Product Market Linkages and the Spillovers from Corporate Debt Restructurings

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We model the spillovers from a distressed firm’s debt restructuring to its competitors and related firms. We demonstrate that there are two channels for these spillovers: a direct channel that transmits the effect of bankruptcy on the firm’s competitiveness, and an indirect channel that transmits information about the firm. When the indirect channel is dominant, a firm’s bankruptcy pushes up its share price and pushes down its competitor’s stock price. The effect on the competitor’s debt is more subtle since the bankruptcy can raise the probability that the competitor will also enter bankruptcy. A strengthening of the direct channel tends to reverse the directions of the price responses of both the competitor’s and firm’s own stocks but may not reverse the price response of the competitor’s debt. The richness of the spillover predictions our model generates matches that of the evidence on the pricing effects of restructurings. Moreover, the predictions explain pricing effects that are inconsistent with existing explanations of the existing literature.

JEL Classification Codes: G33; Keywords: restructuring, distress, spillover, feedback

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Abstract

We model the spillovers from a distressed firm’s debt restructuring to its competitors and related firms. We demonstrate that there are two channels for these spillovers: a direct channel that transmits the effect of bankruptcy on the firm’s competitiveness, and an indirect channel that transmits information about the firm. When the indirect channel is dominant, a firm’s bankruptcy pushes up its share price and pushes down its competitor’s stock price. The effect on the competitor’s debt is more subtle since the bankruptcy can raise the probability that the competitor will also enter bankruptcy. A strengthening of the direct channel tends to reverse the directions of the price responses of both the competitor’s and firm’s own stocks but may not reverse the price response of the competitor’s debt. The richness of the spillover predictions our model generates matches that of the evidence on the pricing effects of restructurings. Moreover, the predictions explain pricing effects that are inconsistent with existing explanations of the existing literature.
1 Introduction

Studies on the spillover effects from corporate bankruptcies document that, on average, firms’ stock prices respond negatively to their own bankruptcies, but their competitor firms’ stock prices responses can be either positive and negative (e.g., Lang and Stulz (1992), Ferris, Jayaraman, and Makhija (1997), and Hertzel, Officer, and Rogers (2008)). The authors have attributed the average stock price response of the bankrupt firms and the dispersion in their competitors’ average stock price responses to the cross-sectional variation in two opposing forces: a competitive effect and a contagion effect. The competitive effect arises because bankruptcy weakens a firm, and allows its competitors to increase their market shares and profits at its expense. The contagion effect arises when information revealed by a firm’s bankruptcy either signals poor prospects for its industry or induces its competitors’ stakeholders to make decisions that hurt the competitors’ profits. Both these forces depend on the assumption that bankruptcy is bad news for the filing firm.\footnote{Consistent with bankruptcy being bad news for the filing firm, many researchers have documented that, on average, firms’ stock prices respond negatively to their own bankruptcies e.g., Lang and Stulz (1992), Ferris, Jayaraman, and Makhija (1997), and Hertzel, Officer, and Rogers (2008)).}

However, firms’ stock prices do not uniformly fall when they enter bankruptcy (e.g., Davydenko, Strebulaev, Zhao (2012)). In fact, we find that firms’ stock prices responded positively to their own bankruptcies in more than 20% of a comprehensive sample of bankruptcies of publicly traded firms from 1978 to 2011 (668 firms). Moreover, in this sample, when the firm’s stock price responds positively to its bankruptcy, its competitor firms’ average stock price response is almost equally likely to be either significantly positive or significantly negative. Therefore, we need a comprehensive explanation for the stock price responses to a firm’s bankruptcy. This explanation must account for both the variability in the stock price responses of the bankrupt firm and its competitors as well as the relation between these sets of stock price responses. It must also account for the price responses of other related firms, for example, supplier and customer firms.

In this paper, we develop a model to provide such an explanation. Our model also provides predictions about the price response of debt securities of the bankrupt firm, the price responses of the debt securities of related firms, future debt restructurings of related firms, and related firms’ stock and debt price responses to successful out-of-bankruptcy debt restructurings. Like the explanation for spillovers from bankruptcies offered in the literature, our explanation is also based on two forces. Moreover, the two forces on which we focus closely resemble the two effects employed by the existing literature: A competition effect that arises because bankruptcy weakens the firm’s competitive position, and an information effect that provides
new information about the firm’s prospects, and thus about related firms’ expected profits. Both forces arise endogenously during debt restructuring negotiations between a firm and its creditors, who are asymmetrically informed. The interplay between these two forces accounts for the rich variation in filing firm and competitor stock price response patterns documents by researchers.

In our model, the strength of a firm’s operations determine its future competitiveness and thus, its value. A firm can restructure its debt outside bankruptcy. However, negotiations between a firm and its debtholders can break down because each firm has private information about the strength of its operations that is not known to other agents, including other firms and its debtholders. If an out-of-bankruptcy negotiation with debtholders breaks down, the restructuring is completed in bankruptcy.\(^2\) Initially, we assume that bankruptcy disrupts a firm’s operations and erodes its competitiveness, and focus on the spillover effects from a firm’s restructuring on its competitors.\(^3\) Later, we examine the effect of the spillovers on firms that have a complementary relationship with the restructuring firm, such as that of a customer or supplier. We also examine the effect of allowing firms’ private information to reveal the prospects for their industry rather than their own operations, and allowing for the possibility that a firm can use bankruptcy protection to restructure its operations to strengthen its competitive position.\(^4\)

The bankruptcy-induced disruption of a firm’s operation is the basis for the competition effect. The extent of a competitor firm’s gain from the bankruptcy, and thus the strength of the competition effect, can vary with the structure of an industry.\(^5\) The information effect is more subtle. Debtholders are at an information disadvantage and cannot tell whether generous credit terms demanded by a firm are warranted or an attempt by a firm to exploit its information advantage. To avoid being exploited, debtholders may challenge a demand for generous credit terms. This will push the firm into bankruptcy, which could impose deadweight costs on both the firm and the debtholders. We demonstrate that, in equilibrium, despite the

\(^2\)We do not explicitly consider a role for firm liquidation. However, the effect of liquidation can easily be accommodated in our analysis; liquidation is an extreme case of lost competitiveness and renders the information effect of bankruptcy irrelevant.

\(^3\)For example, the article “Does the Worldcom Bankruptcy Put My Telecom Service at Risk?” by Harrison notes that “During restructuring, senior management will be preoccupied with maintaining financial viability, not maintaining or improving customer service...Fewer people will be available to answer questions, resolve problems, and correct billing and order processing mistakes...Worldcom is likely to suffer a talent drain as the company restructures.”

\(^4\)Bankruptcy can strengthen a firm’s competitive position in several ways. For example, it can help reduce the firm’s costs by having the Pension Benefit Guaranty Corporation (PBGC) take over pension obligations. A firm can also employ bankruptcy protection to renegotiate its labor contracts. For example, following its bankruptcy GM’s labor costs fell to $50 per hour compared with $72 before its bankruptcy and Ford’s labor costs of $55 (source: “UAW Anger at Contract Concessions on the Rise” By Joseph R. Szczesny, Tuesday, Feb. 23, 2010). Roe and Skeel (2009) argue that bankruptcy protection allowed Chrysler to execute a turnaround strategy that would not have been possible outside bankruptcy. Phillips and Sertsios (2013) document that firms increase product quality in bankruptcy.

\(^5\)See Lang and Stulz (1992) for evidence on cross-sectional variation in the strength of the competition effect across industries.
cost of bankruptcy, a firm with strong operations is more likely to demand generous credit terms and have its demand challenged by its debtholders. Consequently, bankruptcy signals the firm has strong operations. Thus, bankruptcy is good news for the firm and bad news for the firm’s competitors. For the same reason, a successful out-of-court restructuring signals good news about the competitors’ prospects. This information signalled by the restructuring outcomes is the basis of the information effect. The strength of the information effect depends on the level of information asymmetry between the restructuring firm and its debtholders.

The price responses of a firm’s financial claims to its restructuring are jointly dependent on the strength of the information effect and the bankruptcy-induced disruption of its operations. When the disruption from bankruptcy is relatively large, the firm’s stock price will drop when it enters bankruptcy. The price of the firm’s debt will also fall since its debtholders will bear some of the cost of its bankruptcy. When the disruption is relatively small and the information effect is dominant, the bankrupt firm’s stock price response will reverse. The price response of its debt, however, may not. Since the directions of the competition and information effects from a firm’s bankruptcy are opposite to their directions when the firm successfully restructures out of court, a successful out-of-bankruptcy restructuring generates mirror images of these price effects. In fact, in general, the spillover effects from a firm’s bankruptcy tend to be the opposite of those when it restructured outside bankruptcy.

The spillovers to competitor firms will also depend on the information effect and the disruption of the restructuring firm’s operations. However, the industry structure imposes as a wedge between the extent of the disruption of a bankrupt firm’s operations and its competitors gains (the competition effect). When the competition effect is large relative to the information effect, a firm’s bankruptcy will move a competitor into a stronger position within the industry. Therefore, the competitor’s share price will rise. In contrast, when the competition effect is small relative to the information effect of the bankruptcy, the competitor’s stock price will fall. When the firm successfully restructures outside bankruptcy, the competitor’s stock price response are mirror images of these price effects.

A firm’s bankruptcy will also spill over onto its competitors in other ways. When the competition effect is strong, the bankruptcy will raise a competitor’s bankruptcy cost since the competitor will be unable to fully capitalize on its stronger industry position if it too enters bankruptcy. In equilibrium, this rise in the

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6Industry-wide distress is fairly common, and has been studied in the literature both theoretically and empirically (Shleifer and Vishny (1992), Acharya, Bharath, and Srinivasan (2007)). Recent examples include the solar power industry (“Solyndra Bankruptcy Reveals Dark Clouds in Solar Power Industry” By Anne C. Mulkern) and retail industry (“Factbox: Recent Retail Bankruptcies,” Reuters). Simultaneous financial distress of suppliers is discussed, for example, in Benmelech, and Bergman (2008). The automobile industry and its suppliers have also faced financial distress in recent years (see, for example, “The American
competitor’s bankruptcy cost encourages it to demand generous credit terms more aggressively, and raises the likelihood that the competitor will also restructure in bankruptcy. Since the competitor’s debtholders share in its bankruptcy cost but do not enjoy a commensurate benefit from its profits if it avoids bankruptcy, the price of the competitor’s debt falls on news of the firm’s bankruptcy. These spillover effects reverse when the industry structure changes and the competition effect weakens, or when the firm restructures outside bankruptcy.

The competition and information effects also determine spillovers from a firm’s bankruptcy to other related firms, such as customers or suppliers. However, the direction of the competition and information effects is reversed. Now, the bankruptcy-induced erosion of a firm’s competitiveness lowers a supplier’s (customer’s) profits, while the bankruptcy signals that the firm’s operations are strong, which is good news for the supplier (customer). Therefore, when the information effect is relatively strong, a firm’s bankruptcy will raise both its share price and those of related firms, while a successful out-of-court restructuring will lower these share prices.

When we switch from assuming that bankruptcy is disruptive to assuming that a firm can use the protection bankruptcy provides to restructure its operations and emerge as a stronger competitor, only the competition effect of bankruptcy is reversed, aligning it with the information effect. Consequently, a firm’s bankruptcy both signals it has strong operations and weakens a competitor’s industry position. Therefore, regardless of the level of information asymmetry about the bankrupt firm, a competitor’s profitability will deteriorate and its share price will fall (rise) when a firm restructures in (outside) bankruptcy.

Finally, instead of assuming that firms are privately informed about their own operations, we adopt the assumption underlying the contagion effect that researchers have employed to explain spillovers—each firm is privately informed about its industry’s prospects. This change does not alter the tendency for a firm with more positive private information to restructure in bankruptcy. Therefore, instead of signaling good news about a bankrupt firm and bad news for its competitors, bankruptcy now signals better prospects for the entire industry. Thus, the information effect reverses its direction. Consequently, a competitor’s share price will fall (rise) when a firm restructures in (outside) bankruptcy.

There is a long history of models of distress-induced restructuring and bankruptcy (e.g., Giammarino (1989), Gertner and Scharfstein (1991), Mooradian (1994), White (1994), Broadie, Chernov and Sundare-


7We focus our analysis on firms with deep links that do not form relations with other firm in the restructuring firm’s industry.
san (2007), Elkamhi and Jiang (2011), Davydenko, Strebulaev, and Zhao (2012), Li (2013)). For example, Gertner and Scharfstein (1991) and Giammarino (1989) identify factors that determine why debt negotiations may be unsuccessful and restructuring firms often resort to a costly bankruptcy. Mooradian (1994) and White (1994) model the choice between reorganizing under the protection of Chapter 11 of the bankruptcy code and liquidation under Chapter 7 of the code. Li (2013) models the wealth transfers between a firm’s claimants due to bankruptcy. All these models have focused on the effect of a firm’s bankruptcy on the prices of its financial claims or on its assets. Our analysis is related to this literature because we model how a firm may endogenously restructure in bankruptcy, and the impact the bankruptcy has on the value of its debt and equity claims. In fact, we model restructuring negotiations similarly to Giammarino (1989), who also focuses on an environment characterized by information asymmetry. We depart from this literature because our focus is not on the bankrupt firm itself but the spillover effects from debt restructurings on competitor and related firms. By identifying the spillovers from a firm’s restructuring, we are able to provide richer and sharper empirical predictions about corporate restructurings than these models that do not consider the spillovers. Moreover, by identifying restrictions imposed by equilibrium constructs on the spillovers from bankruptcies to related firms, we are also able to assess the explanations that researchers have offered for empirical evidence on this topic.8

Several papers have demonstrated that common ownership of debt or trading links between debtholders can forge links between the firms’ restructurings. For example, Diamond and Rajan (2005) demonstrate that a bank may choose to force some debtors to restructure their loans if the performance of its loans to other debtors fails to meet its expectations. An increase in the bank’s interest cost increases the strength of this relationship between unmet expectations and restructuring. Acharya and Vishwanathan (2009) extend Allen and Gale’s (2000) model to demonstrate that trading links between lenders can magnify crises where firms are forced to liquidate and restructure. We contribute to this literature since we also show that a firm’s bankruptcy can influence the probability that a related firm will also restructure in bankruptcy. Unlike the other papers, this correlation between firms’ bankruptcies arises only because they operate in the same (related) market(s), and because bankruptcy signals information that alters the value of their relationship.

