



Amsterdam Business School

Collective Strategic Default: Bailouts and Repayment Incentives

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Motivation

- Financial / banking crises
 - Transition economies 90s; Russia 98
 - Chile 86, Mexico 94, Argentina 2001
 - Asia 97
 - France Credit Lyonnais 95, US S&L mid 80's

- Costly
 - Caprio and Klingebiel (1996), Lindgren et. al.(1999), Hoggarth, Reis and Saporta (2001)

Motivation (cont'd)

- Determinants:
 - Macro: adversely affects borrowers' performance
 - Depositor panics: self-fulfilling expectations

- Strategic default of solvent firms
 - Eastern Europe: low penalties for delaying repayments
 - Mexico: De Luna-Martinez (2000) identifies the reluctance of borrowers to repay their loans as one of the causes for '94 crisis
 - Minor solvency concerns → debtors stop repaying

Motivation (cont'd)

- What about developed economies?
 - Martin Feldstein (FT, May 7): suggests that structured finance and securitization has created a coordination failure among borrowers which might cause the deepest and longest recession in the US in the last decades
 - Kahn and Roberds (1998): banks with large net debt position relative to their capital find tempting to default or to delay the sending of payment messages to other banks
 - imperfect monitoring by the managers of the payment network or governmental regulators

Exercise

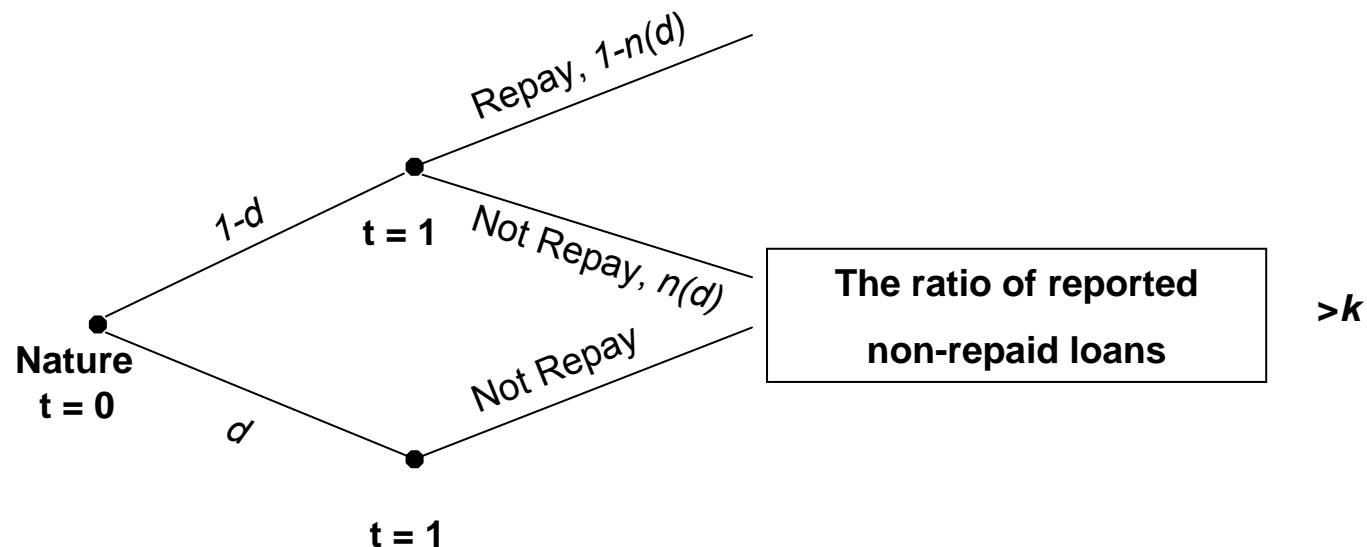
- Simplified framework:
 - One bank, two solvent debtor firms
 - The bank goes bankrupt if *both* firms default
 - Payoffs for firms:

Actions	Repay	Not Repay
Repay	9,9	4,0
Not Repay	0,4	6,6

- If each believes that the other chooses “Not Repay”, optimal strategy is “Not Repay”. The bank fails
- A solvent firm would claim inability to repay if it expects a sufficient number of other firms to do so as well, thus reducing bank’s enforcement ability

Exercise Extended

- A bank and many debtor firms
 - d have 0 cash, $(1-d)$ are solvent
 - the bank is bankrupt if $k > d$ do not repay
- Risk of bank failure due to strategic default, even under strong fundamentals



Research Questions

- What is the incidence of collective strategic default leading to bank collapse?
- When is collective strategic default most likely?
- Role of LOLR under opportunistic behavior of borrowers?

