The Design of a Central Counterparty

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Workshop on Financial Intermediation and Corporate Debt Markets
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The Importance of Clearing

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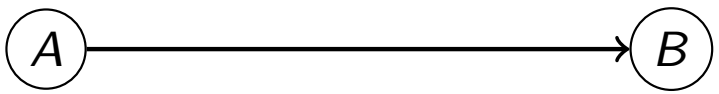

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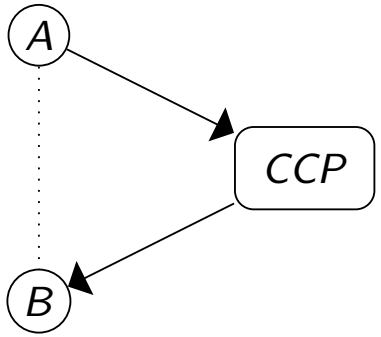
- CCPs became major intermediaries in post-crisis financial system:
  - Interest rate derivatives: 15% cleared in 2009 $\rightarrow$ 60% in 2018 (BIS).
  - Majority of EU repos are centrally cleared (Mancini, 2015).

CCP Design: Mitigating Counterparty Risk?



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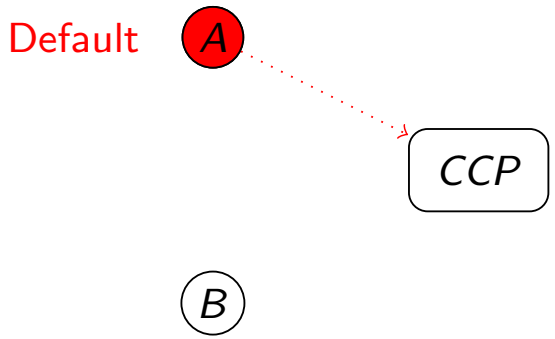

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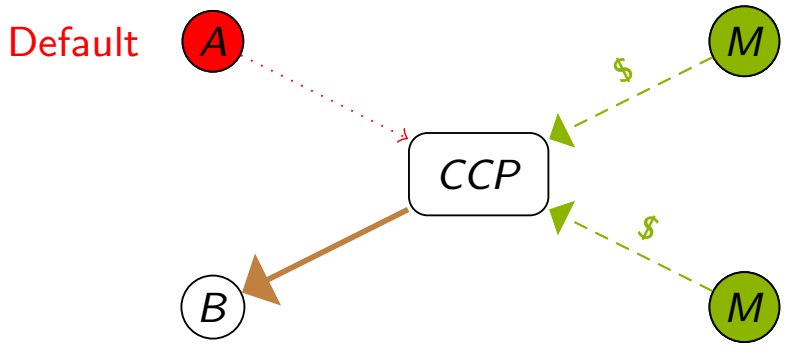

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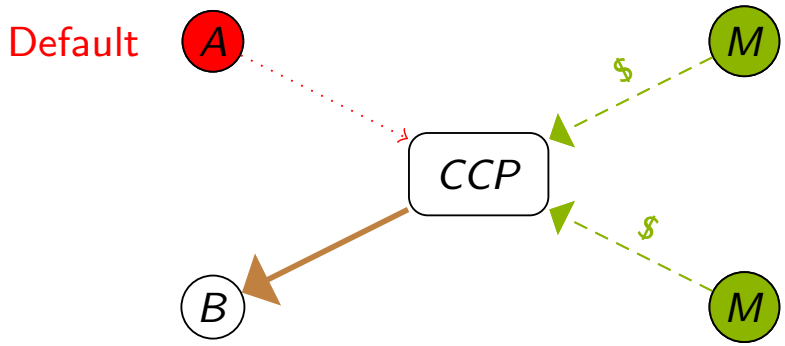

- Are benefits from **loss mutualization** worth the costs?
  1. Collateral (guarantees contract payments + default fund contributions).
  2. Potential weakening of market discipline among investors.
- Who should bear the losses? CCP capital vs. other members?
- Is private loss-sharing design optimal?

This Paper

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- Privately optimal level of SITG capital can be socially inefficient.

Outline

Agents

- 2 dates $t \in \{0, 1\}$. 2 equiprobable aggregate states $S \in \{L, H\}$ at $t = 1$.
- Two groups with N investors each: H-investors and L-investors.
- Gains from trade:
  - S-investors like consumption more in state S. Hedging need $\hat{c}$
  - But they own a non-tradable asset that only pays in state S'.

