Spillovers from good-news and other bankruptcies: Real effects and price responses

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Nina Baranchuk；Michael J. Rebello

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Nina Baranchuk

Naveen Jindal School of Management,
University of Texas at Dallas
Associate Professor

Education

PhD, Washington University in St. Louis, 2004
MA, Washington University in St. Louis, 2000
MS, Moscow State University, 1998

Areas of Interest

Theoretical and empirical analysis of corporate governance ;Agency problems; executive compensation; Applied econometrics

Published Papers

- **Screening of possibly incompetent agents**

  Baranchuk, N., Dybvig, P.H. 2015Economics Letters

- **Motivating innovation in newly public firms**

  Baranchuk, N., Kieschnick, R., Moussawi,R.2014JFE

- **The economics of super managers**

  Baranchuk, N., MacDonald, G., Yang, J. 2011RFS

- **Consensus in diverse corporate boards**

  Baranchuk, N., Dybvig, P.H. 2009RFS

Michael Rebello

Naveen Jindal School of Management, University of Texas at Dallas

Professor

Education

PhD, The University of Texas at Austin, 1991

BA, Delhi University, India, 1984

Areas of Interest

Corporate governance, capital structure and restructuring, security analysts, venture capital financing, mutual funds, experimental economics, genetic algorithms, learning models.

Published Articles

- **Horses for courses: Fund managers and organizational structures**
  Han, Y., Noe, T., Rebello, M. 2017 JFQA
- **Sell-side analyst research and stock comovement**
  Muslu, V., Rebello, M., Xu, Y.2014Journal of Accounting Research
- **A glimpse behind a closed door: The long-term investment value of buy-side research and its effect on fund trades and performance**
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  Koskinen, Y., Rebello, M.J., Wang, J. 2014Journal of Economics and Management Strategy
- **Product market efficiency: The bright side of myopic, uninformed, and passive external finance**
  Noe, T.H., Rebello, M.J., Rietz, T.A. 2012 Management Science
- **Optimal corporate governance and compensation in a dynamic world**
  Noe, T.H., Rebello, M.J. 2012 Review of Financial Studies

Abstract

We model debt restructurings that could endogenously end in bankruptcy, and study spillovers to competitors' operating decisions, profits, restructuring outcomes and security prices. We show that

- while bankruptcy could cause the firm's share price to drop, bankruptcy always signals good news about the firm.
- We identify the conditions under which a bankruptcy also signals good news about competitors.
  - ✓ We demonstrate that when a firm's bankruptcy costs are relatively small, bankruptcy raises its share price while lowering the prices of competitors' shares and debt as well as boosting the probability that they will enter bankruptcy.
  - ✓ When there is little information asymmetry about the firm's prospects, or the information asymmetry is about industry prospects, bankruptcy raises competitors' share and debt prices and lowers their probability of bankruptcy..

Contents

1.Introduction

A. Background

The competition effect arises because bankruptcy weakens the firm's competitiveness. This loss of competitiveness makes bankruptcy costly.

The information effect :.it pivots on bankruptcy being a negative event for the filing firm, so as competitor .

- Bankruptcy gives rise to econom
  negative, spillovers to competito
  explanation for these spillovers..

- The few that examine spillovers focus on negative ones that generate contagion through ownership and trading links between lenders. Empirical studies of bankruptcy primarily analyze spillovers as reflected in stock prices, and have adopted a product market-based explanation for their evidence . it pivots on bankruptcy being a negative event for the filing firm. Hence, it is inconsistent with the sizable fraction of bankruptcies where firms enjoy positive own-firm effects.

B. The main work

There is a need to explain

(1)how bankruptcy can generate both positive and negative own-firm stock price responses

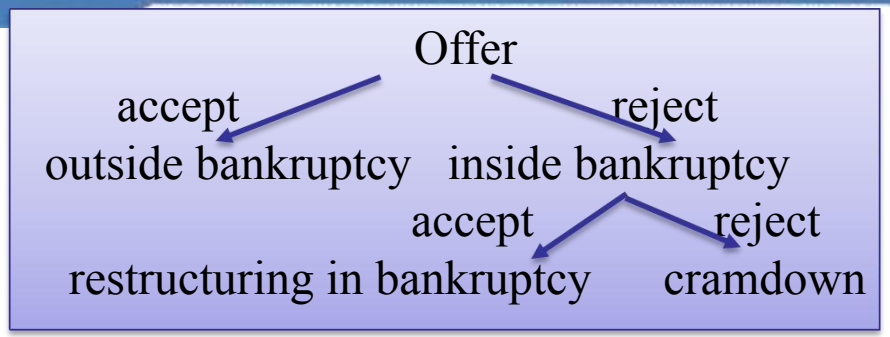
(2)how bankruptcy can generate both positive and negative responses from competitors' stock prices

(3)identify how spillovers from bankruptcy affect competitors' operating policies, financial policies and debt prices

(4)link the spillovers to the own-firm effect of bankruptcy

(5)establish whether product market linkages alone are sufficient to transmit these spillovers

C. Contribution



- Our model incorporates a reduced form of the US Bankruptcy Code. Our focus is on the spillovers from bankruptcy to competitor firms' financial claims as well as their financial and operating decisions. we provide richer and sharper empirical predictions about the effects of bankruptcy than this literature.
- Even absent shared ownership or investor ties, a bankruptcy can raise the likelihood of a related firm's bankruptcy.
- We demonstrate that bankruptcy signals good, not bad, prospects.

2.Model

2.Model

- featuring :costly bankruptcy, information asymmetry between firms and their debtholders, and firms that are linked only via a shared product market.
- Consider a three-period economy populated by risk-neutral agents and a risk-free rate of zero. There are two levered firms: Firm One and Firm Two.
- Firm One (Two) has zero coupon debt with a face value $D_1(D_2)$ that matures in period one (two).
- A single equityholder owns and manages each firm. A single debtholder holds each firm's debt, which permits us to abstract from the effect of debtholder coordination.
- We refer to Firm One's (Two's) equityholder as Equityholder One (Two) and its debtholder as Debtholder One (Two). There are no overlaps or financial ties between the owners of the firms' equity or debt.

The firms engage in Cournot competition. They simultaneously choose their outputs, q_j, at the beginning of period three. Firm j $\in \{1, 2\}$ faces a price per unit of output of p_j, which satisfies the following deterministic demand function:

$$p_j = \alpha - q_j - \gamma\, q_k, \qquad (1)$$

where q_k is the competitor's output. The slope coefficient $\gamma < 1$ captures customers' willingness to switch between the firms' products and the intensity of industry competition.