Our paper is also related to the large literature that focuses on the effect of financial decisions on a firm’s competitive position/profitability. Brander and Lewis (1986), Maksimovic (1988), and Bolton and

8Empirical investigations of spillovers from corporate bankruptcies include Lang and Stulz (1992), Ferris, Jayaraman, and Makhija (1997), Hertzel, Officer, and Rogers (2008), Boone and Ivanov (2012), and Fernando, May, and Megginson (2012).
Like these papers, we also examine the effect of firms’ financial decisions on their competitive position/profit. However, instead of examining the effect of firms’ decisions about their indebtedness, we focus on firms’ restructuring choices. A key difference between our model and the modeling approach adopted in this literature is that, in our model, firms’ restructuring outcomes signal private information. Therefore, both the direct effect of a firm’s choice on its competitiveness and the information it signals about its strength affect its competitor’s decisions.

The remainder of this paper is organized as follows: In Section 2, we develop our model. Section 3 contains derivations of the equilibrium outcomes for each firm. In Section 4, we derive the information effect from a firm’s restructuring. Section 5 contains an analysis of the price responses induced by corporate restorucings. In Section 6, we describe other spillover and feedback effects between corporate restorucings. Section 7 contains an analysis of changes in our results when we vary assumptions regarding the the economic linkages between firms and the nature of bankruptcy costs. In Section 8, we introduce and discuss novel empirical predictions arising from our model. We conclude the paper with a summary of our findings in Section 9.

2 Model

Consider a three-period economy populated by risk-neutral agents with a risk-free rate of zero. There are two levered firms in the economy: Firm One and Firm Two. For now, we assume that the firms compete in a single product market. Each firm is owned and managed by a single equityholder, and its debt is held by a single debtholder. Firm One’s (Two’s) debt has a face value $D_1$ ($D_2$) and is due in period one (two). Neither firm has a cash balance.

Both firms can generate a cash flow in period three. We denote Firm One’s (Two’s) period three cash flow by $\Pi_1$ ($\Pi_2$). Each firm’s cash flow increases with its competitiveness, which we denote by $c_j$ for Firm $j \in \{1, 2\}$. To simplify the analysis, we assume that either $c_j = y$, which implies that Firm $j$ is competitive, or $c_j = n$, which implies that Firm $j$ is uncompetitive. Firm $j$’s period three cash flow is positive when it is competitive and zero when it is uncompetitive, i.e., $\Pi_j = \pi_j > 0$ when $c_j = y$, and $\Pi_j = 0$ when $c_j = n$. For

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9We assume each firm has only one equityholder and one debtholder to simplify the analysis. This permits us to abstract from issues related to coordination between a firm’s claimants and asymmetric information problems that might arise when claimants own claims on both firms.
now, we assume that each firm’s competitiveness is independent of the other’s.

Neither firm’s competitiveness is known until period three, when it becomes public information. However, at the beginning of period one, each equityholder privately observes a noisy signal about her firm’s competitiveness. Each signal’s realization is drawn from the set \{s, w\}. The realization \( s \) (\( w \)) for Firm \( j \) indicates that it is competitive with probability \( \phi_j^s \) (\( \phi_j^w \)). The prior probability of the realization \( s \) for Firm \( j \) is \( q_j \in [0, 1] \). This prior is common knowledge. Hereafter, we refer to a firm that observes the realization \( s \) (\( w \)) as “strong” (weak). Let the likelihood ratio \( \ell_j, j \in \{1, 2\} \), be defined as follows:

\[
\ell_j = \frac{\phi_j^s - \phi_j^w}{\phi_j^s}.
\] (1)

This likelihood ratio is large (small) when there is a large (small) difference between Firm \( j \)’s competitiveness contingent on its private signal realization. Therefore, it is a measure of the private information Firm \( j \)’s equityholder possesses.

### 2.1 Debt restructuring

Since neither firm has cash on hand to repay its debt, both firms have to restructure their debt. Each firm’s restructuring occurs and is completed in the period in which its debt is due, that is, Firm One completes its restructuring in period one and Firm Two completes its restructuring in period two. Each restructuring begins with the equityholder offering to exchange the existing debt for new debt that matures in period three.\(^{10}\) We denote Firm \( j \)’s offer by \( \hat{D}_j \). The debtholder can either accept or reject the offer. If the debtholder accepts, the restructuring is complete. At the end of period three, the debtholder receives \( \min\{\hat{D}_j, \Pi_j\} \) and the equityholder retains the residual cash flow. If the debtholder rejects the offer, the firm enters and completes its restructuring in bankruptcy.

Following Giammarino (1989), we assume that bankruptcy generates deadweight costs and, in bankruptcy, the debtholder and bankruptcy court also observe the firm’s competitiveness signal. This dissipation of the debtholder’s information disadvantage reflects the idea that participants in a bankruptcy learn and share information about the bankrupt firm. As in Giammarino (1989), the bankruptcy court imposes a “fair” restructuring plan. This plan takes into account the firm’s competitiveness signal and shifts the cost of bankruptcy.

\(^{10}\)It is convenient to assume that the new claim is also debt. Our results are qualitatively unchanged if we modify this assumption to allow the firm to offer some mix of debt and equity.
to the debtholder (equityholder) if the equityholder’s original debt exchange offer was fair (unfair).\textsuperscript{11} Given a signal realization \( t \in \{s, w\} \) for Firm \( j \), a fair exchange offer \( F^t_j \) is one that sets the debtholder’s expected payoff equal to the face value of the initial debt claim \( D_j \), i.e.,

\[
F^t_j = D_j / \phi^t_j, \tag{2}
\]

Note that since \( \phi^w_j < \phi^s_j \), a fair offer for a strong firm is lower than a fair offer for a weak firm, i.e., \( F^s_j < F^w_j \). If the firm’s initial exchange offer, \( \hat{D}_j \), was lower than, \( F^t_j \), the court imposes a fair offer on the firm. By leaving the value of the debtholder’s claim undiminished, this bankruptcy plan ensures that the equityholder bears the entire deadweight cost of bankruptcy. If \( \hat{D}_j \geq F^t_j \), the court will determine that the firm’s original offer was fair conditional on the equityholder’s signal realization \( t_j \in \{s, w\} \). Therefore, it will impose a plan under which the debtholder receives a claim whose face value \( D'_j \) satisfies the following condition:

\[
E \left[ \max \{ \Pi_j - F^t_j, 0 \} | t_j, b_j = o, I_j \right] = E \left[ \max \{ \Pi_j - D'_j, 0 \} | t_j, b_j = i, I_j \right]. \tag{3}
\]

Under this plan, the equityholder’s payoff is unchanged by bankruptcy and the debtholder alone bears the dissipative cost.

To simplify the analysis we assume that outside investors do not observe the details of either firm’s debt negotiation. Investors can only observe whether a firm restructures inside or outside bankruptcy. Moreover, we assume that the bankruptcy court handling a firm’s case cannot observe the competitor’s valuation hearings or learn the competitor’s competitiveness signal.\textsuperscript{12} Let \( b_j \) indicate whether Firm \( j \) restructures in bankruptcy, where \( b_j = i \) if it does, and \( b_j = o \) otherwise. Let \( I_j \) represent public information Firm \( j \) has about its competitor’s restructuring when it starts its own negotiations. Then, \( I_2 = b_1 \) since the outcome of Firm One’s negotiation is public information in period two when Firm Two begins negotiating. Since the

\textsuperscript{11}As explained by Giammarino (1989), this allocation of the cost of bankruptcy limits frivolous litigation. Our results are qualitatively unchanged when we adopt a less extreme allocation of bankruptcy costs so long as the allocation does not completely eliminate the penalty for unfair offers. So long as this condition is satisfied, a strong firm is likely incurs a lower bankruptcy cost.

\textsuperscript{12}These assumptions both highlight the information effect and simplify the analysis. They are equivalent to assuming that (a) each restructuring only involves the firm’s claimholders, (b) participants in a firm’s restructuring do not participate in the competitor’s restructuring, and (c) there is a delay between the completion of Firm One’s bankruptcy and the release of information from its valuation hearing to agents who do not participate in the restructuring. Loosening these assumptions results in our having to develop additional notation to characterize Firm Two’s restructuring for several more cases corresponding to each possible (offer and type-contingent) outcome of Firm One’s restructuring. However, the basic insights we develop are unaffected. In fact, in an earlier draft of this paper we demonstrate that the spillover and feedback effects of Firm One’s restructuring we develop below are virtually identical to the average effects of Firm One’s restructuring in the absence of this assumption. We are happy to provide the proofs upon request.
outcome of Firm Two’s negotiation is not known in period one when Firm One begins negotiating, \( \mathcal{F}_1 = \emptyset \).

2.2 The cost of bankruptcy

For now we assume that bankruptcy erodes a firm’s competitiveness and thus its cash flow.\(^{13}\) Each firm’s cash flow depends on its relative competitiveness, which depends on the competitor’s restructuring outcome. Therefore, we assume that Firm \( j \)’s cash flow is a function of its restructuring outcome \( (b_j) \) and competitiveness \( (c_j) \) as well as its competitor \( k \)’s restructuring outcome \( (b_k) \) and competitiveness \( (c_k) \), i.e.,

\[
\Pi_j = \begin{cases} 
0 & \text{if } c_j = n \\ 
\pi_j(b_j, b_k, c_k) & \text{if } c_j = y 
\end{cases} 
\]

We impose the following restrictions on the cash flows:

\[
\pi_j(b_j, b_k, n) > \pi_j(b_j, i, y) > \pi_j(b_j, o, y). 
\]

The first inequality ensures that, since a firm’s competitive position will be strongest when its competition is weakest, the firm’s cash flow will be highest when its competitor is uncompetitive. The second inequality ensures that a firm’s cash flow will be higher when its competitor restructures in bankruptcy. This restriction is consistent with the competitive effect researchers have employed to explain spillovers from bankruptcies.

Let \( \Delta^n_j \) represent the erosion of Firm \( j \)’s cash flow \( (\pi_j) \) because of its bankruptcy, when its competitor (Firm \( k \)) is uncompetitive. Similarly, let \( \Delta^{b_k}_j \) capture the bankruptcy-induced erosion of Firm \( j \)’s cash flow when Firm \( k \) is competitive and its restructuring outcome is \( b_k \in \{i, o\} \), i.e.,

\[
\Delta^n_j \equiv \pi_j(o, b_k, n) - \pi_j(i, b_k, n) > 0; \\
\Delta^{b_k}_j \equiv \pi_j(o, b_k, y) - \pi_j(i, b_k, y) > 0. 
\]

Since management flexibility and attention to the firm’s operations, uninterrupted supplies, and retention of employees are likely to be most profitable when a firm’s competition is weak, we assume that the bankruptcy-

\(^{13}\)The erosion of the firm’s competitiveness may arise from constraints that bankruptcy and its attendant litigation place on management, the reluctance of suppliers to deal with a firm that is disputing creditors’ claims, and the departure of employees.
induced erosion of cash flows is largest when the competitor is weakest, i.e., we assume

$$\Delta_i^j > \Delta_f^j > \Delta_o^j.$$  \hspace{1cm} (7)

Finally, to limit the number of cases we have to consider, we assume that, despite the cost of bankruptcy, the expected value of each firm’s period three cash flow always exceeds its outstanding debt, i.e.,

$$\min_{b_k, c_k} \phi_j^W \pi_j(i, b_k, c_k) > D_j.$$  \hspace{1cm} (8)

### 3 Restructuring equilibria

We solve for Bayesian Nash Equilibria of this game. In these equilibria, each equityholder makes an initial restructuring offer that maximizes the expected value of her shares given the strategies of her firm’s debtholder and the strategies of the competing firm’s equityholder and debtholder. Each debtholder’s response to an offer maximizes his expected payoff given the strategies of the competing firm’s equityholder and debtholder. On the equilibrium path, beliefs are updated using Bayes rule. We follow the standard backward induction procedure to identify equilibria. Therefore, we first characterize equilibria for sub games starting with Firm Two’s restructuring in period two.

#### 3.1 Firm Two’s restructuring

Since Firm Two’s equityholder is privately informed about its competitiveness, only she knows the terms of a fair offer. The equityholder can benefit by getting the debtholder to agree to a promised debt payment lower than a fair offer, which will lower the firm’s debt burden. The debtholder can avoid incurring the mispricing loss inherent in such an offer by pushing Firm Two into bankruptcy. The equilibrium outcome is shaped by this tradeoff between the mispricing effects of the equityholder’s private information and bankruptcy costs resulting from disagreement between Firm Two’s claimants.

