Bidding in mandatory bankruptcy auctions:
Theory and evidence[*]

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Abstract

We analyze bidding incentives and present evidence on takeover premiums in mandatory Swedish bankruptcy auctions, where three-quarters of the firms are sold as going concerns. The bankrupt firms' main creditors (banks) cannot bid in the auction and thus cannot directly influence the winning price. However, we find that the banks often finance bidders. We show that the optimal bid strategy for a bank-bidder coalition mimics a monopolist sales price, in effect getting around the institutional constraint on direct bank bidding. The final auction premium increases with a measure of the bank's debt impairness observed at the beginning of the auction. Cross-sectional regressions with the auction premium as dependent variable support this prediction. There is no empirical support for the proposition that the auctions lead to fire-sale prices, where we use the number of bidders, the degree of industry-wide financial distress, and the business cycle as proxies for auction demand. Moreover, premiums in transactions where insiders repurchase the firm (salebacks) are on average indistinguishable from premiums in sales to company outsiders, which fails to support self-dealing arguments.

1 Introduction

In Sweden, a firm filing for bankruptcy is turned over to a court-appointed trustee who automatically puts the firm up for sale in an open auction. The mandatory auction system has an attractive simplicity. Bids may be for each individual asset (piecemeal liquidation) or for the entire firm as a going concern. Payment must be in cash, allowing the auction proceeds to be distributed to creditors strictly according to absolute priority. Cash constrained bidders often finance the bid using the auctioned firm's assets as collateral, much as in a leveraged buyout (LBO) transaction. In going-concern sales, the buyer typically renegotiates labor contracts to maintain the firm's operations.[1] The auctions are quick (lasting an average of only two months), relatively cost-efficient, and three-quarters of the filing firms survive the auction as a going concern (Thorburn (2000)). Following the auction, firms restructured as going concerns tend to perform at par with non-bankrupt industry rivals (Eckbo and Thorburn (2003a)).[2]

Despite its apparent effectiveness, the idea of a mandatory bankruptcy auction system is unpopular throughout much of Western Europe and the US. In the context of recent European Union bankruptcy reforms, Hart (2000) observes "I'm not aware of any group–management, shareholders, creditors, or workers–who is pushing for cash auctions". In the US, firms are occasionally auctioned out of Chapter 11 (Hotchkiss and Mooradian (1998)). However, the acquisition procedure is not standardized and can be fraught with administrative inefficiencies.[3] Also, there is a concern that the hard constraint on management implied by a mandatory auction system induces inefficient managerial project selection to ward off bankruptcy.[4] The argument is an application of the shareholder risk-shifting incentives originally analyzed in Jensen and Meckling (1976).[5] In Eckbo and Thorburn (2003a), we counter the risk-shifting argument by including in the managerial objective function the preservation of firm-specific private benefits of control. Preserving control benefits requires survival of the firm and thus may induce a more conservative (less risky) prefiling

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[1] Eckbo and Thorburn (2003a) find that about one-third of the incumbent managers are rehired by the buyer.

[2] This survival rate is similar to what is reported for Chapter 11 reorganizations. See, e.g., White (1984), Franks and Torous (1989), Weiss (1990), LoPucki and Whitford (1993). However, the post-bankruptcy performance result contrasts with Chapter 11 evidence where Hotchkiss (1995) find that the restructured firms on average underperform their respective industries.

[3] A recent example is the acquisition by American Airlines of a bankrupt TWA in early 2001 (Eckbo (2001)).

[4] See, e.g., Aghion, Hart, and Moore (1992), White (1996), and Franks, Nyborg, and Torous (1996).

[5] Berkovitch, Israel, and Zender (1997) also argue that an automatic auction system may lead to managerial underinvestment in firm-specific human capital.

managerial investment policy than what is preferred by shareholders. The evidence of high survival rates and post-bankruptcy performance runs counter to the risk-shifting argument and is consistent with managerial conservatism.

In this paper, we focus on concerns with market liquidity, competition, and self-dealing in the mandatory bankruptcy auctions. Shleifer and Vishny (1992) and Aghion, Hart, and Moore (1992) warn that bankruptcy auctions may result in fire-sale prices if they coincide with industry-wide financial distress. Moreover, Strömberg (2000) models creditor incentives to preempt the auction by putting the bankrupt firm back to its former owners (a saleback) at terms detrimental to junior creditors. If these concerns are empirically valid, investors have reason to favor structured bargaining over auctions. We are the first to present direct tests of the fire-sale and self-dealing hypotheses using data on auction premiums.[6] Moreover, we develop and test a theoretical model which suggests that the scope for fire-sales in bankruptcy auctions is countered by the bidding incentives of the bankrupt firm's main creditor (the bank). A key empirical issue is therefore whether the bank's incentives are sufficiently strong to counter self-dealing and fire-sale tendencies.

Our theoretical analysis starts with the observation that, under Swedish rules, the bank can neither present itself as a bidder in the auction nor can it overrule a decision by the trustee to sell to the highest bidder. Thus, although the bank is the main residual claimant, it cannot directly influence the winning price. However, our data shows that the bank often finances a bidder, and we derive an incentive-compatible bid strategy for the bank-bidder coalition. The coalition's optimal bid exceeds the private valuation of the bank's coalition partner (overbidding). Overbidding transfers wealth from bidders other than the coalition partner and thus leaves the bank better off relative to remaining a passive bystander to the auction.[7] We show that the optimal coalition bid mimics a monopolist seller's take-it-or-leave-it offer, in effect getting around the institutional constraint on direct bank bidding.

