Overbidding vs fire–sales in bankruptcy auctions

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First draft, July 2000
This version, June 2002

Abstract

We analyze bidding incentives of the main creditor (bank) in Swedish bankruptcy auctions. Absent a direct mechanism for enforcing its seller reservation price, the bank offers financing to a potential bidder in return for a bid strategy that maximizes the expected profits of the bank-bidder coalition. The coalition overbids (in excess of the coalition's private valuation) by an amount that is decreasing in the bank's "liquidation recovery". This is the recovery if the bank were to receive the piecemeal liquidation value announced by the auctioneer at the start of the auction. Since both the liquidation recovery and the final going-concern auction premium are observable, the overbidding theory is testable. We perform a large-sample, cross-sectional analysis where overbidding is picthed against asset-fire sale arguments. The latter hold that auctions tend to produce *lower* going-concern premiums when taking place during industry-wide financial distress, or when the firm is sold back to old owners or to industry outsiders. The evidence is strongly consistent with overbidding but provides little support for asset fire-sale arguments.

*We have benefitted from the comments of Sandra Betton, Diego Garcia, Robert Hansen, Ronen Israel, Kose John, Dima Lechinski, Christian Riis, Kristian Rydqvist, Keun Kwan Ryu, Chester Spatt, Matthew Spiegel, and seminar participants at the following universities: Dartmouth, Emory, Georgetown, the Norwegian School of Economics and Business Administration, the Norwegian School of Management, Oxford, Rochester, Toronto, and Vanderbilt. We have also benefitted from presentations at the 2000 CEPR Summer Symposium at Gerzensee (Switzerland), the 2001 CEPR Corporate Governance conference at Cormayeur (Italy), the 2001 meetings of the Utah Winter Finance Conference, the Financial Management Association (European), and the European Finance Association, and the 2002 meetings of the American Finance Association and the NBER Corporate Finance Meeting. Partial financial support from Tuck's Center for Corporate Governance, the Norwegian National Research Council (grant no. 125105/510) and the Swedish National Council for Crime Prevention is also gratefully acknowledged. Email: b.espen.eckbo@dartmouth.edu and karin.thorburn@dartmouth.edu.

1 Introduction

Firms resolve financial distress ex post through informal renegotiations (private workouts) or court-supervised, "one shoe fits all" bankruptcy procedures. The optimal design of such procedures is an important but controversial issue. For reasons that are not well understood, different bankruptcy systems have evolved in different countries, with a recent trend toward the structured bargaining process characterizing the US code. This code substantially restricts the liquidation rights of creditors: a Chapter 11 filing triggers automatic stay of debt payments, prevents repossession of collateral, and allows the bankrupt firm to raise new debt with super-priority (debtor-in-possession financing). In contrast, the UK has developed a contract-driven receivership system where creditor rights are enforced almost to the letter. Here, assets pledged as collateral can be repossessed even if they are vital for the firm, and there is no stay of debt claims. This makes it extremely difficult to continue to operate the distressed firm under receivership.

A third, hybrid system has been developed in the small-firm environment in Sweden. On the one hand, the Swedish code maintains the strong protection of the firm as a going concern also found in the US (stay of debt and collateral, and the possibility of super-priority debt financing). On the other hand, as in the UK, court-supervised renegotiation of the senior or secured debt is not an option. Instead, the filing firm is turned over to a court-appointed trustee who arranges an open auction. Bids in this auction are for individual assets (piecemeal liquidation) or for the entire firm as a going concern. All bids must be in cash, and the auction proceeds are distributed strictly according to absolute priority. The cash requirement notwithstanding, the auctions typically attract multiple bidders (shown below).

We provide a theoretical and empirical analysis of the workings of the Swedish bankruptcy auctions. This issue is important as it addresses the puzzling reluctance of most countries to rely on auctions as a bankruptcy procedure.[1] As suggested by Hart (2000), if capital markets work well, auctions should generate an ex post efficient resolution of bankruptcy.[2] Indeed, Thorburn (2000) shows that Swedish auctions are quick (on average two months) and cost-efficient, and argues that direct costs of auctions are substantially lower than the (firm-size-adjusted) direct costs of large-

[1] "I'm not aware of any group–management, shareholders, creditors, or workers–who is pushing for cash auctions", Hart (2000).

[2] While not the focus of this paper, we discuss briefly the issue of *ex ante* efficiency of an auction bankruptcy system in Section 5, below.

firm Chapter 11 proceedings. Moreover, she reports that three-quarters of the firms are sold as going concerns, a firm survivorship rate that is comparable to that reported for Chapter 11 [White (1984)]. Thorburn (2001) further shows that the firms surviving the auction perform at par with their non-bankrupt industry rivals. This is in contrast with the evidence in Hotchkiss (1995) where firms emerging from Chapter 11 on average underperform their respective industries.

However, Shleifer and Vishny (1992) and Aghion, Hart, and Moore (1992) warn that bankruptcy auctions may be disadvantaged by problems of liquidity and lack of competition, possibly resulting in the firm being sold at relatively low, "fire-sale" prices. Specifically, if bankruptcy auctions coincide with industry-wide financial distress, potential industry buyers may be credit constrained, leaving relatively low-valuation industry outsiders to purchase the firm. Or, as modeled by Strömberg (2000), the main creditor may have incentives to preempt the auction and put the bankrupt firm back to its former owners (a saleback) at terms detrimental to junior creditors.[3] The low transaction costs notwithstanding, creditors will be reluctant to rely on auctions if structured bargaining is believed to produce substantially greater overall debt recovery. Since systematic evidence on the fire-sale hypothesis in the context of bankruptcy auctions is virtually nonexistent, the issue remains controversial.[4]

A basic insight of this paper is that the scope for fire-sales in bankruptcy auctions is reduced by the bidding incentives of the bankrupt firm's main creditor (henceforth "the bank").[5] Generally, it is in the bank's interest to both increase liquidity by offering bid financing, and to "assist" the auction in order to increase the expected auction premium. These incentives appear to have been overlooked in the literature on auction fire-sales. The key issue for our empirical analysis is whether these incentives, as modeled below, are sufficient to counter tendencies for fire-sales in Swedish bankruptcy auctions.

Under Swedish rules, the bank can neither bid directly in the auction nor refuse to sell to the winning bidder. Thus, it cannot directly enforce it's reservation price as a (monopolist) seller.

[3] In the empirical analysis below, we show that salebacks, as defined by Strömberg, in fact take place in substantial competition with other interested bidders, and lead to "normal" auction premiums.

[4] There is some evidence on the fire-sale hypothesis based on asset sales by financially distressed firms in the US. Pulvino (1998) finds that sales of aircrafts under conditions of distress on average produce prices that are lower than a theoretical benchmark price, while non-distressed sales do not exhibit a discount. Conditional on his hedonic pricing model being correctly specified, his evidence supports fire-sale arguments. Maksimovic and Phillips (1998) examine company plant closures and sales in and out of Chapter 11 and conclude against the fire-sale hypothesis.

[5] As discussed below, the bankrupt firm in Sweden typically has only a single banking relationship and this bank owns roughly one-third of the debt claims.

However, the bank can influence the auction outcome by financing a bidder in return for a bid strategy that maximizes the bank-bidder coalition's expected revenue. We show that this optimal bid equals the revenue-maximizing reservation price by a monopolist seller, constrained by the face value of debt. Under certain conditions, the bank-bidder coalition optimally bids higher than the private valuation of the bank's coalition partner (overbidding). Successful overbidding leads to a wealth transfer from bidders other than the coalition partner and thus leaves the bank better off relative to remaining a passive bystander to the auction.

Our theoretical analysis is closely related to the literature on "toehold" bidding in takeovers, i.e., optimal bidding strategies when one or more bidders have an equity ownership position (toehold) in the target firm. Bidding with an equity toehold means that the bidder plays the role of *seller* (of the toehold) should another bidder win the auction. As shown by Burkart (1995) and Singh (1998) in the context of auctions with uncorrelated private bidder valuations, as well as by Bulow, Huang, and Klemperer (1999) in a common-value setting, the expected gain on the toehold raises the bidder's ex ante valuation and may lead to aggressive bidding. As indicated by the large-sample empirical analysis of Betton and Eckbo (2000), toehold effects in interfirm tender offers are significant. For example, toehold bidding lowers the winning premium, increases the probability of success on the first bid, and appears to lower the overall cost of the takeover. Toehold effects in the context of bankruptcies are also modeled in Hotchkiss and Mooradian (1999). They focus on a creditor-management coalition seeking to buy a firm out of Chapter 11 and show that the optimal bid depends on the face value of debt held by other creditors.

Our theoretical bidding analysis yields a unique, testable cross-sectional prediction (Proposition 2). This prediction exploits the fact that the trustee announces a professional estimate of the firm's piecemeal liquidation value (the sum of the second-hand market values of each asset if sold piecemeally) at the beginning of the auction. This liquidation value estimate thus forms an observable starting point for bidding. Bids can be for the firm as a going concern or for the firm's assets piecemeally.[6] Our model implies that the expected amount of overbidding is lower the greater the bank's debt recovery should the auction result in piecemeal liquidation. Since the effect of overbidding is to raise the premium over the initial liquidation value paid by the winning bidder,

[6]We show empirically that the final auction price is on average within 8% of the initial liquidation value estimate when the auction results in a piecemeal sale. Thus, the trustee's liquidation value estimate is on average very precise.

a regression of the observed winning auction premium on the bank's recovery at the liquidation value estimate should yield a negative coefficient. In the same regression, we test the overbidding theory against fire-sale arguments by including additional factors related to industry distress, the business cycle and the identity of the buyer. Empirically, we find strong support for the overbidding theory and no support for asset fire-sale arguments, possibly because the effect of overbidding is to counteract tendencies for asset-fire sales.

The rest of the paper is organized as follows. Section 2 derives optimal bidding strategies for a coalition between the bank and a bidder in the auction, and summarizes the central empirical hypothesis to be tested. Section 3 provides a description of the Swedish auction bankruptcy system and of our data. Section 4 presents test of key hypotheses related to the bank's bidding and refinancing behavior, as well as the asset fire-sale hypothesis. Section 5 links our results to the literature on optimal bankruptcy procedures, while Section 6 concludes the paper.

2 A theory of overbidding in bankruptcy auctions

Swedish bankruptcy law mandates a first-price, open auction of the filing firm. A well-established result of auction theory is that, with costless bidding, the price paid by the winning bidder in such an auction equals the price paid in a second-price sealed-bid auction.[7] In the following, we follow Burkart (1995) and use the second-price auction analogy, and we assume that the number of bidders is exogenously given at two. Bidder i values the bankrupt firm at $v_i \equiv v_l + \epsilon_i$, $i = 1, 2$, where v_l is a known constant—henceforth labeled the "piecemeal liquidation value"–and ϵ_i is a private valuation distributed iid with distribution and density functions G and g, respectively. The private valuation may be thought of as unique synergy effects emanating from the bidder's specialized resources when combined with the bankrupt firm.

Given that the piecemeal liquidation value is known, the auction establishes the price to be paid for the right to generate the bidder's private going-concern value. In this auction setting, it is a dominant strategy for each bidder to bid its private valuation. Thus, the firm is sold for $p = \min[v_1, v_2]$ as long as the bank remains a passive bystander. This "ratchet solution" [Hirshleifer (1995)] yields a lower bound on the recovery generated by the auction.

