Dynamic Coordination and Bankruptcy Regulations

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Motivation

Coordination failures among creditors are costly

- runs on banks and corporate debt
- many procedures are designed to prevent these failures

Bankruptcy protection: automatic stay

- firm can file for bankruptcy when k creditors leave
- creditors must stop collection if debtors declare bankruptcy

Prior to bankruptcy: avoidable preference

- payments made m days prior to bankruptcy are reversed
- all remaining creditors share the proceeds
- typical clawback window ranges from 3 months to 2 years
- many bankruptcies involve clawback: Lehman, WaMu, GM

Research Question and Modelling Innovation

Aim at promoting ex-post coordination in bankruptcy

- eliminate "first-come-first-serve" feature in creditor's payoff
- restricting collection in bankruptcy may motivate early runs

What is the ex-ante effect on creditor's incentive to stay invested, when the firm is relatively healthy?

- regulator's design of avoidable preference m
- firm's optimal timing to file for bankruptcy: threshold k

Dynamic coordination game w/ incomplete information

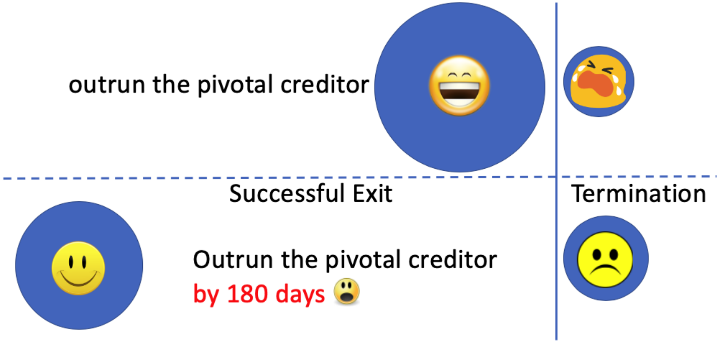
- based on clock game
- Abreu & Brunnermeier 03, Brunnermeier & Morgan 10
- our contribution: endogenize payoffs to creditors and bankruptcy procedures (m and k).

Robust Economic Intuitions: Key Tradeoffs

Ex-post coordination may exacerbate ex-ante run

e.g., avoidable preference – clawback window: $m = 180$ v.s. 0

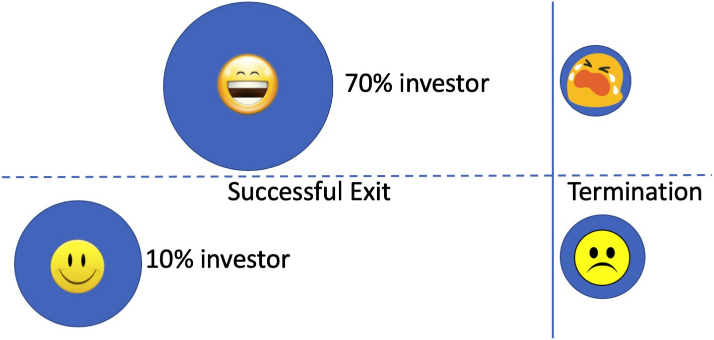
- large payoff gap w/o clawback incentivizes runs
- incentive to stay: higher payoff for creditors in bankruptcy
- incentive to run: need to run sooner to exit successfully



Robust Economic Intuitions: Key Tradeoffs

Bankruptcy threshold: $k = 70\%$ **(late) v.s.** 10% **(early)**

- firm is more robust: takes longer for 70% creditors to leave
- creditors are more patient: easy to be among first 70%
- creditors are more eager to run: remaining 30% receive less



Firm and Creditors

The firm's assets Y_t

- $Y_t = Ae^{gt}$ until a hidden bad shock at $t_0 \sim \text{Poisson}(\lambda)$
- after t_0 — growth slows down to $g' \in [0, g)$

$$dY_t = (g' Y_t - w_t)dt$$

- w_t is the creditors' rate of exit
- exogenous termination at $t_0 + T$ (T is large, nonbinding)

A unit mass of long-term creditors, indexed by $i \in [0, 1]$

- initial debt level 1, interest rate g, no time discount
- performance-based covenants are gradually violated at $t_i \sim \text{Uniform}(t_0, t_0 + \eta)$
- privately decides when to exit, denoted by $t_i + \tau_i \geq t_i$
- promised repayment $e^{g(t_i+\tau_i)}$, outside return 0

Bankruptcy and Payoff to Creditors

Firm goes bankrupt when $k < 1$ creditors decide to exit

- k fraction of assets are liquid enough to make repayment
- for now, the bankruptcy threshold k is a parameter

Avoidable preference

- payments within m dates before bankruptcy are reversed
- assets + clawed back repayments are shared equally