Our empirical analysis begins by showing that the typical auction is competitive, as measured by the number of bidders expressing serious interest as well as by the actual number of bids. Salebacks, which must take place in an open auction setting, produces premium outcomes comparable to those

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[6]The extant empirical literature on fire sales focuses primarily on individual asset sales of financially distressed or bankrupt US firms. See, e.g., Pulvino (1998) and Maksimovic and Phillips (1998).

[7]Overbidding incentives are also discussed in Burkart (1995), Singh (1998), Bulow, Huang, and Klemperer (1999), Betton and Eckbo (2000), Hotchkiss and Mooradian (2003), and Betton, Eckbo, and Thorburn (2004).

in going-concern sales to company outsiders. The incidence of bank financing of the winning bidder is about the same for salebacks as for sales to outside investors.

We then proceed to use our bid premium data to perform cross-sectional tests of the overbidding theory. The overbidding theory predicts that the expected going-concern premium (defined as the final auction price relative to an estimate of the value of the firm's assets if liquidated piecemeal) increases in the degree of impairment of the bank's debt. The regression results support this prediction. There is no evidence of overbidding in the sample of piecemeal liquidations, also as predicted. Overall, the empirical results are consistent with overbidding incentives being played out in the auction.

The regressions also include variables designed to capture fire-sale conditions, including the degree of industry-wide financial distress and business cycle change. We find no evidence that the going-concern premium depends on these variables, with or without the presence of overbidding variables. Correcting for a possible selection bias from prepacks does not alter our conclusions with respect to either the fire-sale argument or the overbidding theory. Finally, comparing salebacks with going-concern sales to company outsiders, we show that salebacks occur independly of industry-wide distress and are significantly more likely to occur when the economy is in a business cycle upturn. This finding runs somewhat counter to Strömberg (2000) who concludes that salebacks are more likely when markets are relatively illiquid. Overall, the data does not support a self-dealing argument for salebacks.

The rest of the paper is organized as follows. Section 2 briefly describes key aspects of the Swedish auction bankruptcy system. We develops our theoretical bidding results and the associated testable implications in Section 3. Section 4 starts the empirical analysis by focusing on the degree of auction competition, and it introduces evidence on average auction premiums and recovery rates. Section 5 presents the paper's tests of the overbidding hypothesis, while the effects of fire-sale conditions and potential conflicts of interest are examined in Section 6. Section 7 concludes the paper.

2 The Swedish auction bankruptcy system

The Swedish mandatory auction bankruptcy system is a hybrid between the bankruptcy codes in the UK and the US. As in the UK, court-supervised debt renegotiation is not an option, which makes the system more contract-driven than the structured bargaining environment dictated by Chapter 11 in US. As in the US, the Swedish code restricts the liquidation rights of creditors: A bankruptcy filing triggers automatic stay of debt payments and prevents repossession of collateral. These provisions help protect the firm as a going concern throughout the bankruptcy process.[8] However, while managers in the US retain substantial control rights in bankruptcy, the Swedish bankruptcy system automatically terminates labor contracts and puts the firm up for sale in an open auction. The bidders in this auction determine whether the firm is economically viable as a restructured going concern or whether the firm's assets are to be liquidated piecemeal.

Table 1 summarizes key legal rules in Sweden with a brief comparison to Chapter 11. For a bankruptcy petition to be approved by court, the firm has to be insolvent, defined as a non-temporary inability to pay its debt obligations.[9] Following filing approval, control of the firm passes to an independent, court-appointed trustee with fiduciary responsibility to creditors. Since the firm is to be sold in an auction, there is no need for a system of creditor voting: creditors simply receive the cash proceeds from the auction which is distributed strictly according to absolute priority. As in the US, bankruptcy filing triggers stay of all creditors, and it is in principle possible to raise super-priority debt to finance the firm's ongoing activities until the final sale. Given the relatively short time to final sale (on average 2 months), there is in practice little demand for such financing.[10] There is also a limited government wage guarantee.[11]

The trustee's main task is to organize the sale of the firm in an open, cash-only auction. Trustees are judged by supervisory agencies and major creditors for their ability to hold a proper, arms-

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[8]In contrast, the UK has 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 difficult to continue to operate the distressed firm under receivership, and Franks and Sussman (2002) find that less than half of filing firms survive the UK bankruptcy process.

[9]If the firm files the petition, insolvency is presumed and the filing approved automatically. If a creditor files, insolvency must be proven before the firm can enter bankruptcy, a process that takes on average two months. In our sample below, about 90% of the filings are debtor-initiated. The bank sometimes force the firm to file by cancelling the firm's credit line.

[10]For evidence on debtor-in-possession financing under Chapter 11, see Dahiya, John, Puri, and Ramirez (2003).

[11]The guarantee is applicable to unpaid salaries for up to six months prior to bankruptcy filing, as well as for some period following filing, depending on the employee's time with the firm. During the sample period of this paper, the maximum guarantee was capped at approximately $55,000 per employee.

length auction procedure.[12] Before accepting a saleback proposal, the trustee is required to make a substantial search effort for competing bids. Auction bids may be for individual assets (piecemeal liquidation) or for the firm as a going concern. 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, much like a leveraged buyout transaction in the US. The firm's assets are transferred to the buyout firm while the debt claims remain on the books of the bankrupt firm. The method of payment is restricted to cash, and creditors are paid according to the absolute priority of their claims. During the auction, workers and the old management team remain temporarily with the firm to keep operations running. In practice, bankrupt firms tend to cover operating expenses by increasing their debt obligations in the form of trade credits that get super-priority, while new (super-priority) debt issues or bank loans are almost never observed.

