resolve the CCP, statutory loss-allocation mechanisms will be required, which may be similar to those found in loss-allocation rules. These will be necessary in order to ensure that the services of the CCP can

(1) For example, CPSS and IOSCO (2012b). The United Kingdom has recently adopted a resolution regime for CCPs as part of changes to the Bank of England's responsibilities. See Murphy and Senior (2013).

(2) See Financial Stability Board (2011). www.financialstabilityboard.org/publications/r_111104cc.pdf.

be maintained, or wound down, in an orderly way with the costs borne by the CCP's shareholders and CMs, rather than by taxpayers.⁽¹⁾

7 Principles to guide the design of loss-allocation rules

This paper has argued that the introduction of loss-allocation rules — which provide a complete description of how any losses faced by a CCP as a result of the default of one or more CMs would be allocated to participants — would have significant financial stability benefits. Sections 5 and 6 discussed the options available and issues to be considered in the design of loss-allocation rules. This section presents some high-level principles to guide the design of loss-allocation rules. The Bank of England has stated that it will have regard to the same set of principles in assessing the suitability of CCPs' loss-allocation rules in its April 2013 publication, *The Bank of England's approach to the supervision of financial market infrastructures*.

First, loss-allocation rules should provide a full and comprehensive description of the way in which losses would be allocated; and they should be clear, transparent and capable of being implemented quickly.

Second, tear-up of contracts should be a last resort to prevent the disorderly failure of the CCP. Tear-up could expose market participants to risks as hedging positions are lost, and might lead to market participants attempting to replace positions in a short space of time during stressed market conditions. That may in turn exacerbate market stress.

Third, for similar reasons, where tear-up is used, it should as far as possible be isolated to the affected clearing services so that the CCP's other clearing services can in principle be maintained.

Fourth, the design of loss-allocation rules should be sensitive to the incentives that they provide to participants. For example, loss-allocation rules should endeavour to incentivise participants to participate competitively in auctions, and should not incentivise participants to resign their membership if that is likely to destabilise the CCP.

Fifth, the existence of loss-allocation rules should not disincentivise effective risk management by CCPs. This suggests that loss-allocation rules should not be structured in such a way that losses fall only on participants while shareholders are unaffected.

Finally, loss-allocation rules intended to maintain the continuity of clearing services should not compromise the CCP's risk management of open positions. For example, if initial margin on open positions is subject to a haircut, the CCP must be able to ensure that that initial margin is replaced so that the CCP is protected against further member defaults.

8 Conclusion

Given the increasingly central role of CCPs in many financial markets, the insolvency of a CCP could be highly disruptive to the financial system if losses fall on participants in an uncertain and disorderly manner. But CCPs have the ability to include in their rulebooks loss-allocation rules that allocate quickly and transparently all losses among their participants. This offers a way to protect their participants from the additional costs, disruption and uncertainty of an insolvency, and allow continuity of systemically important clearing services.

The detailed design of loss-allocation rules has important implications for CCPs, their members and clients, regulators and resolution authorities, and financial stability more generally. This paper has analysed the options available and offers principles to guide the design of loss-allocation rules.

(1) For further discussion, see page 8 of CPSS and IOSCO (2012b).

Annex 1

Examples of existing loss-allocation rules

In the event of member default, most CCPs can apply funds in the following order to cover losses:

- (1) Defaulting member's initial margin.
- (2) Defaulting member's default fund contribution.
- (3) Contribution by the CCP.
- (4) Surviving members' default fund contributions.

After these resources are exhausted, the latter stages of the default waterfall and loss-allocation rules differ across CCPs. The table below describes examples of loss-allocation rules as of April 2013. This list is not intended to be exhaustive.

These rules can be found at:

CME Clearing: www.cmegroup.com/rulebook/CME/

CME Clearing Europe: www.cme clearing europe.com/membership/files/CMECE-Rulebook.pdf.

EuroCCP: www.euroccp.co.uk/docs/EuroCCP_Rules_new.pdf.

Fixed Income Clearing Corporation: www.dtcc.com/legal/rules_proc/FICC-Government_Security_Division_Rulebook.pdf.

Japan Securities Clearing Corporation: [www.jscc.co.jp/en/rule/PDF\(CDS\)/01CDS_Clearing_Business_Rules.pdf](http://www.jscc.co.jp/en/rule/PDF(CDS)/01CDS_Clearing_Business_Rules.pdf),
[www.jscc.co.jp/en/rule/PDF\(IRS\)/01IRSClearingBusinessRules.pdf](http://www.jscc.co.jp/en/rule/PDF(IRS)/01IRSClearingBusinessRules.pdf).

