Self-Fulfilling Credit Market Freezes

Lucian Bebchuk

Harvard Law School and NBER

Itay Goldstein

Wharton School, University of Pennsylvania

Motivation

- One of the interesting features of the financial crisis has been a **credit freeze**, whereby banks did not lend capital available to them.
- Governments have used various policy measures aimed at obtaining a **credit thaw**.
- Analyzing and evaluating these policy responses requires a model that is clear about the source of a freeze.
- We develop such a model and are able to identify the payoffs, limits, and relative desirability of alternative policy responses.

Credit Freezes as Coordination Failures

- Our model suggests coordination failures as a source of credit freeze.
- We describe an economy, where firms are interdependent:
  - Firm A buys inputs from firm B, whose employees are customers of firm C, who buys inputs from firm A, etc.
- In such an economy, the success of a firm depends on the success of other firms, and hence lending by a bank is worthwhile if other banks lend.
- Then, credit freezes arise as a self-fulfilling belief, because banks believe other banks are not going to lend.

Triggers and Government Policy

- We analyze what triggers a freeze and how the government can stop it.
  - Infusion of capital to banks enhances lending coordination to some extent (by increasing confidence that firms will have enough capital to succeed), but banks may still fail to coordinate on lending the capital.
  - Direct lending to firms is better at resolving the coordination problem, but problematic since governments don't have the expertise to identify good borrowers.
  - We analyze other policy measures aimed at obtaining better results.

Some Related Literature

- Strategic complementarities in the macro economy used here have been motivated before, e.g., in Cooper and John (1988).
- The use of global games to analyze self-fulfilling crises and the effectiveness of policy goes back to Carlsson and van Damme (1993), Morris and Shin (1998, 2004, etc.), Goldstein and Pauzner (2005), and others.
- Analysis of capital infusion, lender of last resort policy, etc. has been conducted in various papers, e.g., Rochet and Vives (2004).
    - Main difference is that here the infusion of capital to banks does not solve the problem, as banks may still fail to coordinate on lending. This leads to other policy tools, and their problems due to government's lack of information.

Model

- Continuum *[0,K]* of banks, each one holds $1.
- Need to decide whether to invest in a risk free asset, generating 1 (risk free rate *r* suppressed here), or lend to operating firms.
- Bad operating firms always generate 0. Good operating firms may generate *1+R*, depending if projects succeed
- Banks can tell good firms from bad firms, and obtain the entire surplus from lending to good firms.
- Return from lending is thus:

$$\begin{cases} 1+R & if \quad aL+\theta \geq b \\ 0 & if \quad aL+\theta < b \end{cases}$$

- Here:
  - θ is fundamental of the economy.
  - L is mass of operating firms obtaining financing. In benchmark model, $L = nK$, where n is proportion of banks deciding to lend.
- Fundamental θ is normally distributed with mean y (public news) and standard deviation σ_θ (precision, $\tau_\theta = \frac{1}{(\sigma_\theta)^2}$).
- Banks obtain signals: $x_i = \theta + \varepsilon_i$, where ε_i is normally distributed with mean 0 and standard deviation σ_p (precision, $\tau_p = \frac{1}{(\sigma_p)^2}$).

Equilibrium

- Applying global-games techniques, as long as $\frac{\tau_\theta}{\sqrt{\tau_p}} \leq \frac{\sqrt{2\pi}}{aK}$, there is a unique equilibrium, where:
  - Banks lend if and only if their signals are above x^*.
  - Real projects succeed if and only if the fundamentals are above θ^*:

$$\theta^* = b - aK + aK\Phi\left(\frac{\tau_\theta}{\sqrt{\tau_p}}\left(\theta^* - y + \frac{\sqrt{\tau_\theta + \tau_p}}{\tau_\theta}\Phi^{-1}\left(\frac{1}{1+R}\right)\right)\right)$$