The Swedish bankruptcy system also allows firms to file a "prepackaged" going-concern sale of the firm (henceforth "auction prepack"). Auction prepack negotiations are typically initiated by the owner-manager and is subject to approval by secured creditors. Since the firm remains insolvent following the prepack sale (the cash proceeds from the sale are necessarily less than the face value of outstanding debt), it must file for bankruptcy. The role of the bankruptcy court in this instance is primarily to check for conflicts of interest, and to allow junior creditors to object to the sale. If the sale is approved, the bidder pays the contractually agreed prepack price. If the sale is overturned, the contract is voided and the trustee implements the open auction. If so, the prepack bidder may participate in the auction. Prepackaged asset sale is typically completed the day before–or on the day of–the bankruptcy filing. Auction prepack filings are almost never overturned, and Thorburn (2000) shows that prepacks have significantly lower direct costs than a regular bankruptcy filing.

Swedish bankruptcy law has a provision for "composition", i.e., a procedure for renegotiating *unsecured* debt claims. However, for the court to accept a composition, secured debt and priority claims (taxes, wages, etc.) must be offered full repayment and junior creditors at least 25% of their claim. Thus, one suspects composition to be largely irrelevant, which is confirmed by the population data in Eckbo and Thorburn (2003b). Starting with 1,600 financially distressed firms, they find only four cases where the firm made a successful composition attempt.

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[12]Trustees are certified and licensed by a government supervisory authority ("Tillsynsmyndigheten i Konkurs" or TSM), which also reviews the trustees' compensation and performance. Trustees are compensated on an hourly basis.

Private Swedish firms typically have a single banking relationship, and most of this bank debt is secured (average 94%, median 100% at filing). Overall, the bank is the firm's major creditor (debt claims senior to the bank average less than one percent of total debt) and alone in its creditor class. Thus, the bank is in reality a monopolist seller of the bankrupt firm. This fact notwithstanding, Swedish law prohibits the bank from formally controlling the selling process. For example, it cannot place direct bids, nor can it refuse to sell to the highest bidder. Thus, the bank cannot directly enforce a minimum sales price. However, the theory below shows that the bank may be in a position to substantially influence the final auction price through a coalition with one of the bidders, potentially getting around the institutional constraint on direct bidding.

3   A theory of bank-coalition bidding

In this section, we derive incentive-compatible bid strategies for a coalition between the bank and a bidder in the auction. The Swedish bankruptcy code mandates an open first-price (English) auction, and we use the second-price analogy for tractability. Assuming zero bidding costs and risk neutrality, the second-price auction is revenue-equivalent to the first-price auction (Klemperer (2000)). Given zero bidding costs, we abstract from preemptive bidding strategies (Fishman (1988)), and we assume the presence of two (non-bank) bidders in the auction. Our main theoretical results also presume that the bank learns the coalition partner's valuation of the bankrupt firm. This is a standard assumption in the literature on reorganizations, e.g., Bulow and Shoven (1978), Brown (1989), Gertner and Scharfstein (1991), Strömberg (2000), and Hotchkiss and Mooradian (2003).

3.1   Coalition bid strategy

As indicated above, a going-concern sale takes place by merging the assets and operations of the auctioned firm into an empty corporate shell set up and owned by the bidder. Swedish banking regulations prevent banks from being beneficiary owners (shareholders) of non-financial companies. Thus, the bank cannot hold shares in the shell company, nor can it bid directly for the bankrupt firm. However, there are no regulatory restrictions on the bank's ability to issue debt. Suppose the bank contacts Bidder 1 and offers to provide a loan to the shell company if the merger takes place (i.e., if Bidder 1 wins the auction). As a precondition for the loan, the bank demands a coalition

bid agreement. The agreement requires a bidding strategy that maximizes the joint surplus of the bank-bidder coalition. We show below that this bid strategy is costly for the bidder, and the agreement therefore also requires a compensating transfer from the bank to the bidder. The transfer is priced into the terms of the loan.

The notation is as follows. The bank holds a senior debt claim with face value B on the bankrupt firm. Bidder i's total valuation of the auctioned firm is $V_i \equiv V_L + v_i$, $i = 1, 2$. The valuation component V_L is a constant that is common across bidders and it represents the firm's piecemeal liquidation value. The bidder-specific valuation component $v_i \in [0, 1]$ is private information and realized only if the firm is sold intact as a going concern. Assume v_i distributed i.i.d. with distribution and density functions $G(v_i)$ and $g(v_i)$, respectively. The auction determines the going-concern premium $P - V_L$, i.e. the price in excess of V_L to be paid for the bankrupt firm as a going concern. We first characterize optimal bidding strategies assuming $V_L = 0$ (Proposition 1), and then show how the optimal strategy varies with V_L/B, which generates the key cross-sectional implications of the theory (Proposition 2).

The coalition agreement consists of a minimum transfer payment $T(v_1)$ from the bank to Bidder 1 in return for a coalition bid of $p_c(v_1)$. As stated in Proposition 1, if $B > v_1$ the coalition optimally overbids $(p_c(v_1) > v_1)$:

> **Proposition 1 (Coalition bidding):** *Let $V_L = 0$ and suppose the bank is the bankrupt firm's only senior creditor, holding a debt claim with face value B. The following represents an incentive-compatible coalition bid strategy:*
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> $$p_c(v_1) = \begin{cases} v_1 + h(p_c) & if \quad v_1 \leq B - h(p_c) & (unconstrained\ overbidding) \\ B & if \quad B - h(p_c) < v_1 < B & (constrained\ overbidding) \\ v_1 & if \quad v_1 \geq B, & (no\ coalition\ and\ no\ overbidding) \end{cases}$$
>
> *where $h(v) \equiv [1 - G(v)]/g(v)$. Moreover, in the event that the coalition wins the auction and pays a price p_2 such that $v_1 < p_2 \leq p_c(v_1)$, the bank transfers to Bidder 1 an amount equal to $T(v_1) = p_2 - v_1$.*

Proof: The proof involves three steps. First, we derive the optimal coalition bid $p_c(v)$. Second, we show that with delegated bidding, Bidder 1 actually has an incentive to implement the optimal

bid. Third, we prove that the transfer $T(v_1)$ satisfies the ex ante coalition participation constraint of both the bank and Bidder 1.