Related Literature

- Strategic default (individual)
 - Townsend 1979, Gale and Hellwig 1985, Bolton and Scharfstein 1990, Akerlof and Romer 1993, Johnson et al 2000
- Central Bank as a LOLR: non-performing loans
 - Mitchell 1995, Aghion, Bolton and Fries 1999
- Collective strategic default
 - Bond and Rai 2005
- Global Games
 - Carlsson and van Damme 1993, Morris and Shin 1998, Rochet and Vives 2004, Goldstein and Pauzner 2005

Paper Contribution

- Derives an ex-post optimal solution for Central Bank intervention as a LOLR which has an ex-ante influence on commercial bank / firms behavior
- Enriches the global games literature by looking to a specific coordination problem on the asset side

The Model

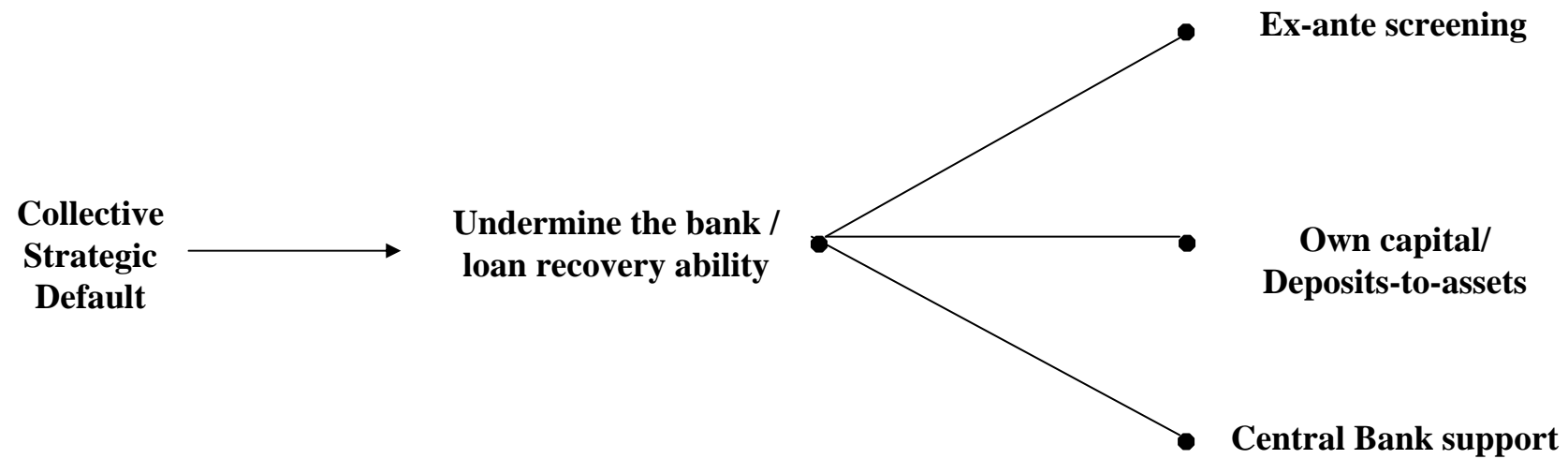
- Static economy with three periods: 0, 1, 2

- Agents
 - Single bank with no capital
 - Continuum of identical risk-neutral firms uniformly distributed over $[0,1]$
 - Central Bank

- Passive depositors; alternative investment: costless storage

- No discounting

Intuition



Extensive form game

Date 0:

- bank collects uninsured deposits; chooses effort e (common knowledge), invests
- nature draws fundamentals d according to the prior normal distribution;
 - realization of d is not common knowledge
 - each debtor receives a private noisy signal

▪ Date 1:

- based on their signals, the debtor firms update their beliefs about bank fundamentals and simultaneously decide to repay their loans or not

▪ Date 2:

- based on the reported number of non-performing loans, the CB decides on the optimal BailOut Amount (BOA)
- the payoffs of the game are revealed and distributed

Agents

1. Commercial Bank

- Date 0
 - finances itself by taking uninsured deposits; total amount q ;
 - invests q in a continuum of identical risky loans of size l each
- Date 1
 - deposits mature; nominal value is $Q > q$
 - return for each loan is realized and yields $D > l$

No cash	No Equity
$\sum \text{Loans} = q$	$\sum \text{Deposits} = q$

Table 1. Bank's balance sheet at date 0.