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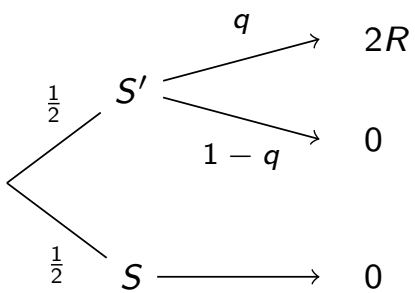
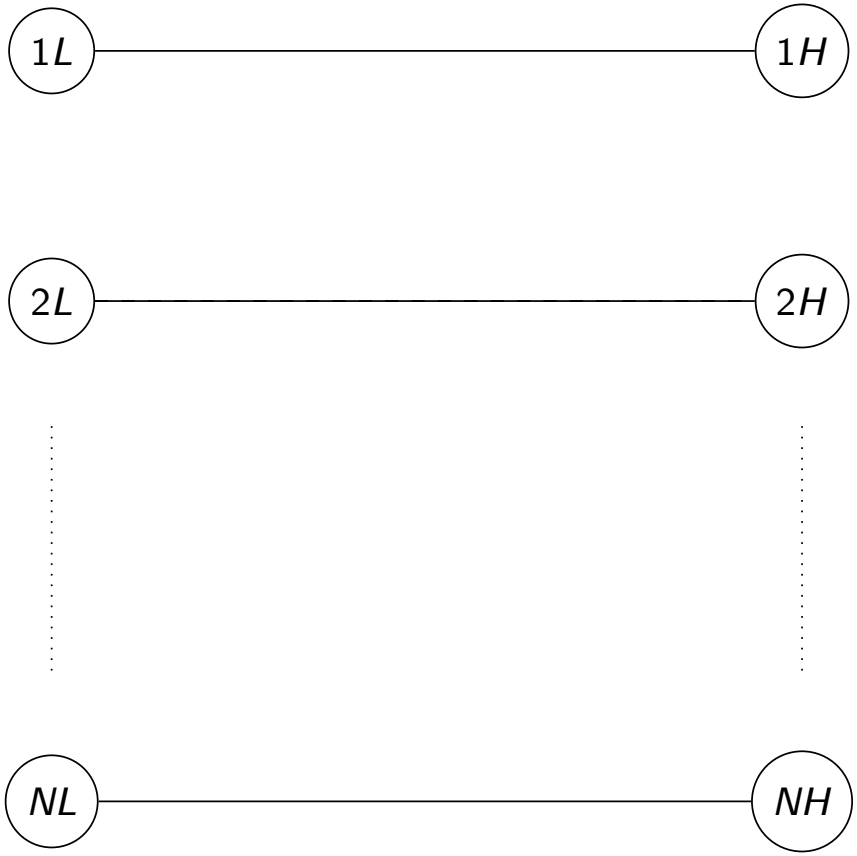


- **Idiosyncratic (counterparty) risk** $\rightarrow$ benefit from mutualization.

Loss Mutualization



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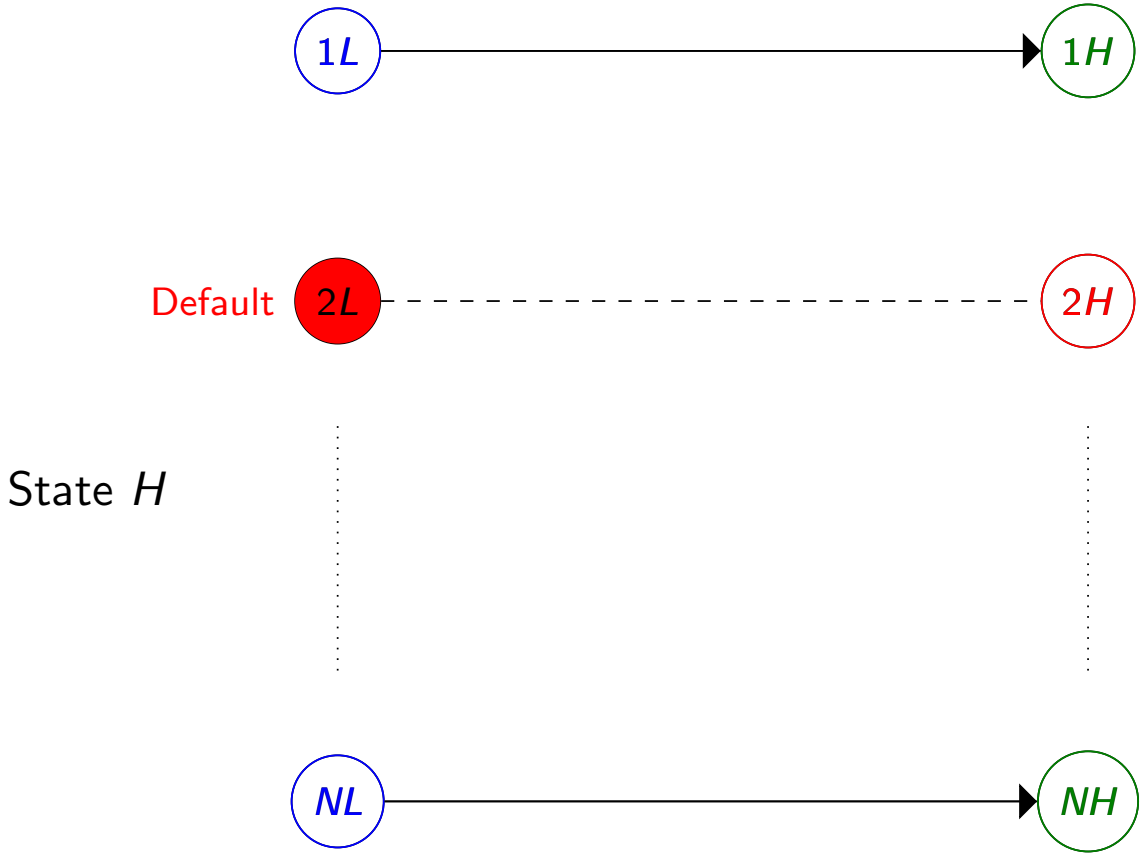

