OPTIMAL REGULATION OF CREDIT LINES

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The views presented here do not necessarily represent those of the Bank of Spain or the Eurosystem.
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  - E.g., reducing investment spending or selling assets in place (Campello et al., 2011)
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⇒ This paper provides a normative analysis of CLs
A contract-theoretical model of CLs in which

- Firms may need liquidity to avert their liquidation
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- Total liquidity demand depends on an aggregate state

At an ex-ante stage

- Firms and banks agree on CL contractual terms (interest rates + fees)
- Banks choose pre-arranged funding and create cash reserves

Banks finance drawdowns with pre-arranged funding & ex-post funding

- Ex-post funding is limited by banks’ revenue
- In high liquidity need states, (costly) pre-arranged funding is key to maintain lending
- Low levels of pre-arranged funding provide limited insurance

Parties optimally agree on the CL contractual terms (prices + pre-arranged funding)
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Parties optimally agree on the CL contractual terms (prices + pre-arranged funding)
Main results

1. I solve for the optimal private arrangement
   → CLs offer partial insurance against liquidity shocks if high liquidity need states are rare

2. I analyze the efficiency of the optimal private arrangement
   → Banks choose low levels of pre-arranged funding, reneging on CLs to often
   → The partial insurance feature & the fire-sale externality justify a regulatory intervention

3. I discuss the implementation of the constrained-efficient allocation
   → It can be implemented using a minimum requirement on pre-arranged funding

4. I examine the main determinants of the regulatory requirement
   → It should go up when the costs of maintaining liquidity buffers are lower, the costs of liquidating firms are higher, or high liquidity need states occur more frequently
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1. Introduction
2. Model
3. Equilibrium Analysis
4. Social welfare analysis
5. Conclusions
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Three dates: $t = 0, 1, 2$
Environment

- Three dates: $t = 0, 1, 2$
- Three types of risk-neutral agents

- Firms → 1 unit of funds at date 1 may be needed to avert their liquidation
- Banks → channel funds from investors to firms by means of CLs → (Junior) pre-arranged funding
  - $E$ is raised at $t = 0$
  - $D$ is raised at $t = 1$ as needed
- Investors → demand $R + \delta$ ($\delta \geq 0$) and $R > 1$ at date 2 for $E$ and $D$, respectively
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Measure one of identical firms that may need $\ell = 1$ at date 1 to avert liquidation.
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Individual uncertainty

$\ell$ is iid and revealed at $t = 1$ according to

$$\ell = \begin{cases} 1, & \text{w.p. } \alpha, \\ 0, & \text{w.p. } 1 - \alpha \end{cases}$$

$\alpha$: Firms’ demand for liquidity
Firms (I)

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  - $\alpha$: Firms’ demand for liquidity

- Aggregate uncertainty
  - $\alpha \sim g(\cdot)$ is publicly revealed at $t = 1$
  - $g(\cdot)$ is known when contracting at $t = 0$
At $t = 2$, the firm produces a cash flow

$$\tilde{x} = \begin{cases} X, & \text{if not liquidated,} \\ Q(z), & \text{if liquidated,} \end{cases}$$

where $z$ is the aggregate size of liquidations and $Q' \leq 0$. 

At most $Y < X$ can be pledged to outsiders $A_2$. $Y < R$ (spot lending is not feasible). Payoffs can be derived from a model of debt overhang with a secondary market for specialized assets.
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**A1.** $X - R > Q(0)$ (continuation return $>$ liquidation return)
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The representative bank offers CL contract \((B, f, E)\) to firms at \(t = 0\)

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Contractual terms \(B, f,\) and \(E\) are determined by competition at \(t = 0\)
The Allocation Problem

In high liquidity need states, $\alpha$ may be unfeasible to meet: $D < \alpha - E$

- The bank randomly reneges on some CLs
- Firms in need of cash are liquidated
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(Junior) pre-arranged funding $E$ helps to sustain lending over a wider range of $\alpha$’s