Firm j's profit :

$$\pi_j = q_j(p_j - \tilde{k}_j)$$

where $\tilde{k}_j$ is a random production cost.

$\tilde{k}_j = k_j^u > \alpha$ ⟶ $\pi = 0$ ⟶ uncompetitive

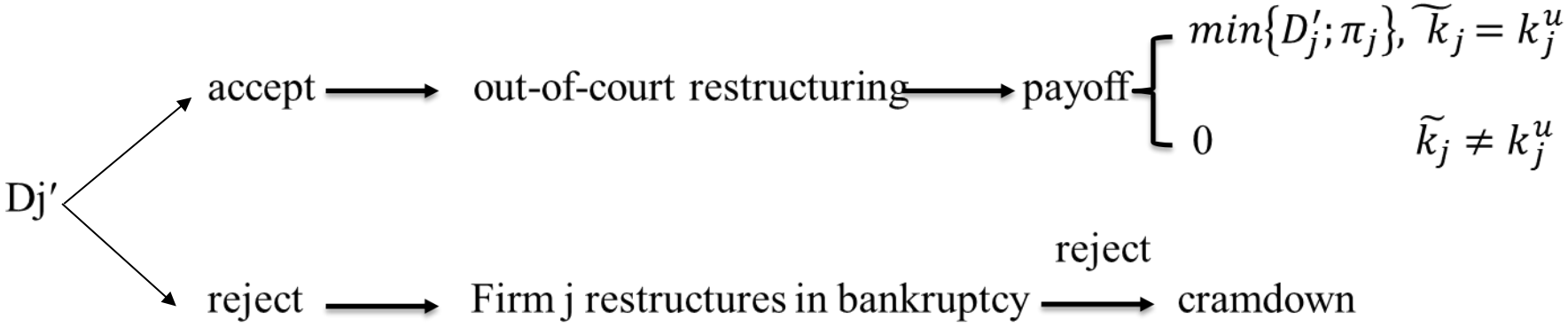
Otherwise ⟶ competitive

- At the beginning of period one, each equityholder observes a noisy private signal about her firm's competitive state. Each signal is drawn from the set $\{s, w\}$, where s (w) indicates that the firm is competitive with probability ϕ_j^s ($\phi_j^w < \phi_j^s$).
- We will refer to an equityholder/firm that draws signal s (w) as strong (weak).
- All agents other than Equityholder j maintain the prior probability $\theta_j \in (0, 1)$ for signal s for Firm j. Let ℓ_j, $j \in \{1, 2\}$, be defined as follows:

$$\ell_j = \frac{\phi_j^s - \phi_j^w}{\phi_j^s}. \qquad (2)$$

it measures the amount of information asymmetry between Firm j's claimants.

- Neither firm has any cash on hand to pay off its debt, and both firms only earn a profit in period three.Firm One restructures in period one and Firm Two restructures in period two.
- Equityholder j initiates Firm j's restructuring by offering to exchange existing debt for new debt with a face value Dj′ that is payable out of the period three profit.
- Debtholder j can accept or reject the offer.



2.1 Bankruptcy

- Bankruptcy negotiations start with either equityholder or debtholder proposing a restructuring plan. The equityholder proposes first with probability $\rho \in (0, 1)$, and the debtholder is first with probability $(1-\rho)$.
- We assume the debtholder automatically accepts a proposal that offers full repayment, i.e. a proposed face value satisfying $\phi_j^t D_j' \geq D_j$ if the firm is type t.
- In bankruptcy, the firm's production cost rises, and the bankruptcy court and the debtholder learn the equityholder's signal about the firm's competitive state.
  - In the competitive state

    $b_j = o \quad \overline{k}_j = k_j^o$

    $b_j = i \quad \overline{k}_j = k_j^i = k_j^o + \delta_j^i \quad , \quad \delta_j^i > 0$

    $b_j = c \quad \overline{k}_j = k_j^c = k_j^o + \delta_j^i + \delta_j^c \; , \; \delta_j^c > 0$
  - uncompetitive : irrelevant

we make the following assumptions about the costs of bankruptcy and cramdown:

Assumption 1. $D_j > \phi_j^s(\alpha - \kappa_j^c)^2/4$.

Assumption 2. $\phi_j^w(2(\alpha - \kappa_j^i) - \gamma(\alpha - \kappa_k^o)) > D_j$.

Assumption 3. $2(\alpha - \kappa_j^c) - \gamma(\alpha - \kappa_k^o) > 0$.

We make the following assumptions to fix the information environment:

(i) each restructuring involves only the firm's claimholders, and

(ii) the release of information about Firm One's restructuring to agents who do not participate in it, other than whether or not Firm One restructures in bankruptcy and cramdown, is delayed until Firm Two's restructuring is complete.

We characterize Perfect Bayesian Nash Equilibria of our model.

- In these equilibria, each firm's residual claimant chooses her firm's output to maximize her expected cash flow given the competitor's output choice.
- Each claimant's restructuring offer maximizes the expected value of her claim given the strategies of her firm's other claimant and the strategies of the competitor's claimants.
- Each claimant's response to a restructuring offer maximizes her expected payoff given the strategies of her firm's other claimant and the strategies of the competitor's claimants.
- On the equilibrium path, belief updates follow Bayes rule.

3. Product market and restructuring equilibria

3.1. Product market outcomes and the competition effect

- When Firm j is competitive, the residual claimant will set qj to maximize the firm's total profit:

$$\pi_j = q_j\left(\alpha - q_j - \gamma q_k - \tilde{\kappa}_j\right)$$

π_j is negatively correlated with $\widetilde{k_j}$ and positively correlated with $\widetilde{k_k}$

We will use the function $\pi_j(\widetilde{k_j};\ \widetilde{k_k})$ Firm j's realized ec

$\widetilde{k_j} \neq k_j^u$ *and* $\widetilde{k_k} \neq k_k^u$ ⟶ Cournot duopoly equili

$$\pi_j(\tilde{\kappa}_j, \tilde{\kappa}_k) = \frac{\left[2(\alpha - \tilde{\kappa}_j) - \gamma(\alpha - \tilde{\kappa}_k)\right]^2}{(4-\gamma^2)^2}. \qquad \text{(A-1)}$$