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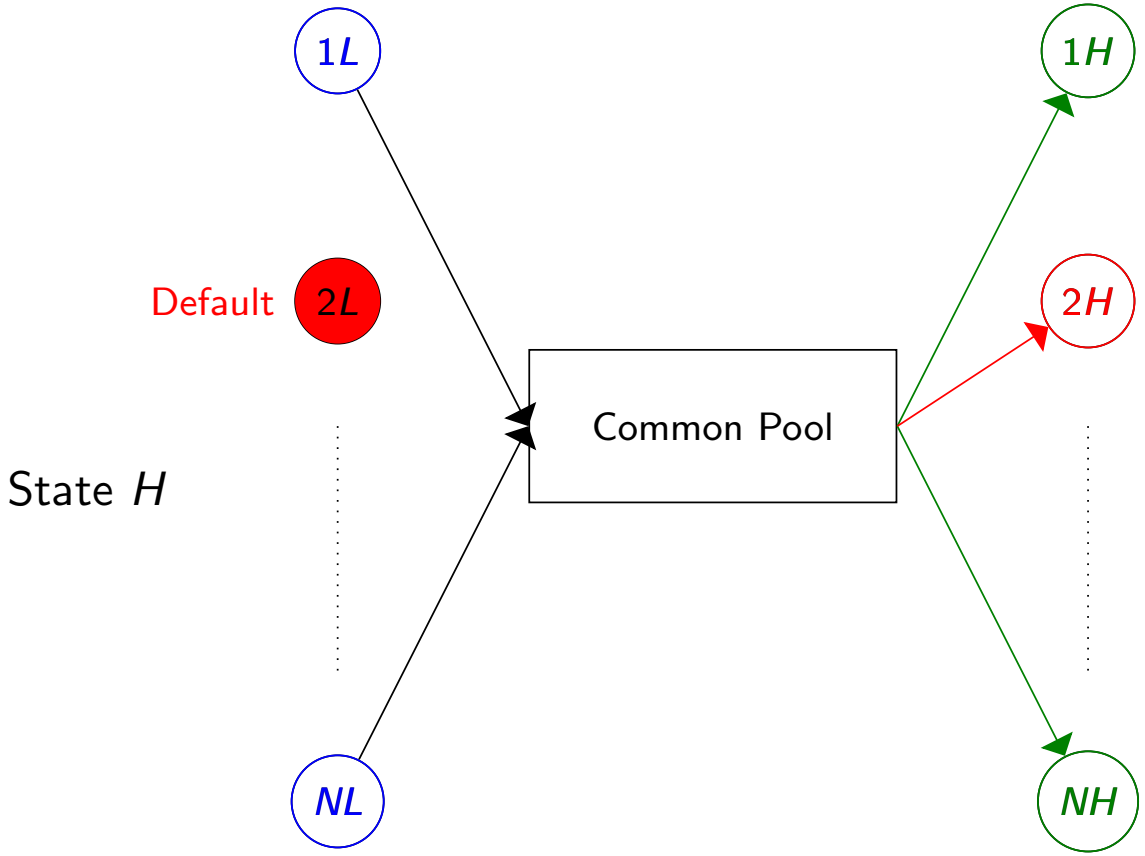

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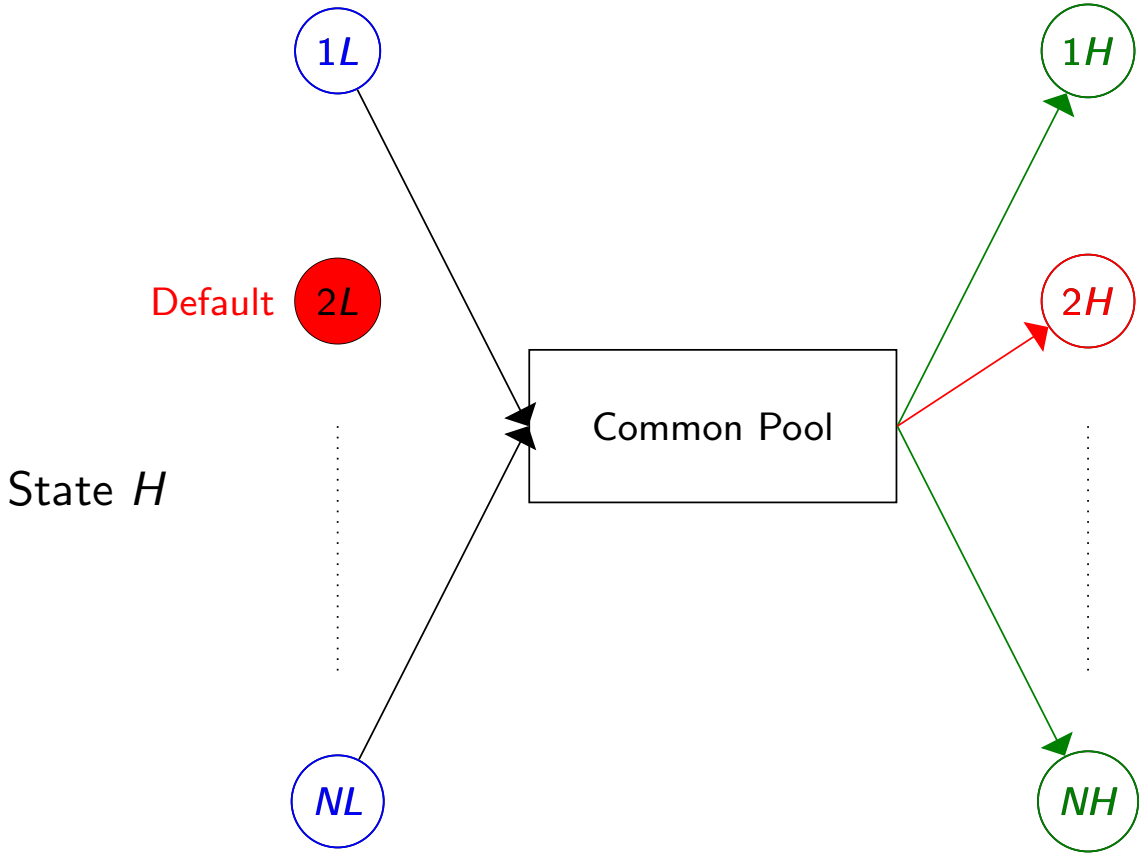