[7] See, e.g., Klemperer (2000) for a review of auction theory.

As mentioned earlier, the bank is restricted from placing direct bids for the auctioned firm, and it cannot refuse to sell to the winning bidder. However, suppose the bank offers to finance bidder 1 in return for a bid strategy p_c that maximizes the expected return to the bank-bidder coalition. As shown in Proposition 1, under certain conditions, the coalition overbids ($p_c > v_1$). The reason is that overbidding raises the expected winning auction price and thus the bank's expected recovery.

Proposition 1 (Coalition bidding strategy): *Suppose that the bank is the sole member of its creditor class, and define*

$$p^* \equiv v_1 + \frac{1 - G(p^*)}{g(p^*)}. \tag{1}$$

Moreover, let b denote the face value of the bank's debt claim and s the face value of all claims senior to the bank. The bank forms a coalition with a bidder (here bidder 1) and implements the following bidding strategy:

$$p_c = \begin{cases} v_1 & \text{if} \quad p^* \leq s \quad \text{(Region I, no overbidding)} \\ p^* & \text{if} \quad s < p^* \leq s + b \quad \text{(Region II, full overbidding)} \\ s + b & \text{if} \quad v_1 \leq s + b < p^* \quad \text{(Region III, partial overbidding)} \\ v_1 & \text{if} \quad v_1 > s + b \quad \text{(Region IV, no overbidding)} \end{cases} \tag{2}$$

Proof: Figure 1 illustrates how the optimal bank-bidder coalition price varies with the value of v_1 in the presence of creditors that are either senior (s) or junior to the bank.[8] For simplicity, the value of v_l is normalized to zero in the figure. We start the proof with Region II, since this is the region that defines the unconstrained (full) overbidding price $p_c = p^*$.

Region II: $s < p^* \leq s + b$. In this region, the bank's claim is impaired but it expects to receive some recovery. If the coalition loses, bidder 2 pays p_c and the bank recovers $p_c - s$ after paying off senior debt. If the coalition wins, it receives v_1 in return for paying p_2, and the bank recovers $p_2 - s$. Thus, the net coalition profit from winning is $v_1 - s$. The expected coalition profit Π_c from

[8] In the sample studied below, the bank's claim is typically junior only to a small amount of top-priority debt claims.

bidding p_c is therefore

$$\Pi_c = (p_c - s)[1 - G(p_c)] + (v_1 - s)G(p_c) = p_c[1 - G(p_c)] + v_1 G(p_c) - s. \tag{3}$$

Maximizing with respect to p_c yields the first-order condition

$$\frac{\partial \Pi_c}{\partial p_c} = [1 - G(p_c)] - p_c g(p_c) + v_1 g(p_c) = 0 \tag{4}$$

which produces an optimal coalition price of $p_c = p^*$. Thus, in Region II, the coalition fully overbids.[9]

Region I: $p^* < s$. In this region, the bank expects zero recovery. Since every dollar overbidding is captured by creditors senior to the bank, it immediately follows that the coalition should not overbid. Formally, the coalition's expected profit is

$$\Pi_c = \int_0^{p_c} (v_1 - p_2) g(p_2) dp_2, \tag{5}$$

and the first-order condition

$$\frac{\partial \Pi_c}{\partial p_c} = (v_1 - p_c) g(p_c) = 0, \tag{6}$$

which implies that the optimal bid is $p_c = v_1$.

Region III: $v_1 \leq s + b < p^*$. In this case, the price p^* is suboptimal because the difference $p^* - (s + b)$ represents a pure transfer from the coalition to creditors junior to the bank. Thus, the maximum coalition price in this region equals $s + b$. This is also the minimum price because it is optimal to overbid towards p^*. In sum, in Region III, $p_c = s + b$; the coalition partially overbids.

Region IV: $v_1 > s + b$. In this case, *any* overbidding is a pure transfer to junior creditors and

[9] To ensure uniqueness, G must be twice continuously differentiable and satisfy the monotonicity condition

$$\frac{\partial}{\partial v} \frac{g(v)}{1 - G(v)} \geq 0.$$

For the case of the uniform distribution, the optimal bid simplifies to

$$p^* = \frac{v_1 + 1}{2}.$$

the optimal coalition price equals v_1. Formally, the expected coalition profit is given by

$$\Pi_c = \int_0^s (v_1 - p_2)g(p_2)dp_2 + (v_1 - s)[G(s+b) - G(s)] + \int_{s+b}^{p_c} (v_1 + b - p_2)g(p_2)dp_2 + b[1 - G(p_c)] \tag{7}$$

The first-order condition is

$$\frac{\partial \Pi_c}{\partial p_c} = (v_1 + b - p_c)g(p_c) - bg(p_c) = (v_1 - p_c)g(p_c) = 0, \tag{8}$$

which yields as the optimal price $p_c = v_1$ (no overbidding). ■

As shown in Lemma 1, the coalition pricing strategy in Region II (full overbidding) effectively mimics the optimal take-it-or-leave-it selling price p_m of a monopolist seller with a private valuation $v_m = v_1$:

> **Lemma 1: (Monopolist seller)** *Suppose the seller faces a single bidder whose private value v is distributed according to $G(v)$. Moreover, suppose that the monopolist foregoes the value v_m by selling the firm. Then, the optimal reservation price for take-it-or-leave-it offer to purchase the bankrupt firm equals*
>
> $$p_m = v_m + \frac{1 - G(p_m)}{g(p_m)}. \tag{9}$$

Proof: Figure 2 shows the optimal price of a monopolist seller in a standard "price-quantity" diagram. As in Klemperer (2000), the "quantity" sold (horizontal axis) is the probability $1 - G(p)$ of selling the firm at an auction price p. A sales price of p yields expected revenue of $R = p[1 - G(p)]$ and expected marginal revenue of $\partial R/\partial p = [1 - G(p)] - pg(p)$. The monopolist's expected cost of selling the firm is $C = v_m[1 - G(p)]$. Thus, the expected marginal cost equals $\partial C/\partial p = -v_m g(p)$, and equating marginal revenue with marginal costs yields p_m. ■

Enforcing p_m means refusing to sell the firm (or its assets) at a price below p_m. The bankruptcy auctioneer, whose fiduciary responsibility is to maximize total creditor recovery, will in practice consider any bid value in excess of the piecemeal liquidation value v_l. Thus, as a passive bystander, the bank expects to receive the lower price equal to the second-highest bidder's valuation (the

ratchet solution). Lemma 1 shows that the bidder coalition strategy of Proposition 1 mimics–subject to the constraints imposed by the face value of other creditor classes–the monopolist seller price.

The presence of multiple creditors in the bank's creditor class alters the optimal coalition strategy in Proposition 1. To see how, suppose the bank holds the fraction $0 < \alpha < 1$ of the total claims b in the class.[10] As shown in Lemma 2, this reduces the coalition's overbidding:

Lemma 2 (Multiple creditors): *The smaller the fraction α of the claims in the bank's debt class that is owned by the bank, the smaller the amount of overbidding by the bank-bidder coalition:*

$$p_\alpha^* = v_1 + \alpha \frac{1 - G(p^*)}{g(p^*)}. \tag{10}$$

Proof: The bank's recovery is now scaled with the constant α, i.e., the coalition realizes $\alpha(p_c - s)$ if losing and $v_1 - p_2 + \alpha(p_2 - s)$ if winning. Thus, the expected payoff equals

$$\Pi_c = \alpha p_c[1 - G(p_c)] + v_1 G(p_c) - (1 - \alpha) \int_0^{p_c} p_2 g(p_2) dp_2 - \alpha s. \tag{11}$$

The first-order condition is

$$\frac{\partial \Pi_c}{\partial p_c} = \alpha[1 - G(p_c)] + v_1 g(p_c) - p_c g(p_c) = 0, \tag{12}$$

which yields the optimal coalition bid p_α^*.[11] ■

The above analysis assumes that the bank's coalition partner (bidder 1) agrees to a bidding strategy that maximizes the total coalition payoff. In a competitive capital market where borrowers and lenders are symmetrically informed, bidder 1 derives no net benefit or cost from the coalition strategy and is thus indifferent. In this case, the bank bears the full cost of overbidding. Lemma 3

[10] Hotchkiss and Mooradian (1999) examine analogous bidding incentives of a management-creditor coalition that seek to acquire a firm out of Chapter 11 in the US. In their context, α would be the proportion of the total creditor class' claims owned by the management-bidder coalition. Buyouts of this type are rare in Chapter 11.

[11] With uniform distributions over $[0, 1]$,

$$p_\alpha^* = \frac{v_1 + \alpha}{1 + \alpha}.$$

Note also that the expression for p_α^* is identical to the optimal bid by a toehold bidder derived by Burkart (1995) in the context of takeovers.

shows the magnitude of these costs:

Lemma 3 (Overbidding cost): *The expected overbidding cost is given by*

$$\int_{v_1}^{p_c} (p_2 - v_1) g(p_2) dp_2 = (p_c - v_1) g(p_c). \tag{13}$$

Proof: As shown in Figure 3, there are three mutually exclusive outcomes of the coalition overbidding. Notice first that overbidding implies zero costs to the coalition when it loses (Figure 3a). Second, overbidding is costless when the coalition wins and pays $p_2 < v_1$ (Figure 3b). Third, overbidding is costly if the coalition wins and pays a price $p_2 > v_1$ (Figure 3c). As indicated in Figure 3, this is also the only auction outcome that implies an inefficient allocation of the bankrupt firm.[12] Thus, as stated in the lemma, the expected cost of overbidding equals $p_2 - v_1$ times the probability that bidder 2's private valuation v_2 falls in the interval $[v_1, p_c]$. Alternatively, one could also derive the same expression for the expected overbidding cost by integrating the area in Figure 2 under the demand curve over the price range $[v_m, p_m]$ (i.e., the usual "deadweight loss"-triangle of monopoly). ■

There are several possible ways for the bank to compensate bidder 1 for the overbidding cost. The bank may, for example, contract to reduce the face value of the bank's debt claim issued on bidder 1 by the full amount of the coalition's overbidding cost should the outcome in Figure 3c materialize. This works in our model since the bank has learned the true value of v_1 at the beginning of the auction (as an input to computing p_c).[13]

The discussion so far has focused exclusively on the *bank's* incentive to overbid. However, it is not uncommon for the owners of small firms to raise bank financing by personally guaranteeing the bank loan. If such an owner decides to bid for the bankrupt firm, the bidder has similar incentives to overbid also without forming a bank-bidder coalition. This follows because the greater bank recovery resulting from (successful) overbidding also reduces the equityholders liability vis-a-vis

[12] Consistent with the actual institutional setup in Sweden, it is assumed that bidders cannot simply withdraw (renege on) the winning bid at this point. See Singh (1998) for an analysis of how allowing the wining bidder to renege may impact optimal bids.

