Loss Sharing in Central Counterparties: Winners and Losers

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*Disclaimer: The views expressed herein are those of the authors and do not necessarily reflect those of the ECB or the Eurosystem.

Derivatives markets and default losses

- OTC (over-the-counter) derivatives markets
  - Large: $8.2 trillion in IRD at CCPs alone (BIS 2022)
  - Core - periphery structure: 16 dealers dominate
  - *Pre 2007*: largely unregulated
- Default losses: Lehman fails on derivative obligations
- Regulators: Reduce default losses by mandating central clearing of derivatives, *although* end-users are very reluctant to voluntarily clear.

This paper: Loss sharing rules = How default losses are distributed among clearing members.

Main findings:
Current rules ($\propto$ net risk): Favor dealers over end-users.
Alternative rules ($\propto$ net + gross risk): Balance clearing benefits.
But: CCP may prefer discriminating against end-users to maximize fee income.

Central clearing

Suppose *Deutsche Bank* buys credit protection (CDS) from *Lehman* & sells it to *JPM*.
⇒ Default loss if Lehman fails on obligation to pay.

Clearing: CCP (Central CounterParty) steps in-between every trade
⇒ Deutsche Bank exposed to CCP instead of Lehman and JPM.

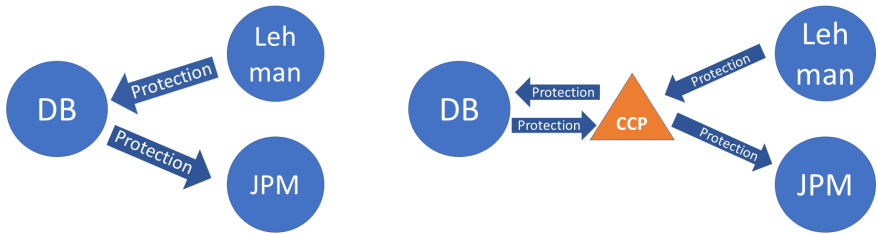


Figure: Uncleared market (left) and central clearing (right).

CCP waterfall

If a clearing member (CM) defaults on its obligation to the CCP, loss is covered by waterfall:

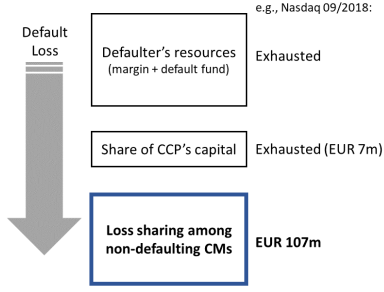


Figure: CCP Waterfall and Example from Nasdaq 09/2018.

$\Rightarrow$ Exposure to CCP = Loss sharing contribution

Central clearing: Loss sharing

What if *Lehman* defaults?
⇒ At CCP, *Deutsche Bank* and *JPM* absorb remaining default losses.
⇒ CCP's loss sharing rules determine who bears how much.

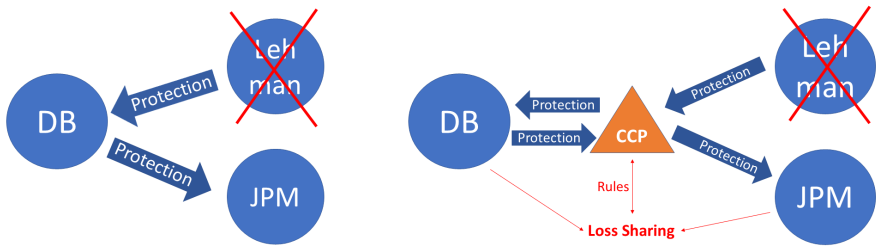
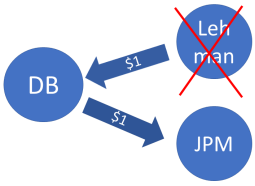


Figure: Uncleared market (left) and central clearing (right).

Loss sharing rules determine allocation of risk *across* entities

Bilateral (uncleared) market



Default losses:
DB = $1
JPM = $0

⇒ DB most exposed

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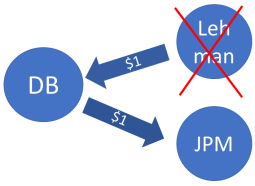

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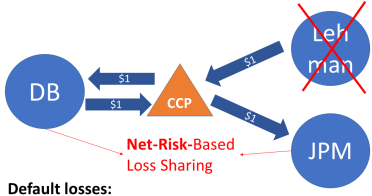
Net-based loss sharing



Default losses:
DB = $0 (no net risk)
JPM = $1 (directional risk)

⇒ DB off the hook, at expense of JPM

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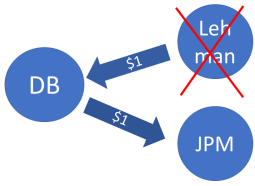

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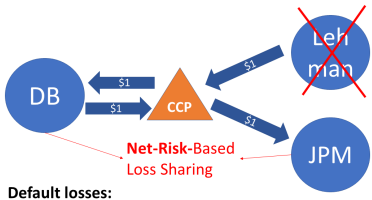

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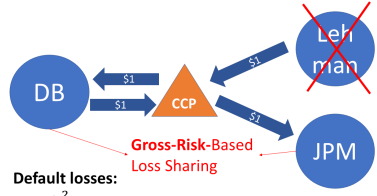
Gross-based loss sharing



Default losses:
DB = $\$\frac{2}{3}$
JPM = $\$\frac{1}{3}$

⇒ Loss more evenly shared.