(1) <u>The coalition bid $p_c(v_1)$</u>: For clarity, the profits of the bank and Bidder 1 are illustrated in Figure 1 for the case where v_i is distributed uniform, $v_i \sim U[0,1]$. The vertical axis is bidder 2's private valuation v_2, and the horizontal axis is $G(v_2)$. In this auction, when bidding alone, it is a dominant strategy to bid the private valuation v_i.[13] So $p_2 = v_2$, as depicted by the forty-five degree line. Area A equals Bidder 1's expected profit from bidding alone. Area C is the bank's expected profit *without* coalition formation, while area D is the expected wealth transfer from bidder 2 resulting from coalition overbidding. The expected total coalition profit is therefore $\Pi_c(v_1) = A + C + D$, or

$$
\begin{aligned}
\Pi_c(v_1) &= \int_0^{v_1} (v_1 - p_2) g(p_2) dp_2 + \int_0^{v_1} p_2 g(p_2) dp_2 + v_1[1 - G(v_1)] + [p_c(v_1) - v_1][1 - G(p_c)] \\
&= v_1 G(p_c) + p_c(v_1)[1 - G(p_c)].
\end{aligned}
\tag{1}
$$

The first-order condition for maximizing expected profit w.r.t $p_c(v_1)$ is

$$
\frac{\partial \Pi_c}{\partial p_c} = v_1 g(p_c) + [1 - G(p_c)] - p_c(v_1) g(p_c) = 0,
\tag{2}
$$

which, when rearranged, yields the "unconstrained overbidding" price in Proposition 1.[14]

As the senior claimant, the bank has no incentive to help generate an auction revenue that exceeds B. Figure 2 illustrates the effect of B on $p_c(v_1)$, again for the uniform case. The horizontal axis plots v_1 and the bold-faced line shows the corresponding coalition bids $p_c(v_1)$. The first segment of the bold-faced line is the unconstrained overbidding price, $p_c(v_1) = v_1 + h(p_c)$. The second (horizontal) segment is the constrained overbidding price in Proposition 1, $p_c(v_1) = B$, which occurs when $B - h(p_c) < v_1 < B$. The segment starts when v_1 is such that the unconstrained bid price equals the face value B. Throughout this segment, B caps the unconstrained overbidding price simply because the value of a bid exceeding B would represent a windfall to junior creditors.

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[13]Bidding less risks foregoing v_i (with no offsetting benefit) while bidding more risks paying more than the valuation. See, e.g., Hirshleifer (1995).

[14]To ensure uniqueness, G must be twice continuously differentiable and satisfy the monotonicity condition $\partial h^{-1}(v)/\partial v \geq 0$. With the uniform distribution in Figure 1, $A + B + D = v_1^2/2 + (v_1 - v_1^2/2) + [p_c(v_1) - v_1][1 - p_c(v_1)] = v_1 + (1 - v_1)^2/4$, and the unconstrained overbidding price is $p_c(v_1) = (v_1 + 1)/2$.

The third segment starts when $v_1 > B$. Here, every dollar overbidding is transferred directly to junior creditors, so the coalition does not overbid, $p_c(v_1) = v_1$.

(2) Delegated bidding: Bids are submitted in written form, and the bank could simply stand by and verify that the bid equals to $p_c(v_1)$. However, Bidder 1 will implement the optimal coalition bid strategy also if the bank were to completely delegate bidding to its coalition partner. Whenever the coalition overbids and is forced to pay a price p_2 such that $v_1 < p_2 \leq p_c(v_1)$, the transfer schedule $T(v_1)$ effectively increases Bidder 1's private valuation of the target from v_1 to p_2. Since it is a dominant strategy to bid the private valuation, Bidder 1 will voluntarily raise its bid to p_2 in this interval.[15] In the second-price auction, it makes no difference to the coalition whether it wins with a bid of $p_c(v_1)$ or $p_2 \leq p_c(v_1)$. Thus, the transfer $T(v_1)$ in Proposition 1 induces Bidder 1 to implement the profit-maximizing coalition bid strategy. As shown below, $T(v_1)$ makes Bidder 1 indifferent to participating in the coalition and is therefore the minimum transfer compatible with coalition formation. Alternatively, the greater transfer $T'(v_1) = p_c(v_1) - v_1$, for $v_1 < p_2 \leq p_c(v_1)$, would also induce Bidder 1 to implement the optimal coalition bid strategy, but at a higher cost to the bank. In terms of Figure 1, $T'(v_1)$ would grant Bidder 1 the triangle which is the mirror image of area E and which constitutes half of the net coalition profit from overbidding.