[13] If the bank and bidder 1 are asymmetrically informed about the true value of v_1, the analysis is more complicated. Now bidder 1 may have an incentive to understate v_1 (it is easily verified that bidder 1 has nothing to gain from *over*stating v_1). Understating v_1 increases the expected compensation bidder 1 receives from the bank for the cost of overpayment. The tradeoff is that lowering v_1 also reduces p_c and thus the probability that bidder 1 will capture the private benefit of running the auctioned firm.

the bank. Thus, overbidding may occur even in the absence of a bank-bidder coalition. Moreover, if a bank-bidder coalition is formed with a bidder that has a personal loan guarantee, then the above analysis goes through with the exception that the bank no longer compensates the coalition bidder for the (full) overbidding cost. These results are summarized in Lemma 4:

Lemma 4 (Personal loan guarantee): *If a bidder has issued a personal loan guarantee, then this bidder has an incentive to overbid without forming a bank-bidder coalition. Moreover, in the event that the bank forms a coalition with such a bidder, the bank no longer compensates the bidder for the full value of the overbidding costs.*

The analysis so far has taken the piecemeal liquidation value v_l as given. We now analyze how the incentive to overbid changes with changes in v_l. This analysis produces the main cross-sectional implication of the paper, namely that the going concern premium $(p - v_l)$ on average is greater the lower v_l. To see this, we first show that the expected amount of coalition overbidding is decreasing in v_l:

Proposition 2 (Expected overbidding and liquidation values): *For liquidation values $v_l < s + b$, the expected coalition overbidding, $E(p_c - v_1)$, is decreasing in v_l.*

Proof: Recall from Proposition 1 that the bank has an incentive to form a coalition and overbid only when $v_1 < s + b$, i.e., when $\epsilon_1 < \epsilon_1^* \equiv max[s + b - v_l, 0]$. Thus, for a given v_l, the expected amount of overbidding is computed by integrating $p_c - v_1$ over the range $[0, \epsilon_1^*]$. This is equivalent to computing the area in Figure 1 under p_c and above v_1 from v_l up to $s + b$:[14]

$$E(p_c - v_1) = \int_0^{\epsilon_1'} (s + b - v_l - \epsilon_1) d\epsilon_1 + \int_{\epsilon_1'}^{\epsilon_1^*} \frac{1 - G(\epsilon_1)}{g(\epsilon_1)} d\epsilon_1, \tag{14}$$

where $\epsilon_1' = s + b - v_l - \frac{1-G(\epsilon_1)}{g(\epsilon_1)} < \epsilon_1^*$, i.e., the breakpoint between Region II and III in Figure 1 (where $p^* = s + b$). Proposition 2 follows directly from the fact that the integral limit ϵ_1^* is decreasing in v_l. ■

Proposition 2 is stated in terms of the overbidding $p_c - v_1$ which is not empirically observable. Lemma 5 transforms Proposition 2 into observables and thus provides the main empirically testable implication of our theory:

[14] As noted above, in Figure 1, $v_l = 0$. A value of $v_l > 0$ simply moves origo towards the right, holding s and b constant.

Lemma 5 (Going concern premia and liquidation recovery rates): *The going concern premium in excess of the piecemeal liquidation value, $p - v_l$, where p is the price paid by the winning bidder, is decreasing in the bank's recovery rate at the liquidation value, $r_l \equiv \min[\max[(v_l - s)/b, 0], 1]$.*

Proof: First, it follows immediately that since $E(p_c - v_1)$ is decreasing in v_l (Proposition 2), $E(p - v_l) = E(p) - v_l$ is also decreasing in v_l. Again, when the coalition overbids and loses, the price p is greater than the price $p = v_1$ implied by no overbidding. When the coalition overbids and wins, $p = v_2$. In sum, with overbidding $p \geq \min[v_1, v_2]$. Since expected overbidding decreases with v_l, $E(p)$ also decreases with v_l. Alternatively, in regions with overbidding (II and III in Figure 1), $\partial r_l / \partial v_l > 0$.[15] ■

Thus, the existence of overbidding as defined by Proposition 1 can be empirically tested by regressing the observable going-concern premium $p - v_l$ on the bank's liquidation recovery rate r_l which is also observable. We now turn to our empirical examination of Lemma 5 and other, related hypotheses.

3 Auction environment and sample characteristics

3.1 Auction environment

Figure 4 illustrates key potential outcomes in a Swedish firm's process towards being sold in a bankruptcy auction, starting with the point of insolvency. The insolvent firm (i.e., a firm where the face value of debt claims exceeds the market value of the assets) may first consider attempting to use the *composition* option (event 1) provided by Swedish insolvency law. This option allows the firm to renegotiate the debt claims of *unsecured* creditors only, which on average constitute one-third of the firm's debt. The bulk of the secured claims is typically held by the firm's (main) bank.[16] Not surprisingly, successful composition is elusive as secured creditors (typically one-third of the total

[15] Since for $0 < r_l < 1$, $\epsilon_1^* = b(1 - r_l)$, the limit ϵ_1^* (and thus the expected amount of overbidding) is decreasing in r_l.

[16] In Sweden, it is common for small firms to have a single bank. This bank holds all of the secured and some of the unsecured debt. As in most of Western Europe, bank financing often take the form of so-called "floating-charge" secured debt. The collateral supporting "floating charge" secured debt are included in the general term "movable assets" (Swedish "rörliga tillgångar"). Movable assets include items such as accounts receivables, patents and other intellectual property, as well as certain assets that can be seized by the creditor (e.g., machinery and inventory but not cash and securities). In contrast, "fixed-charge" collateral refers to assets specified in the covenants of the debt contract (e.g., real estate, buildings, and vessels). In the US., secured debt refers to fixed-charge collateral only.

debt) and priority claims such as taxes and wages are not part of the proposal and need not agree unless they are offered full repayment. Since anything less than full repayment would imply a wealth transfer from secured to unsecured creditors, composition is almost never attempted. Indeed, Eckbo and Thorburn (2000) report 300 bankruptcy filings but only *four* successful composition attempts in the population of 1,650 financially distressed Swedish firms with at least 20 employees during 1990-92.

As an alternative, the firm may explore the potential for negotiating an out-of-court sale of the firm's assets as a going concern (event 2). This negotiation is typically initiated by the owner-manager and is subject to approval by secured creditors. Following this sale, the firm is still insolvent (the cash proceeds from the sale are necessarily less than the face value of outstanding debt) and must thus file for bankruptcy (event 3). This filing represents a prepackaged bankruptcy solution (henceforth "auction prepack") since the assets have already been sold. The asset sale is typically completed the day before–or on the day of–the bankruptcy filing. The role of the bankruptcy court in this instance is primarily to allow junior creditors to object to the sale and, if the sale is overturned, to organize an open auction. Empirically, auction prepack filings are almost never overturned.[17]

When filing for regular auction bankruptcy (event 4), the control of the firm is transfered to an independent, court-appointed trustee with fiduciary responsibility to creditors. Trustees are certified by a government supervisory authority ("Tillsynsmyndigheten i Konkurs" or TSM), which also reviews the trustees' compensation and performance. Poorly performing trustees (e.g., in terms of their efforts to maintain the bankruptcy auction) risk losing their license. Trustees are also subject to the wrath of major creditors should they fail to hold a proper, arms-length auction procedure. This constraint is particularly relevant in the case of a sale-back to the old owners. Trustees are compensated on an hourly basis. The trustee organizes the sale of the firm in an auction which, in our sample below lasts an average of 25 days. This auction results in either the firm being liquidated piecemeally (event 5) or sold as a going concern (event 6).

Financially distressed firms and the buyer self-select the path in Figure 4 depending on firm-

[17] Thorburn (2000) shows that auction prepacks have significantly lower direct costs than a regular bankruptcy filing. Thus, it is natural to assume that a regular auction bankruptcy filing (event 4) signals a failed prepack attempt or that the firm has insufficient going-concern value. Prepack attempts may fail due to insufficient time to line up a buyer and creditor support.

specific characteristics. Using the sample described below, a multinomial logit model reveals that the probability of piecemeal liquidation increases with the fraction of the total debt that is secured (a proxy for the firm's tangible assets), and is higher for bankruptcy filings during the 1991 business cycle downturn. Auction prepacks are more likely the larger the firm and the greater the proportion secured debt. The probability of a going concern sale is greater the greater the number of floating charge debtholders (possibly because increasing cost of debtholder coordination tend to prevent prepack arrangements).[18] In the auction, a going-concern sale takes place by merging the assets and operations of the firm into a receiving company set up or held by the buyer, akin to a leverage buyout transaction.[19] The method of payment is restricted to cash, and creditors are paid according to the absolute priority of their claims.

While in bankruptcy, the firm is protected by an automatic stay of creditors (i.e., debt service is halted and creditors cannot seize collateral.) Furthermore, debtor-in-possession financing is permitted, allowing the firm to raise new debt with super-priority status.[20] In practice, however, bankrupt firms tend to cover operating expenses by increasing their debt obligations in the form of trade credits (which get super-priority), while new debt issues or bank loans are almost never observed.

3.2 Data sources and characteristics

The starting point for our sample of Swedish bankruptcies is the original Strömberg and Thorburn (1996) data base also underlying Thorburn (2000, 2001) and Strömberg (2000). This data set in-

[18] The text reports results for the significant coefficients only. Let $\pi_n(x_j)$ denote the probability of auction outcome n conditional on some vector of firm-specific characteristics x_j. We estimate $\pi_n(x_j)$ across the $(n = 1, 2, 3)$ outcomes piecemeal liquidation, auction prepack, and going-concern sale:

$$\pi_{jn} = \pi_n(x_j) = \exp(x_j'\beta_n) / \sum_{n=1}^{3} \exp(x_j'\beta_n),$$

where β_n is the estimated coefficients. Since the probabilities sum to one, a change in the kth offer characteristic changes all three probabilities simultaneously, so that the partial for one probability becomes

$$\partial \pi_n / \partial x_k = \pi_n(\beta_{kn} - \sum_{e=1}^{3} \beta_{ek}\, \pi_e).$$

Our inferences are based on this partial and the associated t-values. The full results of the multinomial estimation was shown in an earlier version of this paper and is available upon request.

[19] Thus, the firm's assets are transferred to the buyout firm while the debt claims remain on the books of the firm in bankruptcy.

[20] We thank Torgny Håstad, Swedish Supreme Court judge and former professor of law at the University of Uppsala, for assistance in interpreting the legal code.

cludes a total of 263 bankruptcies from 01/88–12/91, selected from a population of 1,159 bankrupt firms having at least 20 employees. The source of the population is UpplysningsCentralen AB (UC), and the Strömberg-Thorburn sample is restricted to bankruptcies in the four largest administrative provinces in Sweden, including the country's three main metropolitan areas, Stockholm, Gothenburg and Malmö. The sample firms are among the largest in Sweden: only 6% of Swedish corporations have 20 employees or more. All firms are privately held, and most have concentrated ownership.[21]

Table 1 shows the number of cases across the outcomes depicted in Figure 4. Of the 263 bankrupt firms in the sample, 53 (20%) succeeded in performing a prepack while the remaining 80% submitted a regular auction bankruptcy filing. Of 207 regular filings, 60 (29%) are liquidated piecemeal and 147 (71%) are sold as a going concern.[22] The sample firms represent more than 30 different 2-digit SIC groups, with 29% in manufacturing industries, 24% in construction and wholesale industries, 10% in the hotel and restaurant industry, 10% in the transportation industry, and the balance of 27% scattered across a number of other industries.

Strömberg-Thorburn collect case-specific information from the official bankruptcy files kept by TSM. These files do not contain information on key characteristics for this paper, such as the number of bidders, the duration (number of days) of the auction, and the financing of the winning bid (old bank versus new bank). We requested this information directly from each individual trustee and received it for 134 individual auctions. As shown in figures 5 and 6 and Table 1, these auctions show a substantial number of both potential and actual bidders across both going-concern sales and piecemeal liquidations. Moreover, the auctions appear active also for the subsample of sale-backs to the old owner/management. The one exception is the prepack category where, as explained above, the trustee simply approves an existing bid and rarely solicits additional bids.