If Firm Two is strong, its equityholder cannot profit from her private information. To see this, note that it is common knowledge that a offer less than $F_2^2$ cannot be fair. Thus, Firm Two’s debtholder knows that if he forces the firm into bankruptcy after such an offer, the bankruptcy court will impose the entire bankruptcy cost on the equityholder and award the debtholder a claim with a value equal to his original claim, $D_2$. 


Consequently, the debtholder will always reject an offer lower than $F_s^2$, and the equityholder will never offer less than $F_s^2$. If Firm Two is strong, the equityholder has no incentive to offer more than $F_s^2$, since the court will always side with her if she makes a fair offer. Therefore, the equityholder will offer exactly $F_s^2$.

In contrast, if Firm Two is weak, the equityholder may profit from keeping her private information hidden. To succeed, she has to offer the same payment she would have if the firm were strong, $F_s^2$. To see this is feasible, suppose that the equityholder offers $F_s^2$ with probability $e_2$. The equityholder will offer $F_s^2$ with probability one if Firm Two is strong. Therefore, by Bayes rule, conditional on the offer $F_s^2$, the debtholder’s posterior probability that Firm Two is weak equals

$$\frac{(1-q_2)e_2}{q_2 + (1-q_2)e_2}.$$

Since $\phi^e F_2^s = D_2 > \phi^w F_2^s$, the debtholder’s expected mispricing loss from an offer of $F_s^2$ is as follows:

$$D_2 - \left(1 - \frac{(1-q_2)e_2}{q_2 + (1-q_2)e_2}\right)\phi^s F_s^2 + \frac{(1-q_2)e_2}{q_2 + (1-q_2)e_2} \phi^w F_s^2 = \frac{(1-q_2)e_2}{Q + (1-q_2)e_2} \ell_2 D_2. \tag{9}$$

Note that the mispricing loss is increasing in $\ell_2$, which measures the equityholder’s information advantage.

To avoid the mispricing loss, the debtholder can reject an offer of $F_s^2$ and force Firm Two into bankruptcy. His willingness to do so will depend on the cost he expects to incur in bankruptcy. Let $\Delta_2(b_1)$ represent the expected bankruptcy-induced decline in Firm Two’s cash flow when it is competitive conditional on Firm One’s restructuring outcome, $b_1$, i.e.,

$$\Delta_2(b_1) \equiv E[\pi_2(o, b_1, c_1) - \pi_2(i, b_1, c_1)|b_1]. \tag{10}$$

Since the court will only impose the bankruptcy cost on the debtholder if Firm Two is strong, and the court’s decision will only matter if Firm Two is competitive ($c_2 = y$) and generates a positive cash flow in period three, the debtholder’s expected cost from rejecting an offer of $F_s^2$ is given by

$$\frac{q_2}{q_2 + (1-q_2)e_2} \phi^s \Delta_2(b_1). \tag{11}$$

By comparing this expression with Eq. (9), which describes the debtholder’s expected mispricing loss, it is clear that his expected bankruptcy cost is larger when

$$q_2 \phi^s \Delta_2(b_1) > (1-q_2) \ell_2 D_2. \tag{12}$$
When condition (12) is satisfied, the debtholder will prefer to accept an offer of \( F_2^s \). Recognizing this, the equityholder will offer \( F_2^s \) even when it is weak. Therefore, when Firm Two’s expected bankruptcy cost is sufficiently large, there will only exist \textit{out-of-bankruptcy} equilibria in which the firm restructures outside bankruptcy. In these equilibria, the equityholder always offers \( F_2^s \) and the debtholder accepts.

The debtholder may be willing to reject an offer of \( F_2^s \) when condition (12) is violated. However, in equilibrium, he will only do so with a probability less than one. To see this, note that, when Firm Two is weak, the equityholder will not offer \( F_2^s \) if she expects the offer to be rejected with probability one. Since the equityholder will not offer \( F_2^s \) when Firm Two is weak, the debtholder’s expected payoff from rejecting \( F_2^s \) is lower than from accepting it, making it suboptimal for the debtholder to \textit{always} reject an offer of \( F_2^s \).

When condition (12) is violated, there only exist equilibria in which the equityholder randomly offers either \( F_2^s \) or \( F_2^w \) when Firm Two is weak. The debtholder always accepts an offer of \( F_2^w \), but randomly rejects an offer of \( F_2^s \). We refer to such an equilibrium, in which Firm Two enters bankruptcy with a positive exante probability, as a \textit{bankruptcy equilibrium}.\(^{14}\) We describe out-of-bankruptcy and bankruptcy equilibrium outcomes we have just described in the following Lemma:

**Lemma 1.** 1. If bankruptcy lowers Firm Two’s expected cash flows by a sufficiently large amount, i.e., condition (12) is satisfied, there only exist out-of-bankruptcy equilibria in which Firm Two’s equityholder offers \( F_2^s \) regardless of the competitiveness signal, and the debtholder always accepts an offer of \( F_2^s \). If condition (12) is violated, there only exist bankruptcy equilibria. In these equilibria, the equityholder always offers \( F_2^s \) if Firm Two is strong. If Firm Two is weak, the equityholder offers \( F_2^s \) with probability

\[
e_2(b_1) = \frac{q_2\phi_2^s\Delta_2(b_1)}{(1-q_2)\ell_2D_2}, \tag{13}\]

and offers \( F_2^w \) otherwise. The debtholder always accepts an offer of \( F_2^w \), but rejects an offer of \( F_2^s \) with probability

\[
d_2(b_1) = \frac{\ell_2D_2}{\phi_2^w\Delta_2(b_1) + \ell_2D_2}. \tag{14}\]

\(^{14}\)The strategies of the equityholder and the debtholder described in Lemma 1 are neither continuous nor monotone in beliefs about Firm One. For example, as long as (12) is violated, the probability \( e_2 \) that the equityholder will offer \( F_2^s \) when the firm is weak increases with beliefs about Firm One that increase the expected cost of bankruptcy \( \Delta_2(b_1) \), but drops to zero when the cost of bankruptcy \( \Delta_2(b_1) \) becomes large enough to satisfy (12). This discontinuity may in fact lead to absence of equilibrium or to multiple equilibria in our model. However, according to our numerical simulations, the set of parameters for which either occurs is small.
2. Condition (12) is satisfied if

\[ q_2 \phi_s^2 (\phi_1^1 \Delta_2^0 + (1 - \phi_1^1) \Delta_2^0) > (1 - q_2) \ell_2 D_2. \]  

(15)

and condition (12) is violated if

\[ q_2 \phi_s^2 (\phi_1^w \Delta_2^0 + (1 - \phi_1^w) \Delta_2^0) < (1 - q_2) \ell_2 D_2. \]  

(16)

From Lemma 1 it is clear that whether Firm Two restructures in bankruptcy is crucially dependent on the size of the bankruptcy-induced decline in Firm Two’s cash flow, \( \Delta_2(b_1) \). This relation is discontinuous and non-monotone. In a bankruptcy equilibrium, the debtholder’s cost from rejecting \( F_2^e \) rises when \( \Delta_2(b_1) \) rises. Therefore, the debtholder will respond to an increase in \( \Delta_2(b_1) \) by rejecting \( F_2^e \) with a lower probability. Anticipating a lower rejection rate for \( F_2^e \), Firm Two’s equityholder is more likely to make this offer when the firm is weak. The equityholder’s increased propensity to exploit her information advantage is always sufficiently large to ensure that an increase in \( \Delta_2(b_1) \) raises Firm Two’s overall probability of bankruptcy, \( \beta_2(b_1) \), which can be seen from the following expression:

\[ \beta_2(b_1) = q_2 d_2(b_1) + (1 - q_2) e_2(b_1) d_2(b_1) = q_2 \frac{\phi_2^2 \Delta_2(b_1) + \ell_2 D_2}{\phi_2^w \Delta_2(b_1) + \ell_2 D_2}. \]  

(17)

However, in an out-of-bankruptcy equilibrium, which occurs for a sufficiently values of \( \Delta_2(b_1) \), Firm Two’s bankruptcy probability equals zero and remains there as \( \Delta_2(b_1) \) rises further.

Lemma 2. If Firm Two’s bankruptcy cost, \( \Delta_2(b_1) \), is large enough to satisfy condition (12), the ex ante probability that Firm Two will restructure in bankruptcy, \( \beta_2(b_1) \), equals zero and remains at zero as its bankruptcy cost rises. If condition (12) is violated, Firm Two’s ex ante probability of bankruptcy is greater than zero and rises with its bankruptcy cost.

3.2 Firm One’s restructuring

Firm One’s debt renegotiation only differs from Firm Two’s because Firm One’s claimants have to select their strategies based on their expectation about the competitor firm’s restructuring outcome rather than the restructuring outcome itself. As we demonstrate below, in spite of this difference, the two sets of
claimants have similar incentives and the two sets of restructurings yield similar outcomes. As in Firm Two’s restructuring, Firm One’s equityholder wants to exploit her information advantage and the debtholder can avoid a mispricing loss by forcing Firm One into bankruptcy. There exist out-of-bankruptcy equilibria in which Firm One’s equityholder makes the lowest offer the bankruptcy court would deem as fair, $F_1^s$, and the debtholder accepts. There also exist bankruptcy equilibria in which the equityholder offers $F_1^i$ when Firm One is strong and sometimes offers $F_1^w$ when Firm One is weak. The debtholder sometimes rejects an offer of $F_1^i$ to avoid the mispricing inherent in such an offer. The debtholder will never reject an offer of $F_1^i$ when bankruptcy is sufficiently costly, i.e., when

$$q_1 \phi_1^i \Delta_1 > (1-q_1) \ell_1 D_1,$$

where $\ell_1$ captures the equityholder’s information advantage and $\Delta_1$ represents Firm One’s expected bankruptcy-induced cash flow loss conditional on the expectation of Firm Two’s restructuring outcome.\(^{15}\) We formalize this discussion in the following Lemma:

**Lemma 3.** If bankruptcy lowers Firm One’s expected cash flows by a sufficiently large amount, i.e., condition (18) is satisfied, there only exist out-of-bankruptcy equilibria in which Firm One’s equityholder offers $F_1^i$ regardless of the competitiveness signal, and the debtholder always accepts an offer of $F_1^i$. If condition (18) is violated, there only exist bankruptcy equilibria. In these equilibria, Firm One’s equityholder always offers $F_1^i$ if Firm One is strong. If Firm One is weak, the equityholder offers $F_1^i$ with probability

$$e_1 = \frac{q_1 \phi_1^i \Delta_1}{(1-q_1) \ell_1 D_1},$$

and offers $F_1^w$ otherwise. The debtholder always accepts an offer of $F_1^w$, but rejects an offer of $F_1^i$ with probability

$$d_1 = \frac{\ell_1 D_1}{\phi_1^w \Delta_1 + \ell_1 D_1}.$$

We illustrate the equilibrium restructuring outcomes described in Lemmas 1 and 3 in Figure 1. This figure also illustrates the links between the two restructurings, which we examine in detail in the remainder of the paper. To create this figure and those that follow, we assume that the period three cash flow for Firm

\(^{15}\)We provide insight into the structure and magnitude of $\Delta_1$ later and express $\Delta_1$ in terms of exogenous parameters in Eq. (24).
\[ j \in \{1, 2\} \text{ is described by the following function:} \]

\[ \pi_j(b_j, b_k, c_k) = \alpha_j(1 - I_{b_j})[1 + (1 - I_{c_k})I_{b_k} \delta c_k \gamma_k + I_{c_k} \gamma_b], \]  

(21)

where \( \alpha_j \) is Firm \( j \)'s cash flow when both firms are competitive and are not weakened by bankruptcy, \( I_{b_j} \) (\( I_{b_k} \)) is a bankruptcy indicator function for Firm \( j \) (\( k \)) that takes the value one when \( b_j = i \) (\( b_k = i \)), \( I_{c_k} \) is a competitiveness indicator function that takes the value one when \( c_k = n \), \( \delta_j \) (\( \delta_k \)) measures the deterioration of Firm \( j \)'s (\( k \)'s) competitiveness because of its bankruptcy, \( \gamma_c \) determines a firm's gain when its competitor is uncompetitive, and \( \gamma_b \) determines a firm's gain when its competitor is weakened by bankruptcy. The cash flow structure in Eq. (21) reflects our assumptions that a firm's cash flow falls when it enters bankruptcy, and the bankruptcy cost rises as as the competitor becomes weaker. To construct all our examples, we assume that all agents believe that Firm \( j \) is weak in the off-equilibrium-path event that it make an offer different than \( F^s_j \) in an out-of-bankruptcy equilibrium, or different that \( F^s_j \) and \( F^w_j \) in a bankruptcy equilibrium.

In Figure 1, we vary the cost of bankruptcy for Firm One and the information advantage of its equity-holder by varying \( \delta_1 \) and \( \ell_1 \), respectively. To vary \( \ell_1 \), we increase \( \phi_1^+ \). Consistent with the tradeoff between bankruptcy costs and mispricing faced by Firm One’s claimants captured, the regions where Firm One is in a bankruptcy equilibrium shrink as \( \delta_1 \) rises and expand as \( \ell_1 \) rises. The Figure also illustrates that Firm Two’s restructuring outcome is sensitive to the tradeoff faced by Firm One’s claimants: Firm Two is more likely to be in a bankruptcy equilibrium for high values of \( \ell_1 \), when Firm One’s restructuring is likely to yield the strongest information effect. However, the sensitivity of Firm Two’s restructuring outcome to \( \ell_1 \) falls as \( \delta_1 \) rises strengthening the competition effect.