$\widetilde{k_j} \neq k_j^u$ and $\widetilde{k_k} = k_k^u$ ⟶ monopoly equilibrium

$$\pi_j(\tilde{\kappa}_j, \kappa_k^u) = \frac{(\alpha - \tilde{\kappa}_j)^2}{4}. \qquad \text{(A-2)}$$

- uncompetitive

$$\pi_j(\kappa_j^u, \tilde{\kappa}_k) = 0. \qquad \text{(A-3)}$$

Bankruptcy lowers a firm's realized profit. We refer to this decline as realized bankruptcy cost

$$\Delta_j(\tilde{\kappa}_k) \equiv \pi_j(\kappa_j^o; \tilde{\kappa}_k) - \pi_j(\kappa_j^i; \tilde{\kappa}_k). \tag{3}$$

$$\Delta_j(\kappa_k^u) \equiv \delta_j^i \frac{\left[2(\alpha - \kappa_j^o) - \delta_j^i\right]}{4};$$

$$\Delta_j(\kappa_k^i) \equiv 4\delta_j^i \frac{\left[2(\alpha - \kappa_j^o) - \delta_j^i - \gamma(\alpha - \kappa_k^i)\right]}{(4-\gamma^2)^2}; \text{ and}$$

$$\Delta_j(\kappa_k^o) \equiv 4\delta_j^i \frac{\left[2(\alpha - \kappa_j^o) - \delta_j^i - \gamma(\alpha - \kappa_k^o)\right]}{(4-\gamma^2)^2}. \tag{A-4}$$

Lemma 1

1. *A firm's equilibrium realized profit falls as its production cost increases, and rises as the competitor's production cost in*

$$\pi_j\left(\kappa_j^o;\tilde{\kappa}_k\right)>\pi_j\left(\kappa_j^i;\tilde{\kappa}_k\right)>\pi_j\left(\kappa_j^c;\tilde{\kappa}_k\right)>\pi_j\left(\kappa^u;\tilde{\kappa}_k\right)=$$

$$\pi_j\left(\tilde{\kappa}_j;\kappa_k^u\right)>\pi_j\left(\tilde{\kappa}_j;\kappa_k^c\right)>\pi_j\left(\tilde{\kappa}_j;\kappa_k^i\right)>\pi_j\left(\tilde{\kappa}_j;\kappa_k^o\right) \quad (5)$$

for $\tilde{\kappa}_j \neq \kappa_j^u$.

2. *A firm's equilibrium realized bankruptcy cost increases as the competitor's production cost increases:*

$$\Delta_j\left(\kappa_k^u\right)>\Delta_j\left(\kappa_k^c\right)>\Delta_j\left(\kappa_k^i\right)>\Delta_j\left(\kappa_k^o\right)>0. \quad (6)$$

The boost to realized profit from the competitor's bankruptcy is the source of the competition effect.

3.2. Restructuring outcomes and the information effect

while Firm Two's claimants negotiate after observing Firm One's restructuring outcome,b_1, Firm One's claimants negotiate based on Firm Two's expected restructuring outcome.

$$\mathscr{I}_1 = \emptyset \qquad \mathscr{I}_2 = \mathbf{b_1} \in \{\mathbf{i}, \mathbf{o}, \mathbf{c}\}$$

Since bankruptcy dissipates information asymmetry, its outcome is transparent: the first offer will be accepted and the firm will avoid cramdown, which would dissipate type t's value to $\phi_j^t E\left[\pi_j\left(\kappa^c; \tilde{\kappa}_k\right) | \mathscr{I}_\mathbf{j}\right]$.

If Equityholder j makes the first offer, he will offer $E[\pi_j\left(\kappa^c; \tilde{\kappa}_k\right) | \mathscr{I}_\mathbf{j}]$, and Debtholder j will accept. If Debtholder j makes the first offer, she will demand full repayment and Equityholder j will accept.

The following lemma characterizes the debtholders' resulting expected equilibrium bankruptcy payoffs.

Lemma 2

1. *If Firm j is type t, Debtholder j's expected payoff in bankruptcy is* $\phi_j^t D_j^t(\mathscr{I}_j)$, *where*

$$D_j^t(\mathscr{I}_j) \equiv \frac{(1-\rho)\mathscr{D}_j}{\phi_j^t} + \rho\mathscr{E}\left[\pi_j\left(\kappa_j^c;\tilde{\kappa}_k\right)\middle|\mathscr{I}_j\right]. \tag{7}$$

2. *Debtholder j's expected loss from bankruptcy is larger when the firm is type w:*

$$D_j - \phi_j^w D_j^w(\mathscr{I}_j) > \mathscr{D}_j - \phi_j^s \mathscr{D}_j^s(\mathscr{I}_j). \tag{8}$$

Since $D_J^W > D_J^S$, Debtholder j will rationally reject any offer lower than D_J^S outside bankruptcy, and debtholder j will always accept D_J^W. Therefore, we can restrict our attention to out-of-bankruptcy offers in the interval $[D_J^S, D_J^W]$

We characterize key properties of all equilibria in the following proposition.

Proposition 1

In any equilibrium,

1. *Equityholder j will make one of three possible offers outside bankruptcy:* D_j^s, D_j^w, *and* D_j^{sw}, *where* $D_j^{sw} \in \left(D_j^s, D_j^w\right]$. *If only type w makes an offer it will be* D_j^w, *and if only type s makes an offer it will be* D_j^s. *When both types make an offer it will be* D_j^{sw}.

2. *For any two offers made in equilibrium, the lower one is rejected with a higher probability.*

3. *The posterior belief that Firm j is type s,* $\hat{\theta}_j(b_j)$, *satisfies* $\hat{\theta}_j(i) \geq \hat{\theta}_j(o)$.

type s is more likely to restructure in bankruptcy

Proposition 1 demonstrates that in all equilibria of our moc
bankruptcy signals that the firm is likely to be type s. Ther
we focus the remainder of our analysis on the unique equil
refinement, which we will henceforth refer to as the baseli

In the baseline equilibrium, type w makes the highest reasonable offer, D_j^w, and never enters bankruptcy. Type s makes only the lowest reasonable offer, D_j^s, and enters bankruptcy with a positive probability.