Figure 5 shows the frequency distribution of the number of interested bidders for 102 cases where the firm was sold as a going concern. An "interested bidder" is a party that contacts the trustee and expresses an interest in bidding. The number of interested bidders ranges from one to forty, and 75% of the cases attracted multiple bidder interest. The average number of interested

[21] The sample firms are small in absolute terms. The book value of total assets one year prior to filing averages $2.5 million, and the number of employees averages 43.

[22] Three regular filings cannot be classified as to their going-concern-sale status due to insufficient information in the court documents.

bidders equals 5.7 with a median of 3.0 (Table 1).

As shown in Figure 6, the substantial expression of interest translates into multiple bids in a majority of the auctions. The average number of actual bids in going-concern sales equals 3.2 with a median of 2.0 (Table 1). As expected, the number of bidders in auctions leading to piecemeal sale of the firm's assets is greater than for going-concern sales. The average (median) number of interested bidders in piecemeal sales is 11.4 (5.0) while the corresponding number of actual bids is 9.8 (5.0). Table 1 indicates that auctions resulting in saleback to the old owner/management also exhibit substantial competition, with an average (median) number of interested and actual bidders of 5.3 (3.0) and 3.0 (1.5), respectively.

We also collect information on the old bank's decision to finance the bidder in going-concern auctions. This information is drawn from the trustee's responses and from Thorburn (2000) where the data source is the national register of corporate floating charge claims ("Inskrivningsmyndigheten för företagsinteckning"). Of the 200 going concern sales listed in Table 1, the bank financing of the winning bid is identified for 111 cases. The old bank finances the winning bidder in half (64) of the cases. Similarly, the old owner receives bid financing from the old bank in about half of the saleback cases.[23] We also incorporate the information on equity ownership of incumbent CEOs compiled by Thorburn (2000). 75% of the CEOs own 10% or more of their respective firms' equity, and 50% are controlling shareholders (50% ownership or more).

Our measures of industry distress (discussed below) is based on the financial statements of the entire population of more than 15,000 Swedish firms with at least 20 employees. The industry is defined on a 4-digit level.[24] The source of this information is UC. The industry information is also used to estimate the relative accounting (operating) performance of bankrupt firms.

Finally, we extend the Strömberg-Thorburn data base with information from Statistics Sweden on the business cycle. We construct an equal-weighted monthly, composite business cycle index from the producer price index, the gross national product, aggregate consumption, rate of unemployment, and total number of bankruptcy filings. All variables are normalized with their mean and standard deviations before entering the business cycle index. Over the sample period 01/88–12/91, the period 88-90 was a period of general business upturn followed by deep recession and real estate

[23] There is no significant correlation between the identity of the winning bidder (old or new owners) and the source of bank financing (old or new bank).

[24] Swedish industry classifications mirrors the SIC code system used in the US.

crisis in 1991. The economic downturn continued in 1992, when a currency crisis drove the overnight interbank interest rate to unprecedented heights, forcing a substantial devaluation of the Swedish krona. As discussed in Section 4.2 below, the substantial economic downturn makes our business cycle index particularly interesting from the point of view of examining asset fire-sale arguments.

3.3 Auction premiums and average recovery rates

Table 2 lists the average and median values of the auction premium and total recovery rates classified by bankruptcy outcome (going-concern sales, prepacks, and piecemeal liquidations) and the identity of the buyer (old or new owner). The auction premium is defined as $p/v_l^a - 1$, i.e., the winning bid price p in percent of the trustee's liquidation value estimate *of the assets sold in return for p.* With few exceptions, the auction sale excludes accounts receivables and other financial claims, thus $v_l^a < v_l$.[25] Table 2 does not list the value of the going-concern premium for auction prepacks since the trustee's liquidation value estimate is made, if at all, when the prepack sales price is known.[26]

The average value of the auction premium ranges from a low of 8% for piecemeal liquidations to a high of 125% for going-concern sales. Note that the 8% premium (median 2%) for piecemeal liquidations supports our contention that the trustee's liquidation estimate is just that; a good estimate of the winning bid value in a piecemeal liquidation auction.

Table 2 also shows the average and median values of the total debt recovery rate (column 2), computed as the total market value of the assets sold in percent of total debt face value. The average total recovery rate ranges from a low of 26% for piecemeal liquidations to a high of 39% for going-concern sales.[27] Furthermore, column 3 of Table 2 shows the bank's average realized recovery rate, which ranges from a low of 46% in piecemeal liquidations to a high of 77% in auction prepacks. Thus, the bank recovers substantially more (and junior debt substantially less) than the average for the firm as a whole.

Finally, column 4 lists the bank's liquidation recovery rate r_l defined in Lemma 5, i.e., $r_l \equiv \max[0, \min[v_l - s/b, 1]] \in [0, 1]$. Since r_l is the bank's recovery rate if the auction were to produce the trustee's estimate of the piecemeal liquidation value, it is computed using v_l and not just v_l^a.

[25] The empirical correlation between v_l and v_l^a is 0.60.

[26] In an auction prepack, the trustee reports the final prepack sales price (which includes the going-concern premium) and typically does not publish the a separate estimate of the piecemeal liquidation value.

[27] See Thorburn (2000) for a cross-sectional analysis of the total recovery rates in our sample.

Obviously, r_l represents a lower bound on the bank's recovery rate since it ignores the going-concern premium produced by the auction. The average value of r_l ranges from a low of 45% (median 39%) in piecemeal liquidations to a high of 66% (median 77%) in going-concern sales. Figure 7 shows the frequency distribution of r_l for the full sample of in-bankruptcy auctions (excluding prepacks). The bank receives full recovery at the trustee's liquidation estimate ($r_l = 1$) in 58 bankruptcy filings (30%) and zero recovery ($r_l = 0$) in another 8 cases. The 130 intermediate cases are evenly distributed across the range from 0 to 1.

4 Tests of overbidding vs fire-sales

In the theoretical setting of Section 2, the bank offers to finance a bidder in the auction. This increases auction liquidity if the bidder is financially constrained and does not otherwise have access to credit. Moreover, the implication of overbidding is to raise the final auction price, thus counteracting tendencies for asset "fire-sales". In this section, we examine the overbidding and asset fire-sale hypotheses empirically.

4.1 Overbidding

The bank-bidder overbidding hypothesis stated in Lemma 5 is tested using a cross-sectional regression of the going-concern premium, denoted $Prem$, on the bank's liquidation recovery rate $r_l = (v_l - s)/b \in [0, 1]$, and a vector $\mathbf{x}$ of eleven other explanatory variables, all defined in Table 3:

$$Prem_j = \beta_0 + \beta_1 r_{lj} + \sum_{i=2}^{12} \beta_i \mathbf{x_j} + u_j, \quad j = 1, .., N, \tag{15}$$

where u is a mean zero error term and N is the sample size. Note that the final auction price p incorporates the piecemeal liquidation value, $p = Prem + v_l^a$. We represent $Prem$ using both the rate of return $ln(p/v_l^a)$ and the dollar value $p - v_l^a$. According to Lemma 5, the regression coefficient β_1 on r_l should be negative indicating that greater liquidation recovery reduces overbidding.

Recall that the liquidation recovery rate r_l is observable at the beginning of the auction while the final going-concern premium $Prem$ is established at the end. Thus, there is a natural causal relationship (if any) running from r_l to $Prem$ through the incentives to overbid. The reverse

causality is unlikely. For the expected going-concern premium to affect r_l, the bank would need to somehow impact (increase) v_l prior to bankruptcy filing. Opportunistic asset transfers (fraudulent conveyance) to the bank in the period prior to filing risks being overturned by the court. Perhaps more importantly, such transfers are unlikely to gain the necessary management cooperation because it would hasten the very bankruptcy filing they are (at this point) trying to avoid. In sum, we take r_l as exogenous to $Prem$ and, accordingly, estimate its impact on $Prem$ in a single-equation setting.[28]

In addition to the liquidation recovery rate r_l, the vector $\mathbf{x}$ includes six explanatory variables defined in Table 3. These are intended to capture firm- and deal-specific characteristics that impact $Prem$ in addition to the effect of overbidding, The variables are: the pre-filing book value of total assets ($Size$), the industry-adjusted profit margin ($Profmarg$), the proportion of total debt that is secured ($Secured$), a dummy indicating piecemeal liquidations ($Piecemeal$), the number of bids submitted in the auctions ($Bids$), and $Bankfin$, a dummy indicating that the old bank finances the winning bidder. Table 4 lists summary statistics for these and other explanatory variables used below.

Table 5 shows the results of the cross-sectional estimation. Panel A uses the total sample of going-concern sales and piecemeal liquidations, while Panel B restricts the sample to going-concern sales. This restriction allows us to exploit information on the number of actual bidders and bank financing not available for piecemeal liquidations.[29] The third panel (C) shows the results of estimating the regression across the sample of piecemeal liquidations only. As explained below, this particular regression provides an additional check on the overbidding theory itself.

Regardless of the regression specification, in Table 5, in panels A and B lower liquidation recovery rates lead to significantly greater auction premiums, as predicted by our Lemma 5. When using $Prem = ln(p/v_l^a)$, the estimate or β_1 is -0.88 in Panel A and ranges from -1.22 to -1.34 in Panel B, all with p-values below 0.00. When using $Prem = p - v_l^a$, the estimate of β_1 (divided by

[28] Interestingly, this is in contrast to the bidding environment in corporate takeovers. As developed by Bulow, Huang, and Klemperer (1999), the size of the bidder toehold in the target affects the final bid premium through the incentives of potential bidders to enter the auction. A toehold bidder bids aggressively and exacerbates the winner's curse problem for non-toehold bidders in a common value auction setting. Expectations of aggressive bidding may deter competition and thus result in lower premiums. Betton and Eckbo (2000) estimate the impact of toeholds on takeover premiums using a simultaneous-equation system. They find that greater initial bidder toeholds are in fact associated with lower bid premiums.

[29] We also estimated the impact of the number of interested bidders (variable $Interest$ in Table 3). Inferences based on $Interest$ are similar to inferences based on $Bids$, and we report results for the latter only.

1,000,000 to ease exposition) equals -1.89 in Panel A and -1.22 in Panel B, again highly significant. Both the sign and significance of β_1 are virtually unchanged when adding additional explanatory variables related to the fire-sale hypothesis in Table 6. Notice also that since the regressions in Panel B exclude piecemeal liquidations where the going-concern premium is close to zero (Table 2), the increase in the magnitude of the estimated value of β_1 further indicates robustness of the overbidding incentives emanating from r_l under Lemma 5.

Of the remaining explanatory variables in Table 5, the estimate of β_2 for $Size$ is insignificant when $Prem = ln(p/v_l^a)$ and highly significant and positive (as expected) when the premium is measured in dollar values. Moreover, for both specifications of $Prem$, the estimate of β_5 for $Piecemeal$ is negative and significant, confirming the lack of going-concern value for piecemeal liquidations discussed earlier in Table 2.

The coefficient β_7 for $Bankfin$ is positive and significant across both specifications of the dependent variable. Thus, old-bank financing of the winning bidder has a positive impact on the going-concern premium that goes beyond the overbidding effect captured by r_l.