- Q normalized such that $Q < l$
- The bank is the most efficient at extracting cash from debtor firms due to its collection skills (Diamond and Rajan 1998, 2001)

Agents

1. Commercial Bank (cont'd)

- At date 0 the bank set up loan screening strategy
 - costly effort e ; $c(e) = ((e^2)/2)D$
 - e lies in $[0, 1]$
 - e is common knowledge
- d is ratio of firms in genuine financial distress
 - represents bank fundamentals
 - is normally distributed with mean $\mu - e$ and variance $1/\alpha$
 - lies in $[0, 1]$
 - realization of d is not common knowledge

Agents

2. Firms

- *Good firm*: a solvent firm with positive cash flow $C > D$ at date 1
 - Actions: repay in full or not repay
- *Bad Firm*: an insolvent firm with zero cash at date 1
 - Action: not repay
- Each debtor firm receives a noisy signal about bank's fundamentals:

$$x_i = d + \varepsilon_i$$

with ε_i normally distributed $(0, 1/\beta)$, independent of d and i.i.d. across firms

Agents

3. The Central Bank

- Objective: to minimize the moral hazard
- It can verify at zero cost the number of non-performing loans reported
- It can not differentiate between bad firms and mimicking good firms
 - Actions: full bailout or no bailout
- Two cases:
 - *Inactive CB*: ex-ante declares no bailout policy, ex-post is consistent
 - *Active CB*: might provide additional funds if necessary

Payoff Functions

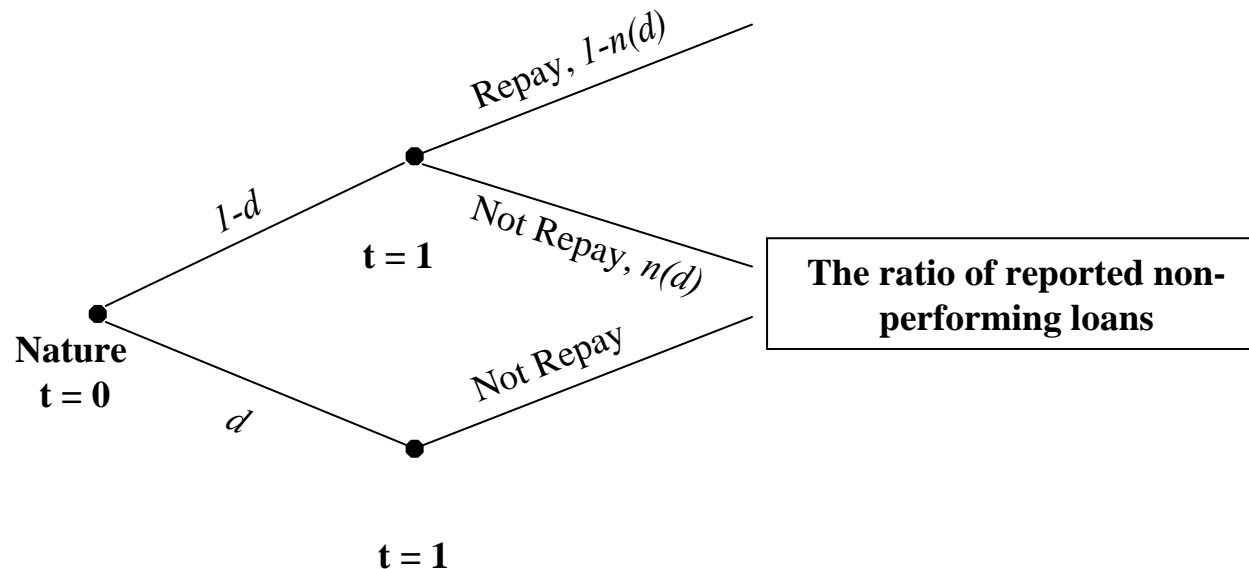
1. Firms

- Good Firm's Payoff:
- $D > X$, $F > 0$, $V > D$
- A default is triggered by non repayment at date 1

	Repay	Not Repay
Bank Survives	V	$-F$
Bank Fails	0	$D-X$

Payoff Functions

1. Firms (cont'd)



- $z(d) = (1-d)n(d)$, the necessary fraction of firms which should choose not to repay their loan such that the bank will fail
- $z(d)$ is decreasing in d

Payoff Functions

2. Commercial Bank

- Default condition at date 2:

$$[1 - d - \underbrace{(1 - d)n(d)}_{z(d)}] * D < Q$$

- Upon bankruptcy, bank can no longer enforce contracts
- The bank's expected payoff *if it survives*:

$$D * \underbrace{E_d[(1 - d) * (1 - n(d))]}_{\text{expected ratio of repaying firms}} + (F + D) * \underbrace{E_d[(1 - d) * n(d)]}_{\text{expected ratio of mimicking firms}} - Q - c(e),$$