Proposition 2

There is a unique equilibrium that satisfies the D1 refinement. In this equilibrium, Equityholder j offers only D_j^s if he is type s and offers only D_j^w if he is type w. Debtholder j always accepts D_j^w and rejects D_j^s with probability d_j that leaves type w indifferent to mimicking type s, i.e.,

$$d_j = \frac{(1-\rho)\ell_j D_j}{\phi_j^w \overline{\Delta}_j + (1-\rho)\ell_j D_j}. \qquad (10)$$

$\overline{\Delta}_j(\mathscr{I}_j)$ denote Firm j's expected bankruptcy cost conditional on it being competitive

$$\bar{\Delta}_j(\mathscr{I}_j) \equiv E[\Delta_j(\tilde{\kappa}_k)|\mathscr{I}_j].$$

4. Price responses and spillovers

4.1. Good-news and bad-news bankruptcies

（1）We first establish the result for Firm j's stock price：

before Firm j's restructuring, type w Equityholder j's expected payoff is

$$\phi_j^w\Big(E[\pi_j(\kappa_j^o;\tilde{\kappa}_k)|\mathscr{I}_j]-D_j^w(\mathscr{I}_j)\Big), \tag{A-14}$$

while type s Equityholder j's expected payoff is

$$\phi_j^s\Big(E[\pi_j(\kappa_j^o;\tilde{\kappa}_k)|\mathscr{I}_j]-D_j^s(\mathscr{I}_j)-d_j(\mathscr{I}_j)\,\bar{\Delta}_j(\mathscr{I}_j)\Big), \tag{A-15}$$

So firm j's equity value before it restructures is

$$\begin{aligned}&E[\phi_j]E[\pi_j(\kappa_j^o;\tilde{\kappa}_k)|\mathscr{I}_j]-\theta_j\phi_j^sD_j^s(\mathscr{I}_j)-(1-\theta_j)\phi_j^wD_j^w(\mathscr{I}_j)\\&-\theta_j\phi_j^sd_j(\mathscr{I}_j)\,\bar{\Delta}_j(\mathscr{I}_j),\end{aligned} \tag{A-16}$$

where $E[\phi_j]=(\theta_j\phi_j^s+(1-\theta_j)\phi_j^w)$

Since only type s files for bankruptcy in equilibrium, Firm j's equity value when it enters bankruptcy is

$$\phi_j^s\Big(E[\pi_j(\kappa_j^o;\tilde{\kappa}_k)|\mathscr{I}_j]-D_j^s(\mathscr{I}_j)-\bar{\Delta}_j(\mathscr{I}_j)\Big). \qquad \text{(A-17)}$$

(A-17)-(A-16)

$$=\begin{aligned}&(1-\theta_j)(\phi_j^s-\phi_j^w)E[\pi_j(\kappa_j^o;\tilde{\kappa}_k)]-(1-\theta_j)(\phi_j^sD_j^s-\phi_j^wD_j^w)\\&-\phi_j^s\left(1-\theta_j\frac{(1-\rho)\ell_jD_j}{\phi_j^w\bar{\Delta}_j+(1-\rho)\ell_jD_j}\right)\bar{\Delta}_j. \qquad \text{(A-18)}\end{aligned}$$

$$=\begin{aligned}&\phi_j^s(1-\theta_j)\ell_j\Big(E[\pi_j(\kappa_j^o;\tilde{\kappa}_k)]-\rho E[\pi_j(\kappa_j^c;\tilde{\kappa}_k)]\Big)\\&-\phi_j^s\left(1-\theta_j\frac{(1-\rho)\ell_jD_j}{\phi_j^w\bar{\Delta}_j+(1-\rho)\ell_jD_j}\right)\bar{\Delta}_j. \qquad \text{(A-20)}\end{aligned}$$

(A-20) is positive when $\bar{\Delta}_j=\delta_j^i$, (A-17)-(A-16) > 0 ⟶ stock price rise

is negative when l_j=0 , (A-17)-(A-16) < 0 ⟶ stock price fall

（2）Now consider Firm j's expected profit.

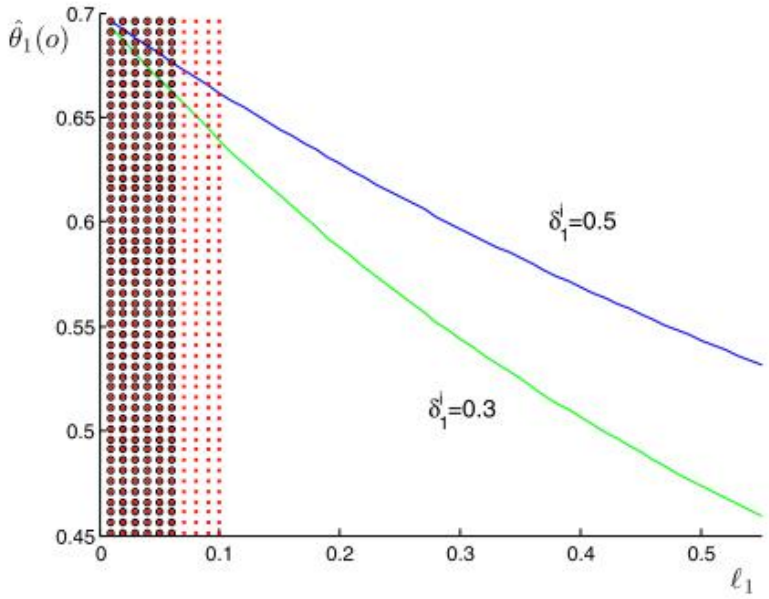
we can represent the difference between Firm j's post bankruptcy and ex-ante
expected profit as follows:

Proposition 3

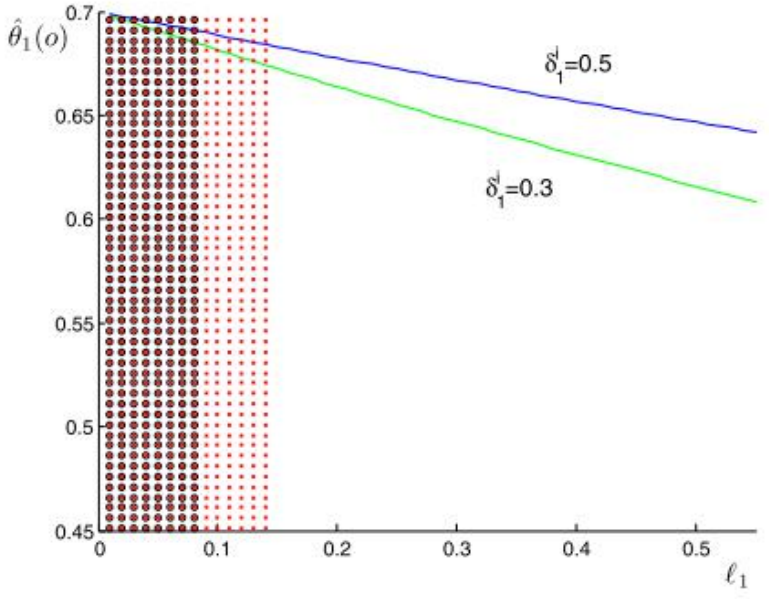
When Firm j enters bankruptcy its expected profit and stock price will rise if δ_j^i is sufficiently small, and fall if ℓ_j is sufficiently small.