Secured has a significant (and negative) impact on $Prem = ln(p/v_l^a)$ when $Bankfin$ is not included in the regression. A greater proportion secured debt tends to reflect a greater proportion of assets in place and thus a higher v_l. As a result, *Secured* tends to be negatively correlated with the going-concern premium over v_l. The fact that inclusion of $Bankfin$ (with a positive β_7) drives *Secured* to be insignificant is evidence that the old bank tends to finance firms with a low proportion assets in place and a correspondingly high going-concern value emanating from intangibles.

Finally, Panel C shows the results of restricting the sample to piecemeal liquidations. If the bank expects the auction to result in a piecemeal liquidation, it has no incentive to overbid. In terms of Proposition 1, this is the case when the going-concern-value ϵ is close to zero. This is confirmed by the fact that the final auction price in this subsample ends up very close to the liquidation value itself (recall that the median premium in Table 2 is 2% for piecemeal liquidations). Thus, we predict an insignificant coefficient β_1 in this subsample. This proposition is supported by the results in Panel C, where β_1 is statistically insignificant with a p-value of 0.74 when the premium is defined in logs and 0.53 when defined in absolute values. Note also that the remaining explanatory variables in Panel C all receive statistically insignificant coefficients.

In sum, the results in Table 5 strongly support the overbidding theory relating r_l to the size of the auction premium. We now turn to the alternative hypothesis, namely that auctions tend to produce fire-sale prices.

4.2 Asset fire-sales

Shleifer and Vishny (1992) argue that firms tend to file for bankruptcy when there is widespread illiquidity in the firm's industry, resulting in low intra-industry demand for the auctioned firm. In their model, industry outsiders are assumed to be both less efficient at running the bankrupt firm and excluded from hiring industry insiders. Given that industry insiders are cash constrained, industry outsiders tend to win the auction at relatively low "fire-sale" prices.[30]

The definition of a "fire-sale" requires an empirical specification of the "normal" or unconstrained value of the asset. Pulvino (1998) approaches this issue by estimating a theoretical pricing model for his sample of aircrafts, and compares actual sales prices to the model price. He reports that sales during times when the airline is financially distressed result in prices that are on average 13% lower than the model price. In contrast, sales prices during periods without financial distress are on average 9% greater than the hedonic price. Thus, conditional on the model price being true, this evidence supports the detrimental effect of illiquidity predicted by the fire-sale hypothesis. Maksimovic and Phillips (1998) use a Cobb-Douglas production function to model plant efficiency and examine to what extent plant sales allocate corporate assets to their most efficient alternative use. Their evidence supports the efficiency hypothesis and does not support the fire-sale argument. Again, their empirical conclusions are necessarily conditional on the validity of the empirical model for plant efficiency.

In this paper, we avoid the need to specify a theoretical price benchmark for the value of the firm under its most efficient allocation. Although we cannot determine whether or not the going-concern premium *on average* suffers from fire-sales, this hypothesis also predicts that the *cross-sectional variation* in the premium depends on certain fundamentals. Thus, by adding these fundamental factors to the cross-sectional regression function for $Prem$, we provide a test of the fire-sale hypothesis after controlling for the effect of overbidding.

[30] Note that since the typical buyer debt finances the acquisition, much like in a leveraged buyout (LBO), it is not a priori obvious that the cash-only requirement in Swedish bankruptcy auctions represents much of a binding constraint.

The results are shown in Table 6. The table reports results for $Prem = ln(p/v_l^a)$ as dependent variable only, as the dollar premium produces similar statistical inferences. The explanatory variables include six of the seven variables in Table 5, excluding *Bids*, and an additional four variables dictated by fire-sale hypotheses.[31]

The additional explanatory variables include the degree of industry distress (*Distress*), a business cycle index (*Cycle*) and a dummy variable for whether or not the buyer in the auction is an industry outsider *Outsider*. As defined in Table 3, *Distress* is the fraction of Swedish firms with at least 20 employees and in the same 4-digit SIC code as the bankrupt firm that is financially distressed in the year of the bankruptcy filing. A firm is financially distressed if it has an interest coverage ratio (EBITDA plus interest income divided by interest expense) of less than one or files for bankruptcy in the same calendar year. The business cycle index *Cycle* is an equal-weighted monthly index where the elements are the GDP, the producer price index, aggregate consumption, the unemployment rate, and the total number of bankruptcy filings.[32] We follow Strömberg (2000) and let the binary variable *Outsider* indicate when the buyer (i) is a firm with a different 3-digit SIC code than the bankrupt firm, (ii) is not identified as a competitor, and (iii) is not a former employee or owner/manager.

Moreover, the regressions in Table 6 include the binary variable *Saleback* which takes a value of one when the firm is sold back to the old owner. This variable is motivated by the model in Strömberg (2000), which implies that saleback transactions may take place at lower premiums. Essentially, in his model, the bank colludes with the owner of the bankrupt firm to approve a saleback prior to the bankruptcy auction. As pointed out earlier, the auction is mandatory following bankruptcy filing, and the trustee cannot legally allow a saleback without competing bids.[33] Thus, the real-world counterpart to Strömberg's saleback event is a private, out-of-court workout submitted as a prepackaged bankruptcy solution. As discussed above (Table 2), since the trustee does not provide a piecemeal liquidation value for auction prepacks, we cannot compute *Prem* for prepacks. However, we have data on *Prem* for salebacks that took place in the open auctions. Thus, we use the variable *Saleback* to test whether the average going-concern premium is lower for salebacks.

As shown in Table 6, inclusion of the four fire-sale variables does not alter the magnitude

[31] Inclusion of *Bids* reduces the sample size from 84 to 55 and this variable receives an insignificant coefficient.
[32] The index elements are normalized by their mean and standard deviations before entering the index.
[33] This point is confirmed in our communications with the trustees.

and significance of the overbidding variables. This is true also for the sub-sample of piecemeal liquidations in Panel C, where the overbidding variable r_l continues to be insignificant, as predicted. Moreover, none of the fire-sale variables receive statistically significant coefficients.[34] In other words, there is no evidence that the going-concern premium covaries with either industry-wide distress, macroeconomic conditions, the purchaser being an industry outsider, or the auction resulting in a saleback.

In sum, our regressions fail to support the fire-sale hypothesis. This conclusion holds for salebacks as well, which we show generate "normal" premiums for competitive going-concern sales.[35] Since our regression controls for the effect of overbidding on the going-concern premium, a consistent explanation for our result is that overbidding effectively counteracts any tendency towards fire-sales.

5 Auction bankruptcy and managerial incentives

In the overbidding theory of Section 2, as well as in the asset fire-sale hypotheses, managerial incentives are implicitly assumed to be aligned with shareholder interests. In this section, we provide a brief discussion of potential inefficiencies arising from adverse managerial incentives that may arise ex ante in an auction bankruptcy setting.

5.1 Risk shifting and asset substitution

Thorburn (2001) presents evidence that the Swedish auction system imposes significant personal costs on the CEOs of the bankrupt firms. Only one-third of the CEOs are rehired by the buyer in the auction, and the median CEO experience an income loss of 40% over the two-year period following the year of bankruptcy filing. Several authors (e.g., Aghion, Hart, and Moore (1992), Franks, Nyborg, and Torous (1996), White (1996), Hart (2000)) argue that high personal costs of bankruptcy tend to induce management to undertake activities that are designed to delay (a perhaps inevitable) filing. The argument is an application of the asset substitution (risk shifting) incentives raised by Jensen and Meckling (1976). That is, incumbent managers have an incentive

[34] This is true also if we include only a single one of the four variables at a time.

[35] Recall from Table 1 that salebacks take place in multiple-bid auctions with an average of 3 bids and 5 interested bidders per case.

to liquidate low-risk assets and invest the proceeds in high-risk projects.[36]

Managerial overinvestment in risky projects arguably reduces the going-concern value of the bankrupt firm.[37] Thus, the evidence in Thorburn (2000, 2001) on debt recovery rates, firm survival rates, and post-bankruptcy performance in Swedish bankruptcy auctions is at least indirectly relevant for judging the empirical relevance of costly risk shifting. Her evidence indicates that the reorganized firms are generally "healthy" relative to their non-bankrupt industry peers. Also, the evidence on large going-concern premiums (above liquidation values) reported in this paper are somewhat difficult to square with the costly risk-shifting story.

It appears that the reorganized firms in Sweden are also healthy compared to firms reorganized under Chapter 11 in the US. Thorburn (2000) reports debt recovery rates that average 39% for going concern sales, which compares to 41% median recovery reported by Franks and Torous (1994) for a sample of Chapter 11 firms with data on the market value of debt. Moreover, as mentioned in the introduction, firms survive Swedish auction bankruptcy as going concerns at a rate that is no less than the small-firm survivorship rate in Chapter 11 [White (1984)]. Also, the evidence in Hotchkiss (1995) that firms emerging from Chapter 11 on average underperform their respective industries is in contrast to the results in Thorburn (2001) that firms surviving the auction perform at par with their non-bankrupt industry rivals. In sum, while not a settled issue, there is little support for the costly asset substitution hypothesis in the available empirical evidence.

5.2 Managerial underinvestment in human capital

Berkovitch, Israel, and Zender (1997, 1998) point to another potential problem induced by a bankruptcy auction system: managers may underinvest in firm-specific human capital. In their model, the firm is financed by outside debt with face value F, and the manager's compensation equals the residual firm value after the debt is paid off. In this setting, the first-best level of managerial investment in human capital occurs only if managers are not expropriated by creditors ex post. Since the manager is the residual claimant, this is equivalent to Myers (1977) underinvestment problem. In states where the firm value is below the face value of debt, the manager's incentive to

[36] Gertner and Scharfstein (1991) examine the effect of Chapter 11 bankruptcy on corporate investment incentives. Hoshi, Kashyap, and Scharfstein (1990) report that financially distressed firms in Japan that belong to a Kereitsu group tend to maintain a greater level of investment compared to non-Keiretsu firms.

[37] If you bet and win, you avoid bankruptcy. If you bet and lose, you file for bankruptcy.

invest is reduced.

Berkovitch-Israel-Zender propose the following solution: allow the manager to always buy out the debt at $v_l < F$ whenever the true firm value v is such that $v_l < v < F$. The buyout mechanism they propose is a bankruptcy auction where no outside bids are greater than v_l. Specifically, since the creditor *must* be assumed to be equally informed as the managers (otherwise it would not supply the initial debt capital in this model), the creditor must also be restricted from participating in the auction.[38]

Using the intuition from the Berkovitch-Israel-Zender model, one might argue that the bank-bidder coalition that is the key element of our theory will lead to inefficient managerial investment in human capital. However, this does not necessarily follow since the optimality of the coalition bidding strategy holds for more general managerial compensation contracts. This is particularly relevant when managerial human capital formation is only one of many inputs to the creation of firm value. In this case, a combination of bank-bidder coalition bidding and a side-payment to management may be more efficient than allowing the management team to stay on. The latter solution would also address the concern that the incumbent management may be the *cause* of the financial distress.

6 Conclusion

We study the role of distressed bank debt in affecting the outcome of Swedish bankruptcy auctions. The auction determines the going-concern premium, i.e., the premium over the piecemeal liquidation value to be paid for the right to acquire the bankrupt firm as a going concern. We show that the bank has an incentive to finance a bidder and induce the coalition to overbid. Moreover, the coalition's optimal bid equals the revenue-maximizing reservation price of a monopolist seller constrained by the face value of creditors senior and junior to the bank.