- Claims associated to $E$ can be diluted to raise additional funds at $t = 1$
- Yet, pre-arranged funding $E$ demands a higher return
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Solving for the unregulated CL contract

The representative bank’s problem:

- **Given aggregate liquidations** $z(\alpha)$, the expected payoff of the representative firm is maximized subject to
  - The participation constraint of investors who provide $E$
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$(\dagger)$ Symmetric eq. can fully characterize the unregulated CL $(B^U, f^U, E^U)$
The representative bank’s problem

Given aggregate liquidations \( z(\alpha) \), the representative bank maximizes

\[
\max_{B,f,E} \int_0^{\alpha} \left( (1 - \alpha)(X - f) + \alpha(X - B) \right) g(\alpha) d\alpha + \int_{\alpha}^{1} \left( (1 - \alpha)(X - f) + \alpha \left( \frac{L}{\alpha}(X - B) + (1 - \frac{L}{\alpha})Q(z) \right) \right) g(\alpha) d\alpha,
\]

subject to the initial investors’ participation constraint

\[
(R + \delta)E = \int_0^{\alpha} \left( \alpha B + (1 - \alpha)f - R(\alpha - E) \right) g(\alpha) d\alpha. \quad \text{(PC)}
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Unregulated CL contract

- Trade-off of increasing $E$:
  - Wider realizations of $\alpha$ can be insured
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- If high realizations of $\alpha$ are rare, $E$ is optimally chosen s.t. the unregulated CL contract does not provide full insurance
- Are liquidations in high liquidity need states due to partial insurance efficient?
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Solving for the constrained efficient CL contract

The social planner’s problem:

- The expected payoff of the representative firm is maximized subject to
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  2. **Aggregate liquidations**
In the presence of a fire-sale externality, there is scope for regulation.
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Contractual terms are chosen to equalize marginal social benefit to marginal social cost of $E$

Socially desirable to increase $E > E^U$
• By means of a regulation that requires banks to pre-finance CL drawdowns with a minimum $E$ of pre-arranged junior funding (e.g., Basel III liquidity ratios)
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Result

If $E = E^*$, then the regulated eq. is constrained efficient.
Implementation

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• Effects of regulation:
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  → A higher liquidation value is obtained if a liquidity need is not covered
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2. Adequate tuning of the minimum liquidity requirement is relevant
   → High requirements can make CLs excessively costly
   → Low requirements can have null impact on welfare
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- Chosen pre-funding is insufficient

A liquidity requirement that links pre-funded cash reserves to undrawn CLs can implement the constrained efficient allocation.

Though this requirement makes CLs more expensive, welfare improves by:

- More lending in high liquidity need states
- Higher liquidation values

The model can guide how regulators can tune up liquidity requirements on undrawn CLs in different jurisdictions.
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Appendix
Definition: Symmetric laissez-faire equilibrium

It consists of a choice \((B^U, f^U, E^U)\) for the representative bank and aggregate liquidations \(z^U(\alpha)\) such that

1. Given \(z^U(\alpha), (B^U, f^U, E^U)\) solves the bank’s optimization problem, that is,

\[
\max_{B,f,E} V(B, f, E)
\]

subject to the participation constraint (PC) of initial investors.

2. Given \((B^U, f^U, E^U)\), aggregate liquidations are computed as \(z^U(\alpha) = \alpha - L\ \ \forall \alpha\), where

\[
L = \begin{cases} 
\alpha, & \text{if } \alpha \leq \bar{\alpha}, \\
\frac{RE^U + (1 - \alpha)f^U}{R - B^U}, & \text{if } \alpha > \bar{\alpha}.
\end{cases}
\]
Effect of the regulatory requirement on welfare

(A) Pre-arranged funding vs. Fire-sale externality intensity

(B) Welfare vs. Fire-sale externality intensity

- Laissez-faire
- Planner’s solution
Effect of the regulatory requirement on welfare

Welfare Gain (% relative to laissez-faire regime)

Regulatory Requirement $E$

$E^U$ $E^*$