(A-21) is positive when $\bar{\Delta}_j = \delta_j^i$ ⟶ expected profit rise
is negative when $l_j = 0$ ⟶ expected profit fall

Fig. 1. The information effect and own-price effects.



(a) $\rho = 0.3$



(b) $\rho = 0.8$

$\alpha = 25, \gamma = 0.5, \kappa_1^o = \kappa_2^o = 3, D_1 = D_2 = 4, \theta_1 = \theta_2 = 0.7, \phi_1^w = \phi_2^w$. In
$= 0.3, \delta_2^i = 0.3, \delta_1^c = \delta_2^c = 20,$ and $\phi_2^s = 0.9$

4.2. Spillovers to competitors' stock prices

(1)We will first establish the claim about Firm Two's stock price response. Let Firm Two's tock price following Firm One's restructuring outcome, b1, be given by S2(b1)

$$
\begin{aligned}
&S_2(i) - S_2(o) \\
&= E[\phi_2]\big([\phi_1^s - \phi_1(o)][\pi_2(\kappa_2^o;\kappa_1^i) - \pi_2(\kappa_2^o;\kappa_1^u)] \\
&+ \phi_1(o)[\pi_2(\kappa_2^o;\kappa_1^i) - \pi_2(\kappa_2^o;\kappa_1^o)]\big) \\
&- E[\phi_2]\rho\big([\phi_1^s - \phi_1(o)][\pi_2(\kappa_2^c;\kappa_1^i) - \pi_2(\kappa_2^c;\kappa_1^u)] \\
&+ \phi_1(o)[\pi_2(\kappa_2^c;\kappa_1^i) - \pi_2(\kappa_2^c;\kappa_1^o)]\big) \\
&+ \theta_2\phi_2^s\left(\frac{\bar{\Delta}_2(o)(1-\rho)\ell_2 D_2/\phi_2^w}{\bar{\Delta}_2(o) + (1-\rho)\ell_2 D_2/\phi_2^w}\right. \\
&\left. - \frac{\bar{\Delta}_2(i)(1-\rho)\ell_2 D_2/\phi_2^w}{\bar{\Delta}_2(i) + (1-\rho)\ell_2 D_2/\phi_2^w}\right).
\end{aligned}
\tag{A-26}
$$

when δ_1^i approaches zero, $S_2(i) - S_2(o) < 0$ ⟶ stock price fall

when l_1 approaches zero, $S_2(i) - S_2(o) > 0$ ⟶ stock price rise

(2)Now consider Firm Two's expected profit

we can represent Firm Two's expected profit when Firm One restructures in bankruptcy minus its expected profit when Firm One restructures outside bankruptcy as

Proposition 4

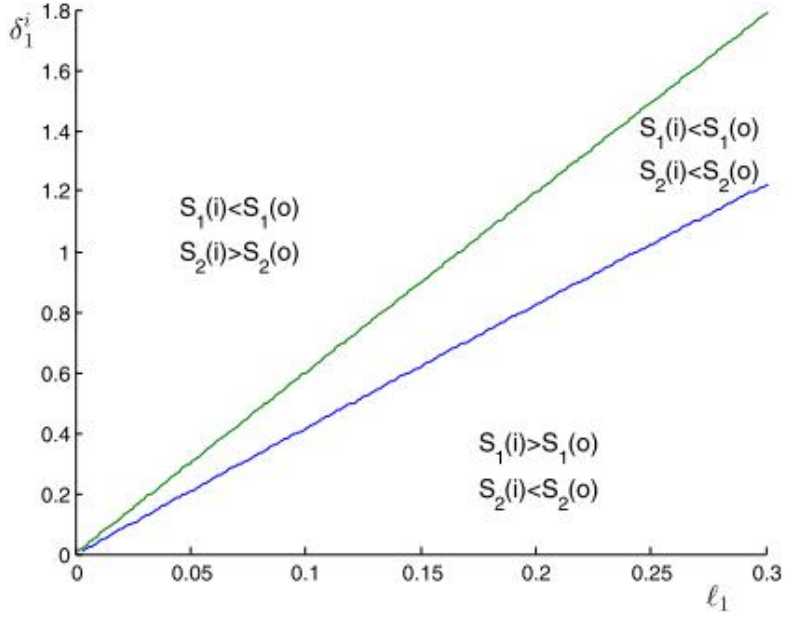
When Firm One enters bankruptcy, Firm Two's expected profit and stock price will fall if δ_1^i is sufficiently small and rise if ℓ_1 is sufficiently small.

$$+\theta_2\phi_2^s\left(\frac{\bar{\Delta}_2(o)(1-\rho)\ell_2 D_2/\phi_2^w}{\bar{\Delta}_2(o)+(1-\rho)\ell_2 D_2/\phi_2^w} - \frac{\bar{\Delta}_2(i)(1-\rho)\ell_2 D_2/\phi_2^w}{\bar{\Delta}_2(i)+(1-\rho)\ell_2 D_2/\phi_2^w}\right). \quad \text{(A-32)}$$

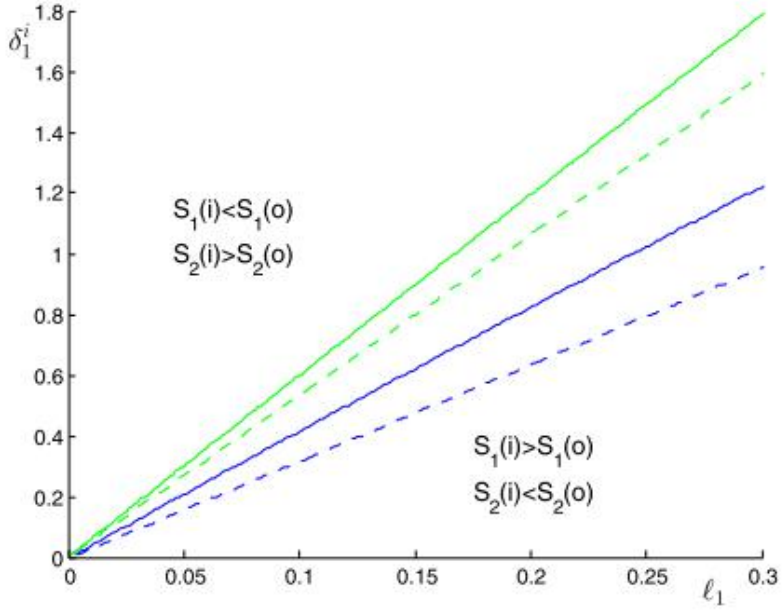
when δ_1^i approaches zero, (A-32) < 0 ⟶ expected profit fall

when l_1 approaches zero, (A-32) > 0 ⟶ expected profit rise

Fig. 2. Bankruptcy spillovers to stock prices.



