Amplification: Conceptual and Empirical Frameworks

IMF-LSE Symposium

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Different Sources of Amplification

- Direct Contagion
  - Financial institutions are interconnected; failure of one adversely affects other connected institutions
- Indirect Contagion
  - Financial institutions interact via the market; the failure of one adversely affects market conditions which hurt other institutions
- Strategic Complementarities
  - Financial institutions want to take the same action at the same time amplifying an underlying shock

Understanding Strategic Complementarities:

Example Based on Bebchuk and Goldstein (2011)

- Continuum *[0,K]* of banks, each one holds $1
- Need to decide whether to invest in a risk free asset, generating 1, or lend
- Lending generates *1+R* if projects succeed. Specifically, return is:

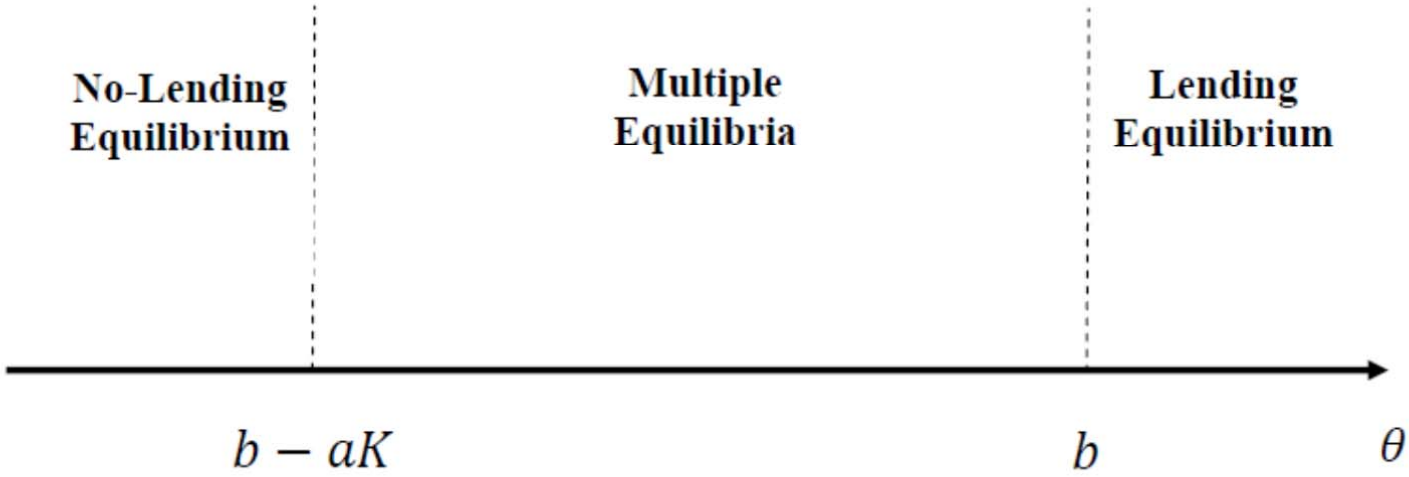
$$\begin{cases} 1+R & if \quad aL+\theta \geq b \\ 0 & if \quad aL+\theta < b \end{cases}$$

  - θ is fundamental; L is aggregate lending. $L = nK$, where n is proportion of banks deciding to lend

Multiple Equilibria

- Three ranges of fundamentals (θ):
  - **Below $b - aK$** (lower dominance region):
    - Unique equilibrium: (efficient) credit freeze.
  - **Between $b - aK$ and b** (intermediate region):
    - Multiple equilibria: either lending or (inefficient) credit freeze.
  - **Above b** (upper dominance region):
    - Unique equilibrium: lending.