Literature

Previous studies:

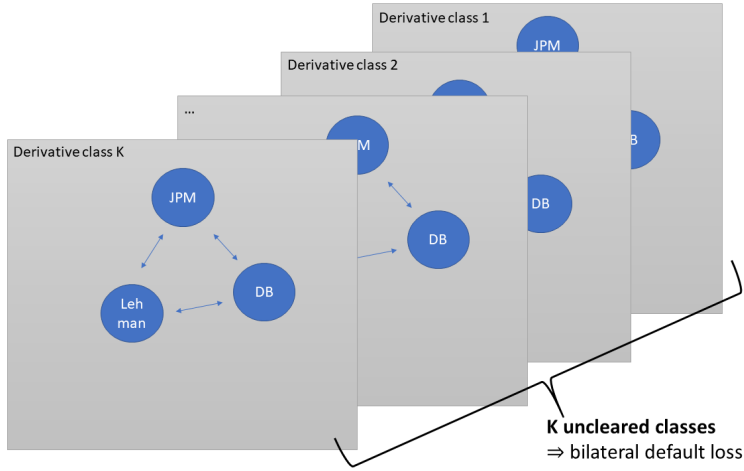
- Netting: offsetting gains & losses across contracts across different counterparties reduces overall default losses (Duffie and Zhu, 2011; Cont and Kokholm, 2014; Lewandowska, 2015)
- Loss sharing/risk pooling: interaction with CCP collateral and fee policies (Capponi et al., 2017; Capponi and Cheng, 2018; Huang, 2019) and risk management incentives (Biais et al;., 2012, 2016; Antinolfi et al., 2022; Kuong and Maurin, 2022; Wang et al., 2022)

Our contribution:

- Varying loss sharing rules
- Netting + Pooling: Agents differ in portfolio directionality (e.g., dealers & end-users)
- Choice of loss sharing rule by profit-maximizing CCP

Model: Uncleared market

K derivative classes, N market participants



Model: Derivative contracts

Profit of agent i on contract with agent j in derivative class k:

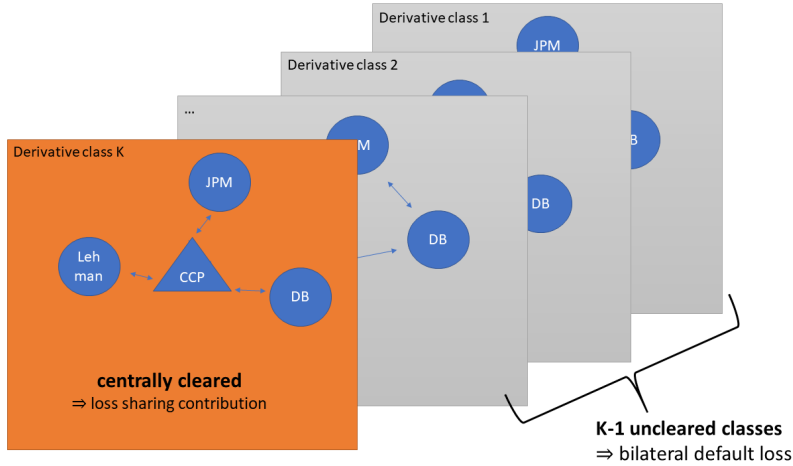
$$X_{ij}^k = \underbrace{v_{ij}}_{\text{Position}} \times \underbrace{r^k}_{\text{Return} \sim \mathcal{N}(0,\sigma^2)} .$$

Default loss of i (after collateral C):

$$DL_i^K = \sum_j \underbrace{D_j}_{\text{Default indicator}} \times \max\left(\underbrace{\sum_{k=1}^{K} X_{ij}^k - C_{ji}^K}_{\text{Net obligation of } j \text{ to } i} , 0 \right)$$

Model: Market with central clearing

Class-K is now centrally cleared:



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Aggregate default loss of CCP (in class K, after collateral):

$$DL^{CCP} = \sum_j \underbrace{D_j}_{\text{Default indicator}} \times \max\left(\underbrace{\sum_g X_{gj}^K - C_j^{CCP}}_{\text{Net obligation of } j \text{ to CCP}} , 0 \right)$$

$\Rightarrow$ DL^{CCP} is allocated to surviving clearing members.