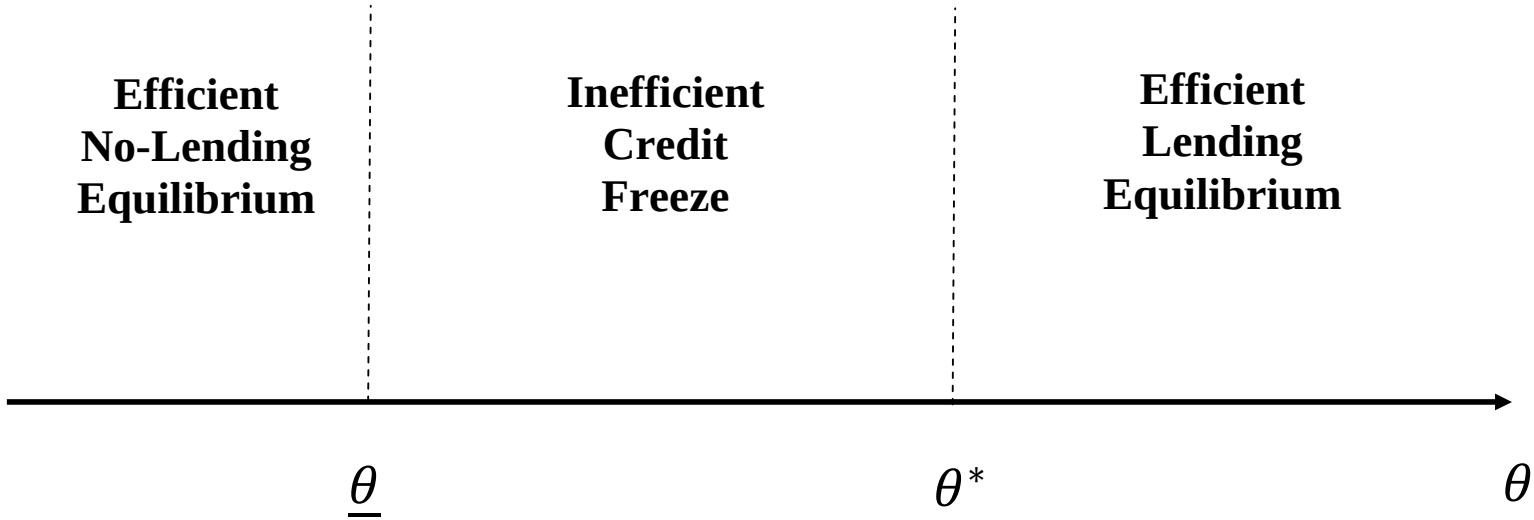
Credit Freeze

- When banks observe very precise signals, i.e., τ_p approaches infinity, x^* and θ^* converge to the same value:

$$\theta^* = b - aK + aK\frac{1}{1+R}$$

- Three ranges of fundamentals:
  - Below $b - aK$: **Efficient No-Lending Equilibrium**.
  - Between $b - aK$ and $b - aK + aK\frac{1}{1+R}$: **Inefficient credit freeze**.
  - Above $b - aK + aK\frac{1}{1+R}$: **Efficient Lending Equilibrium**.

Equilibrium Outcomes



- What determines the threshold?
- When observing θ^*, a bank is indifferent between lending and not lending.
  - The bank is certain about the level of the fundamentals.
  - But, faces a strategic risk about what other banks are going to do. He expects a uniform distribution about the proportion of other banks that decide to lend.
- This gives the following indifference condition, which can be rearranged to express θ^*:

$$1 = \left(1 - \frac{b - \theta^*}{aK}\right)(1 + R)$$

What Triggers A Credit Freeze?

- A downward shift in fundamentals:
  - If fundamentals drop from a level above $b - aK + aK\frac{1}{1+R}$ to a level below it.
- A decrease in banks' capital:
  - Suppose that banks lost a fraction l of their capital, the threshold for a credit freeze would increase to:

$$\theta^* = b - aK(1-l) + aK(1-l)\frac{1}{1+R}$$

Government Policy 1: Capital Infusion to Banks

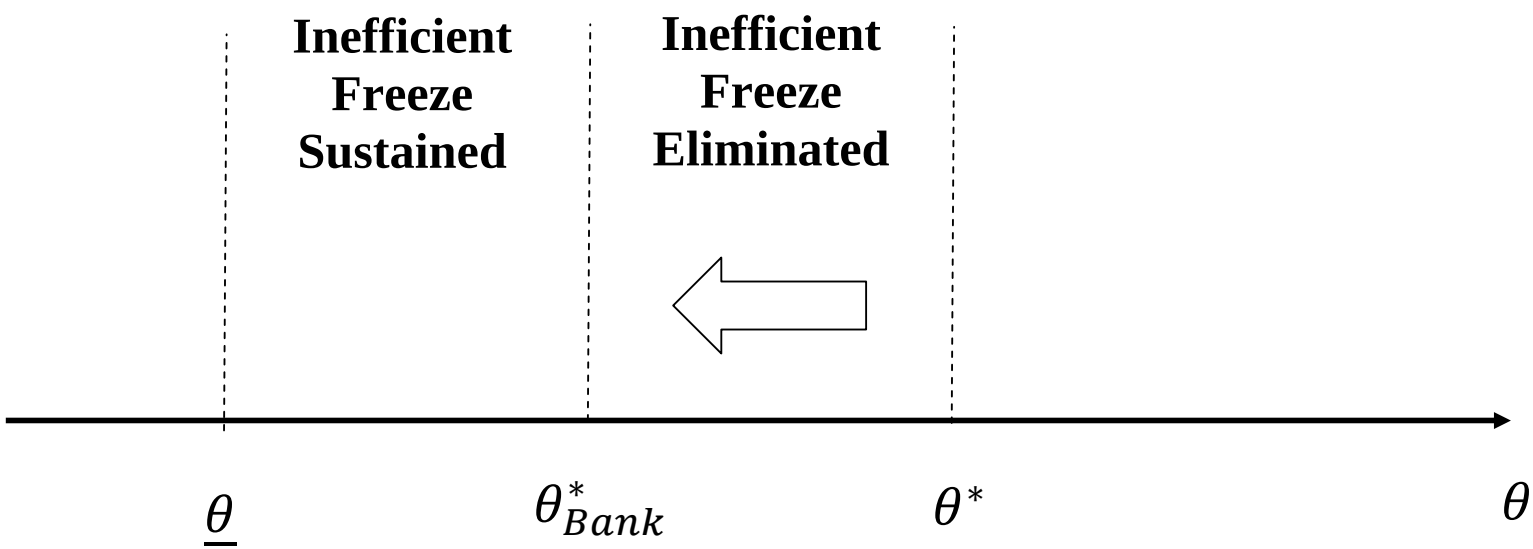
- Suppose that the government has total capital of $\alpha l K$.
- What is the effect of infusing that capital to the banking system?
- This will reduce the likelihood of a freeze to:

$$\theta^*_{Bank} = b - aK(1-(1-\alpha)l) + aK(1-(1-\alpha)l)\frac{1}{1+R}$$

- But, there are still inefficient credit freezes that occur just because banks believe that other banks are not going to lend to operating firms.
- What is the mechanism at work?

- The additional capital available to banks gives other banks confidence that operating firms will do well if they receive financing, and may induce them to lend capital they already have.
    - Recall the indifference condition behind the threshold θ^*: with additional capital available to banks, a uniform distribution for the proportion of lending banks implies more capital being lent and higher likelihood of success. This reduces the fundamental θ^* that makes banks indifferent.
- But, coordination failures still arise, as banks choose not to lend if they expect other banks will not lend.

The Effect of Capital Infusion to Banks



Government Policy 2: Direct Lending to Operating Firms

- Under the policy discussed thus far, the government did not provide the capital to those who need it (operating firms) but rather to intermediaries who might choose not to use it.
- One could consider a “lender-of-last-resort” policy to provide capital directly to operating firms.
- This is indeed more efficient in getting the economy out of a credit freeze and inducing banks to lend, yielding the threshold:

$$\theta^*_{Direct} = b - aK(1-(1-\alpha)l) + aK(1-l)\frac{1}{1+R}$$

- Recall that: $\theta^*_{Bank} = b - aK(1-(1-\alpha)l) + aK(1-(1-\alpha)l)\frac{1}{1+R}$

- The fact that the government provides the capital directly to operating firms makes banks even more confident that real projects will succeed, and induces them more strongly to lend.
  - This is in comparison with a situation where the capital goes to banks, who may fail to coordinate on lending it.
- But, there are inefficiencies with direct lending by the government due to the fact that it cannot tell the difference between bad and good firms.

- Suppose the proportion of bad firms is β (assumption that bad firms generate externalities implies that direct lending gets its best chance…).
- Then, comparing capital infusion to banks with direct lending yields:
  - $(\mathbf{1}-(\mathbf{1}-\boldsymbol{\alpha})\boldsymbol{l})\boldsymbol{K}-(\mathbf{1}-\boldsymbol{l})\boldsymbol{K}>0$ **below** $\boldsymbol{\theta}^{*}_{\boldsymbol{Direct}}$**.**
    - Here, credit freeze occurs in both regimes; under direct lending, government ends up making bad loans (to good and bad firms).
  - $(\mathbf{1}-(\mathbf{1}-\boldsymbol{\alpha})\boldsymbol{l})\boldsymbol{K}-\big(\mathbf{1}-\boldsymbol{l}+\boldsymbol{\alpha l}(\mathbf{1}-\boldsymbol{\beta})\big)\boldsymbol{K}(\mathbf{1}+\boldsymbol{R})$ **between** $\boldsymbol{\theta}^{*}_{\boldsymbol{Direct}}$ **and** $\boldsymbol{\theta}^{*}_{\boldsymbol{Bank}}$**.**
    - Here, direct lending prevents a credit freeze, but generates waste due to lending to bad firms. Sign is ambiguous.