Assumption (relaxed in paper): 1 surviving payer can cover hedging needs .

$$2R \geq N \underbrace{\hat{c}}_{\text{Hedging need}}$$

Frictions

- Friction 1: Limited asset pledgeability $\tilde{\beta} < \hat{c} < 2$.
  - If expected liability/asset $\geq \tilde{\beta}$, investor shirks at date 0 $\rightarrow$ asset pays 0.
  - Captures endogenous risk-taking behavior/wrong-way risk.

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- Monitoring: effort cost ψ $\rightarrow$ investor $\tilde{\beta} = \beta > 0$.

$$\text{No effort cost} \rightarrow \text{investor } \tilde{\beta} = \begin{cases} \beta & (\text{prob. } \alpha) \\ 0 & (\text{prob. } 1 - \alpha) \end{cases}$$

$\rightarrow$ Friction 2: Monitoring effort and outcome not observable.

CCP agent

- Third-party CCP agent endowed with (cash) capital E at date 0

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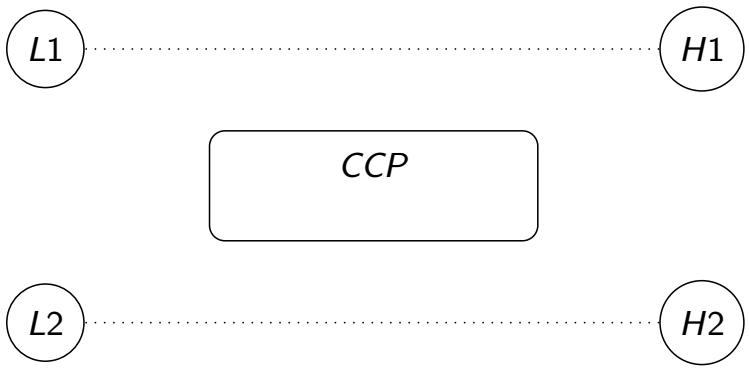
- Potential CCP roles:

  1. Enable loss mutualization
  2. Act as a centralized monitor of investors (vs. bilateral monitoring).

Multilateral Contracting Framework



Optimal contract properties (maximizes investors' utility)

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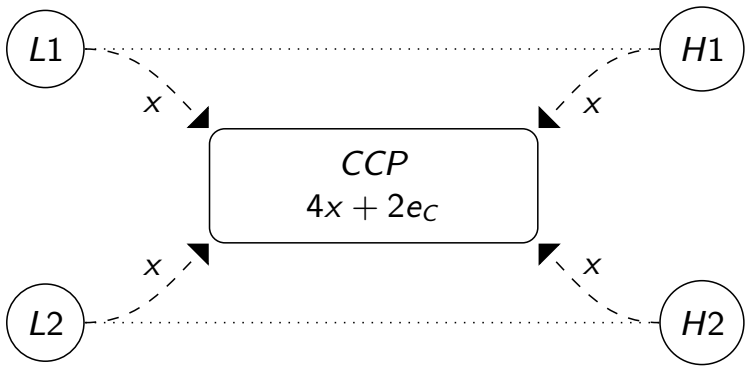

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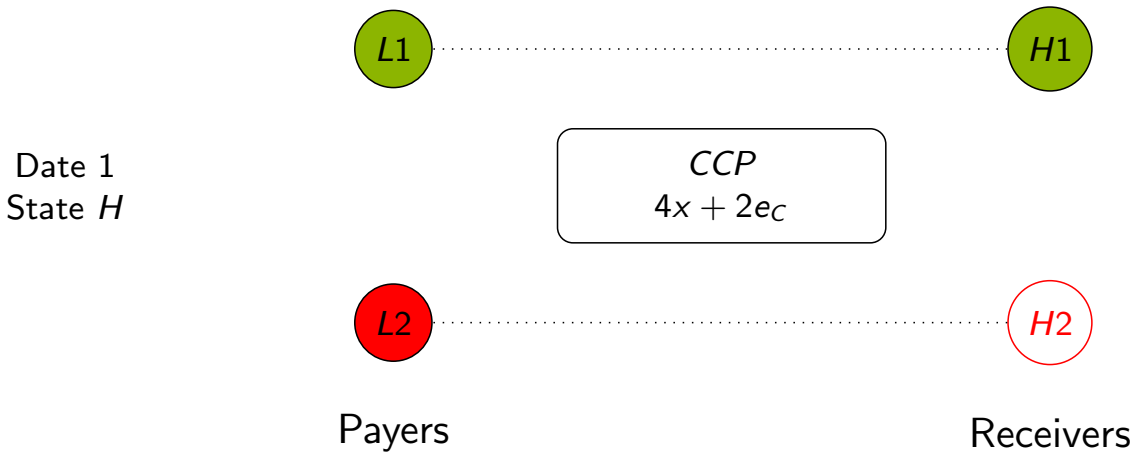