LCH.Clearnet Ltd: www.lchclearnet.com/Images/lch_default_fund_rules_-_28.03.13_tcm6-43735.pdf.

LCH.Clearnet SA: www.lchclearnet.com/Images/T+0%20CDS%20Clearing%20Rule%20Book%202015%20Feb%202013_tcm6-63058.pdf.

Table 1A Examples of existing loss-allocation rules

CCP	Products	Rights of assessment/cash call	Variation margin haircutting	Tear-up
CME Clearing	Credit default swaps and interest rate swaps	Capped at a size estimated to provide sufficient resources in the event of the default of the four clearing members to which CME Clearing is most exposed under stress tests	None	Complete
CME Clearing Europe	Interest rate swaps	Capped at a size estimated to provide sufficient resources in the event of the default of the four clearing members to which CME Clearing Europe is most exposed under stress tests	Yes	Complete
	Commodity derivatives	Capped at 275% of default fund contribution	Yes	None
EuroCCP	Cash equities	Uncapped if the participant remains a member; if the participant gives notice of its intention to resign its membership by close of business on the business day following the cash call, then capped at 200% of the sum of that participant's initial margin and default fund contribution	None	None
Fixed Income Clearing Corporation	US government debt and mortgage-backed securities	Uncapped if the participant remains a member; if the participant gives notice of its intention to resign its membership by close of business on the day on which the payment is due, then capped at 100% of the sum of that participant's initial margin and default fund contribution	None	None
Japan Securities Clearing Corporation	Credit default swaps and interest rate swaps	Capped at 100% of default fund contribution	Yes	Complete
LCH.Clearnet Ltd	Interest rate swaps and foreign exchange non-deliverable forwards	Capped at 100% of default fund contribution	Yes. Capped at the higher of (i) £100mn (IRS)/ \$100mn (FX NDF), and (ii) 100% of default fund contribution	Complete
	Repo	Capped at 100% of default fund contribution	None	Complete
LCH.Clearnet SA	Credit default swaps	Capped at 100% of default fund contribution	Yes. Capped at the higher of (i) €100mn, and (ii) 100% of default fund contribution	Complete

Annex 2

Numerical examples of loss-allocation rules

The following example provides an illustration of how losses may be allocated by the application of each of four mechanisms: cash call; variation margin haircutting; complete tear-up of outstanding transactions; and selective tear-up.⁽¹⁾ In practice, loss-allocation rules can involve more than one of these mechanisms in combination.

Consider a CCP clearing cash-settled futures in product x and product y. For simplicity, we assume that initial margin and default fund are of value zero. Suppose the members' open positions at the time of default are as shown in **Table 2A**:

Table 2A

Member	Position	Change in mark-to-market mid-price valuation since default
A (defaulter)	-1 product x	−£2
B	−2 product y	−£6
C	+1 product x	+£2
D	+ 2 product y	+£6

The change in mark-to-market mid-price valuation is used to calculate variation margin obligations. So the CCP is due to pay **£8** in **variation margin** (£2 to Member C and £6 to Member D).

Subsequent to calculating variation margin obligations, the CCP holds an auction to dispose of Member A's positions and return to a matched book. Suppose that the price, established in **auction**, at which members will take on Member A's positions is **−£4** (ie the CCP must pay £4 to a member in order for that member to take on a position of -1 product x). This means that the CCP must pay out an additional **£4** in order to return to a matched book.

Note that the auction price of **−£4** is at a premium to the mark-to-market mid-price valuation of **−£2** used to calculate variation margin obligations.

So in total, the CCP is due to pay out **£12** (£8 + £4).

Meanwhile, the CCP is due to receive **£6** in variation margin from Member B. Of course, Member A is unable to meet its payment obligation to the CCP as it has defaulted.

The CCP cannot meet these obligations in full and has a shortfall of **£6** (£12 – £6).

The four mechanisms cover the shortfall in different ways and have different distributional effects.

Cash call

The CCP maintains solvency by requiring its members to pay it cash amounts which are in aggregate equal to the shortfall of **£6**. A cash call offers the greatest degree of flexibility in the

way that losses are allocated. The amount that a particular individual member is required to pay to the CCP depends on the details of the rule but could, for example, be proportional to that member's initial margin requirement or default fund contribution at the point of Member A's default.