- The bank's expected payoff *if it fails*: $-c(e)$

Payoff Functions

3. The Central Bank

- CB minimizes expected cost by trading off social cost of bank failure vs. cost of full intervention
 - Marginal cost of intervention γ ; positive and common knowledge
- The expected cost if CB decides to bailout commercial bank

$$-\gamma[Q - \underbrace{D * (1 - d) * (1 - n(d))}_{\text{repaid loans}}],$$

- The expected social cost if the CB allows commercial bank to go bankrupt

$$-V * \underbrace{(1 - d) * (1 - n(d))}_{\text{ratio of repaying firms}}.$$

Global Games Methodology

- Common knowledge creates self-fulfilling beliefs equilibria
- Global games are games with incomplete information
 - underlying fundamentals are not common knowledge
 - players observe a *noisy signal* of the underlying state
- Small amount of noise can pin down a *unique equilibrium*
 - agents play threshold strategies
- Central assumption: *individual actions are strategic complements*

Main Findings

- Active CB intervention decision: minimizes expected cost function
- CB is more likely to intervene under high social cost caused by the bank closure, and is more likely to allow bank failure in the case of high intervention costs
- The CB intervenes and bailout the bank when

$$NPL^* \leq \frac{V + \gamma D - \gamma Q}{V + \gamma D}$$

$$NPL(d) = d + (1 - d)n(d)$$

- This threshold is decreasing in γ and in Q , and increasing in D

Main Findings (cont'd)

Inactive CB case:

$$d^* + \frac{Q}{D} = \frac{V + F}{V + F + D - X}$$

▪ Higher X , F or $V \rightarrow$ Higher d^*

▪ A lower deposit-to-assets ratio

\rightarrow higher thresholds d^* , d^{**}

\rightarrow a lower probability of bank failure due to collective strategic default

Active CB case:

$$d^{**} = 1 - \frac{Q}{D}$$

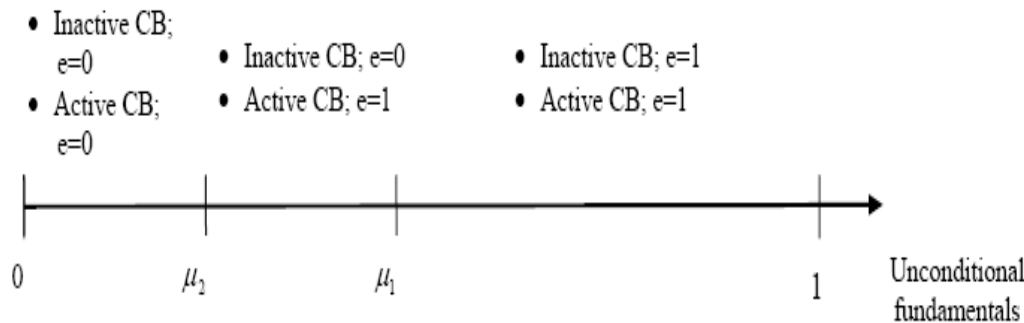
An active Central Bank can mitigate strategic default behavior of debtor firms, as it allows commercial banks to survive more often, preserving its loan enforcement capacity

$$d^* < d^{**}$$

Main Findings (cont'd)

- The CB meets its objective only when the marginal cost of intervention is high enough

$$\gamma > \gamma^* = \frac{V(D-X)}{Q(V+F) + (D-X)(Q-D)}$$



$$\mu_1 = \frac{V+F}{V+F+D-X} - \frac{Q}{D}$$

$$\mu_2 = 1 - \frac{Q}{D} - \frac{\gamma Q}{V+\gamma D}$$

Comparative Statics

- Higher probability for a bank failure (lower thresholds d^* and d^{**}) AND higher coordination among solvent firms for
 - $\uparrow \mu$, the unconditional bank fundamentals
 - $\uparrow \gamma$, the marginal cost of intervention
 - $\uparrow Q$, the nominal value of deposits at date 1
 - $\downarrow D$, the nominal value of loan at date 1

Conclusions

- When financial environment is characterized by inadequate bankruptcy laws and poor disclosure rules, banks may be subject to risk of failure even when fundamentals are strong due to a coordination problem among debtors
- Marginal cost of intervention has a double-edge effect. Higher cost
 - mitigates the moral hazard problem at the commercial bank level
 - increases the probability of bank failure due to collective strategic default
- Comparing the two scenarios inactive CB vs. active CB, commercial bank survives more often and CB meets its objective when CB is active and the cost of intervention is high
- High expected profitability is indispensable for banks to protect themselves against collective strategic default from debtor firms. Low deposit-to-asset ratio allows commercial banks to survive more often