4 The information effect of bankruptcy

Investors will update their beliefs about each firm’s competitiveness once they learn its restructuring outcome. Therefore, each firm’s stock and bond prices will respond to its restructuring outcome. First consider the response to bankruptcy: the stock price will drop under some circumstances and rise in others. To see why bankruptcy will not always cause a negative stock price reaction even though it generates a deadweight cost that could erode the equityholder’s cash flows, note that a firm only enters bankruptcy following the debtholder’s rejection of an offer of \( F^s_j \). Since the equityholder is more likely to make such an offer when
her firm is strong and the debtholder is unable to condition his rejection on the firm’s competitiveness, a firm is more likely to enter bankruptcy when it is strong. Consequently, bankruptcy will cause investors to revise upwards their beliefs about the firm’s competitiveness. This should raise the share price. However, there is a likelihood that the equityholder will bear a deadweight cost if the bankruptcy court discovers that the firm is weak and the equityholder had made an unfair offer. This possibility will act as a drag on the firm’s share price. In the following proposition we demonstrate that, when there is a lot of information asymmetry surrounding the firm, the first effect will dominate since the bankruptcy will cause investors to aggressively raise their assessments of the firm’s competitiveness and thus their valuations of its shares.

The stock price response to an out-of-court restructuring will typically be the opposite of the response to bankruptcy. While an out-of-court settlement ensures the firm will not incur the bankruptcy-induced deadweight cost, it is more likely when the firm is weak. Therefore, when the information effect is relatively strong, the stock price will fall, and when it is relatively weak, the stock price will rise. Given this inverse relation between the information and competition effects of bankruptcy and out-of-bankruptcy settlements, in the interest of brevity, we focus on price responses to bankruptcy in the remainder of the paper.

While a firm’s stock price may respond either positively or negatively to its bankruptcy, its bond price response will be negative. To see this note that, in a bankruptcy equilibrium, the debtholder can expect to receive either an offer of $F^w_j$ or $F^s_j$ when a firm begins its restructuring. The debtholder’s expected payoff if he accepts $F^w_j$ equals the value of his original claim on Firm $j$, $D_j$. His expected payoff if he accepts $F^s_j$ is lower since the equityholder might make this offer when the firm is weak. Since the debtholder is indifferent between accepting and rejecting the offer $F^s_j$, his expected payoff from rejecting such an offer is also lower than $D_j$. Therefore, the probability that the debtholder will receive an offer worth $D_j$ is higher when Firm $j$ begins restructuring than when the debtholder forces it into bankruptcy by rejecting an offer of $F^s_j$.

**Proposition 1.** When Firm $j \in \{1, 2\}$ has a large information advantage and a small bankruptcy cost, i.e., $\ell_j$ is large and $\Delta_j$ is small, the market value of Firm $j$’s equity will increase following the news of its bankruptcy. The price of Firm $j$’s debt always declines following the announcement of its bankruptcy. These effects will reverse in a successfully out-of-bankruptcy restructuring.

Proposition 1 indicates that, even in the presence of a deadweight cost imposed by bankruptcy, there will be considerable cross-sectional variation in the responses of firms’ stock prices to news of their bankruptcies; a firm’s stock price will tend to respond positively when there is considerable information asymmetry about
its prospects and negatively otherwise. This prediction is consistent with the behavior of stock prices around over 20% of bankruptcy announcements between 1976 and 2011, and the findings in other studies (e.g., Davydenko, Strebulaev, Zhao (2012)).

We illustrate the information signaled by Firm One’s restructuring in Figure 2. In the figure, we plot the posterior belief that Firm One is strong, conditional on it restructuring in and out of bankruptcy. From the figure, it is clear that the posterior belief is always higher when Firm One restructures in bankruptcy. Moreover, the difference between the posterior assessments following bankruptcy and an out-of-bankruptcy restructuring, which captures the strength of the information effect, increases as the likelihood ratio $\ell_1$ rises.

In Figure 3, we illustrate the price response of Firm One’s stock to its bankruptcy. In the figure, we plot Firm One’s stock price both before its begins restructuring and when it enters bankruptcy. We vary the likelihood ratio $\ell_1$ and the prior assessment of Firm Two’s competitiveness, $q_2$. Not surprisingly, Firm One’s stock price is decreasing in $q_2$. The tension between the deadweight cost and information effects of Firm One’s bankruptcy is clear. When $\ell_1 = 0.1$ and thus Firm One’s equityholder has little private information, the deadweight cost of bankruptcy dominates and Firm One’s share price is lower when it enters bankruptcy. In contrast, when $\ell_1 = 0.5$ and thus Firm One’s equityholder has significant private information, the information effect dominates and Firm One’s share price is higher when it enters bankruptcy.

5 Price reactions to a competitor’s bankruptcy

Stock and bond prices can also be impacted by competitors’s debt restructurings. Consider, for example, the responses of Firm Two’s stock and bond prices to news of Firm One’s bankruptcy. As we describe below, these responses will depend on the competition and information effects of Firm One’s bankruptcy. The strength of the competition effect depends on the structure of the industry in which the two firms operate.

5.1 Stock price reactions

If the information effect of Firm One’s bankruptcy is weak, Firm Two’s expected profit will rise when Firm One’s bankruptcy is expected to give Firm Two a big competitive advantage. As we demonstrate in the following proposition, this is sufficient to ensure that Firm Two’s stock price will rise when Firm One enters bankruptcy. When the information effect dominates the competition effect, however, Firm One’s bankruptcy will induce investors to believe that Firm Two faces a strong competitor and thus expect lower profits. As we
demonstrate in the following proposition, this drop in anticipated profit will lower Firm Two’s share price.

The reason that Firm Two’s stock price reaction to Firm One’s bankruptcy is driven solely by its effect on Firm Two’s expected profit is straightforward. When Firm Two is strong, the equityholder’s payoff is the same regardless of the type of equilibrium or the debtholder’s response. When Firm Two is weak, in an out-of-bankruptcy equilibrium, the equityholder’s payoff is unaffected by Firm One’s bankruptcy. In a bankruptcy equilibrium, the equityholder’s expected payoff is the same whether she makes a fair offer of $F_2^v$ or offers $F_2^s$.

**Proposition 2.** Firm Two’s stock price will respond positively to news of Firm One’s bankruptcy if

\[ \ell_1 < \frac{\pi_2(o,i,y) - \pi_2(o,o,y)}{\pi_2(o,i,n) - \pi_2(o,o,y)} \]  

(22)

Otherwise, a negative reaction is possible.

Stock prices often respond positively to news of a competitors’ bankruptcy. Stock prices respond negatively with a comparable frequency. Prior studies attribute the positive stock price responses to bankruptcy-induced damage to the competitors’ operations, and the negative stock price responses to negative industry-wide news revealed by the bankruptcy filings. Both these explanations imply that bankruptcy is bad for the filing firms. Therefore, they cannot rationalize many bankruptcies where the filing firms’ stock price responses are positive. In contrast, Proposition 2 rationalizes both positive and negative stock price responses to a competitor’s bankruptcy, both when the competitor’s own price responds positively and when it responds negatively to its own bankruptcy.

We illustrate this result in Figure 4. In the figure, consistent with Proposition 1, Firm One’s stock price responds positively to its bankruptcy when $\ell_1$, which captures the amount of private information possessed by its equityholder, is relatively large. Firm Two’s stock price tends to respond negatively to Firm One’s bankruptcy when both $\ell_1$ and $\gamma_c$, which captures Firm Two’s ability to capitalize on Firm One’s lack of competitiveness, are large. For these parameter values, the information effect from Firm One’s bankruptcy is relatively large, and thus Firm One’s bankruptcy signals that Firm Two is unlikely to enjoy a competitive advantage over Firm One.
5.2 Bond price reactions

Firm Two’s bond price responds very differently from its stock price to Firm One’s restructuring. One reason is that Firm Two’s debtholder does not share in the expected profit change resulting from Firm One’s bankruptcy. Another reason is that, unlike Firm Two’s equityholder, its debtholder is always adversely affected by any development in Firm One’s restructuring that increases the likelihood that Firm Two will seek concessions from its debtholder.

To see the dependence of Firm Two’s restructuring on Firm One’s restructuring, note that Firm Two’s bankruptcy cost, \( \Delta_2(b_1) \), can be expressed as follows:

\[
\Delta_2(b_1) = E[\phi_1|b_1](\pi_2(o,b_1,y) - \pi_2(i,b_1,y)) + (1 - E[\phi_1|b_1])(\pi_2(o,b_1,n) - \pi_2(i,b_1,n))
\]

\[
= E[\phi_1|b_1]\Delta_2^b + (1 - E[\phi_1|b_1])\Delta_2^n,
\]

where \( E[\phi_1|b_1] \) is the posterior probability that Firm One will be competitive in period three conditioned on public information about its restructuring outcome, \( b_1 \). Since \( \Delta_2^i > \Delta_2^o \) by Assumption (7), the above expression suggests that Firm Two’s bankruptcy cost will be higher when Firm One restructures in bankruptcy. The impact on the bankruptcy cost will be greater when \( \Delta_2^i - \Delta_2^o \) is large. This will be the case when the competition effect of Firm One’s bankruptcy is strong and greatly strengthens Firm Two’s industry position. However, since Firm One is more likely to restructure in bankruptcy when it is strong, \( E[\phi_1|b_1 = i] > E[\phi_1|b_1 = o] \). The difference in these two conditional probabilities will be large when \( \ell_1 \) is large and the information effect of Firm One’s restructuring is strong. The following lemma demonstrates that the information and competition effects work in opposite directions. Therefore, Firm Two’s bankruptcy cost will be higher following Firm One’s bankruptcy when the bankruptcy deeply erodes Firm One’s competitiveness but will be lower when Firm One’s equityholder has a lot of private information.

**Lemma 4.** Firm Two’s bankruptcy cost will be higher following Firm One’s bankruptcy when Firm One’s bankruptcy deeply erodes its competitiveness and Firm One has little private information about its competitiveness, i.e., \( \Delta_2(i) > \Delta_2(o) \) when

\[
\ell_1 < \frac{\Delta_2^i - \Delta_2^o}{\Delta_2^i - \Delta_2^o}.
\]

When condition (23) is violated Firm Two’s bankruptcy cost may be lower following Firm One’s bankruptcy.
We illustrate the effect of Firm One’s bankruptcy on Firm Two’s bankruptcy cost in Figure 5. As predicted by Lemma 4, Firm Two’s bankruptcy cost is higher following Firm One’s bankruptcy when $\delta_1$ is larger and thus Firm One incurs a greater loss of competitiveness. In contrast, for higher values of $\ell_1$, when the information effect of Firm One’s bankruptcy is relatively strong, Firm Two’s bankruptcy cost is lower following Firm One’s bankruptcy.

By influencing Firm Two’s bankruptcy cost, Firm One’s bankruptcy also influences the amount of debt forgiveness that Firm Two’s equityholder can obtain. In anticipation of the change in debt forgiveness, Firm Two’s bond price changes on news of Firm One’s bankruptcy. For example, when the competition effect of Firm One’s bankruptcy is stronger than its information effect, Firm Two’s expected bankruptcy cost is higher following Firm One’s bankruptcy. This discourages Firm Two’s debtholder from rejecting an offer of $F_2^s$ and encourages Firm Two’s equityholder to seek concessions more aggressively. Since the debtholder’s expected payoff from an offer of $F_2^s$ does not vary with his response in a bankruptcy equilibrium, the debtholder’s expected payoff is lower after Firm One enters bankruptcy.

**Proposition 3.** *If bankruptcy deeply erodes Firm One’s competitiveness and its equityholder has little private information, i.e., condition (23) is satisfied, then Firm One’s bankruptcy will induce a weakly negative price reaction for Firm Two’s bonds. The price response reverses when condition (23) is violated.*

We illustrate Proposition 3 in Figure 6, where we plot the price of Firm Two’s debt conditional on Firm One’s restructuring outcome. When $\ell_1$ is small, the competition effect of Firm One’s bankruptcy dominates. Therefore, Firm One’s bankruptcy signals weaker competition and a larger bankruptcy cost for Firm Two. Since a larger bankruptcy cost encourages Firm Two’s equityholder to seek concessions, Firm Two’s bond price is lower when Firm One’s restructures inside bankruptcy. When $\ell_1$ is large and the information effect from Firm One’s restructuring is dominant, the prices are reversed: Firm Two’s bond price is lower when Firm One restructures outside bankruptcy.

### 6 Interdependence between restructuring outcomes

As is clear from Lemma 4, Firm One’s restructuring outcome influences Firm Two’s bankruptcy cost. This spillover can influence Firm Two’s restructuring outcome. There also exists a potential feedback effect to Firm One’s restructuring outcome. We explore these possibilities in this section.
6.1 Spillovers to Firm Two’s restructuring

Lemma 4 demonstrates that Firm Two’s bankruptcy cost rises with Firm One’s bankruptcy when the information effect is weak. Further, Lemma 2 demonstrates that Firm Two’s restructuring bankruptcy probability can rise along with its bankruptcy cost. In the following proposition we combine these results and demonstrate that, when the information effect of Firm One’s equityholder is relatively weak, Firm One’s bankruptcy can raise the likelihood that Firm Two will also restructure in bankruptcy.

The price response of Firm Two’s equity to its own bankruptcy will also vary with Firm One’s restructuring outcome because of this spillover. To see this, suppose the information effect of Firm One’s bankruptcy is relatively weak. The competition effect of Firm One’s bankruptcy will directly raise Firm Two’s bankruptcy cost and thus increase the downward drag exerted by Firm Two’s bankruptcy cost on its share price. Second, the rise in Firm Two’s bankruptcy cost induced by Firm One’s bankruptcy will raise the probability that its equityholder will make an offer that the debtholder will contest. As we demonstrate in the following proposition, both effects work in concert to dampen the positive price response of Firm Two’s share price to its own bankruptcy. Firm Two’s higher bankruptcy cost also ensures that its bond price will respond more negatively to its bankruptcy following Firm One’s bankruptcy. We formalize these spillovers from Firm One’s restructuring to Firm Two’s in the following proposition.