At the beginning of the auction, the trustee announces a market-value based estimate of the firm's piecemeal liquidation value. We show that the expected amount of overbidding in the auction is decreasing in the bank's recovery were it to receive the piecemeal liquidation value only. Since

[38] Aghion, Hart, and Moore (1992) take issue with the managerial incentive rationale for softening the bankruptcy code and suggest a simpler solution: lower the firm's debt-equity ratio ex ante. "If the state-provided bankruptcy mechanism is harsh, it seems relatively easy for a firm to soften it ex ante. If those people choosing the corporation's financial structure wish to protect managers from bankruptcy, they can do so by choosing a low debt-equity ratio."

both the final auction premium and the piecemeal liquidation value are observable, this overbidding theory is testable. We perform cross-sectional regressions using a large sample of Swedish bankruptcy auctions. The results yield strong support for the overbidding theory.

Controlling for the incentives to overbid, we also examine asset fire-sale arguments which hold that the auctions tend to attract relatively low-valuation buyers. This is an issue if the all-cash auctions take place during times of industry-wide financial distress (so competitors are cash constrained and do not bid). Or, it may reflect opportunistic dealings between the bank and the old owners in a saleback arrangement.

We find no evidence that the going-concern premium generated by the auctions is lower in periods with severe industry-wide distress nor in business cycle downturns. Moreover, the auction premium is no lower when the buyer is identified as an industry outsider. Also, we reject the hypothesis that salebacks lead to lower average premiums. The latter result may be a direct reflection of the fact the salebacks take place in active auctions (with an average of 3 bids and 5 interested bidders), much like those resulting in non-saleback going concern sales. In sum, we find no support for asset fire-sale arguments. Since we control for overbidding incentives, a consistent explanation is that overbidding incentives effectively counteract fire-sale tendencies in relatively illiquid auctions.

While an auction bankruptcy system that imposes significant costs on managers in principle may induce suboptimal managerial actions ex ante, there is mounting evidence that firms reorganized in the Swedish bankruptcy system are in fact relatively healthy. The auction system has the additional benefit over a Chapter 11 type of system in that it makes it easier to replace incumbent management. Several authors point to the pro-management bias inherent in Chapter 11 where managers retain substantial control rights.[39] This bias does not exist in the Swedish system since managerial employment contracts are automatically terminated upon bankruptcy filing. By being "hard" on incumbent management, the auction bankruptcy code removes a potentially serious obstacle (entrenched management) to an efficient restructuring ex post. The effect of this is to reduce the cost of debt financing ex ante.

[39] See, e.g., Jensen (1991), Bradley and Rosenzweig (1992), Aghion, Hart, and Moore (1992).

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Table 1

Bidding characteristics for 263 private Swedish firms filing for bankruptcy, 1988-1991, split by auction outcome. For going concern sales, the table shows a further break down by whether the buyer of the bankrupt firm is the old owner (*Saleback=1*) or not (*Saleback=0*). The table reports the mean, while the median and number of observations are shown in parentheses.

	Total number of cases	Number of interested bidders		Number of actual bids		Duration of auction (days) [1]	
All auctions							
	263	5.5	(3.0; 156)	3.6	(2.0; 146)	25.3	(14.5; 46)
Going concern sales [2]							
	147	5.7	(3.0; 102)	3.2	(2.0; 95)	24.2	(15.0; 40)
Saleback=1	90	5.3	(3.0; 55)	3.0	(1.5; 52)	23.4	(15.0; 17)
Saleback=0	54	6.1	(4.0; 46)	3.5	(3.0; 42)	24.8	(15.0; 23)
Auction prepacks [2]							
	53	1.5	(1.0: 33)	1.2	(1.0; 33)	-	-
Piecemeal liquidations							
	60	11.4	(5.0; 20)	9.8	(5.0; 17)	15.0	(14.0; 5)

[1] The duration is the number of days during which the trustee accepts bids for the assets of the bankrupt firm.
[2] Due to missing information on the identity of the buyer, the "All cases" categories contain more cases than the sum of the subcategories "Saleback" and "New owner".

Table 2

Average auction premiums and recovery rates (in percent) for a sample of 263 private Swedish firms filing for auction bankruptcy, 1988-1991. The table shows a split by bankruptcy outcome. Median and number of observations are shown in parentheses.

Auction premium [1]		**Total recovery rate** [2]		**Bank recovery rate** [2]		**Bank liquidation recovery rate** [3]	
All auctions							
92.1	(8.7; 188)	34.5	(33.1; 263)	69.3	(82.8; 238)	59.9	(68.1; 196)
Going concern sales							
125.3	(13.5; 135)	39.0	(38.1; 147)	76.3	(89.3; 141)	65.6	(76.8; 141)
Auction prepacks [4]							
n / a		32.1	(31.3; 53)	77.1	(91.3; 40)	n / a	
Piecemeal liquidations							
7.6	(1.6; 50)	25.6	(21.2; 60)	45.7	(40.4; 55)	45.3	(39.0; 55)

[1] Auction premium is defined here as $(p/v_l^a)-1$, where p is the price paid in the auction and v_l^a is the trustee's estimate of the liquidation value of the auctioned assets.

[2] Recovery rate is the payoff to debtholders as a fraction of the face value of their debt claims.

[3] Bank liquidation recovery rate r_l is the bank's recovery rate if the bankruptcy proceeding produces total proceeds equal to the trustee's estimated liquidation value v_l, defined as $r_l = \max[0, \min[(v_l - s)/b, 1]]$ and where s and b are the face values of debt senior to the bank and the bank's debt, respectively. The trustee's estimate v_l is the sum of v_l^a and assets that are collected or sold outside the bankruptcy auction, e.g., accounts receivables, financial claims and non-core real estate holdings.

[4] Auction premiums are not meaningful for auction prepacks since the trustee estimates v_l^a after the going concern price has been negotiated.

Table 3

Description of the explanatory variables used in the auction premium estimations presented in Tables 5 and 6.

Label	Variable definition
A: Regressors for overbidding (Lemma 5)	
r_l	Bank liquidation recovery rate if the auction produces the trustee's estimate of the firm's liquidation value v_l, $r_l \in [0,1]$.
Size	Natural log of the book value of total assets as reported in the firm's last financial statement prior to filing.
Profmarg	Difference between the firm's pre-filing operating margin, defined as EBITDA divided by sales, and the contemporaneous median operating margin for the population of Swedish firms with at least 20 employees and the same 4-digit SIC code as the bankrupt firm.
Secured	Fraction secured debt of the firm's total debt at filing.
Piecemeal	Binary variable indicating that the firm is liquidated piecemeal (x_j=1) vs. sold as going concern (x_j=0).
Interest	Number of interested potential bidders in auctions where the firm is sold as a going concern.
Bids	Number of bids submitted in auctions where the firm is sold as a going concern.
Bankfin	Binary variable indicating that the buyer of a going concern is financed by the filing firm's old bank (x_j=1) vs. by a new bank (x_j=0).
B: Regressors for asset fire-sales	
Distress	Fraction of all Swedish firms with at least 20 employees and the same 4-digit SIC code as the sample firm that either reports an interest coverage ratio (defined as the sum of EBITDA and interest income divided by interest expense) of less than one or files for bankruptcy in the calendar year of the sample firm's bankruptcy filing.
Cycle	Equal-weighted monthly index of the gross national product (+), the producer price index (+), aggregate consumption (+), unemployment rate (-) and number of corporate bankruptcy filings (-). The variables are normalized with their mean and standard deviation before entering the index.
Outsider	Binary variable indicating that the buyer of a going concern is an industry outsider (x_j=1) vs. an industry insider (x_j=0). Following Strömberg (2000), outsider sales are cases where the buyer (i) is a firm with a different 3-digit SIC code than the bankrupt firm, (ii) is not identified as a competitor of the bankrupt firm, or (iii) is not a former employee or owner / manager of the bankrupt firm.
Saleback	Binary variable indicating that the firm is sold as a going concern to the old owner (x_j=1) vs. to a new owner (x_j=0).

Table 4

Summary statistics for the explanatory variables used in the auction premium estimations presented in Tables 5 and 6, split by auction outcome (going concern or piecemeal liquidation). Sample of 196 private Swedish firms that filed for bankruptcy during 1988-1991. The variables are defined in Table 3.

	Going concern sales				**Piecemeal liquidations**			
Variable	Mean	Median	Std dev	N	Mean	Median	Std dev	N
A: Regressors for overbidding (Lemma 5)								
r_l	0.66	0.77	0.35	141	0.45	0.39	0.35	55
Size	16.0	15.8	0.97	147	15.9	15.9	1.17	58
Profmarg	-0.05	-0.04	0.09	146	-0.08	-0.04	0.23	58
Secured	0.40	0.38	0.23	147	0.42	0.41	0.25	60
Piecemeal	0.00	0.00	0.00	147	1.00	1.00	0.00	60
Interest	5.67	3.00	6.69	102	-	-	-	-
Bids	3.24	2.00	3.64	95	-	-	-	-
Bankfin	0.46	0.00	0.50	94	-	-	-	-
B: Regressors for asset fire-sales								
Distress	0.41	0.38	0.15	147	0.44	0.38	0.17	60
Cycle	0.26	0.66	2.22	147	0.09	0.17	2.42	60
Outsider	0.23	0.00	0.42	147	-	-	-	-
Saleback	0.61	1.00	0.49	144	-	-	-	-

Table 5

Coefficients from OLS estimations of the auction premium for 186 Swedish firms auctioned in bankruptcy 1988-1991, and sold as going concerns or liquidated piecemeally. The dependent variable *Prem* is defined as either $\ln(p/v_l^a)$ or $p - v_l^a$, where p is the price paid in the auction and v_l^a is the trustee's estimate of the liquidation value of the auctioned assets. The explanatory variables are defined in Table 3. Parentheses show p-values and, for the adjusted R^2, degrees of freedom.[1]

Dependent variable		**Regressors for overbidding (Lemma 5)**									
Prem	*Constant*	r_l	*Size*	*Profmarg*	*Secured*	*Piecemeal*	*Bids*	*Bankfin*	*Adj. R^2*	*F-value*	*N*
	β_0	β_1	β_2	β_3	β_4	β_5	β_6	β_7			
A: Sample of going concern sales and piecemeal liquidations [2]											
$\ln(p/v_l^a)$	0.91	-0.88	0.02	-0.05	-0.65	-0.58			0.14	6.75	173
	(0.35)	(0.00)	(0.78)	(0.91)	(0.04)	(0.00)			(df=5)	(0.000)	
$p - v_l^a$	-10.16	-1.89	0.78	0.41	-0.35	-1.20			0.16	8.37	186
	(0.00)	(0.00)	(0.00)	(0.73)	(0.68)	(0.00)			(df=5)	(0.000)	
B: Sample of going concern sales											
$\ln(p/v_l^a)$	1.70	-1.34	-0.02	-0.70	-0.46			0.36	0.26	6.94	84
	(0.21)	(0.00)	(0.78)	(0.47)	(0.28)			(0.03)	(df=5)	(0.00)	
$\ln(p/v_l^a)$	2.08	-1.22	-0.03	0.73	-0.82		-0.04		0.19	4.93	85
	(0.12)	(0.00)	(0.73)	(0.50)	(0.08)		(0.12)		(df=5)	(0.00)	
$p - v_l^a$	-23.9	-3.35	1.68	-1.29	-0.49		-0.16	2.08	0.29	4.75	56
	(0.00)	(0.02)	(0.00)	(0.81)	(0.84)		(0.48)	(0.03)	(df=6)	(0.00)	
C: Sample of piecemeal liquidations											
$\ln(p/v_l^a)$	-0.62	-0.12	0.01	-0.10	-0.54				-0.08	0.22	44
	(0.75)	(0.74)	(0.69)	(0.84)	(0.37)				(df=4)	(0.926)	
$p - v_l^a$	-2.04	-0.25	0.16	0.14	-0.73				-0.04	0.56	44
	(0.29)	(0.53)	(0.22)	(0.81)	(0.24)				(df=4)	(0.696)	

[1] For reporting purposes, the coefficient estimates have been divided by 1,000,000 when using $p - v_l^a$ as dependent variable.