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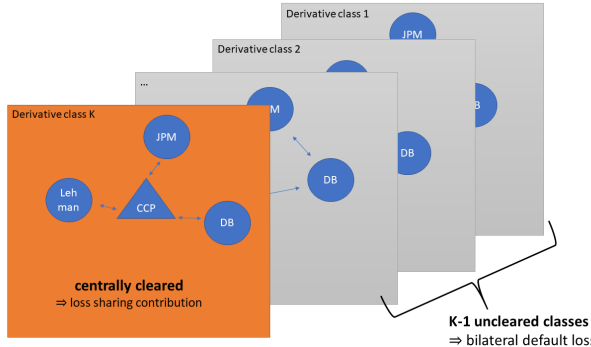


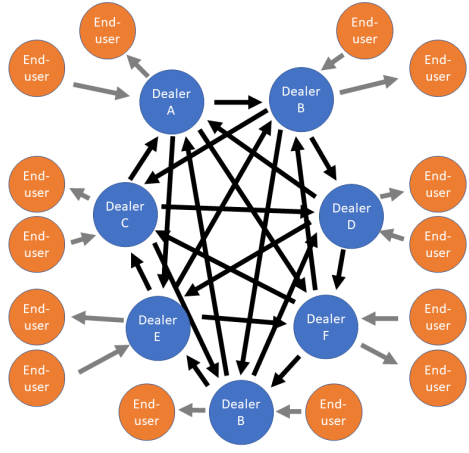
Impact of central clearing: $\Delta DL = \frac{\mathbb{E}[\text{Loss sharing} + DL^{\text{uncleared},K-1}] - \mathbb{E}[DL^{\text{uncleared},K}]}{\mathbb{E}[DL^{\text{uncleared},K}]}$

$\Rightarrow$ If $\Delta DL < 0$, loss sharing *reduces* expected default losses.

Portfolio directionality

Measure for entity i's class-K portfolio directionality: $\eta_i = \frac{|\text{Net position across counterparties}|}{\text{Gross position}}$

E.g., $\eta(\text{Dealer}) \approx 0$, $\eta(\text{End-user}) \approx 1$:



Portfolio directionality and aggregate risk

Lower directionality on average $\Rightarrow$ CCP more useful to net positions *across* counterparties:

Lemma (Aggregate risk)

Average entity's portfolio directionality $\downarrow \Rightarrow$ *Total clearing benefits in the economy* $\uparrow$

$\Rightarrow$ In aggregate, loss sharing rules are irrelevant. Directionality matters.

Net-based loss sharing

Share of losses allocated to entity i: $\frac{\text{Net position}_i}{\sum_{\text{survivors } j} \text{Net position}_j}$

The lower entity i's portfolio directionality, the larger the benefit of clearing relative to its uncleared risk exposure:

Lemma (Net-based loss sharing)

If entity i has a lower portfolio directionality than j, i benefits relatively more from clearing.

$\Rightarrow$ Dealers benefit more from central clearing than end-users.

Lemma (Dealers vs. end-users)

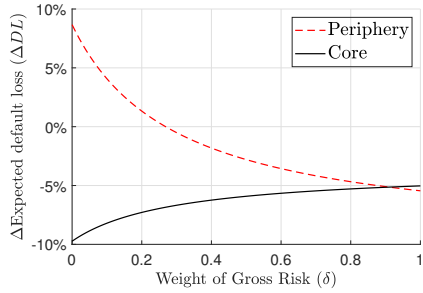
Dealers always benefit from central clearing. End-users may be hurt.

$\Rightarrow$ Impairs end-users' incentives to use central clearing, consistent with anecdotal evidence.

Gross-based loss sharing

Share of losses allocated to entity i: $\frac{\text{Gross position}_i}{\sum_{\text{survivors } j} \text{Gross position}_j}$

Gross-based loss sharing offsets cross-sectional differences in clearing benefits:



Instead, common market practice: net-based loss sharing ($\delta = 0$).
$\Rightarrow$ Why would CCPs not want to make everyone equally happy?

CCP's objectives

Consider a monopolistic for-profit CCP. Chooses Fee and loss sharing rule δ.
Maximize total volume-based fees s.t. participation constraints:

$$\max_{\text{Fee},\delta} \underbrace{\sum_i 1\{i : \text{clears}\} \times \text{Gross position}_i}_{\text{Quantity (depends on loss sharing rule } \delta)} \times \underbrace{\text{Fee}}_{\text{Price}}$$

$$\text{s.t. } \mathbb{E}[\text{Loss sharing}_i(\delta) + DL_i^{\text{uncleared},K-1}] + \text{Gross position}_i \times \text{Fee} \leq \mathbb{E}[DL_i^{\text{uncleared},K}] \quad \forall i : \text{clears}$$

Lemma

Under some conditions, it is optimal for the CCP to use net-based loss sharing because it deters end-users from using central clearing.

$\Rightarrow$ Privately optimal for CCPs to keep dealers happy ($\rightarrow$ large volumes).
$\Rightarrow$ Externality on clearing participation: Net-based loss sharing not necessarily socially optimal.

Conclusion

3 key insights:

(1) Loss sharing in practice is based on net risk
- favors dealers over end-users
- impairs end-users' incentives to use central clearing

(2) Alternative loss sharing rules take gross risk into account
- balance clearing benefits across entities

(3) To maximize fee income, CCPs may rather keep dealers happy at expense of end-users.

$\Rightarrow$ Important trade-offs for financial stability. Regulation of loss sharing rules?
Caveat: Model abstracts from impact of loss sharing rules on positions. More research needed!

Thank you for your attention.

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