Proposition 4. If Firm One’s equityholder has little private information, bankruptcy deeply erodes Firm One’s competitiveness, and Firm Two remains in a bankruptcy equilibrium regardless of Firm One’s restructuring outcome, i.e., condition (23) is satisfied and condition (12) is violated for both \( b_1 = i \) and \( b_1 = o \), then

1. Firm Two’s probability of bankruptcy will be higher following Firm One’s bankruptcy.
2. When \( \ell_2 \) is relatively big, the increase in Firm Two’s stock price in response to its own bankruptcy will be smaller if Firm One restructures in bankruptcy.
3. Firm Two’s bond price will experience a larger negative response to its own bankruptcy if Firm One has restructured in bankruptcy.
6.2 Feedback from Firm One’s restructuring

A feedback effect from Firm One’s restructuring arises when Firm One’s bankruptcy cost, $\Delta_1$, depends on expectations about Firm Two’s renegotiation outcome, $b_2$. To see this, note that Firm Two can only be in one of three situations in period three: uncompetitive, competitive following bankruptcy, or competitive after restructuring outside bankruptcy. The ex ante probability that Firm Two will be competitive is exogenous and equals $q_2 \phi_s^2 + (1 - q_2) \phi_w^2$. Let $E[\phi_2] = q_2 \phi_s^2 + (1 - q_2) \phi_w^2$ denote this probability. Note that $E[\phi_2]$ is exogenous, as is the ex ante probability that Firm Two will be uncompetitive, which is given by $1 - E[\phi_2]$. Let $\hat{\beta}_2(b_1)$ represent the probability of Firm Two restructuring in bankruptcy, conditional on it being competitive and Firm One’s restructuring outcome. Then we can express $\Delta_1$ as follows:

$$
\Delta_1 = E[\pi_1(o, b_2, p_2) | b_1 = o] - E[\pi_1(i, b_2, p_2) | b_1 = i]
= (1 - E[\phi_2]) \pi_1(o, i, n) + \hat{\beta}_2(o) \pi_1(o, i, y) + (E[\phi_2] - \hat{\beta}_2(o)) \pi_1(o, o, y)
- (1 - E[\phi_2]) \pi_1(i, i, n) - \hat{\beta}_2(i) \pi_1(i, i, y) - (E[\phi_2] - \hat{\beta}_2(i)) \pi_1(i, o, y)
= (1 - E[\phi_2]) \Delta_1^o + E[\phi_2] \Delta_1^i + \hat{\beta}_2(o) (\Delta_1^i - \Delta_1^o)
+ (\hat{\beta}_2(o) - \hat{\beta}_2(i)) (\pi_1(i, i, y) - \pi_1(i, o, y)).
$$

From Eq. (24), it is clear that there could exist a feedback effect from Firm One’s restructuring captured by the difference term $\hat{\beta}_2(o) - \hat{\beta}_2(i)$. As we demonstrate in the following lemma, in equilibrium, these two variables are in fact identical for most parameter values. Their difference is not equal to zero only when Firm One’s bankruptcy causes Firm Two to switch from a bankruptcy equilibrium to an out-of-bankruptcy equilibrium. In this case, $\hat{\beta}_2(i)$ takes on the extreme value of zero and thus makes the difference between $\hat{\beta}_2(o)$ and $\hat{\beta}_2(i)$ large, implying a large feedback effect.

**Proposition 5.** A feedback effect from Firm One’s restructuring negotiation exists if and only if Firm One’s bankruptcy causes Firm Two to switch from an out-of-bankruptcy to a bankruptcy equilibrium.

Proposition 5 indicates that a feedback effect from Firm One’s restructuring will only exist for parameters where Firm Two’s bankruptcy cost is close to the level that makes it prohibitively expensive for its debtholder to challenge the equityholder’s offer. It follows that only a small set of parameters supports a feedback effect from Firm One’s restructuring. To see the intuition behind Lemma 5, consider the case where Firm Two remains in a bankruptcy equilibrium regardless of Firm One’s restructuring outcome. If
the competition effect of Firm One’s bankruptcy is strong relative to its information effect, Firm One’s bankruptcy will lower (raise) the probability that Firm Two restructures in bankruptcy if it is strong (weak). These opposing effects exactly offset each other to ensure that the ex ante probability that Firm Two restructures in bankruptcy and remains competitive is unaffected by the outcome of Firm One’s restructuring. For similar reasons, there is also no feedback effect when the competition effect of Firm One’s bankruptcy is weak relative to its information effect. Firm One’s restructuring also has no feedback effect when Firm Two remains in an out-of-bankruptcy equilibrium, since Firm Two’s restructuring outcome remains unchanged in this case.

7 Related firms, competitiveness improvements, and industry information

Thus far, we have assumed that (i) the firms are competitors and thus benefit from each other’s bankruptcies, (ii) bankruptcy weakens competitiveness, and (iii) the firms’ cash flows are uncorrelated and each firm’s private information is only about its own competitiveness. We now explore the effect of modifying each assumption.

7.1 Partners not competitors

It is natural to assume that the erosion of a firm’s competitiveness can hurt its customers’ and suppliers’ profits. For example, if a firm’s products become less attractive to customers when it files for bankruptcy, its suppliers will suffer because of reduced demand for their output, especially when they have few alternative customers. Similarly, if a firm’s operations are disrupted because of its bankruptcy, it may not be able to fulfill its agreements with its customer firms. This will hurt the customers’ profits, especially if they cannot source from other firms. We demonstrate that, when the two firms switch from being competitors to being partners, the spillover effects from a restructuring reverse.

To capture complementarities between partner firms, we replace our assumptions about a firm’s bankruptcy on the second firm’s cash flow and bankruptcy cost, conditions (5) and (7), with the following assumptions:

\[ \pi_j(b_j, b_k, n) < \pi_j(b_j, i, y) < \pi_j(b_j, o, y), \]  \hspace{1cm} (25)

\[ \Delta_j^o < \Delta_j^i < \Delta_j^o. \]  \hspace{1cm} (26)
Assumption (25) ensures that a firm is most profitable when its partner is competitive and has not experienced bankruptcy, and least profitable when its partner is uncompetitive. Assumption (26) ensures that bankruptcy is most costly when a firm’s partner is competitive and has not experienced bankruptcy, and least costly when its partner is uncompetitive.

These changes do not affect the conditions for out-of-bankruptcy or bankruptcy equilibria we have presented in Lemmas 1 and 3, respectively. However, because of the firms’ changed relationship, the competition and information effects of Firm One’s bankruptcy on Firm Two reverse. Now, by eroding Firm One’s competitiveness, its bankruptcy lowers its partner’s cash flow. Therefore, the competition effect hurts Firm Two. Firm One continues to be more likely to make a low restructuring offer and enter bankruptcy when it is strong. Therefore, bankruptcy continues to be a noisy signal that the Firm One is strong. This is good news for Firm Two, implying that it benefits from the information effect. We formalizes the impact of the reversal of the directions of the competition and information effects of Firm One’s bankruptcy in the following proposition:

**Proposition 6.** Suppose that Firm Two remains in the bankruptcy equilibrium whether or not Firm One files for bankruptcy. Then, if (23) is satisfied and bankruptcy’s information effect for Firm One is weak relative to its competition effect:

1. The ex ante probability that Firm Two will restructure in bankruptcy is lower when Firm One restructures in bankruptcy.

2. The price of Firm Two’s debt will rise on news of Firm One’s bankruptcy.

3. If additionally (22) holds for Firm Two, its stock price will react negatively to Firm One’s bankruptcy.

When (23) is reversed, these spillover effects may reverse.

### 7.2 Competitiveness rises in bankruptcy

The automatic stay on creditors triggered by bankruptcy is intended to shield firms from the turmoil surrounding financial restructurings, and can provide firms with a window to restructure their operations. For example, like GM in the recent financial crisis, firms take this advantage of opportunity and emerge as stronger competitors. In light of this evidence, we now examine the effect of assuming that firms can improve their competitiveness in bankruptcy.
If bankruptcy improves competitiveness sufficiently to increase a firm’s expected cash flow, the firm will always conspire with its debtholders to enter bankruptcy. To rule out this sort of extreme behavior, we assume that a bankrupt firm incurs a direct cost of $L_j$ that is unrelated to its competitive position.\(^{16}\) To capture the notion that bankruptcy can increase a firm’s competitiveness, we assume that:

\[
\pi_j(b_j, b_k, n) > \pi_j(b_j, o, y) > \pi_j(b_j, i, y),
\]

(27)

\[
\Delta^n_j < \Delta^o_j < \Delta^i_j < 0,
\]

(28)

and

\[
L_j + \Delta^n_j > 0.
\]

(29)

Assumption (27) formalizes the notion that bankruptcy makes a firm more competitive by ensuring that a firm’s profitability is eroded when its competitor restructures in bankruptcy. Assumption (28) ensures that, because its competitor becomes stronger in bankruptcy, a firm’s competitiveness gain from entering bankruptcy is smallest when its competitor also enters bankruptcy. Assumption (29) ensures that bankruptcy results in a deadweight loss and thus, firms will prefer to avoid it. Our remaining assumptions about bankruptcy remain unchanged.

The modified assumptions result in the following obvious changes to the equilibrium conditions: The necessary and sufficient condition for an out-of-bankruptcy equilibrium (12) changes to

\[
q_j(L_j + \phi_j^s \Delta_j(s)) > (1 - q_j) \ell_j D_j.
\]

(30)

In bankruptcy equilibria, the expressions for the probability with which a weak firm makes an offer of $F_j^s$ and the probability with which the debtholder rejects such an offer, (13) and (14), change to

\[
e_j(s) = \frac{q_j(L_j + \phi_j^s \Delta_j(s))}{(1 - q_j) \ell_j D_j},
\]

(31)

\(^{16}\)Firms incur direct costs such as lawyers’ fees and court fees when they enter bankruptcy. Such costs are quite different from the bankruptcy costs we have assumed thus far that are only determined by the erosion of a firm’s competitiveness.
and
\[
d_j(A_j) = \frac{\ell_j D_j}{\phi_j^w \Delta_j(A_j) + \ell_j D_j + L_j},
\]
respectively. The expression for a firm’s unconditional bankruptcy probability changes to
\[
\beta_j(A_j) = q_j \phi_j^w \Delta_j(A_j) + \ell_j D_j + L_j.
\]

Now bankruptcy both strengthens a firm and acts as a noisy signal that it is strong. A strong firm lowers
the operating benefit its competitor can reap from entering bankruptcy. Given the competitor has to bear
the direct bankruptcy cost, the firm’s bankruptcy raises its competitor’s bankruptcy cost. It follows that the
Firm Two’s bond price will respond to Firm One’s restructuring in the manner described in Proposition 3
when the competition effect of Firm One’s bankruptcy dominates its information effect. The spillover effect
on Firm Two’s stock price, however, is the reverse of the one described in Proposition 2 for the case where
when the competition effect of Firm One’s bankruptcy dominates its information effect. This reversal occurs
because both the information and competition effects of Firm One’s bankruptcy indicate that Firm Two’s
profit will be lower if Firm One restructures in bankruptcy.

**Proposition 7.** Suppose that Firm Two remains in the bankruptcy equilibrium whether or not Firm One files
for bankruptcy. Then:

1. The unconditional probability that Firm Two will restructure in bankruptcy is higher when Firm One
restructures in bankruptcy.

2. Both the price of Firm Two’s debt and the price of Firm Two’s stock will react negatively to Firm
One’s bankruptcy.

### 7.3 Industry information and correlated profits

We now consider a situation where a firm’s bankruptcy reveals information about its industry rather than
about the firm itself. This is only feasible if the firms in an industry have correlated cash flows. For
simplicity, we consider the extreme case where the competitiveness signals and cash flows of the two firms
in our model are perfectly correlated. This implies that the firms have identical types, i.e., \( \phi_1^s = \phi_2^s = \phi^s \),
\[ \phi_1^w = \phi_2^w = \phi^w, \text{ and } q_1 = q_2 = q. \] Otherwise, the information structure is unchanged. That is, while it is public information that the two firms are of the same type, a debtholder does not observe his firm’s competitiveness signals, while the equityholder does.

The analysis remains largely unchanged, so we only highlight the main differences from our earlier results. Now Firm One’s bankruptcy filing conveys information about both Firm One’s competitiveness and Firm Two’s prospects. In period two, Firm Two’s debtholder uses this information and Bayes rule to update his beliefs about his firm’s competitiveness as follows: If Firm One enters bankruptcy, Firm Two’s debtholder believes that Firm Two is strong with probability

\[
q_2(i) = \frac{qd_1}{qd_1 + (1-q)e_1d_1},
\]

while if Firm One restructures out of bankruptcy, then Firm Two’s debtholder believes that Firm Two is strong with probability

\[
q_2(o) = \frac{q(1-d_1)}{q(1-d_1) + (1-q)(1-e_1) + (1-q)e_1(1-d_1)}.
\]

Note that the above expressions imply that \( q_2(i) > q_2(o) \), that is, Firm One’s bankruptcy signals that Firm Two is more likely to be strong. With the updated beliefs in place, the negotiations between Firm Two debtholder and equityholder proceed as before.