Variation margin haircutting

Under a variation margin haircutting loss-allocation rule, the CCP haircuts the **£8** that it is due to pay in **variation margin**. After the CCP has paid the **£4** necessary to return to a matched book, it has £2 remaining of the £6 that it has received in variation margin. So the haircut on the variation margin that it owes is 75% ($1 - \frac{2}{8}$), and if applied pro rata the CCP pays £0.5 to Member C and £1.5 to Member D.

Complete tear-up

Now suppose that the **auction** establishes a more extreme price at which members will take on Member A's positions of **−£10** (ie the CCP must pay £10 to a member in order for that member to take on a position of -1 product x). Thus the CCP must pay out **£10** in order to return to a matched book.

So in total, the CCP is due to pay out **£18** (£8 + £10).

The CCP cannot meet these obligations in full, and cannot pay the auction price of **£10** even with a 100% variation margin haircut (we assume that the CCP does not haircut the auction price). So the CCP tears up all open contracts at their mark-to-market mid-price valuations: it terminates all open contracts and is due to receive £6 from Member B, pay £2 to Member C and pay £6 to Member D. Since the payments due from the CCP (£8) exceed the payments due to the CCP (£6), the payments from the CCP are haircut by 25%, ie the CCP pays £1.5 to Member C and £4.5 to Member D.

In this example the haircut imposed by the CCP is smaller under complete tear-up than under variation margin haircutting. The reason for this is that in the case of complete tear-up, the CCP does not pay the auction premium. But after the complete tear-up, the members' positions in product x and product y are no longer open; if the members wish to re-establish these positions they will need to enter new trades to do so. So under complete tear-up, members' potential losses from replacing their torn-up positions in the market are uncapped, and may be significant. Replacing the contracts may also entail operational costs and risks that a variation margin haircutting solution would avoid.

Selective tear-up

Faced with the same extreme price established in the auction of **−£10**, rather than tearing up all open contracts, the CCP tears up the smallest subset of contracts that will return it

(1) This is a stylised example for illustrative purposes only and does not refer to the resources or procedures of any specific CCPs.

to a matched book: it tears up Member C's positions in +1 product x at its mark-to-market mid-price valuation.

As before, the CCP is due to receive £6 from Member B, pay £2 to Member C and pay £6 to Member D. Since the payments due from the CCP (£8) exceed the payments due to the CCP (£6), the payments from the CCP must be haircut.

The CCP could haircut the tear-up price and variation margin equally, ie a 25% haircut so that the CCP pays £1.5 to

Member C and £4.5 to Member D (this differs from complete tear-up in that Member D's positions are not terminated).

Alternatively, the CCP could compensate Member C for the cost of replacing its positions, and fund this compensation by making the variation margin haircut greater than 25%. For example, the CCP could increase the variation margin haircut to 33% and pay £2 to Member C and £4 to Member D.

References

Bank of England (2011), *Financial Stability Report*, December.

Bank of England (2013), *The Bank of England's approach to the supervision of financial market infrastructures*, April.

Committee on Payment and Settlement Systems and International Organization of Securities Commissions (2012a), *Principles for financial market infrastructures*, April.

Committee on Payment and Settlement Systems and International Organization of Securities Commissions (2012b), *Recovery and resolution of financial market infrastructures*, July.

Financial Stability Board (2011), *Key attributes of effective resolution regimes for financial institutions*, October.

G20 (2009), G20 Leaders Statement: The Pittsburgh Summit, September.

Hay Davison, I (1988), *The operation and regulation of the Hong Kong securities industry: report of the Securities Review Committee*, May.

Hong Kong Exchanges and Clearing Ltd (2008), *2008 Annual Report*.

Hull, J (2012), 'CCPs: their risks, and how they can be reduced', *Journal of Derivatives*, Vol. 20, No. 1, pages 26–29.

IMF (2010), 'Making over-the-counter derivatives safer: the role of central counterparties', *Global Financial Stability Report*, April, pages 91–117.

Murphy, E and Senior, S (2013), 'Changes to the Bank of England', *Bank of England Quarterly Bulletin*, Vol. 53, No. 1, pages 20–28.

Nahai-Williamson, P, Ota, T, Vital, M and Wetherilt, A (2013), 'Central counterparties and their financial resources — a numerical approach', *Bank of England Financial Stability Paper No. 19*.

Norman, P (2011), *The risk controllers: central counterparty clearing in globalised financial markets*, John Wiley & Sons Ltd.