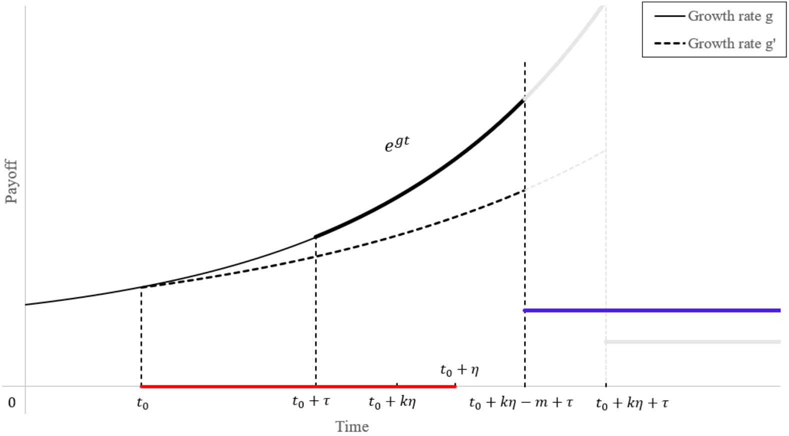
Payoff to creditors exiting at $t_i + \tau$ (symmetric τ_i)

- first $k - \frac{m}{\eta}$ creditors receive $e^{g(t_i+\tau)}$
- remaining $1 - k + \frac{m}{\eta}$ creditors each receives

$$\frac{1}{1-k+\frac{m}{\eta}}\left(Y_{t_0+k\eta+\tau} + \int_{t_0+k\eta+\tau-m}^{t_0+k\eta+\tau} \frac{e^{gt}}{\eta} dt\right) \equiv \alpha(\tau, m) e^{gt_0}$$

- can microfound w/ a costly restructuring & continuation

Timeline of the Game



FOC

Equilibrium Concept

Creditor chooses exit time $t_i + \tau_i$ to max expected payoff: FOC

$$\max_{\tau_i} \underbrace{\int_{t_i+\tau_i-\tau^*+m}^{\infty} e^{g(t_i+\tau_i)} \psi_k(t_k|t_i) dt_k}_{\text{successful exit: } t_i+\tau_i \leq t_k+\tau^*-m}$$

$$+ \underbrace{\int_0^{t_i+\tau_i-\tau^*+m} E[\alpha(\tau^*, m) e^{gt_0} | t_i, t_k] \psi_k(t_k|t_i) dt_k}_{\text{payoff in bankruptcy: } t_i+\tau_i > t_k+\tau^*-m}$$

- ψ_k: posterior belief of $t_k = t_0 + k\eta$ (creditor k gets signal)
- focus on symmetric equilibrium: $\tau_i^* = \tau^*$

Regulator chooses clawback window m to maximize welfare:

$$W(\tau^*(m)) = \int_{t_0+\tau^*}^{t_0+\tau^*+k\eta} \frac{1}{\eta} e^{gt} dt + Y_{t_0+\tau^*+k\eta}$$

Equivalent Welfare Measure: τ^*

Proposition: Maximizing welfare $W(m)$ is equivalent to maximizing waiting time $\tau^*(m)$

- clawback policy m is purely redistributional
- welfare implication through affecting creditors' strategy τ^*

Intuition for the result

- repayments start later $t_0 + \tau^*$
- bankruptcy occurs later $t_0 + \tau^* + k\eta$
- both channels improve asset accumulation after bad shock

Creditors' Strategy: Tradeoff Associated with Waiting

FOC w.r.t. τ from creditor's expected payoff payoff timeline

$$\underbrace{ge^{g(t_i+\tau^*)}\int_{t_i+m}^{\infty} f_k(t_k|t_i)dt_k}_{\text{benefit of delay: higher payoff}} = \underbrace{\left[e^{g(t_i+\tau^*)} - \alpha(\cdot)e^{g(t_i-k\eta)}\right] f_k(t_k = t_i + m|t_i)}_{\text{cost of delay: more likely to end up in bankruptcy}}$$

The hazard rate:

$$\frac{f_k(t_k = t_i + m|t_i)}{\int_{t_i+m}^{\infty} f_k(t_k|t_i)dt_k} = \frac{\lambda e^{\lambda(k\eta-m)}}{e^{\lambda(k\eta-m)} - 1} \equiv h_k(m)$$

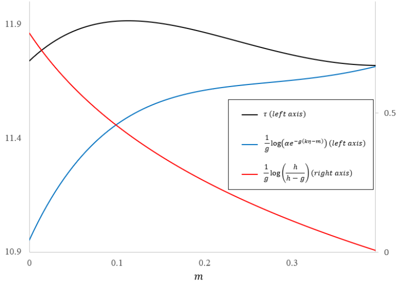
Hence,

$$\frac{g}{1-\alpha(\tau^*, m)e^{-g(\tau^*+k\eta-m)}} = h_k(m)$$

Tradeoff Associated with Clawback Window *m*

$$\tau^* = \underbrace{\frac{1}{g}\ln \alpha(\tau^*, m)e^{-g(k\eta - m)}}_{\text{payoff gap: } \frac{\text{bankruptcy payoff}}{\text{full exit payoff}}} + \underbrace{\frac{1}{g}\ln \frac{h_k(m)}{h_k(m) - g}}_{\text{outrunning the clawback window}}$$