Firm One’s debtholder and equityholder will anticipate and account for the updating of Firm Two’s debtholder’s beliefs in their equilibrium strategies. Firm Two’s negotiations affect Firm One only through their effect on the expected cost of bankruptcy \( \Delta_1 \). Under our earlier assumptions, this bankruptcy cost \( \Delta_1 \) is independent of the firm’s competitiveness because, by definition, it is evaluated conditional on Firm One being operational. Under the modified assumptions, however, knowledge about Firm One’s competitiveness helps evaluate this conditional bankruptcy cost. This is because Firm Two, which has identical cash flows, will file for bankruptcy with a higher probability if it is strong than if it is weak, and Firm Two’s bankruptcy filing influences Firm One’s conditional bankruptcy cost. Letting \( \Delta_{1s} \) (\( \Delta_{1w} \)) denote the bankruptcy cost conditional on Firm One being strong (weak), we can describe Firm One’s equilibrium strategy as follows:
Firm One’s equityholder will make the offer $F_1^s$ with probability

$$e_1 = \frac{q_1 \phi_s \Delta_s}{(1 - q_1)\ell_1 D_1},$$

and the debtholder will reject this offer with probability

$$d_1 = \frac{\ell_1 D_1}{\phi_s \Delta_w + \ell_1 D_1}.$$  

In equilibrium, the conditional bankruptcy costs $\Delta_s$ and $\Delta_w$ will satisfy:

$$\Delta_t = (\beta_2(o)\pi_1(o,i,y) + (1 - \beta_2(o))\pi_1(o,o,y)) - (\beta_2(i)\pi_1(i,i,y) + (1 - \beta_2(i))\pi_1(i,o,y))$$

where $t$ denotes type, $t \in s,w$, and $\beta_2$ is the probability of bankruptcy for Firm Two when Firm Two is of type $t$. In equilibrium, we have $\beta_2(s) = d_2(b_1)$ and $\beta_2(w) = e_2(b_1)$. Solving for equilibrium requires identifying bankruptcy cost values $\Delta_s$ and $\Delta_w$ that simultaneously satisfy all of the above equations.

Under the modified assumption, the expression for the stock price of Firm Two immediately following news about Firm One’s restructuring is

$$S_2(b_1) = (q_2(b_1)\phi_s + (1 - q_2(b_1))\phi_w)\pi_2(o,b_1,y) - D_2.$$  

This expression is increasing in $q_2(b_1)$ and we have shown that $q_2(i) > q_2(o)$. Thus, the information effect of Firm One’s bankruptcy, which conveys industry-wide information, pushes the price of Firm Two’s stock up. That is, the information effect reverses and a firm’s bankruptcy is always good news for its competitor’s equityholders.

### 8 Empirical Implications

Our model demonstrates that the level of information asymmetry about a restructuring firm’s prospects is a key determinant of the spillovers from its restructuring to related firms. The specifics of the spillovers are crucially dependent on the structure of the industries in which the firms operate, the nature of their business relations, the nature of bankruptcy and bankruptcy costs, and the subject of the asymmetric information. Based on our results, we can offer the following sharp predictions about the cross-sectional variation in
spillovers from a firm’s financial restructuring:

1. If there is a high level of information asymmetry about a firm’s prospects and bankruptcy only weakly erodes competitiveness, a firm’s bankruptcy

   • will lower competitors’ stock prices, and raise its suppliers’/customers’ stock prices;
   • will raise the prices of competitors’ debt claims, and lower the prices of suppliers’/customers’ debt claims;
   • will lower the probability that competitors will restructure in bankruptcy, and raise the probability that suppliers/customers will restructure in bankruptcy.

2. If there is a low level of information asymmetry about a firm’s prospects and bankruptcy can significantly erode competitiveness, the direction of the spillovers from a firm’s bankruptcy to its customers and suppliers will tend to reverse. The spillovers to the firm’s competitors’ will also reverse when the industry structure allows them to capitalize heavily on the firm’s bankruptcy-induced weakness.

3. If a firm’s operation can be strengthened under bankruptcy protection, its bankruptcy filing will lower its competitors’ stock prices and the prices of their debt claims, and raise the probability that they will restructure in bankruptcy.

4. If there is a high level of information asymmetry about an industry’s prospects and bankruptcy erodes competitiveness, a firm’s bankruptcy will raise competitors’ stock prices.

While the above predictions focus on the spillovers from corporate bankruptcies, our analysis also provides similarly sharp predictions about spillovers from successful out-of-court restructurings. The direction of these spillover are the reverse of the ones we have listed.

The economic importance and general thrust of these predictions is supported by existing evidence. Several studies of the spillover effects of bankruptcy find that a firm’s bankruptcy has a significant impact on the security prices of related firms.\footnote{Lang and Stulz (1992), Cheng and McDonald (1996), and Ferris, Jayaraman and Makhija (1997) have focused on the effect of a firm’s bankruptcy on the security prices of its competitors. Hertzel, Officer, and Rogers (2008), and Fernando, May, and Megginson (2011) have documented the security price responses of supplier and customer firms to news of a firm’s bankruptcy.} These studies indicates that the nature of the firms’ relationships influences the direction of these spillovers. Many finance textbooks and research papers have acknowledged that the toll bankruptcy imposes on a firm and the spillovers to related firms will vary across industries.
These influences vary systematically 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. In some instances, bankruptcy may actually benefit firms (Wruck (1990), and Phillips and Sertsios (2011)). For example, firms from the airline and automobile industries appear to have been able to use the protection afforded by bankruptcy to restructure their operations and improve their competitiveness. Bankruptcy can also remove other impediments to competitiveness, e.g., a court judgement (Cutler and Summers (1988)).

As is clear from contrasting Predictions 1 and 2 with Prediction 3, our model predicts that the spillovers from a firm’s bankruptcy will vary with dramatically with the effect of bankruptcy on its operations. Firms in legacy industries with high pension obligations or a heavily unionized workforce are likely to be better able to use the protection afforded by bankruptcy to strengthen their operations and competitiveness. Therefore, for firms in these industries the information and competitiveness of bankruptcy will be aligned. Consequently, as Prediction 3 indicates, we should expect little variation in the impact of a firm’s bankruptcy on its competitors or partners: Competitors’ equity and debtholders will be adversely impacted, while partners’ equity and debtholders will benefit. In contrast, as Prediction 1 and 2 indicate, the impact on claimants of competitor and partner firms in other industries, where bankruptcy is more likely to hurt a firm’s operations, will be more varied. First, the equity and debtholders of related firms will be impacted very differently. Second, in each case, the direction of the spillovers will depend on the level of information asymmetry about the bankrupt firms. When the level of information asymmetry is high, the information effect of a bankruptcy will be relatively strong. Thus, competitor firms’ equityholders will be hurt but their debtholders will benefit, and partner firms’ equityholders will benefit but their debtholders will be hurt. When the level of information asymmetry is low or the firm operates in a very competitive industry, we expect the spillovers to reverse.

Studies have also examined the effect of industry competitiveness on spillovers from bankruptcy (e.g., Lang and Stulz (1992)). However, they have not accounted for the level of information asymmetry surrounding the bankrupt firms. As our analysis demonstrates, this information asymmetry encourages self-selection by firms that file for bankruptcy, the root of the information effect we unearth and thus the spillovers we expect. The degree of information asymmetry between a firm’s claimants is likely to vary systematically

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18Direct estimates of the competitiveness of bankruptcy have focused on the products offered by bankruptcy firms and their competitors, and the prices of these products (Ciliberto and Schenone, 2010). Other studies have focused on the effect of bankruptcy on profitability measures such as return on equity (Iqbal (2002)).
across firms and industries. It should be high in industries that are relatively opaque and employ complex productions technologies. The level of information asymmetry surrounding a firm should also vary systematically with its level of disclosure, the number of analysts covering the firm, the difference between the number of equity and debt analysts covering the firm, the firm’s mix of bank and public debt, and the concentration of the firm’s ownership with insiders.

To keep our model manageable, we have treated overall demand and technology as fixed exogenous variables. Shifts in industrywide technology and demand can lead to widespread financial distress. They can also give rise to feedback and spillover effects since investors can use the information about technology and demand they obtain from one firm’s restructuring to fix their strategies in a related firm’s restructuring (Hertzel, Officer, and Rogers, 2008). Therefore, when testing our predictions, it is important to control for systematic shocks that can affect industry cash flows.

9 Conclusion

Developments during a debt renegotiation of a financially distressed firm often have a profound impact on the firm’s competitors, suppliers, and customers. This paper investigates the determinants of this impact using a game-theoretic model of debt restructuring, where asymmetric information between a firm and its debtholders can cause a breakdown in negotiations and force the firm into bankruptcy. Our model suggests that there are two important determinants of the spillover effect on the firm’s competitors, suppliers, and customers: the information generated about the firm’s competitiveness and the prospects for its industry, and the size of indirect 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 bankruptcy impedes firm competitiveness and profitability or, as commentators have argued, helps a firm regain its competitiveness and improve its profitability. Whether the asymmetric information pertains to the firm’s operations or about industry prospects also matters.
References


Appendix

Proof of Lemma 1: The restructuring analysis for Firm Two is virtually identical to that of Giammarino (1988). Therefore, we provide a sketch of the proof.

In equilibrium, inequality (12) is either satisfied or violated. We first establish that, if (12) is satisfied, the equilibrium is an out-of-bankruptcy equilibrium, and the claimants follow the strategies described in the Lemma 1. To see this note that it is a dominant strategy for the debtholder to reject any offer lower than $F^s_2$ and a dominant strategy for type $s$ to offer $F^s_2$. It is also optimal for type $w$ to offer $F^s_2$ with certainty since any other offer will either be higher or be rejected by the debtholder. Inequality (12) ensures that accepting an offer of $F^s_2$ is incentive-compatible for the debtholder given the optimal strategies of types $s$ and $w$. The uniqueness of this equilibrium follows directly from noting that, when (12) is satisfied, the debtholder will accept an offer of $F^s_2$ even when they believe that type $w$ will offer $F^s_2$ with certainty. Since this offer maximizes type $w$'s payoff, it will always offer $F^s_2$.

We next establish that, if (12) is violated, the equilibrium is a bankruptcy equilibrium, as defined in the Lemma. In this case, it is still a dominant strategy for the debtholder to reject any offer lower than $F^s_2$ and a dominant strategy for type $s$ to offer $F^s_2$. However, it cannot be an equilibrium strategy for type $w$ to offer $F^s_2$ with certainty since inequality (12) is violated implying that the debtholder rejects $F^s_2$ with certainty leaving type $w$ better off if it deviates and offer $F^w_2$. Thus, in equilibrium, type $w$ makes an offer different from $F^s_2$ with a nonzero probability. Because any offer different from $F^s_2$ signals to the debtholder that it is coming from type $w$, the debtholder rejects the offer as long as it is below $F^w_2$, and accepts it as long as it is at or above $F^w_2$. Thus, in equilibrium, type $w$ offers $F^w_2$ with a positive probability. To see that this probability is less than one, note that, If type $w$ were to offer $F^w_2$ with certainty, an offer of $F^s_2$ would signal type $s$ to the debtholder. It follows that the debtholder would always accept an offer of $F^s_2$. However, if type $w$ expects $F^s_2$ to be accepted with certainty, type will deviate to offering $F^s_2$ with certainty. Therefore, in equilibrium, type $w$ offers $F^s_2$ with probability $0 < e_2 < 1$, and the debtholder accepts $F^w_2$ with certainty, and rejects $F^s_2$ with probability $0 < d_2 < 1$.

The debtholder is willing to randomize between accepting and rejecting an offer of $F^s_2$ if the debtholder is indifferent between these two alternatives. Rejecting $F^s_2$ is costly to the debtholder if the bankruptcy court finds the firm to be type $s$ and thus requires the debtholder to cover the expected bankruptcy cost of $\phi^s_2 \Delta_2(b_1)$. Accepting $F^s_2$ is costly to the debtholder if the firm happens to be type $w$ and thus underpays the
debtholder $\phi_s^2(F_s^2 - F_s^2)$ in expectation. Given that type $s$ offers $F_s^2$ with certainty and type $w$ makes such an offer with probability $e_2$, the debtholder’s posterior probability that the firm is type $s$ following an offer of $F_s^2$ is $\frac{q_2}{q_2 + (1-q_2)e_2}$. Hence, the debtholder is indifferent between accepting and rejecting an offer of $F_s^2$ if $e_2$ satisfies:

$$
\frac{q_2}{q_2 + (1-q_2)e_2} \phi_s^2 \Delta_2(b_1) = \frac{(1-q_2)e_2}{q_2 + (1-q_2)e_2} \phi_w^2(F_w^2 - F_s^2).
$$

Rearranging this expression gives us (13).