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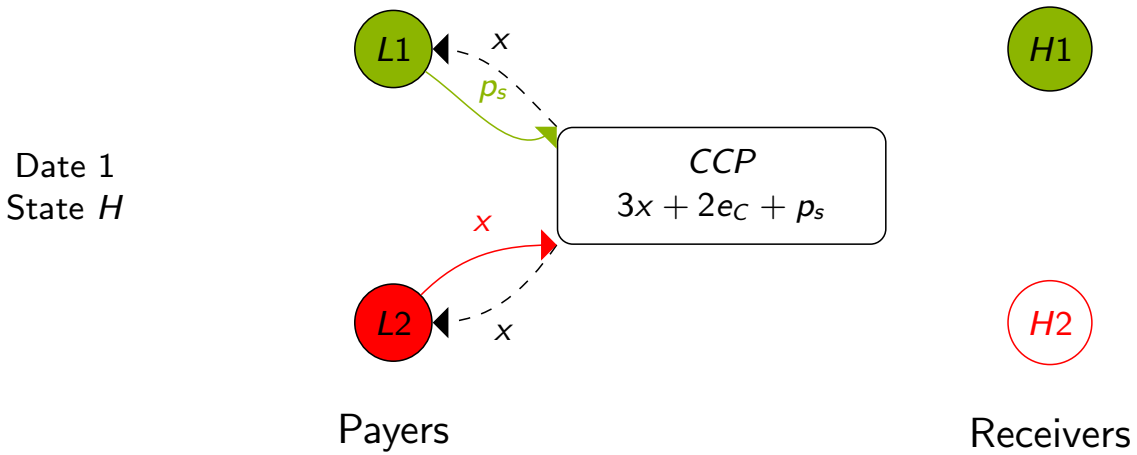

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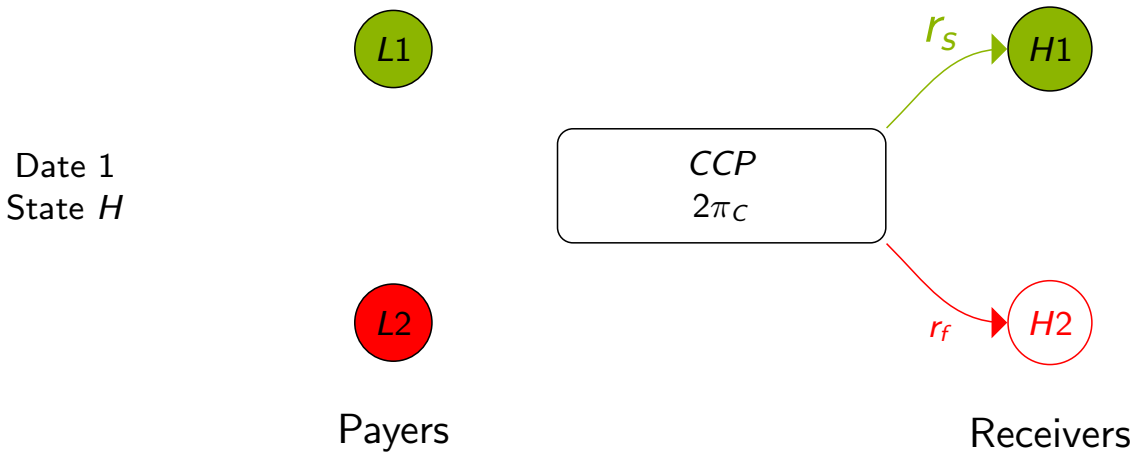

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2. Receiver transfer either r_s, r_f or $2x + e_C$ (if all payers default).

   $\rightarrow$ Minimize transfer variability (risk-aversion) vs. bilateral monitoring incentives

Outline

First-Best

- Investors' asset fully pledgeable $\rightarrow$ monitoring is redundant.
  $\rightarrow$ no CCP capital, no compensation.

- Investor's Problem: Maximize over (r_s, r_f, x):

$$U = qR - xk + \frac{\nu - 1}{2}\left\{q\min\{r_s, \hat{c}\} + (1-q)\min\{r_f, \hat{c}\} - (1-q)^N\left[\min\{r_f, \hat{c}\} - \min\{2x, \hat{c}\}\right]\right\}$$

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2. Use collateral to hedge joint-default state iff

$$k \leq \underline{k}_N \equiv (\nu - 1)(1-q)^N$$

$\rightarrow$ Contract is fully collateralized, that is, $x = \frac{\hat{c}}{2}$ when $k \leq \underline{k}_N$.

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Limited Pledgeability: New Role for Collateral

- Full-loss-mutualization contract payment exceeds pledgeable income

$$\mathbb{E}[payment|succesful] = \mathbb{E}[p_s] = \frac{1-(1-q)^N}{q}\hat{c} \geq \hat{c} > \beta$$

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1. $EPC(0) = \beta - \hat{c} < 0$
2. $EPC'(x) = (2 - q\beta) > 0 \rightarrow$ collateral needed for loss mutualization!