(a) $\rho = 0.3$



(b) $\rho = 0.3$ and $\rho = 0.8$

$\alpha = 25, \gamma = 0.5, \kappa_1^o = \kappa_2^o = 3, D_1 = D_2 = 4, \theta_1 = \theta_2 = 0.7, \phi_1^w = \phi_2^w.$
$= 0.3, \delta_2^i = 3, \delta_1^c = \delta_2^c = 15;$ and $\phi_2^s = 0.9$

4.3. Bankruptcy contagion and bond prices

(1) Bankruptcy contagion

Consider Firm Two's bankruptcy cost $\bar{\Delta}_2(b_1)$

$$\overline{\Delta}_2(b_1) = E[\phi_1|b_1]\ \Delta_2\left(\kappa_1^{b_1}\right) + (1 - E[\phi_1|b_1])\ \Delta_2(\kappa_1^u)$$

$$\begin{aligned}\bar{\Delta}_2(i) - \bar{\Delta}_2(o) &= \phi_1^s \Delta_2(\kappa_1^i) + (1-\phi_1^s)\Delta_2(\kappa_1^u) \\ &\quad - \left(\phi_1(o)\Delta_2(\kappa_1^o) + (1-\phi_1(o))\Delta_2(\kappa_1^u)\right), \qquad \text{(A-22)}\end{aligned}$$

where $\phi_1(o) = \frac{(1-\theta_1)\phi_1^w + \theta_1(1-d_1)\phi_1^s}{(1-\theta_1)+\theta_1(1-d_1)}$.

The above expression has the same sign as

$$\begin{aligned}&\frac{\Delta_2(\kappa_1^i) - \Delta_2(\kappa_1^o)}{\Delta_2(\kappa_1^u) - \Delta_2(\kappa_1^i)} - \frac{\phi_1^s - \phi_1(o)}{\phi_1(o)} \\ &= \frac{\Delta_2(\kappa_1^i) - \Delta_2(\kappa_1^o)}{\Delta_2(\kappa_1^u) - \Delta_2(\kappa_1^i)} - \frac{(1-\theta_1)\ell_1}{(1-\theta_1)\phi_1^w\phi_1^s + \theta_1 d_1}. \qquad \text{(A-23)}\end{aligned}$$

when δ_1^i approaches zero, (A-23) < 0 , $\bar{\Delta}_2(i) < \bar{\Delta}_2(o)$

when l_1 approaches zero, (A-23) > 0 , $\bar{\Delta}_2(i) > \bar{\Delta}_2(o)$

Changes in Firm Two's bankruptcy cost induce Debtholder Two to alter her negotiating strategy: as Firm Two's bankruptcy cost rises, Debtholder Two rejects the strong-type offer at a lower rate, thus lowering $\beta_2(b_1)$,the probability that Firm Two enters bankruptcy

$$\beta_2(b_1) = \theta_2\, d_2(b_1) = \theta_2 \frac{(1-\rho)\ell_2 D_2}{\phi_2^w \bar{\Delta}_2(b_1) + (1-\rho)\ell_2 D_2}. \qquad (11)$$

when δ_1^i approaches zero, $\beta_2(i) > \beta_2(o)$;when l_1 approaches zero, $\beta_2(i) < \beta_2(o)$

Proposition 5

1. *Firm Two's bankruptcy cost satisfies* $\overline{\Delta}_2(i) > \overline{\Delta}_2(o)$ *when* ℓ_1 *is sufficiently small and satisfies* $\overline{\Delta}_2(i) < \overline{\Delta}_2(o)$ *when* δ_1^i *is sufficiently small.*

2. *Firm Two's probability of bankruptcy satisfies* $\beta_2(i) < \beta_2(o)$ *when* ℓ_1 *is sufficiently small and satisfies* $\beta_2(i) > \beta_2(o)$ *when* δ_1^i *is sufficiently small.*

(2) bond prices

Firm Two's debt price immediately after Firm One's restructuring is

$$B_2(\mathscr{I}_2) = \theta_2 \phi_2^s D_2^s(\mathscr{I}_2) + (1-\theta_2)\phi_2^w D_2^w(\mathscr{I}_2). \qquad \text{(A-37)}$$

Therefore

Proposition 6

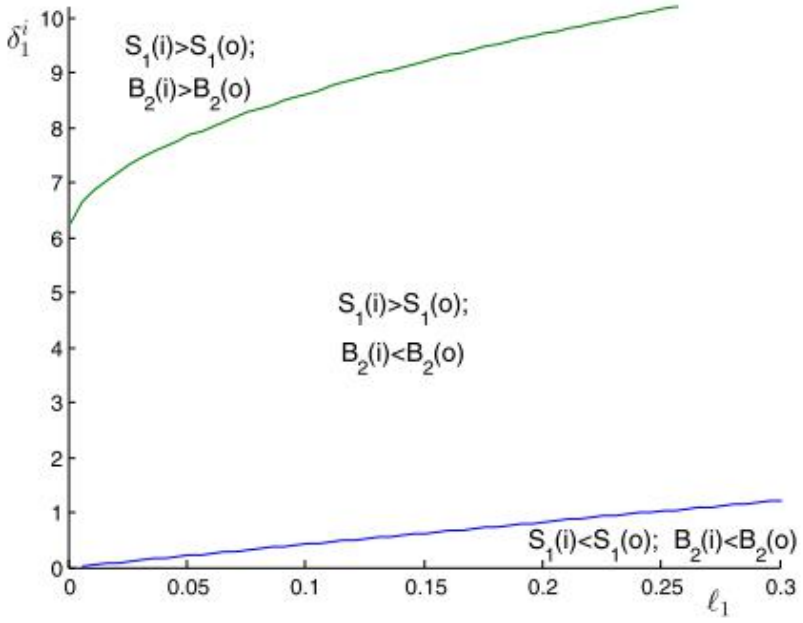
When Firm One enters bankruptcy the price of Firm Two's debt will fall if δ_1^i *is sufficiently small and rise if* ℓ_1 *is sufficiently small.*