- $m \uparrow \Rightarrow$ hazard rate $h_k(m) \uparrow \Rightarrow$ creditors exit earlier $\frac{h_k}{h_k - g} \downarrow$
- $m \uparrow \Rightarrow$ payoff ratio $\alpha e^{-g(k\eta - m)} \uparrow \Rightarrow$ creditors exit later



Parameters: $g = 2, g' = 1.9, \lambda = 0.05, \eta = 0.8, A = 2, T = 40, k = 0.5$

Solving for the Optimal Clawback Window m^*

Optimal m^* to maximize firm life

$$m^* = \arg\max_m \tau^*(m) = \frac{1}{g - \lambda} - (1 - k)\eta$$

Optimal clawback window m^* independent of g' and A

- universal clawback regulation for all corporate bankruptcies
- benefit of m: payments clawed back increase $\alpha \perp g', A$
- cost of m: need to outrun extra $\frac{m}{\eta}$ creditors $\perp g', A$

Implications and Policy Design

Dispersed covenants (splitting control $\eta \uparrow$) increase welfare

- post 2008, cov-lite lending becomes popular
- split of creditor rights (e.g. Berlin, Nini and Edison 2020)
- knowing others are "slow," creditors are more willing to wait

Aiming at higher recovery rate may backfire

- longer clawback $m > m^*$ improves recovery in bankruptcy
- but more difficult for creditors to exit a troubled firm ex-ante
- hence, creditors run more anxiously $\tau^* \downarrow$

Clawing back too much ($m > m^*$) is better than too little

- see picture: τ^* is steeper when $m < m^*$
- stronger effect of clawback on the payoff gap for small m

Clear comparative statics on g, λ, and k

- lower interest rate g, higher shock intensity λ, late filing $k \uparrow$ increase optimal clawback window m^*

Firms' choice of bankruptcy threshold k

In the baseline model, bankruptcy trigger k is exogenous

In practice, firms can decide when to declare bankruptcy

- "commit" to a bankruptcy policy k by illiquid asset holding
- if liquid assets (k fraction) runs out, the firm goes bankrupt
- difficult to adjust liquid asset composition ex-post
- additional application: bank runs

Need to introduce equity to model firm's objective

- recall in the baseline model, equity gets 0 at termination

Modified Model Setup

Modify the bad shock at t_0

- with probability p, growth slows down to g' (same old)
- with probability $1 - p$, growth rate stays at g
- for simplicity, no clawback ($m = 0$)

Firm commits to a threshold k^* ex-ante to max equity

$$(1 - p)(A - 1)e^{g(t_0 + k\eta + \tau^*(k))}$$

- if growth @ g', equity receives 0 in bankruptcy
- if growth @ g, equity is always $(A - 1)e^{gt}$

Optimal Bankruptcy Trigger k^*

Firm's equivalent objective: maximizing survival time

$$\max_k k\eta + \tau^*(k)$$

Should the firm deplete all its assets to survive longer?

- choose $k_{\max}$ s.t. the bankruptcy payoff $\alpha = 0$
- NO, creditors will run frantically $\tau^*(k) = 0$
- this is also a rationale for bankruptcy protection

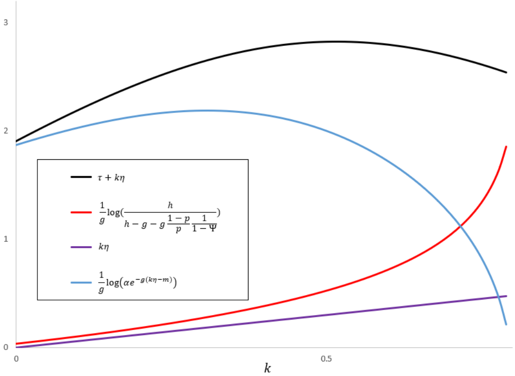
Similar to before, creditors' waiting time:

$$\tau^* = \underbrace{\frac{1}{g} \ln \alpha(\tau^*, k) e^{-g(k\eta - m)}}_{\text{payoff gap}} + \underbrace{\frac{1}{g} \ln \frac{h_k}{h_k - g - g\frac{1-p}{p(1-F)}}}_{\text{chance of successful exit, } h_k \downarrow}$$

Graph and Takeaway

Higher k allows for more exits and delays bankruptcy

- mechanically delays bankruptcy $k\eta \uparrow$
- creditors likely to exit successfully $h_k \downarrow \Longrightarrow \tau^* \uparrow$
- lower payoff in bankruptcy $\alpha(\tau, k) \downarrow \Longrightarrow \tau^* \downarrow$



$Parameters$: $g = 2, g' = 1.6, \lambda = 0.15, \eta = 0.6, q = 0.95, A = 2, T = 40, m = 0$

Conclusion

Bankruptcy regulations affect creditor's decision to stay invested ex-ante

- a tractable dynamic coordination framework
- feature 1: endogenous bankruptcy payoff
- feature 2: efficient design of policy parameters

Key tradeoff:

- payoff gap between successful exit and bankruptcy
- ex-ante incentive to outrun other creditors

Two applications:

- the optimal design of clawback window m^*
- optimal to trigger bankruptcy when some assets still remain (i.e., k^* is interior)

Thank you for your comments!