Contract under Observable Monitoring

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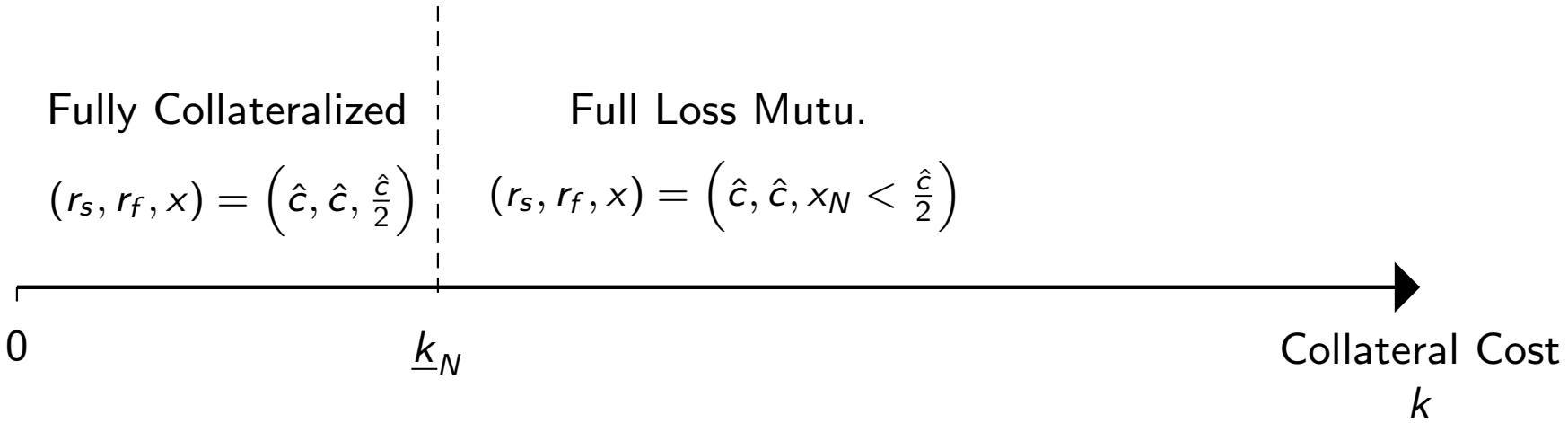

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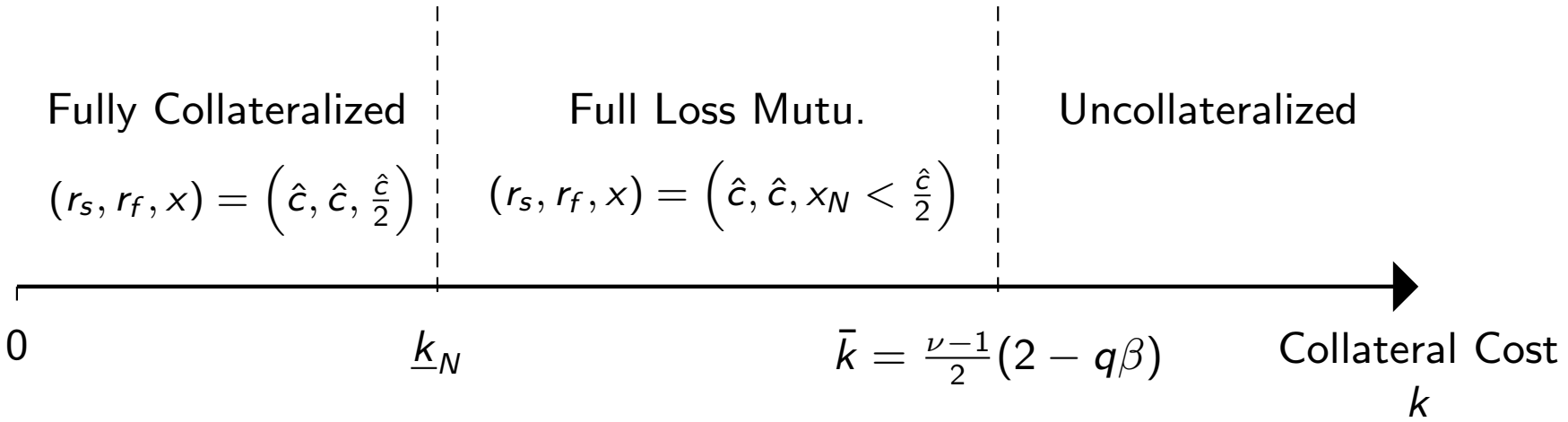