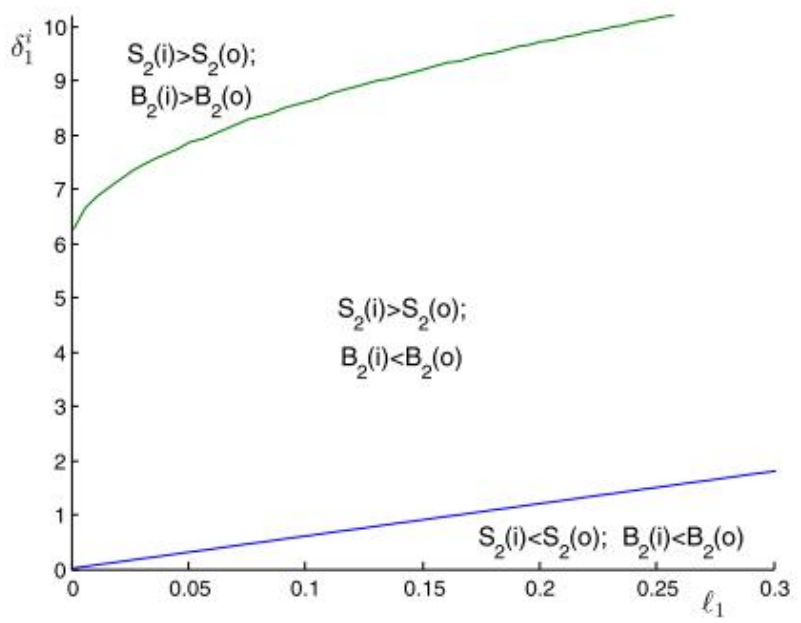
(A-38)

when δ_1^i approaches zero, $B_2(i) - B_2(o) < 0$ bond price fall

when l_1 approaches zero, $B_2(i) - B_2(o) > 0$ bond price rise

Fig. 3. Bankruptcy spillovers to debt prices..





$\rho = 0.3,$
$\alpha = 25, \gamma = 0.5, \kappa_1^o = \kappa_2^o = 3, D_1 = D_2 = 4, \theta_1 = \theta_2 = 0.7, \phi_1^w = \phi_2^w.$
$= 0.3, \delta_2^i = 3, \delta_1^c = \delta_2^c = 15;$ and $\phi_2^s = 0.9$

5. The locus of information asymmetry and spillovers

Competing firms face common industry and macroeconomic shocks.

consider the extreme case where both firms share the same competitive state.

- Both equityholders observe the same private signal about the common shock. So $\phi^s = \phi_1^s = \phi_2^s$ or $\phi^w = \phi_1^w = \phi_2^w$
- Other investors share the same prior belief about both firms: $\theta = \theta_1 = \theta_2$.
- These changes have obvious implications:

  (i) Since the two firms share a competitive state, neither one can enjoy monopoly profits

  (ii) Since both equityholders observe the same private signal, Equityholder Two no longer learns about Firm One's type from its restructuring outcome.

  (iii) after Firm One's restructuring, Debtholder Two's and outsiders' beliefs about Firm Two's type is given by the posterior $\hat{\theta}_2(b_1) = \hat{\theta}_1(b_1)$.

- If it is type t, Equityholder Two will offer Debtholder Two D_2^t outside bankruptcy and the debtholder will accept. Otherwise, Firm Two's claimants face the same tradeoff they do in the baseline model: concessions to the equityholder against the cost of bankruptcy. Firm One's claimants also face the same tradeoff. Moreover, Debtholder One's information set is unchanged from the baseline model. Hence, the equilibrium restructuring outcomes described in Propositions 1 and 2 apply to the changed setting for Firm One and for Firm Two so long as Firm One restructures outside bankruptcy, and thus does not reveal Firm Two's type

- In the unique equilibrium that satisfies the D1 refinement, when Firm One enters bankruptcy, all agents update their priors to the posterior beliefs

$$\hat{\theta}_2\left(b_1 = i\right) = \hat{\theta}_1\left(b_1 = i\right) = 1 > \theta.$$

- If Firm One enters bankruptcy, agents also learn that Firm Two is type s. Thus, the information effect of Firm One's bankruptcy aligns with its competition effect to raise Firm Two's expected profit.

- Debtholder Two optimally accepts a strong-type offer from Equityholder Two, and Firm Two restructures outside bankruptcy with certainty. Hence, the information effect also eliminates any bankruptcy-related dissipation in Firm Two's value. Consequently, Firm Two's stock and debt prices rise in response to Firm One's bankruptcy.

- if Firm One restructures outside bankruptcy, investors lower their belief that Firm Two is type s. This downward revision lowers their expectation of Firm Two's profit and its stock price.

- Since Debtholder Two is now more likely to end up receiving a weak-type debt offer, which provides a lower expected payoff, the price of Firm Two's debt also declines

Proposition 7

Suppose the two firms' competitiveness signals and profits are perfectly correlated. Then, following the news of Firm One's bankruptcy, Firm Two's bankruptcy probability will fall (to zero), and its bond and stock prices will increase.

6. Robustness and extensions

6.1. A refinancing option

We can formally introduce the refinancing option as follows:

- suppose that prior to negotiating with Debtholder j, Equityholder j can try to raise Dj to pay off existing debt by selling a bond.
- Investors compete in Bertrand fashion to buy the bond, and demand a period three repayment of Dj′.
- Investors have access only to publicly available information. Hence, they have the same information as Debtholder j.
- If Equityholder j fails to raise Dj or chooses not to refinance, he must renegotiate the debt.

6.1. A refinancing option

Suppose investors demand a face value D_j' for refinancing the debt.