[2] The sample reduction when using $\ln(p/v_l^a)$ is caused by the elimination of cases where $p < v_l^a$.

Table 6

Coefficients from OLS estimations of the auction premium for 186 Swedish firms auctioned in bankruptcy 1988-1991, and sold as going concerns or liquidated piecemeally. The dependent variable *Prem* is defined as $\ln(p/v_l^a)$, where p is the price paid in the auction and v_l^a is the trustee's estimate of the liquidation value of the auctioned assets. The explanatory variables are defined in Table 3. Parentheses show p-values and, for the adjusted R^2, degrees of freedom.

	Regressors for overbidding (Lemma 5)						**Regressors for asset-fire sales**						
Constant	r_l	*Size*	*Prof-marg*	*Secured*	*Piece-meal*	*Bankfin*	*Dis-tress*	*Cycle*	*Out-sider*	*Sale-back*	*Adjus-ted R^2*	*F-value*	*N*
β_0	β_1	β_2	β_3	β_4	β_5	β_7	β_8	β_9	β_{10}	β_{11}			
A: Sample of going concern sales and piecemeal liquidations													
0.65	-0.86	0.03	-0.06	-0.66	-0.57		0.30	0.02			0.14	5.01	173
(0.52)	(0.00)	(0.69)	(0.89)	(0.03)	(0.00)		(0.51)	(0.55)			(df=7)	(0.00)	
B: Sample of going concern sales													
0.60	-1.10	0.05	0.02	-0.97			0.30	0.02			0.13	4.31	130
(0.62)	(0.00)	(0.55)	(0.99)	(0.01)			(0.59)	(0.61)			(df=6)	(0.00)	
1.59	-1.15	-0.01	0.20	-0.76			0.27	0.01	-0.31	-0.02	0.16	3.95	126
(0.19)	(0.00)	(0.88)	(0.82)	(0.04)			(0.62)	(0.76)	(0.19)	(0.92)	(df=8)	(0.00)	
1.92	-1.34	-0.02	-0.69	-0.48		0.36	-0.60	0.02			0.25	5.02	84
(0.17)	(0.00)	(0.81)	(0.49)	(0.26)		(0.03)	(0.34)	(0.63)			(df=7)	(0.00)	
1.55	-1.32	-0.01	-0.68	-0.47		0.36	-0.63	0.02	0.14	0.20	0.24	3.94	84
(0.29)	(0.00)	(0.93)	(0.50)	(0.28)		(0.04)	(0.33)	(0.59)	(0.65)	(0.38)	(df=9)	(0.00)	
C: Sample of piecemeal liquidations													
-1.09	-0.00	0.01	-0.17	-0.61			0.60	0.01			-0.08	0.44	44
(0.58)	(0.96)	(0.62)	(0.75)	(0.32)			(0.53)	(0.39)			(df=6)	(0.846)	

Figure 1

Bank-bidder coalition's optimal bid price p_c as a function of the coalition's private valuation v_1 and the face value of the firm's creditors, assuming a common liquidation value v_l of 0 and that bidders' private going-concern valuations are distributed uniformly over the interval [0,1]. The face value of creditors senior to the bank is denoted s and the face value of the bank's claim is denoted b. The coalition bid price with full overbidding is denoted p^*, which in the case of the uniform distribution equals $p^* = (v_1 + 1)/2$. The figure shows that the optimal coalition price p_c varies between v_1 and p^* depending on the value of v_1 relative to s and $s+b$. In the four regions, Regions I and IV imply no overbidding $(p_c = v_1)$, Region II implies full overbidding $(p_c = p^*)$, and Region III implies partial overbidding $(v_1 < p_c < p^*)$. The shaded area indicates the magnitude of coalition overbidding for alternative values of v_1.

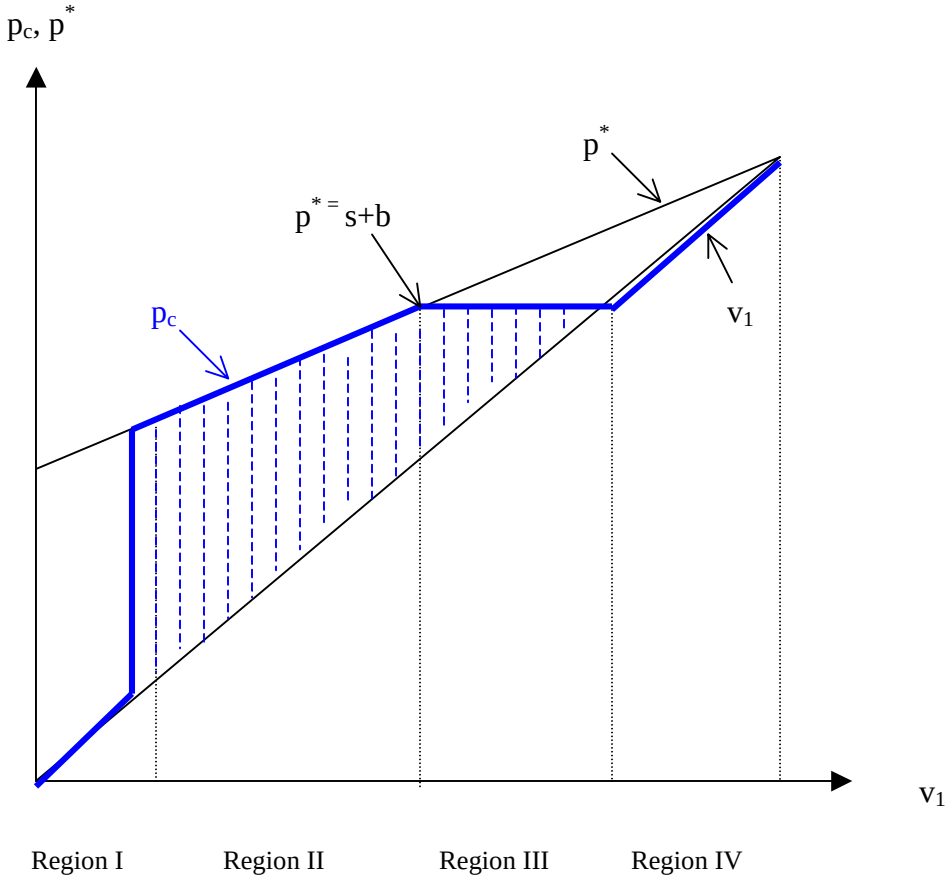


Figure 2

A monopolist's expected-profit-maximizing selling price p_m in a take-it-or-leave-it offer for the bankrupt firm in an open, ascending auction with zero bidding costs. Bidders' private valuations v are uniformly distributed with distribution and density functions $G(v)$ and $g(v)$. The seller 's opportunity cost is v_m.

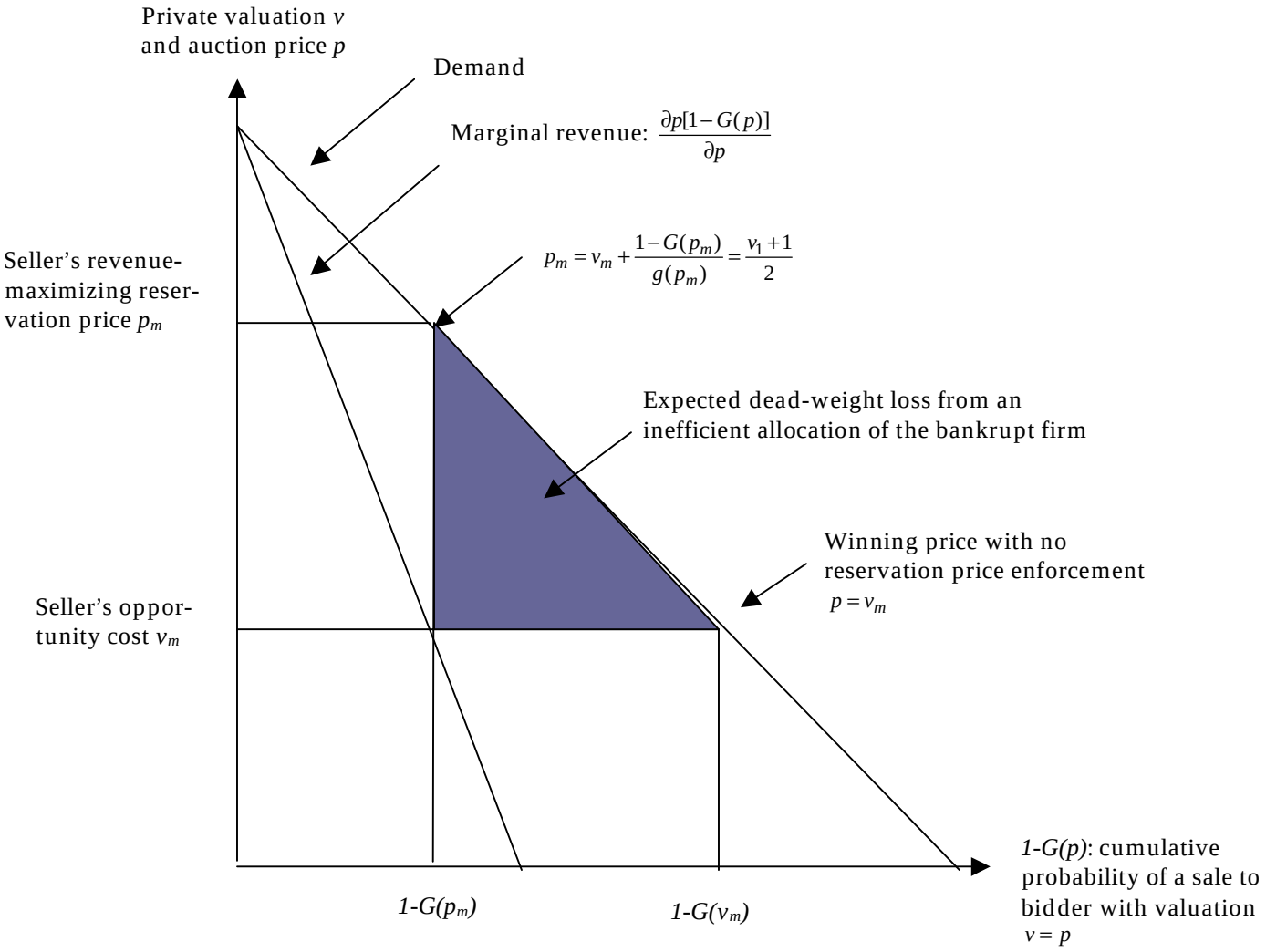


Figure 3

Potential auction outcomes with bank-bidder coalition overbidding ($p_c \geq v_1$) in the bankruptcy auction. p_c is the optimal bid by the coalition, v_1 is bidder 1's private valuation of the firm and v_2 is the private valuation of the rival bidder. Bidder 2 bids his private valuation v_2.