Similarly, type $w$ is willing to randomize between offering $F_s^2$ and $F_w^2$ if type $w$ is indifferent between the two alternatives. If type $w$ offers $F_w^2$, it ends up paying $D_2$ in expectation. If it offers $F_s^2$, it stands to earn a mispricing gain of $\phi_w^2(F_w^2 - F_s^2)$ if the debtholder accepts the offer, which happens with probability $1-d_2$. If the debtholder rejects the offer, which happens with probability $d_2$, Firm Two stands to incur a bankruptcy cost of $\phi_w^2 \Delta_2(b_1)$ in addition to paying the debtholder $D_2$ in expectation. Therefore, type $w$ is indifferent between $F_s^2$ and $F_w^2$ if $d_2$ satisfies:

$$
D_2 = (1-d_2)(D_2 - \phi_w^2(F_w^2 - F_s^2)) + d_2(D_2 + \phi_w^2 \Delta_2(b_1)).
$$

Rearranging this expression gives us (14). □

**Proof of Lemma 3:** The prof for this Lemma is virtually identical to that for Lemma 1. □

**Proof of Proposition 1:** In a bankruptcy equilibrium, conditional on being type $s$, Firm Two’s payoff is given by

$$
\phi_s^2 E[\pi_s(o,b_1,c_1)|b_1] - D_2.
$$

(37)

Conditional on being type $w$, Firm Two’s equityholder is indifferent between making a fair offer, $F_w^2$, and trying to obtain concessions from its debtholder. Therefore, the equityholder’s expected payoff conditional on being type $w$ is given by

$$
\phi_w^2 E[\pi_w(o,b_1,c_1)|b_1] - D_2.
$$

(38)
It follows that Firm Two’s equity value before it begins restructuring is given by

\[ S_2 = E[\phi_2]E[\pi_2(o,b_1,c_1)|b_1] - D_2, \]  

(39)

where \( E[\phi_2] = (\phi_s^w + q_2(\phi_s^s - \phi_s^w)) \). Firm Two’s stock price will change depending on whether it restructures inside or outside bankruptcy. The news that Firm Two has entered bankruptcy signals information regarding its type. It also results in an updated estimate of the expected bankruptcy cost the firm will bear if it is revealed to be type \( w \) in bankruptcy. Therefore, Firm Two’s equity value immediately following news of its bankruptcy will be given by

\[ S_2(i) = E[\phi_2|b_2 = i,b_1]E[\pi_2(o,b_1,c_1)|b_1] - D_2 - Pr(w|b_2 = i,b_1)\phi_s^w \Delta_2(b_1), \]  

(40)

where \( Pr(w|b_2, b_1) \) represents the conditional probability that Firm Two is type \( w \) if it restructuring outcome is \( b_2 \). The last term in the above expression captures the fact that type \( w \) covers the deadweight cost of bankruptcy (if any) in equilibrium.

To better understand the difference between \( S_2 \) and \( S_2(i) \) we next evaluate the extent to which the market revises its beliefs upon the news of Firm Two’s bankruptcy. While the prior probability of a type \( s \) Firm Two is \( q_2 \), after observing bankruptcy filing, the market updates this probability to \( q_2/(q_2 + (1 - q_2)c_2) > q_2 \). Using this observation, we can express the difference between the new and the original equity value as

\[ S_2(i) - S_2 = (E[\phi_2|b_2 = i,b_1] - E[\phi_2])E[\pi_2(o,b_1,c_1)|b_1] - Pr(w|b_2 = i,b_1)\phi_s^w \Delta_2(b_1) \]
\[ = \left( \frac{\ell D_2}{\ell D_2 + \phi_2 \Delta_2(b_1)} - q_2 \right) (\phi_s^s - \phi_s^w)E[\pi_2(o,b_1,c_1)|b_1] + \left( \frac{\ell D_2}{\ell D_2 + \phi_2 \Delta_2(b_1)} - 1 \right) \phi_s^w \Delta_2(b_1) \]  

(41)

The above decreases in \( \Delta_2(b_1) \) and increases in \( \ell_2 \). Moreover, at \( \Delta_2(b_1) = 0 \), the above equals \( (1 - q_2)(\phi_s^s - \phi_s^w)E[\pi_2(o,b_1,c_1)|b_1] > 0 \).

Firm One’s stock price response can be evaluated similarly to that of Firm Two. Specifically, the differ-
ence between the new and the original stock price is

$$S_1(i) - S_1 = (E[\phi_1|b_1 = i] - E[\phi_1])E[\pi_1(o,b_2,c_2)] - Pr(w|b_1 = i)\phi_w^w \Delta_1$$

$$= \left(\frac{\ell_1D_1}{\ell_1D_1 + \phi_1^s \Delta_1} - q_1\right) (\phi_1^s - \phi_1^w)E[\pi_1(o,b_2,c_2)] + \left(\frac{\ell_1D_1}{\ell_1D_1 + \phi_1^s \Delta_1} - 1\right) \phi_w^w \Delta_1$$

The above decreases in $\Delta_1$ and increases in $\ell_1$, and at $\Delta_1 = 0$ takes the positive value of $(1 - q_1)(\phi_1^s - \phi_1^w)E[\pi_1(o,b_2,c_2)]$.

The claim about bond prices for both firms follows from the observation that the debtholder is indifferent between accepting and rejecting the low offer, and therefore filing for bankruptcy simply indicates that Firm Two did not make the high offer, which is bad news for the debtholder. Formally, this can be shown as follows.

In the bankruptcy equilibrium, if Firm Two is type $w$ and the equityholder offers $F_2^w$, which happens with probability $(1 - q_2)(1 - e_2(b_1))$, the debtholder receives $D_2$ in expectation. If, however, the equityholder offers $F_2^s$, the debtholder is indifferent between accepting and rejecting the offer. If the offer is accepted, the debtholder receives $D_2$ in expectation if the firm turns out to be type $s$ (which happens with probability $q_2$), and $D_2 - \ell_2D_2$ in expectation if Firm Two turns out to be type $w$ (which happens with probability $(1 - q_2)e_2(b_1)$). Thus, $B_2(b_1)$ can be evaluated as

$$B_2(b_1) = (1 - q_2)(1 - e_2(b_1))D_2 + q_2D_2 + (1 - q_2)e_2(b_1)(D_2 - \ell_2D_2)$$

$$=D_2 - q_2\phi_2^s \Delta_2(b_1),$$

(42)

Similar logic implies that after filing for bankruptcy, Firm Two’s bond price becomes

$$B_2(b_1,i) = \frac{q_2}{q_2 + (1 - q_2)e_2(b_1)}D_2 + \frac{(1 - q_2)e_2(b_1)}{q_2 + (1 - q_2)e_2(b_1)}(D_2 - \ell_2D_2)$$

$$=D_2 - \frac{(1 - q_2)e_2(b_1)}{q_2 + (1 - q_2)e_2(b_1)}\ell_2D_2$$

$$=D_2 - \phi_2^s \Delta_2(b_1)\ell_2D_2 + \phi_2^w \Delta_2(b_1)\ell_2D_2$$

(43)
The difference between (43) and (42) can be evaluated as

\[ B_2(b_1, i) - B_2(b_1) = q_2 \phi_2^i \Delta_2(b_1) - \phi_2^i \Delta_2(b_1) \frac{\ell_2 D_2}{\ell_2 D_2 + \phi_2^i \Delta_2(b_1)} \]

\[ = - \phi_2^i \Delta_2(b_1) \frac{\ell_2 D_2 (1 - q_2) - q_2 \phi_2^i \Delta_2(b_1)}{\ell_2 D_2 + \phi_2^i \Delta_2(b_1)} \]

(44)

The negative sign of the above follows from the necessary condition for bankruptcy filing, which is a violation of (12). □

**Proof of Proposition 2:** We will show the result by proving that when (22) holds, we have \( E[\pi_2(o, b_1 = i, c_1)] > E[\pi_2(o, b_1 = 0, c_1)] \). Stock price reaction then follows from (39).

\[ E[\pi_2(o, i, c_1)] \]

\[ = E[\pi_2(o, i, n)] - E[\phi_1 | b_1 = i](\pi_2(o, i, n) - \pi_2(o, i, y)) \]

\[ > E[\pi_2(o, i, n)] - \phi_1^i(\pi_2(o, i, n) - \pi_2(o, i, y)) \]

\[ > E[\pi_2(o, i, n)] - \phi_1^w(\pi_2(o, i, n) - \pi_2(o, o, y)) \]

\[ > E[\pi_2(o, i, n)] - E[\phi_1 | b_1 = o](\pi_2(o, i, n) - \pi_2(o, o, y)) \]

\[ = E[\pi_2(o, o, c_1)] \]

In the above, the first inequality follows from observing that \( E[\phi_1 | b_1 = i] < \phi_1^i \) and \( (\pi_2(o, i, n) - \pi_2(o, i, y)) > 0 \). The second inequality follows from (22) and the third inequality follows from observing that \( \phi_1^w < E[\phi_1 | b_1 = o] \) and \( (\pi_2(o, i, n) - \pi_2(o, i, y)) > 0 \).

The possibility of the negative stock price reaction is proven using numerical examples (see the figures).

□

**Proof of Lemma 4:** When (23) holds, we have

\[ \Delta_2 = \Delta_2^w - E[\phi_1 | b_1 = i](\Delta_2^w - \Delta_2) > \Delta_2^w - \phi_1^w(\Delta_2^w - \Delta_2) \]

\[ > \Delta_2^w - \phi_1^w(\Delta_2^w - \Delta_2^w) \]

\[ > \Delta_2^w - E[\phi_1 | b_1 = o](\Delta_2^w - \Delta_2^w) = \Delta_2(o), \]

In the above, the first inequality follows from observing that \( \Delta_2^w > \Delta_2^w \) according to (23), and that \( E[\phi_1 | b_1 = i] < \phi_1^i \). The second inequality follows from (23). Finally, the last inequality follows from observing that
Lemma 5. When (23) holds, there does not exist an equilibrium where Firm Two is in the bankruptcy subgame equilibrium when \( b_1 = i \) and in the out-of-bankruptcy subgame equilibrium when \( b_1 = o \).

Proof of Lemma 5: From Lemma 1, Firm Two is in the out-of-bankruptcy bankruptcy equilibrium if and only if (12) holds. Because, from Proposition 4, inequality (23) implies \( \Delta_2(i) > \Delta_2(o) \), it is not possible for (12) to hold when \( b_1 = o \) and not hold when \( b_1 = i \).

Proof of Proposition 3: If Firm Two is in the bankruptcy equilibrium following the news \( b_1 \) about Firm One’s restructuring outcome, then the proof of Proposition 1 shows that \( B_2(b_1) \) is given by (42). In the out-of-bankruptcy equilibrium, bond price \( B_2(b_1) \) for Firm Two after Firm One’s restructuring can be evaluated as

\[
B_2(b_1) = D_2 - (1 - q_2)\ell_2 D_2. 
\]

Expressions (42) and (46) imply that, if Firm Two is in the bankruptcy equilibrium for both \( b_1 = i \) and \( b_1 = o \), then the result follows from Lemma 4. Suppose next that Firm Two is in the out-of-bankruptcy equilibrium when \( b_1 = i \), but in the bankruptcy equilibrium when \( b_1 = o \). Then, according to Lemma 1, (12) does not hold for \( b_1 = o \), implying that

\[
q_2 \phi_2^* \Delta_2(o) < (1 - q_2)\ell_2 D_2. 
\]

Therefore, \( B_2(i) < B_2(o) \) in this case. Finally, we obtain \( B_2(i) = B_2(o) \) if Firm Two is in the out-of-bankruptcy equilibrium for both \( b_1 = i \) and \( b_1 = o \). Out-of-bankruptcy equilibrium when \( b_1 = o \) and bankruptcy equilibrium when \( b_1 = i \) is not possible according to Lemma 5.

Proof of Proposition 4: Suppose that condition (23) is satisfied and condition (12) is violated for both \( b_1 = i \) and \( b_1 = o \).

1. According to Lemma 4, (23) implies that \( \Delta_2(i) > \Delta_2(o) \). Because Firm Two’s probability of bankruptcy given by (2) increases in \( \Delta_2(b_1) \), we obtain that Firm Two’s probability of bankruptcy is be higher when Firm One restructures in bankruptcy than when Firm One restructures outside bankruptcy.

2. Proof of Proposition 1 shows that Firm Two’s stock price reaction to own bankruptcy, (41), decreases
in $\Delta_2(b_1)$, and is positive value for sufficiently large $\ell_2$. Further, according to Lemma 4, (23) implies that $\Delta_2(i) > \Delta_2(o)$. Therefore, when $\ell_2$ is sufficiently large, the Firm Two’s stock price increases in response to its own bankruptcy, but the increase is smaller if Firm One restructures in bankruptcy.

3. Firm Two’s bond price reaction to own bankruptcy filing is derived in the proof of Proposition 1 and is given by (44), which is negative for all admissible parameter values. The derivative of (44) with respect to $\Delta_2(b_1)$ can be evaluated as

$$
-\phi_2^i \left( \frac{\ell_2 D_2}{\ell_2 D_2 + \phi_2^i \Delta_2(b_1)} - q_2 \right) + \phi_2^i \Delta_2(b_1) \left( \frac{\ell_2 D_2 \phi_2^i}{(\ell_2 D_2 + \phi_2^i \Delta_2(b_1))^2} \right) 
= \frac{\phi_2^i}{(\ell_2 D_2 + \phi_2^i \Delta_2(b_1))^2} \left( -\ell_2 D_2(\ell_2 D_2 + \phi_2^i \Delta_2(b_1)) + q_2(\ell_2 D_2 + \phi_2^i \Delta_2(b_1))^2 + \ell_2 D_2 \phi_2^i \Delta_2(b_1) \right) 
$$

The negative sign of the above follows from the necessary condition for bankruptcy filing, which is a violation of (12). Because, according to Lemma 4, (23) implies that $\Delta_2(i) > \Delta_2(o)$, the negative sign of the above derivative implies that Firm Two’s bond price will experience a larger negative response to its own bankruptcy if Firm One has restructured in bankruptcy.

$\Box$

**Proof of Proposition 5:** That the difference between $\hat{\beta}_2(o)$ and $\hat{\beta}_2(i)$ is a necessary and sufficient condition for feedback effect to exist follows from the expression (24) for $\Delta_1$. In what follows, we evaluate whether there is a difference separately for the following three cases: (i) Firm Two is in the out-of-bankruptcy equilibrium for both $b_1 = i$ and $b_1 = o$; (ii) Firm Two is in the bankruptcy equilibrium for both $b_1 = i$ and $b_1 = o$; and (iii) Firm Two switches from the bankruptcy to the out-of-bankruptcy equilibrium depending on $b_1$.