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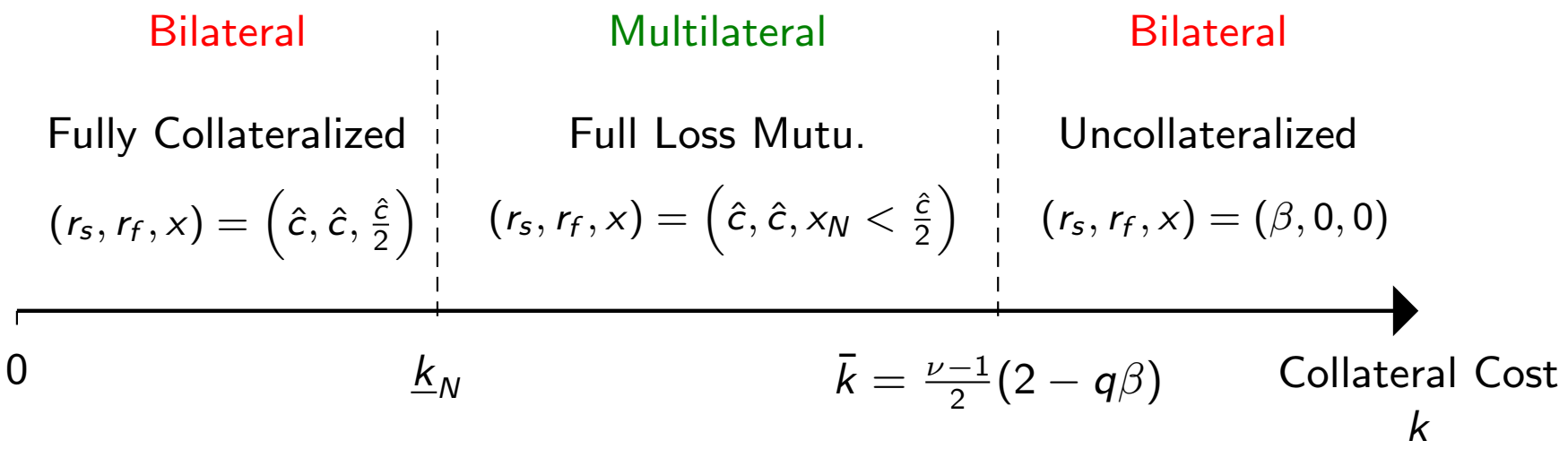

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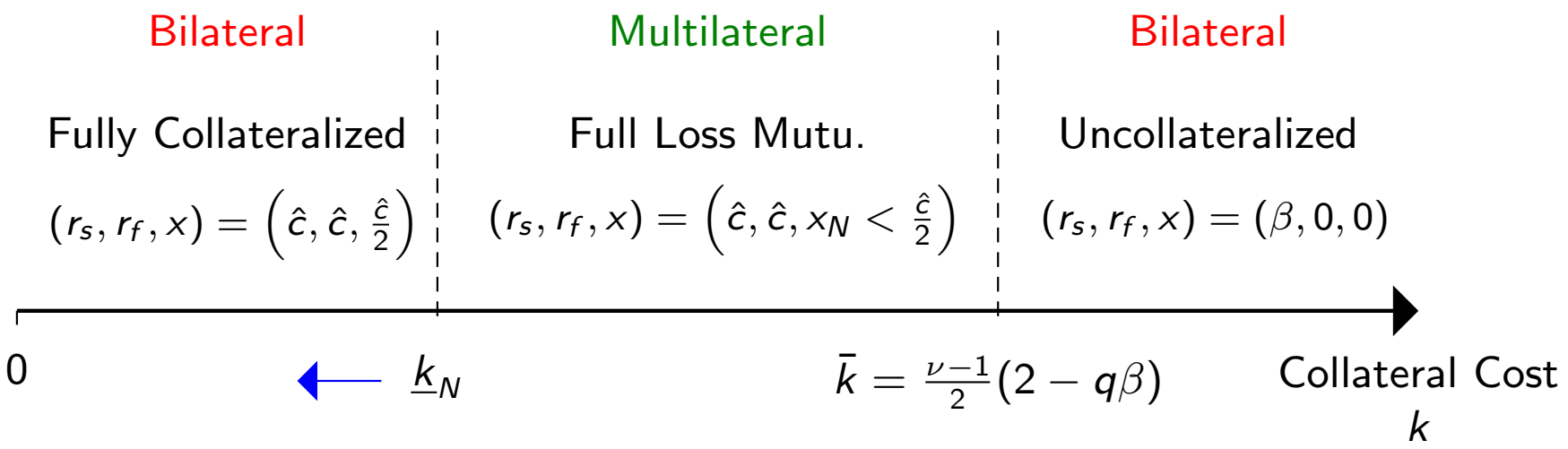

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- Central clearing more desirable with more members (N goes up). More

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U_R: utility of a receiver

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U_R: utility of a receiver

- Incentive Compatible Bilateral monitoring $\rightarrow$ reduced loss mutualization.

CCP as a monitor

- Alternative to bilateral monitoring: Centralized monitoring by CCP.

- CCP contract: Capital contribution Ne_c at $t = 0$.

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Result: Centralized monitoring $\succeq$ for N large or severe monitoring frictions.

CCP contract

Proposition *The optimal CCP contract is such that the CCP contributes capital and gets paid if and only if no CCP member defaults.*

- High-powered contract best disciplines a centralized monitor.
  - → Akin to "cross-pledging" benefits in corporate finance.
  - → Interpretation: **CCP gets first-loss equity tranche.**
- Similar to CCP management compensation practice (e.g. OCC, LCH)
- **CCP "skin in the game" capital**: requested by investors.

$$\underbrace{\nu_C e_C^*}_{\text{Cost of capital}} = \underbrace{\frac{2\psi\alpha^N}{1-\alpha^N}}_{\text{Monitoring Rent}}$$

Empirical Relevance

CCP agent role: Centralized Monitor

$\rightarrow$ CCP Due diligence: internal credit classification, on-site visits,... (ESMA 2020)

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CCP agent role: Centralized Monitor