- $(\mathbf{1}-(\mathbf{1}-\boldsymbol{\alpha})\boldsymbol{l})\boldsymbol{K}(\mathbf{1}+\boldsymbol{R})-\big(\mathbf{1}-\boldsymbol{l}+\boldsymbol{\alpha l}(\mathbf{1}-\boldsymbol{\beta})\big)\boldsymbol{K}(\mathbf{1}+\boldsymbol{R})>0$

  above $\boldsymbol{\theta^*_{Bank}}$.

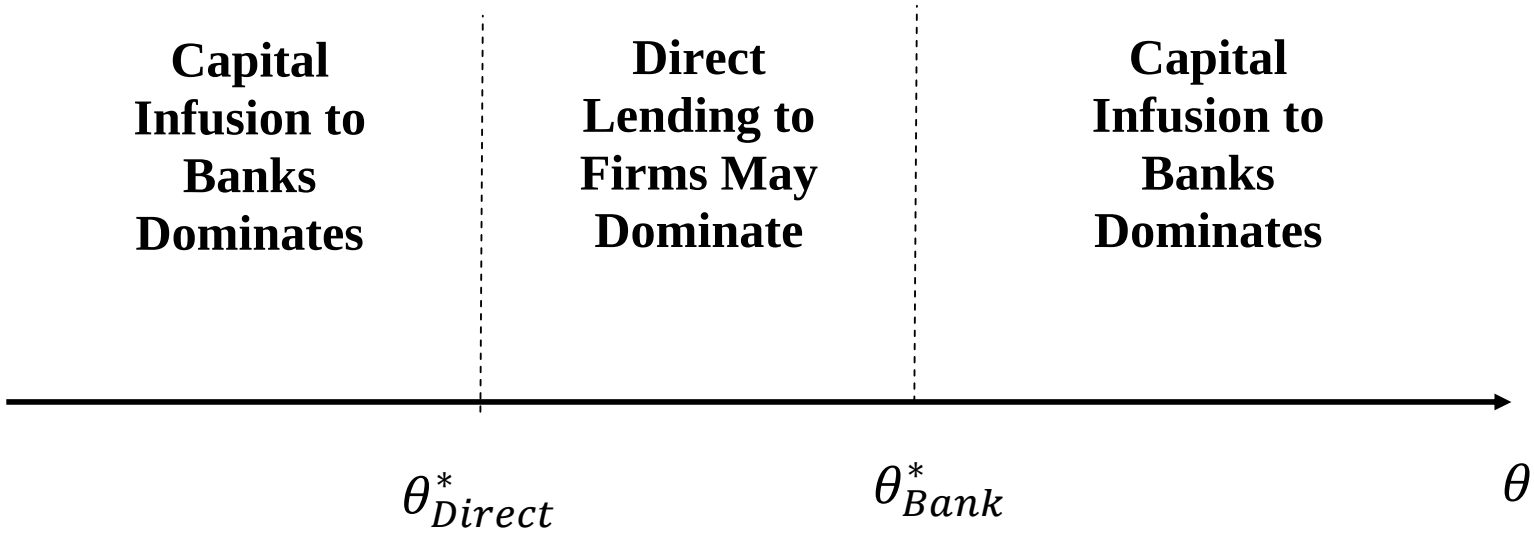
  - Here, credit freeze does not occur in both regimes; under direct lending, government ends up making bad loans (to bad firms).

- Overall, comparison yields:

$$\alpha lK\Phi\left(\frac{\theta^*_{Direct}-y}{\sigma_\theta}\right)+\big(\alpha\beta l-\big(1-l+\alpha l(1-\beta)\big)R\big)K\left[\Phi\left(\frac{\theta^*_{Bank}-y}{\sigma_\theta}\right)-\Phi\left(\frac{\theta^*_{Direct}-y}{\sigma_\theta}\right)\right]+\alpha\beta lK(1+R)\left[1-\Phi\left(\frac{\theta^*_{Bank}-y}{\sigma_\theta}\right)\right].$$

- **Direct lending is preferred when $\boldsymbol{y}$ (known fundamental) is in an intermediate range, $\boldsymbol{\beta}$ is low, and $\boldsymbol{R}$ is high.**

Comparing Capital Infusion to Banks with Direct Lending to Firms



Government Policy 3: Government Funds

- The challenge is to have a policy that achieves the lower likelihood of credit freeze while utilizing the expertise of private agents in finding good banks.
- Suppose that the government puts its capital in funds managed by private agents, who are compensated only on returns above 1.
- Private agents are motivated to always lend to good operating firms. Hence, the threshold for the occurrence of a credit freeze will be (the low) θ^*_{Direct}.