(i). Suppose Firm Two is in the out-of-bankruptcy equilibrium for both $b_1 = o$ and $b_1 = i$. Then, the probability of bankruptcy $\beta_2(b_1)$ equals zero for both $b_1 = o$ and $b_1 = i$, and thus the probability $\hat{\beta}_2$ of Firm Two being bankrupt and operational also equals zero for both $b_1 = o$ and $b_1 = i$. The lack of difference between $\hat{\beta}_2(o)$ and $\hat{\beta}_2(i)$ implies that there is no feedback effect.
(ii). Suppose Firm Two is in the bankruptcy equilibrium for both \( b_1 = o \) and \( b_1 = i \). Then, the probability \( \hat{\beta}_2(b_1) \) of Firm Two being bankrupt and operational can be evaluated as follows.

\[
\hat{\beta}_2(b_1) = q_2 \phi'_2 \beta'_2(b_1) + \frac{\ell_2 D_2}{\phi'_2 \Delta_2(b_1) + \ell_2 D_2} + \frac{q_2 \phi'_2 \Delta_2(b_1)}{(1 - q_2) \phi'_2 \Delta_2(b_1) + \ell_2 D_2}
\]

\[
= q_2 \phi'_2.
\]

The above is independent of Firm One’s restructuring outcome \( b_1 \), and thus there is no difference between \( \hat{\beta}_2(o) \) and \( \hat{\beta}_2(i) \). The lack of difference implies that there is no feedback effect.

(iii). If Firm Two is in the out-of-bankruptcy equilibrium for \( b_1 = o \) and in the bankruptcy equilibrium for \( b_1 = i \), then \( \hat{\beta}_2(o) \) equals zero, while \( \hat{\beta}_2(i) \) differs from zero and is given by (48). Similarly, if Firm Two is in the out-of-bankruptcy equilibrium for \( b_1 = i \) and in the bankruptcy equilibrium for \( b_1 = o \), then \( \hat{\beta}_2(i) \) equals zero, while \( \hat{\beta}_2(o) \) differs from zero and is given by (48).

**Proof of Proposition 6:** Firm Two’s probability of bankruptcy \( \beta_2(b_1) \) is still given by (17), price of Firm Two’s debt is also still given by (42), and price of Firm Two’s stock before Firm Two’s bankruptcy negotiations is still given by (39).

Thus, as before, Firm One’s bankruptcy negotiations affect Firm Two’s bankruptcy probability and price of debt only through \( \Delta_2(b_1) \), and \( \beta_2 \) is increasing in \( \Delta_2 \) while \( B_2 \) is decreasing in \( \Delta_2 \). However, Lemma 4 no longer holds given assumption (25). Instead, in this case, (23) implies \( \Delta_2(i) < \Delta_2(o) \), as we show below. Thus, \( \beta_2 \) is smaller while \( B_2 \) is larger when Firm One restructures in bankruptcy. We can show that \( \Delta_2(i) < \Delta_2(o) \) as follows.

\[
\Delta_2(i) = \Delta'_2 + E[\phi_1 | b_1 = i](\Delta'_2 - \Delta'_2) < \Delta'_2 + \phi'_1(\Delta'_2 - \Delta'_2)
\]

\[
< \Delta'_2 + \phi'_1(\Delta'_2 - \Delta'_2)
\]

\[
< \Delta'_2 + E[\phi_1 | b_1 = o](\Delta'_2 - \Delta'_2) = \Delta_2(o),
\]

In the above, the first inequality follows from observing that \( \Delta'_2 < \Delta'_2 \) according to (23), and that \( E[\phi_1 | b_1 = i] < \phi'_1 \). The second inequality follows from (23). Finally, the last inequality follows from observing that \( \Delta'_2 < \Delta'_2 \) according to (23), and that \( \phi'_1 < E[\phi_1 | b_1 = i] \).

To show the result regarding the stock price, we can follow the steps of the proof of Proposition 2.
Specifically, we will show the result by proving that (22) implies $E[\pi_2(o,b_1 = i,c_1)] > E[\pi_2(o,b_1 = 0,c_1)]$. Stock price reaction will then follow from (39).

\[ E[\pi_2(o,i,c_1)] = E[\pi_2(o,i,n)] + E[\phi_1 | b_1 = i](\pi_2(o,i,y) - \pi_2(o,i,n)) \]
\[ < E[\pi_2(o,i,n)] + \phi_1^i(\pi_2(o,i,y) - \pi_2(o,i,n)) \]
\[ < E[\pi_2(o,i,n)] + \phi_1^o(\pi_2(o,o,y) - \pi_2(o,i,n)) \]
\[ < E[\pi_2(o,i,n)] + E[\phi_1 | b_1 = o](\pi_2(o,o,y) - \pi_2(o,i,n)) \]
\[ = E[\pi_2(o,o,c_1)] \]

In the above, the first inequality follows from observing that $E[\phi_1 | b_1 = i] < \phi_1^i$ and $(\pi_2(o,i,y) - \pi_2(o,i,n)) > 0$. The second inequality follows from (22) and the third inequality follows from observing that $\phi_1^o < E[\phi_1 | b_1 = o]$ and $(\pi_2(o,o,y) - \pi_2(o,i,n)) > 0$. □

**Proof of Proposition 7**: The expression for Firm Two’s probability of bankruptcy $\beta_2(b_1)$ is given by (33) and Firm Two’s bond price $B_2(b_1)$ can be expressed as (the derivation closely follows that in (42) for the price of debt in the base model)

\[ B_2(b_1) = D_2 - q_2(L_2 - \phi_2^2\Delta_2(b_1)), \]

Thus, as before, $b_1$ affects the probabilities of bankruptcy and price of debt only through $\Delta_2(b_1)$, and $\beta_2(b_1)$ is increasing while $B_2(b_1)$ is decreasing in $\Delta_2(b_1)$. The proposition claims about $\beta_2(b_1)$ and $B_2(b_1)$ then obtain from observing that, from assumption (28), we have $\Delta_2(i) > \Delta(o)$, which can be shown as follows:

\[ \Delta_2(i) = \Delta_2^o + E[\phi_1 | b_1 = i](\Delta^i_2 - \Delta^o_2) > \Delta_2^o + E[\phi_1 | b_1 = i](\Delta^o_2 - \Delta^o_2) \]
\[ > \Delta_2^o + E[\phi_1 | b_1 = o](\Delta^o_2 - \Delta^o_2) \]
\[ = \Delta_2(o), \]

The expression for Firm Two’s stock price $S_2(b_1)$ is still given by (39), so we again can follow the steps of
the proof of Proposition 2. Specifically, we have

\[ E[\pi_2(o, i, c_1)] \]

\[ = E[\pi_2(o, i, n)] - E[\phi_1 | b_1 = i](\pi_2(o, i, n) - \pi_2(o, i, y)) \]

\[ < E[\pi_2(o, i, n)] - E[\phi_1 | b_1 = o](\pi_2(o, i, n) - \pi_2(o, o, y)) \]

\[ = E[\pi_2(o, o, c_1)] \]

(50)

In the above, the inequality follows from observing that \( E[\phi_1 | b_1 = i] > E[\phi_1 | b_1 = o] \) and \( \pi_2(o, i, n) - \pi_2(o, i, y) > \pi_2(o, i, n) - \pi_2(o, o, y) \) according to (27). Using the inequality \( E[\pi_2(o, b_1 = i, c_1)] > E[\pi_2(o, b_1 = 0, c_1)] \) derived above, we then obtain that Firm Two’s stock price reaction is negative from (39).

\[ \square \]
Figure 1: Equilibrium regions. This figure illustrates the parameter sets that support out-of-bankruptcy and bankruptcy equilibria. Areas labeled OBE$_j$ indicate parameter values that yield zero ex ante probabilities of bankruptcy for Firm $j$, while BE$_j$ indicates parameter values that yield positive ex ante probabilities of bankruptcy. Along the $y$ axis we vary Firm One’s cost of bankruptcy ($\delta$) and along the $x$ axis we vary its equityholder’s information advantage ($\ell_1$). We vary $\ell_1 = (\phi_1^t - \phi_1^w)/\phi_1^t$ by changing $\phi_1^t$. To generate the figure, we assume that $\delta_2 = 0.18$, $\gamma_0 = \gamma_c = 0.90$, $\alpha_1 = 20$, $\alpha_2 = 25$, $D_1 = D_2 = 4$, $q_1 = q_2 = 0.30$, $\phi_1^r = 0.90$, $\phi_1^w = \phi_2^w = 0.30$, and $\phi_2^r = 0.85$. 
Figure 2: The information signaled by restructuring outcomes. This figure illustrates the posterior probability of Firm One being type $s$ conditional on whether it restructures in or out of bankruptcy, $b_1 = i$ and $b_1 = o$, respectively. We vary the equityholder’s information advantage, $\ell_1 = (\phi_{s1}^i - \phi_{w1}^i)/\phi_{s1}^i$. To generate the figure, we assume that $\alpha_1 = \alpha_2 = 20, \delta_1 = \delta_2 = 0.05, \gamma_b = \gamma_c = 0.9, D_1 = D_2 = 4, q_1 = q_2 = 0.3, \phi_{s1}^w = 0.3, \phi_{w2}^w = 0.4$, and $\phi_{s2}^t = 0.9$. 
Figure 3: A firm’s stock price reaction to its own restructuring. This figure illustrates how Firm One’s stock price reacts to news of its bankruptcy for different levels of Firm Two’s competitiveness \( q_2 \). Each set of two lines is generated using a given value of a key determinant of mispricing. The solid (dashed) lines correspond to a relatively small (large) equityholder information advantage given by \( \ell_1 = 0.1 \) (\( \ell_1 = 0.5 \)). To generate the figure, we assume that \( \alpha_1 = \alpha_2 = 20, \delta_1 = \delta_2 = 0.05, \gamma_b = \gamma_c = 0.9, D_1 = D_2 = 4, q_1 = 0.3, \phi^{s}_1 = \phi^{s}_2 = 0.9, \) and \( \phi^{w}_1 = \phi^{w}_2 = 0.4 \). The breaks in the lines occur because at these values of \( q_2 \) multiple equilibria are possible.
Figure 4: Stock price response to a competitor’s bankruptcy. This figure illustrates parameter values that support positive and negative price responses of Firm One and Firm Two’s stock prices to news of Firm One’s bankruptcy. To generate the figure, we assume that $\alpha_1 = 20, \alpha_2 = 25, \delta_1 = 0.15, \delta_2 = 0.3, \gamma = 0.9, D_1 = D_2 = 4, q_1 = q_2 = 0.3, \phi_1^w = \phi_2^w = 0.3$, and $\phi_2^s = 0.9$. 
Figure 5: Spillovers to bankruptcy costs. This figure illustrates the parameter sets where Firm’s Two dead-weight costs of bankruptcy is higher following Firm One’s bankruptcy. To generate the figure, we assume that $\alpha_1 = \alpha_2 = 20, \delta_2 = 0.05, \gamma_b = \gamma_c = 0.9, D_1 = D_2 = 4, q_1 = q_2 = 0.3, \phi_{1w} = 0.3, \phi_{2w} = 0.4$, and $\phi_z = 0.9.$
Figure 6: Firm two’s debt price reaction to Firm One’s restructuring. This figure illustrates how the price of Firm Two’s debt reacts to Firm One’s restructuring outcome for different levels of the information advantage of Firm One’s equityholder, $\ell_1$. To generate the figure, we assume that $\alpha_1 = \alpha_2 = 20$, $\delta_1 = \delta_2 = 0.10$, $\gamma = \gamma_0 = 0.9$, $D_1 = 4$, $D_2 = 2$, $q_1 = q_2 = 0.3$, $\phi_1^w = 0.4$, $\phi_2^w = 0.3$, and $\phi_1^s = \phi_2^s = 0.9$. 

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Table 1: Bankruptcy Statistics, 2-digit SICs
The first two columns report the number of statistically significant CARs that are positive (column 1) and that are negative (column 2). The numbers in parentheses also include statistically insignificant CARS. The following two columns report the mean and the last two columns report the median values of the corresponding CARs. The first row reports statistics on CAR for bankrupt firms themselves; the second row reports on the industry reaction; rows three and four focus on the industry reaction for the subsample where own firm reaction is positive (line 3) or negative (line 4). All CARs are obtained by first regressing returns from date -250 to date -50 on the value-weighted market portfolio, and then using the estimated beta to evaluate excess return for the (-3,+3) event window. We included only those firms for which at least one price observation was available during the three days following bankruptcy filing.

<table>
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Table 2: Bankruptcy Statistics, 3-digit SICs.
The first two columns report the number of statistically significant CARs that are positive (column 1) and that are negative (column 2). The numbers in parentheses also include statistically insignificant CARS. The following two columns report the mean and the last two columns report the median values of the corresponding CARs. The first row reports statistics on CAR for bankrupt firms themselves; the second row reports on the industry reaction; rows three and four focus on the industry reaction for the subsample where own firm reaction is positive (line 3) or negative (line 4). All CARs are obtained by first regressing returns from date -250 to date -50 on the value-weighted market portfolio, and then using the estimated beta to evaluate excess return for the (-3,+3) event window. We included only those firms for which at least one price observation was available during the three days following bankruptcy filing.

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<th>Median CAR</th>
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