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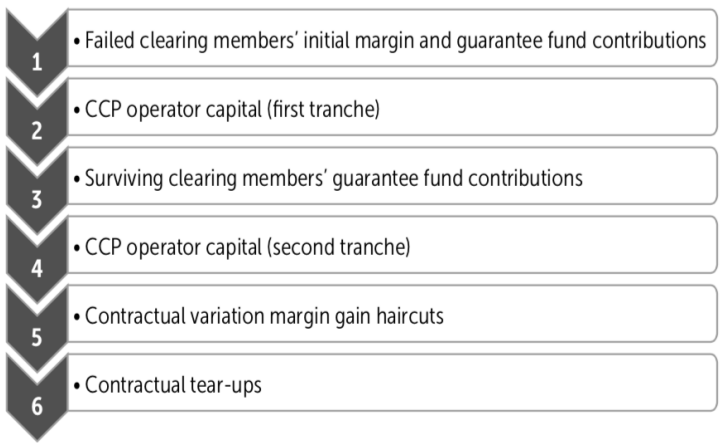
CCP Design: Rationalize elements of the default waterfall (see Duffie, 2015).

- *Defaulter pays first* principle (collateral is seized)
- CCP junior equity tranche.
- loss mutualization from surviving members.



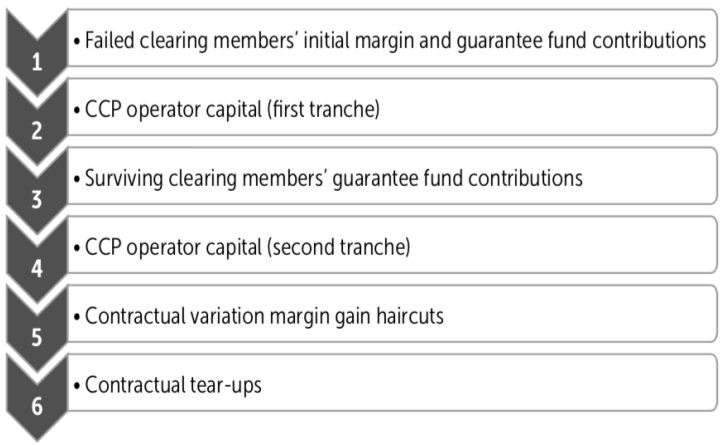
Empirical Relevance

CCP agent role: Centralized Monitor

→ CCP Due diligence: internal credit classification, on-site visits,... (ESMA 2020)

CCP Design: Rationalize elements of the default waterfall (see Duffie, 2015).

- *Defaulter pays first* principle (collateral is seized)
- CCP junior equity tranche.
- loss mutualization from surviving members.



CCP Ownership: small member-owned CCP vs. large third-party CCP.

Regulating (Third-Party) CCP Capital?

- Social planner seeks to maxmimize total surplus (investors+CCP).

- Similar objective to fully mutualize losses but different choice of capital

$$\max_{e_C \in \{0, e_C^*\}} \quad 2NU(e) + \underbrace{N\nu_C(e_C^* - e_C)}_{\text{CCP's profit}}$$

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- Echoes tension btw. CCPs (LCH 2015) and members (ABN-AMRO 2020).

Literature

- Central Counterparty Clearing (Empirics): *Duffie, Scheicher & Vuillemey (2015), Mancini, Ranaldo & Wrampelmeyer (2015), Ghamami & Glasserman (2017), Menkveld (2017), Bernstein, Hughson & Weidenmier (2019), Huang, Menkveld & Yu (2020), Vuillemey (2020).*

- Central Counterparty Clearing (Theory): Duffie and Zhu (2011), Leitner (2011), Biais, Heider, Hoerova (2012) Koeppl (2013), Murphy and Nahai-Williamson (2014), Koeppl and Monnet (2017), Antinolfi, Carapella & Carli (2018), Huang (2020), Wang, Capponi & Zhang (2020), Huang & Zhu (2021)

  $\rightarrow$ **Focus on loss mutualization role of CCPs.**

  $\rightarrow$ **Role of CCP agent, CCP compensation and capital structure**.

- OTC vs. Centralized Trading: *DGP (2005), Acharya & Bisin (2014), Malamud & Rostek (2017), Babus & Kondor (2018), Lee & Wang (2019), Glode & Opp (2020), Dugast, Uslu & Weill (2020), ...*

  $\rightarrow$ **Benefits depend on collateral cost, market size, counterparty quality**.

Outline

Conclusion

- Model of central clearing by CCPs to mitigate counterparty risk.

- **Main results**:

  1. Central clearing is useful when collateral cost is intermediate.
  2. Many contract features endogenized (margins, default funds, CCP capital).
  3. CCP can act as centralized monitor and hold junior tranche for incentives.
  4. Conflict between CCP and members about CCP capital size.

- **Future Work?** Competition between CCPs.

THANK YOU!

Implications: Bilateral vs. Centralized Clearing

Corollary 1: *Larger market favors central clearing* $\rightarrow [\underline{k}_N, \bar{k}]$ *expands with* N.

- Complete Loss Mutualization $\succ$ Full Insurance for $k \geq \underline{k}_N$.
- Full Insurance advantage = joint default insurance (low value for large N).

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Corollary 2: *Central clearing may require less collateral than bil. trading.*

- With bilateral trading, collateral is the only insurance device available.
- For $N > 1$, region $[\underline{k}_N, \underline{k}_1]$: Bilateral $\rightarrow$ Full Insurance

  Multilateral $\rightarrow$ Complete Loss Mutualization.

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