(3) Coalition participation constraints: Consider first Bidder 1's incentive to participate in the coalition. Absent the transfer $T(v_1)$, overbidding provides no direct benefit to Bidder 1, only a potential cost. The cost arises when the coalition wins and pays a price greater than v_1, i.e. when $p_c(v_1) > v_2 > v_1$. In Figure 1, the expected cost of overbidding for Bidder 1 equals area E, where

$$E \equiv \int_{v_1}^{p_c(v_1)} (p_2 - v_1)g(p_2)dp_2 = \bar{T}(v_1),\tag{3}$$

and where $\bar{T}(v_1)$ denotes the expected value of the transfer payment.[16] In other words, the expected transfer $\bar{T}(v_1)$ is equal to the expected cost of overbidding. Moreover, in Figure 1, the condition for Bidder 1 being better off in the coalition than bidding alone is $A - E + \bar{T}(v_1) \geq A$, or $\bar{T}(v_1) \geq E$. Thus, $\bar{T}(v_1)$ is the minimum transfer that induces Bidder 1 to participate.

The bank prefers coalition bidding only if its expected coalition profit, $C + D + E - \bar{T}(v_1)$, is at least as large as its expected non-coalition profit, area C in Figure 1. That is, the bank's

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[15]It is assumed that if the two bidders present identical offers, Bidder 1 is declared winner.
[16]With the uniform distribution, $E = (1/8)(1 - v_1)^2$.

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participation constraint is $\bar{T}(v_1) \leq E + D$, which always holds for $\bar{T}(v_1) = E$. Area $D = [p_c(v_1) - v_1][1 - G(p_c)]$ is the expected rent extraction from bidder 2 resulting from coalition overbidding $[p_c(v_1) - v_1 > 0]$. This shows that there exists transfers $\hat{T}(v_1) > T(v_1)$ that will also induce coalition formation, as long as $E \leq \hat{T}(v_1) \leq E + D$ and $D \geq 0$. ∎

Proposition 1 provides the foundation for our main empirical prediction, stated in Proposition 2. Let P denote the total price paid by the winning bidder in the auction, so $P - V_L$ is the actual going-concern premium paid. Moreover, define the bank's recovery rate at the piecemeal liquidation value V_L as $R_L \equiv V_L/B \in [0,1]$. That is, R_L is the fraction of the face value recovered by the bank if there are no going-concern bids and the firm is liquidated piecemeal. B and V_L are both known at the beginning of the auction, and R_L influences the optimal coalition bid—and therefore the expected auction premium—as follows:

> **Proposition 2 (Expected auction premium):** *The coalition bid strategy of Proposition 1 implies that the expected auction premium is decreasing in the piecemeal liquidation recovery rate observed at the beginning of the auction:* $\partial E(P - V_L)/\partial R_L < 0$.

Proof: The formal proof is in Appendix A. The intuition is as follows. Recall that, if the coalition loses to bidder 2, bidder 2 is forced to pay a going-concern premium of $p_c(v_1) > v_1$. If the coalition wins, it pays an expected premium of $E(p_2|p_c(v_1)) > E(p_2|v_1)$. Thus, overbidding raises the expected auction premium. Greater values of V_L means that the bank's debt is less impaired at the beginning of the auction, and thus the lower the incentive to overbid. The intuition for this is easily illustrated using Figure 2. The figure is drawn for $V_L = 0$, which means that the claim B is paid down using only the going-concern premium generated by the auction. That is, in Figure 2 the entire value B is at risk for the bank. The effect of increasing V_L is to reduce this risk exposure to $B' = B - V_L$ since V_L will be recovered for sure. As $B' < B$, the region for unconstrained overbidding is reduced. As a result, the expected amount of overbidding $E(p_c(v_1) - v_1)$, given by the shaded area in the figure, is also reduced. ∎

3.2   Additional coalition bidding results

The bank-bidder coalition is motivated by the institutional constraint on direct auction bidding by the bank. In this section, we show that the optimal coalition bid strategy of Proposition 1 mimics

the monopoly sales price in a take-it-or-leave-it offer to bidder 2. Furthermore, we show how the optimal coalition bid changes if the bank shares its debt class with other creditors, and how the bidder's incentive to participate in the coalition is affected by an existing personal loan guarantee to the bank.

Proposition 3: *The following holds for the transfer $T(v_1)$ and the unconstrained over-bidding price $p_c(v_1) = v_1 + h(p_c)$ defined in Proposition 1:*

(1) *$p_c(v_1)$ is equal to the monopolist selling price in a take-it-or-leave-it sales offer to bidder 2.*

(2) *If the bank owns a fraction $\alpha < 1$ of the debt in its priority class, the coalition price with unconstrained overbidding is $p_c(v_1) = v_1 + \alpha h(p_c)$.*

(3) *In a saleback coalition, the existence of a personal guarantee of the bank's debt issued by the manager/owner of the bankrupt firm reduces the minimum transfer $T(v_1)$ required for coalition overbidding.*

Proof: Starting with part (1) of the proposition, note that as a monopolist seller, the bank-bidder coalition would be asking a price p_c in a take-it-or-leave-it offer to bidder 2. Selling to bidder 2 means that Bidder 1 foregoes v_1, and so the expected opportunity cost of the monopolist seller is $v_1[1 - G(p_c)]$. The probability that bidder 2's private valuation exceeds p_c is $1 - G(p_c)$, so the monopolist's expected revenue is $p(v_1)[1 - G(p_c)]$. The expected marginal revenue is $1 - G(p_c) - p(v_1)g(p_c)$, and the expected marginal cost equals $-v_1 g(p_c)$. Equating the two yields the monopoly selling price $p_c(v_1) = v_1 + h(p_c)$. Interestingly, the (unconstrained) coalition bid strategy mimics that of a monopolist seller. In other words, the bank has achieved its (gross) revenue objective despite the institutional restriction on direct bank bidding in the auction.