Equilibrium Outcomes for Common Knowledge



Refining Predictions: Global-Games Approach

- Suppose that 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, $\tau_p = \frac{1}{(\sigma_p)^2}$).
- As long as private information is sufficiently precise relative to public information (formally, $\frac{\tau_\theta}{\sqrt{\tau_p}} \leq \frac{\sqrt{2\pi}}{aK}$), there is a unique equilibrium, where
  - Banks lend if and only if their signals are above x^*.
  - Lending succeed if and only if the fundamentals are above θ^*:

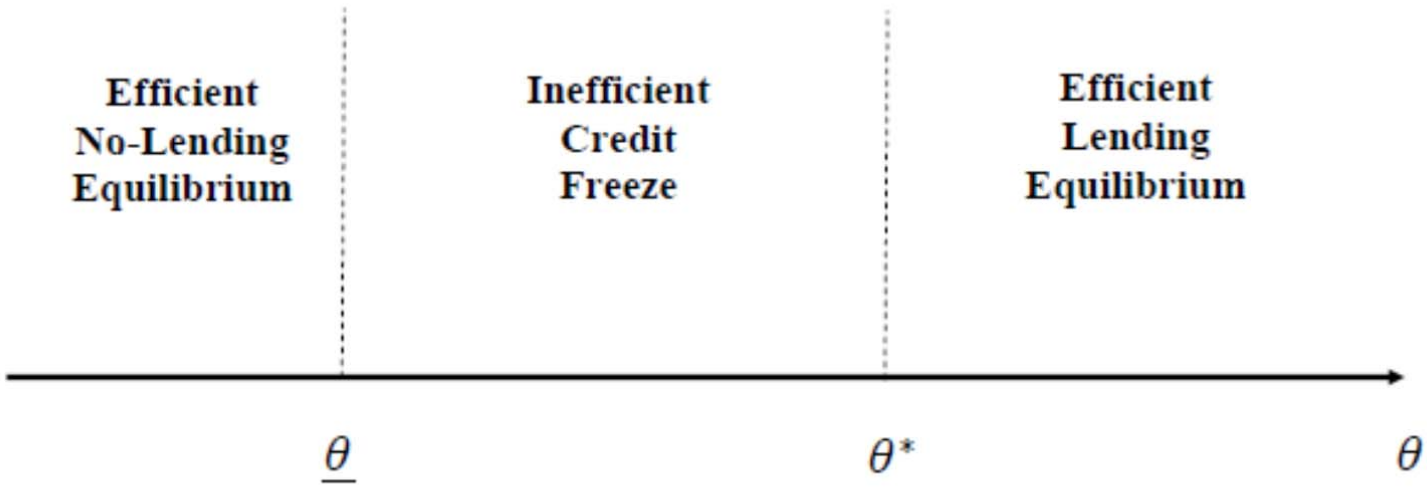
Equilibrium Characterization (limit case)

- 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 credit freeze**.
  - Between $b - aK$ and $b - aK + aK\frac{1}{1+R}$: **Inefficient credit freeze**.
  - Above $b - aK + aK\frac{1}{1+R}$: **No credit freeze**.

Equilibrium Outcomes



Amplification

- What may trigger a credit freeze?
  - **A downward shift in fundamentals**:
    - Fundamentals drop to a level below θ^*.
  - **A decrease in banks' capital**:
    - Suppose that banks lost a fraction l of their capital, the threshold for a credit freeze would increase.
- Small changes in underlying fundamentals or bank conditions can lead to big effects on outcome due to endogenous banks' response.

Capturing Sources of Amplification in Stress Tests

- Direct Contagion
  - Understanding network of institutions' interconnections and exposures
- Indirect Contagion
  - Modelling institutions' effects on the markets and vice versa
    - Price pressures induced by asset fire sales
    - Effect of price decrease on other institutions
  - These effects might be different over time:
    - E.g., greater price impact in downturns

How to Account for Strategic Complementarities

- More difficult…
- First, need to understand theoretical reasons for complementarities:
  - Within institutions:
    - Liquidity transformation
    - Rollover and default dynamics
  - Across institutions:
    - Network externalities
    - Relative performance

- Second, find empirical evidence for the presence of complementarities
  - Similar behavior across institutions in certain times
  - Stronger aggregate reaction in cases of stronger complementarities (Chen, Goldstein, and Jiang, 2010)
- Third, consider mitigating factors; institutions that will take a contrarian action and stabilize the market
  - It is important to consider all market players and their different motives and behaviors