- Type w Equityholder j will find defection strictly attractive as long as $D_j' < D_j^w$. Type s will find it attractive only as long as $D_j' < D_j^s + d_j\bar{\Delta}_j$
- Note

$$
\begin{aligned}
& D_j^s + d_j\bar{\Delta}_j \\
& = D_j^w - (1-\rho)\ell_j D_j/\phi_j^w + \frac{(1-\rho)\ell_j D_j}{\phi_j^w\bar{\Delta}_j + (1-\rho)\ell_j D_j}\bar{\Delta}_j \\
& = D_j^w - (1-\rho)\ell_j D_j/\phi_j^w \\
& \quad + (1-\rho)\ell_j D_j/\phi_j^w \frac{\bar{\Delta}_j}{\bar{\Delta}_j + (1-\rho)\ell_j D_j/\phi_j^w} \\
& < D_j^w. \qquad \text{(A-47)}
\end{aligned}
$$

Therefore $D_j' < D_j^s + d_j\bar{\Delta}_j < D_j^w$

- the defection to refinancing be associated with the belief that the defector is type w and an investor demand of $D_j' = D_j/\varphi_j^w > D_j^w > D_j^s + d_j\bar{\Delta}_j$
- Defection is not a best response for a combination of two reasons

6.2. Persistent information asymmetry

suppose that information asymmetry persists in bankruptcy with probability ξ

- With persistent information asymmetry, type w can now enjoy the benefit of mispricing in bankruptcy if he mimics: while previously type w expected to pay D_j^w in bankruptcy, now he will expect to pay D_j^w if information asymmetry dissipates and D_j^s if it persists. Hence, the rate at which the debtholder rejects D_j^s must rise to deter type w from mimicking.
- While the value of the firm's claims contingent on it being type w remain unchanged, the higher rejection rate alters their values conditional on it being type s. These changes are continuous in ξ and approach zero as ξ approaches zero.

6.2. Persistent information asymmetry

Now consider Firm Two's stock price response to Firm One's restructuring outcome

$$
\begin{aligned}
&S_2(i) - S_2(o) \\
&\quad = E[\phi_2]\big([\phi_1^s - \phi_1(o)][\pi_2(\kappa_2^o;\kappa_1^i) - \pi_2(\kappa_2^o;\kappa_1^u)] \\
&\quad\quad + \phi_1(o)[\pi_2(\kappa_2^o;\kappa_1^i) - \pi_2(\kappa_2^o;\kappa_1^o)]\big) \\
&\quad\quad - E[\phi_2]\rho\big([\phi_1^s - \phi_1(o)][\pi_2(\kappa_2^c;\kappa_1^i) - \pi_2(\kappa_2^c;\kappa_1^u)] \\
&\quad\quad + \phi_1(o)[\pi_2(\kappa_2^c;\kappa_1^i) - \pi_2(\kappa_2^c;\kappa_1^o)]\big) \\
&\quad\quad - \theta_2\phi_2^s\left(\frac{(1-\rho)\ell_2 D_2(i)}{\phi_2^w\bar{\Delta}_2(i) + (1-\xi)(1-\rho)\ell_2 D_2(i)}\bar{\Delta}_2(i)\right. \\
&\quad\quad \left. - \frac{(1-\rho)\ell_2 D_2(o)}{\phi_2^w\bar{\Delta}_2(o) + (1-\xi)(1-\rho)\ell_2 D_2(o)}\bar{\Delta}_2(o)\right).
\end{aligned}
\tag{A-52}
$$

Firm Two's debt price immediately after Firm One's restructuring is

$$
B_2(\mathscr{I}_2) = \theta_2\phi_2^s D_2^s(\mathscr{I}_2) + (1-\theta_2)\phi_2^w D_2^w(\mathscr{I}_2). \tag{A-53}
$$

the spillover from bankruptcy are qualitatively unchanged so long as ξ is sufficiently small.

6.3. Debtholders initiate restructurings

Suppose Debtholder j kicks off Firm j's restructuring by demanding D_j', the face value of a debt contract that matures in period three. If Equityholder j rejects the demand, the firm enters bankruptcy and negotiations proceed as in the baseline model. If the equityholder accepts, the period three profits are shared according to Debtholder j's demand.

The equityholder expects to pay the debtholder D_j^t in bankruptcy if the firm is type t. type s will always reject a demand exceeding $D_j^s + \bar{\Delta}_j$, and type w will always accept any demand up to $D_j^w + \bar{\Delta}_j$, in equilibrium, Debtholder j will demand either $D_j^s + \bar{\Delta}_j$ or $D_j^w + \bar{\Delta}_j$.

6.3. Debtholders initiate restructurings

bankruptcy will occur with a positive probability if Debtholder j prefers to demand $D_j^w + \bar{\Delta}_j$, This is the case when the bankruptcy cost is relatively low.

- Now in any equilibrium with a positive probability of bankruptcy, an out-of-bankruptcy restructuring will unambiguously signal the firm is type w. However, as in our original equilibrium, bankruptcy will signal the firm is type s, and thus the information effect of bankruptcy remains unchanged.
- The competition effect of bankruptcy, which depends only on the effect of bankruptcy on production costs, is also unchanged if debtholders initiate restructurings.

7. Empirical implications

Problem

- a sample selection problem: costs inferred from such samples will tend to understate the average cost of bankruptcy.

- a problem faced when inferring bankruptcy costs from returns around bankruptcy announcements: these returns reflect both bankruptcy costs and the information effect of bankruptcy, which is always positive.

Prediction 1

- If bankruptcy only slightly disrupts a firm's operations, its bankruptcy will
  - –raise its stock price;
  - –lower competitors' expected profits as well as stock and debt prices; and
  - –raise the probability that competitors will restructure in bankruptcy.
- The own stock price and spillover effects will tend to reverse when firms face high bankruptcy costs.

✓ Tests of these predictions require proxies for bankruptcy costs. Glover (2016) methodology can yield such proxies.

✓ the cost of bankruptcy varies with the importance of long-term relationships with customers, the importance of synchronized and efficient supply chains, and the depth of the job market for employees. Because of systematic variation in the cost of bankruptcy across industries, industry membership can be a viable proxy for testing our predictions.

Prediction 2

- When competitors' profits and stock returns are more highly correlated, bankruptcy is
  - –more likely to raise competitors' expected profits as well as stock and debt prices; and
  - –the firm's own stock price can either rise or fall.

Prediction 3

- Spillovers from bankruptcy to competitors' stock and debt prices are likely to be less positive after 2005. This change should be more marked in bankruptcy courts with judges that were more prone to extending the exclusivity period.

8. Conclusion

- There are two important determinants of the spillovers from bankruptcy to the firm's competitors:
  - positive information generated about the firm's competitiveness or the prospects for its industry,
  - and the size of bankruptcy costs resulting from disrupted operations, lost customers, or weakened worker relations.
- The overall spillover effect depends on the relative importance of these two factors.
- The overall spillover effect is also crucially dependent on whether the asymmetric information pertains to the firm's operations or about industry prospects.

Thank you !