In part (2), the bank's recovery is scaled with the constant α, so the coalition realizes $\alpha p_c(v_1)$ if losing and $v_1 - p_2 + \alpha p_2$ if winning. The first-order condition for the coalition's profit maximization in Eq. (2) changes to

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

which yields the optimal coalition bid stated in the proposition.[17]

In part (3) of the proposition, the existence of a personal loan guarantee issued by the manager/owner of Bidder 1 to the bank—which is not uncommon for small firms in Sweden—relaxes the bidder's participation constraint. The loan guarantee provides the bidder with its own incentive to overbid: The greater bank recovery resulting from overbidding reduces the bidder management's personal liability vis-a-vis the bank. Thus, a personal loan guarantee lowers the value of $T_c(v_1)$ required to induce such a bidder to participate in the coalition. If the personal guarantee covers the entire value of B, then a transfer $T(v_1) = 0$ is incentive compatible for Bidder 1. ∎

As stated above, our theoretical analysis presumes that v_1 is known to the bank. Suppose instead that bidders have information about their private valuations that the bank does not have. The bank now faces a screening problem. The monotonicity condition $\partial h(v)/\partial v \geq 0$ implies that the minimum transfer is decreasing in v_1.[18] As a result, Bidder 1 has an incentive to understate its true valuation (reporting $\hat{v}_1 \leq v_1$). Intuitively, bidders earn informational rents which reduces the bank's profit and incentive to form a coalition.

Given the profits from overbidding in the symmetric case, the bank has an incentive to reduce the information asymmetry, e.g., by approaching a bidder with whom it has a prior banking relationship, or by auditing Bidder 1. The degree to which banks are successfully reducing the information asymmetry is an empirical issue. The very existence of bank-bidder coalitions (evidenced by bank financing of bidders) suggests that informational issues between the bank and its coalition partner may not be prohibitive. The key empirical issue below is whether actual auction premiums also reflect overbidding incentives of the type implied by our symmetric information framework.

4 Bid frequencies and average auction premiums

Some commentators (e.g., Aghion, Hart, and Moore (1992) and Strömberg (2000)) warn that the type of auctions studied here may lack competition. The theoretical analysis above presumes the

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[17]This expression reproduces the optimal bid by a toehold bidder derived by Burkart (1995) in the context of corporate takeovers, where the toehold is an ownership fraction $\alpha < 1$ owned by the bidder in the target firm.

[18]The derivatives of the participation constraints of the bidder and of the bank when binding are, respectively,

$$\frac{\partial \bar{T}(v_1)}{\partial v_1} = \begin{cases} (p_c(v_1) - v_1)g(p_c)\frac{\partial p_c(v_1)}{\partial v_1} - (G(p_c) - G(v_1)) \\ (1 - G(p_c))\frac{\partial p_c(v_1)}{\partial v_1} - (1 - G(v_1)), \end{cases}$$

which, given the monotonicity condition $\partial h^{-1}(v)/\partial v \geq 0$, are less than or equal to zero.

existence of (at least) two bidders. Thus, we start the empirical analysis examining the degree of auction competition and the magnitude of average auction premiums across bid outcomes. The auction premium data is explored in greater detail in Section 5 where we present our cross-sectional tests of Proposition 2.

4.1 Auction data

We study the sample of Swedish bankruptcies in Strömberg and Thorburn (1996), expanded to include firm- and auction characteristics required to test our bidding hypotheses. First, the additional information includes bidder interest, actual bids, and liquidation value estimates, obtained in direct communication with auction trustees. Second, we incorporate information on bank financing from the national register of corporate floating charge claims ("Inskrivningsmyndigheten för företagsinteckning"), supplemented by the trustees. Third, we create a quarterly business cycle index using information from Statistics Sweden (SCB). Fourth, we incorporate the information on industry distress and profit margins compiled by Thorburn (2000) for this sample.

The sample contains 263 bankruptcies from 01/88–12/91, selected from a population of 1,159 bankrupt firms having at least 20 employees.[19] The sample firms are small, privately held companies with concentrated ownership. On average, book value of assets is \$2.5 million, and the CEO owns 59% of the equity. As shown in the last row of Table 2, of the total sample of 263 bankrupt firms, 53 (20%) filed a prepackaged bankruptcy (auction prepack), while the remaining 80% (207 cases) petitioned for bankruptcy without a prepack arrangement. Of these 207 filings, 60 (29%) are liquidated piecemeal (piecemeal liquidations) and 147 (71%) are sold as a going concern (going-concern auctions), while we lack information to classify three cases. About sixty percent of all going concern sales (auction prepacks and going-concern auctions combined) are sales back to the old owner/manager (salebacks).

Table 2 also shows the distribution of the bankruptcy filings across eight industry groups. The largest industry is Manufacturing with 29% of the sample (76 cases), followed by Wholesale/Retail and Construction with 17% and 13%, respectively. A further 29 cases (11%) are in Transporta-

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[19]Over the sample period, 6% of all (approximately 16,000) Swedish corporations had 20 employees or more. The sample is restricted to bankruptcies in the four largest administrative provinces in Sweden, including the country's four main metropolitan areas, Stockholm, Gothenburg, Malmö and Uppsala. See Thorburn (2000) for a detailed description of the sampling procedure.

tion and 26 cases (10%) are in Hotels and Restaurants. The distribution of auction outcomes is quite similar across industry groups, with the greatest relative frequency of piecemeal liquidations occurring in Transportation (14 of 29 cases, or 48%). The industry with the highest proportion salebacks is Construction (20 of 26 cases, or 77%). As it turns out, controlling for industry fixed effects does not materially change our conclusions, and we do not report industry-specific results in the analysis below.