- Comparing capital infusion to banks with government funds yields:
  - $(\mathbf{1}-(\mathbf{1}-\boldsymbol{\alpha})\boldsymbol{l})\boldsymbol{K}-(\mathbf{1}-\boldsymbol{l})\boldsymbol{K}>0$ **below** $\boldsymbol{\theta}^{*}_{\boldsymbol{Direct}}$**.**
    - Here, credit freeze occurs in both regimes; under government funds, government's capital is wasted because of the freeze.
  - $(\mathbf{1}-(\mathbf{1}-\boldsymbol{\alpha})\boldsymbol{l})\boldsymbol{K}-(\mathbf{1}-(\mathbf{1}-\boldsymbol{\alpha})\boldsymbol{l})\boldsymbol{K}(\mathbf{1}+\boldsymbol{R})<0$ **between** $\boldsymbol{\theta}^{*}_{\boldsymbol{Direct}}$ **and** $\boldsymbol{\theta}^{*}_{\boldsymbol{Bank}}$**.**
    - Here, government funds prevent a credit freeze and generate a better outcome.
  - **0 above** $\boldsymbol{\theta}^{*}_{\boldsymbol{Bank}}$**.**
    - Here, credit freeze doesn't occur in both; results are identical.

- Overall, comparison yields:

  $\alpha l K \Phi\left(\frac{\theta^*_{Direct}-y}{\sigma_\theta}\right) - (1-(1-\alpha)l)RK\left[\Phi\left(\frac{\theta^*_{Bank}-y}{\sigma_\theta}\right) - \Phi\left(\frac{\theta^*_{Direct}-y}{\sigma_\theta}\right)\right]$.

- Placing the capital at the hands of government funds managed by private agents prevents the inefficiency associated with lending to bad firms, but doesn't help with the inefficiency that government's capital gets wasted in case of a credit freeze.

- **Government funds are preferred (relative to infusion of capital to banks) when *y* and *R* are high.**

- Capital infusion to banks is still dominant when *y* is low.

Government Policy 4: Guarantees

- The problem with the previous two mechanisms is that government capital is being lent in a credit freeze.
- A potential way to prevent this, while still encouraging banks to lend is for the government to provide guarantees to banks in case their loans fail.
- Suppose that the government provides a return γ to banks that lent to operating firms and failed. We obtain:

$$\theta^*_{Guarantees} = b - aK(1-l) + aK(1-l)\frac{1-\gamma}{1+R-\gamma}$$

- To provide comparison with the previous mechanism, let's impose a budget constraint, and assume that the maximum that the government can guarantee is its available capital $\alpha l K$. Hence, $\gamma = \frac{\alpha l}{(1-l)} < 1$.

- It can be shown then that $\theta^*_{Guarantees} > \theta^*_{Direct}$:

  - Lending the capital is more effective in preventing credit freeze than providing it as guarantees.

- But, in a credit freeze, the guarantees regime does not generate a waste of government capital, as the capital is not being lent.

- Overall, guarantees will be preferred when *y* is low.

Government Policy 5: Matching / Government Funds with Private Equity Participation

- Suppose that the government gives αl to a bank under the condition that it lends this amount as well as its own money $(1 - l)$ to operating firms.
- Now, a bank faces the following tradeoff:
  - Lend: $(1 - l + \alpha l)(1 + R)$ in case of success, and *0* otherwise.
  - Not lend: $(1 - l)$.
- The result is that banks lend if and only if the fundamental is below θ^*_{Direct}. They only lend to good firms.

- Hence, this mechanism achieves a better outcome that the other mechanisms we considered.
- Relative to direct lending by the government:
  - Banks are provided stronger incentive to lend.
  - Government capital is not guaranteed to get into the economy.
  - These effects cancel out with each other, generating the same threshold θ^*_{Direct}.
  - Moreover, money is only lent to successful projects.
- Open question: what is optimal degree of private equity participation?

Conclusion

- A model of credit freezes as coordination failures is developed.
- Credit freezes may be triggered by drop in fundamentals or loss of capital.
- The model is used to analyze various government tools and provides implications as to their payoffs and limits.
- Capital infusion to banks can eliminate some but not all inefficient credit freezes, while direct lending to firms is better at this but might be wasteful.
- Among non-traditional responses analyzed, government funds with private capital participation may be most effective.