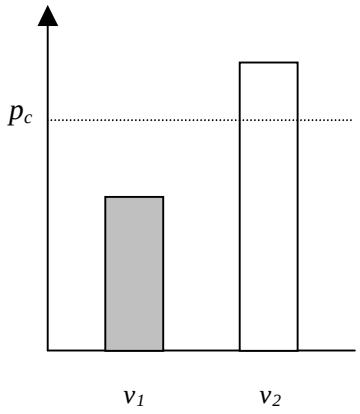
Efficient auction outcomes:

Inefficient auction outcomes:

(3a)

Private valuation, v, and bid value p_c

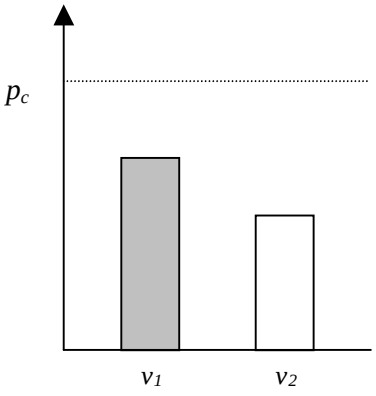
Coalition loses to bidder 2:



Non-existing

(3b)

Coalition wins against bidder 2:



(3c)

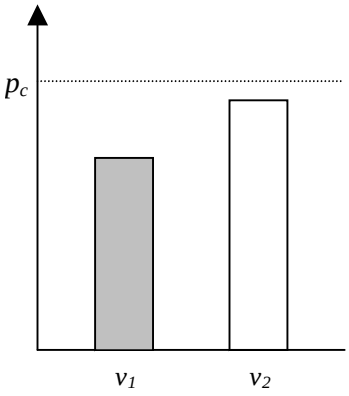


Figure 4

Key outcomes in Swedish auction bankruptcy.

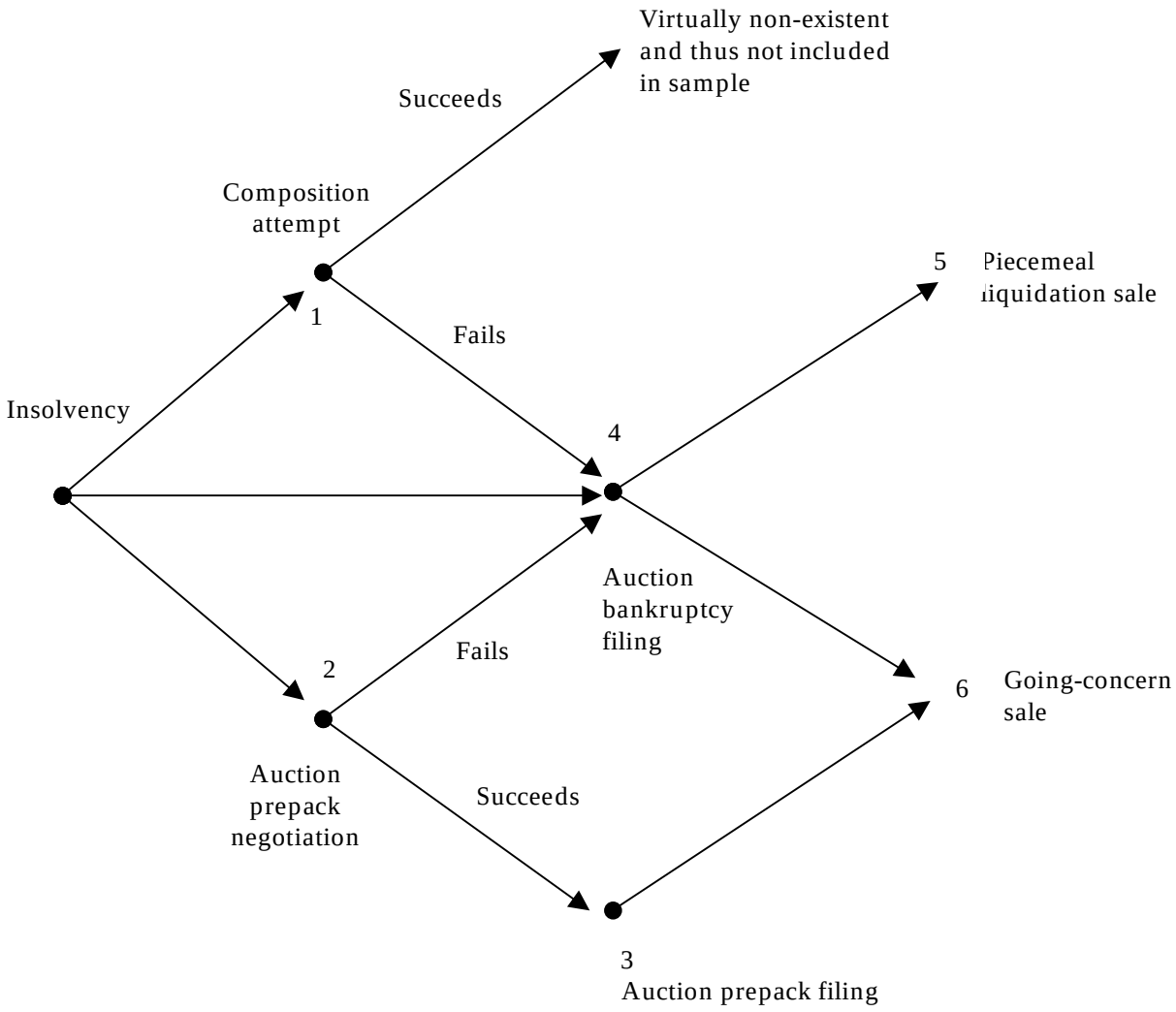


Figure 5

Frequency distribution for the number of potential buyers indicating a serious interest in bidding in the auction. Sample of 102 Swedish bankruptcy auctions of private firms sold as going concerns, 1988-1991.

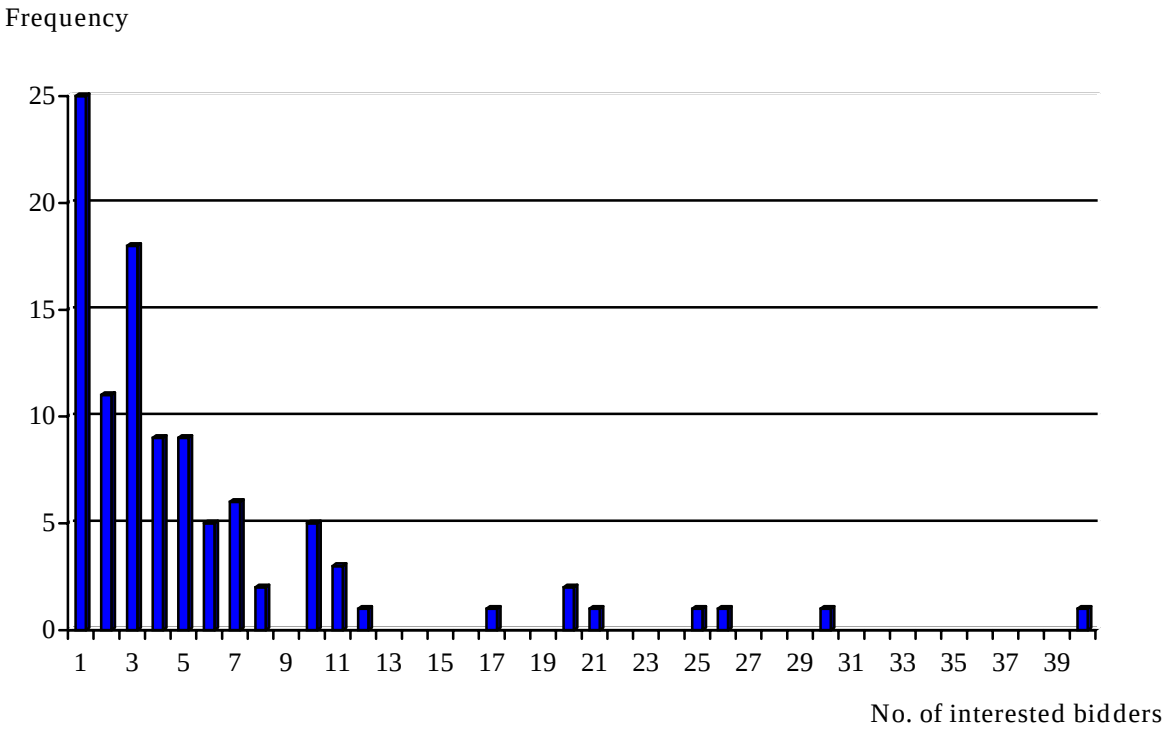


Figure 6

Frequency distribution for the number of actual bids submitted in the auction. Sample of 95 bankruptcy auctions of private Swedish firms sold as going concerns, 1988-1991.

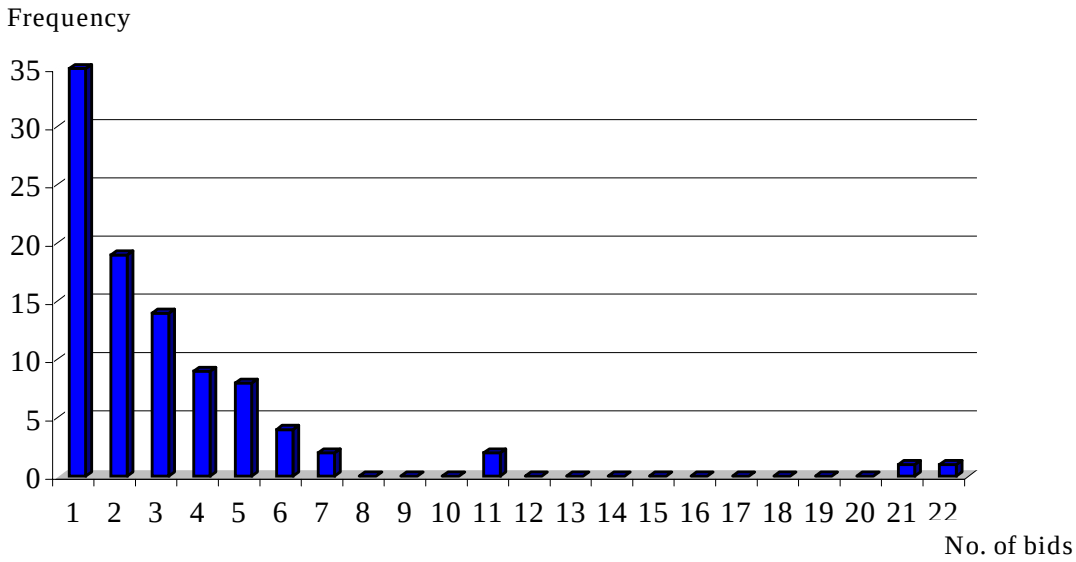


Figure 7

Frequency distribution for the bank liquidation recovery rate r_l, defined as $r_l = \max[0, \min[(v_l - s)/b, 1]]$, where v_l is the trustee's estimate of the liquidation value of the firm, and s and b are the face values of claims senior to the bank, and of the bank, respectively. Sample of 196 private firms auctioned as going concerns or liquidated piecemeal in Swedish bankruptcy auctions.