4.2 Bid frequencies and bank financing

Table 3 and Figure 3 summarize the number of potential buyers expressing an interest in bidding (*Interest*), and the number of submitted bids (*Bids*). In Figure 3, the number of interested bidders ranges from one to forty in the sample of 102 going-concern auctions with bid information. Moreover, 75% of the auctions attract multiple bidder interest. The number of actual bids ranges from 1 to 22, with multiple bids in 63% of the going-concern auctions.

Panel A of Table 3 expands on Figure 3 to include auction prepacks and piecemeal liquidations. For the total sample, the average number of interested bidders equals 5.5 with a median of 3.0. As indicated above, this expression of interest translates into multiple bids in a majority of the auctions. The average number of submitted bids is 3.6 with a median of 2.0. The auctions are active also for the subsample of salebacks. In salebacks resulting from going-concern auctions, the average (median) number of interested bidders and actual bidders are 5.3 (3.0) and 3.0 (2.0), respectively.

In the sample of auction prepacks, the number of interested bidders and actual bids average 1.2, ranging from 1 to 2. [20] Finally, the expression of bidder interest and actual bids is greatest in the piecemeal liquidation subsample, 11.4 and 9.8 (median values of 5). In piecemeal liquidations, bids are for individual assets, implying multiple bids. Overall, these findings suggest that the bankruptcy auctions tend to attract competition.

A decision by the filing firm's bank to finance a bidder adds liquidity to the auction. In Panel B of Table 3, we present information on the bank financing of the winning bidder for a total of 132 going concern sales (going-concern auctions and prepacks). The bank finances the winning bidder

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[20]In a prepack filing, the trustee typically approves the petitioner's purchase agreement without recording potential competition. Thus, the data on bidders in prepacks is incomplete.

in approximately half (48%) of the cases, distributed as 44 of 95 going-concern auctions and 20 of 35 auction prepacks. Focusing on salebacks, the winner is financed by the bank in 49% of salebacks following a going-concern auction, and in 62% of saleback-prepacks. Overall, we conclude that the bank adds substantial liquidity across auctions, with no particular tendency to finance salebacks.

4.3 Average premiums and recovery rates

Competition affects average auction premiums as well as total debt recovery rates. We focus here on two predictions. First, competition to run the firm as a going concern is expected to produce substantially greater premiums in going-concern sales than in piecemeal liquidations. Second, if salebacks are as competitive as non-salebacks (as indicated by the bid frequencies above), they should produce similar average premiums.

Panel C of Table 3 lists the average and standard deviation of the auction premium and the debt recovery rate. The percent auction premium is computed as $P/V_L^a - 1$, where P is the price paid by the winning bidder and V_L^a is the trustee's liquidation value estimate for the assets sold in return for P. Non-core assets such as real estate holdings, accounts receivables, securities, cash holdings, etc., are often sold and collected separately even when the firm's core operations are auctioned as a going concern, thus $V_L^a < V_L$. We use the bankruptcy file to infer the asset exclusion. This opens for a measurement error in V_L^a (but not in V_L) if the file omits information on some of the assets sold.

Judging from Table 3, the error in V_L^a does not bias the premium estimate: The average percentage premium is only 8% for piecemeal liquidations, with a dollar value of $0.005 mill. The standard deviation of this premium estimate is 56% or $0.122 mill. In contrast, the premium in going-concern auctions averages 125% (standard deviation of 282%). This is consistent with our maintained hypothesis that competition produces greater auction premiums when the going-concern value is positive. Moreover, the average premium is 131% for salebacks, and a statistically indistinguishable 120% for non-saleback going-concern auctions. This indicates that salebacks take place at premiums similar to those in sales to company outsiders.

Turning to recovery rates, the average total debt recovery in Panel C is 26% for piecemeal liquidations and 39% for going-concern auctions (significantly different at the one percent level). In prepack auctions, the average recovery is 32%. The recovery rate averages 38% in salebacks that

occur in going-concern auctions, and 29% when the saleback occurs via an auction prepack filing. The averages across these two saleback categories are not significantly different from each other.

Finally, Panel C lists the bank's liquidation recovery rate R_L. As noted in Section 2, debt claims senior to the bank averages only 1% of total debt. When computing R_L, we reduce V_L with any such senior debt. The trustee's estimate of V_L is typically not available for auction prepacks and R_L is therefore not shown for this category. The frequency distribution of R_L is plotted in Figure 4 for both going-concern auctions and piecemeal liquidations. The bank receives full recovery at the trustee's liquidation value estimate in 58 bankruptcy filings (30%). The 138 cases with less than full liquidation recovery are evenly distributed across the range of R_L from 0 to 99%. In Table 3, the average value of R_L is 45% in piecemeal liquidations and 66% in going-concern auctions. This difference is statistically significant at the one percent level, indicating that firms liquidated piecemeal tend to have more impaired bank debt. Again, there is no discernable difference between salebacks and non-saleback transactions.[21]

5 Auction premiums and the overbidding hypothesis

5.1 Tests of overbidding

Hypothesis 1 (H1) summarizes the empirical implications of the bidding theory:

> **Hypothesis 1 (Overbidding):** *When the coalition bids for the bankrupt firm as a going concern, $R_L < 1$ generates overbidding, with $\partial ln(P/V_L^a)/\partial R_L < 0$. If $R_L = 1$, the bank's debt is not impaired and there is no overbidding. If the going-concern premium is close to zero, there is no coalition formation or overbidding, and the auction results in piecemeal liquidation.*

We use a cross-sectional regression framework where the auction premium $ln(P/V_L^a)$ is regressed on the bank's liquidation recovery rate R_L, and a vector X of control variables. Structurally, the direction of causality in these cross-sectional regression runs from R_L (observed at the beginning of the auction) to the auction premium through the hypothesized incentive to overbid. Notice also

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[21]Of course, while it appears that saleback bidders do not get away with paying a lower premium than bidders in non-saleback auctions, they may still capture greater rents. For example, saleback bidders may enjoy private benefits of control not completely competed away by outside bidders.

that, in our institutional setting, it is safe to assume that R_L is exogenous to the bank. For the bank to increase R_L it would need to reduce B prior to bankruptcy filing. However, the Swedish secondary market for private bank debt was illiquid during our sample period, and particularly so for distressed debt.

We test H1 using the combined sample of going-concern sales (indicated by the binary variable *Concern*) and piecemeal liquidations (with *Piecemeal* as indicator variable) and the following three linear regressions:

$$
ln(\frac{P}{V_L^a}) = \begin{cases} \alpha_1 + \beta_1 Piecemeal + \beta_2 R_L + \gamma_1 X + \epsilon_1 \\ \alpha_2 + \beta_1 Piecemeal + \beta_3 R_L * Piecemeal + \beta_4 R_L * Concern + \gamma_2 X + \epsilon_2 \\ \alpha_3 + \beta_1 Piecemeal + \beta_2' R_L + \beta_3' R_L * Piecemeal + \gamma_3 X + \epsilon_3 \end{cases} \quad (5)
$$

where α is the constant term, γ is the vector of regression coefficients for the control variables in X, and ϵ is an error term. The different indicator- and interaction variables in the three regression offer different ways to check for overbidding effects. In the first regression, $\beta_1 < 0$ reflects the absence of going-concern premiums in piecemeal liquidations, while $\beta_2 < 0$ captures the effect of overbidding in going-concern auctions. In the second regression, $\beta_3 = 0$ indicates absence of overbidding for piecemeal liquidations, while $\beta_4 < 0$ indicates overbidding in the sample of going-concern auctions. In the third regression, $\beta_2' \equiv \beta_4 < 0$ again captures the presence of overbidding for going-concern auctions, while for piecemeal liquidations $\beta_3' \equiv \beta_3 - \beta_4 > 0$ is required to undo the effect of overbidding captured by β_2'. In sum, H1 implies the following:

H1 : $\beta_1 < 0$ and $\beta_2 < 0$; $\beta_3 = 0$ and $\beta_4 < 0$; $\beta_2' < 0$ and $\beta_3' > 0$.

Variable definitions, including the control variables in X, are listed in Table 4, with the pairwise correlations shown in Table 5. The control variables include *Size* (natural logarithm of book value of total assets), *Profmarg* (pre-filing, industry-adjusted operating profitability), and *Secured* (the fraction of secured debt in the capital structure). We use *Secured* as a proxy for the proportion tangible assets.[22] From the pairwise correlations in Table 5, R_L is significantly negatively correlated

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[22]Absent data on the market value of equity for the (private) firms in our sample, *Secured* is a useful proxy for this proportion as long as firms lever up their tangible assets and the cross-sectional variation in the total debt ratio is small.

with the piecemeal liquidation dummy (confirming Figure 4 and Table 3) and with *Secured*. The negative correlation between R_L and *Secured* is -0.35 and is in part driven by the high correlation between *Secured* and the fraction bank debt B of total debt (R_L is decreasing in B). *Secured* is also significantly and positively correlated with *Size*.

Table 6 shows the estimated regression coefficients for system (5). Panel A uses the total sample of 173 going-concern sales and piecemeal liquidations with available data,[23] while panel B restricts the sample to the 118 cases with $R_L < 1$. The regressions produce adjusted R^2 ranging from 0.14 to 0.19. Of the three miscellaneous control variables, only *Secured* is statistically significant. As expected, the indicator *Piecemeal* is always negative and significant (confirming the finding of Table 3 of lower auction premiums in piecemeal liquidations). Presumably, a piecemeal liquidation occurs because no bidder has a sufficiently large going-concern valuation of the bankrupt firm. In our data, piecemeal liquidations occur only in the absence of a going-concern bid.

In both panels A and B of Table 6, the coefficients on R_L, $\beta_2 = -0.881$ and $\beta'_2 = -1.134$, are of the right sign and highly significant (p-values of 0.00). In the second regression of Panel A, β_3 is indistinguishable from zero as predicted (p-value 0.70). Moreover, $\beta_4 = -1.133$ and significant. In the third regression, $\beta'_3 > 0$ as predicted (p-value of 0.013). These results essentially repeat in Panel B, where the sample is restricted to cases with impaired bank debt ($R_L < 1$). Reducing the sample from 173 to 118 appears to reduce power, however. The coefficient estimate for β'_3 in Panel B is of similar magnitude as in Panel A but is now insignificant (p-value of 0.12). That is, we can no longer reject the hypothesis that $\beta_3 = \beta_4$, i.e. that the degree of overbidding differs across the two subsamples. The overall conclusion emerging from Table 6 is that lower values of R_L lead to higher values of the premium paid in the auction, as predicted by H1.

5.2   Robustness issues

The coefficient estimates β_2 and β'_2 for R_L reported in Table 6 do not separate the effects of overbidding from the effect of the correlation between V_L^a (the denominator of the dependent variable) and V_L (the numerator of R_L). In the sample of 173 going-concern sales and piecemeal liquidations used in Panel A, this correlation is 0.44. To examine whether this correlation alone

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[23]The data reduction from 263 reflects missing information on V_L. Recall that, by definition, there is no data on V_L in the 50 auction prepacks.

may drive the significance of the overbidding variable, we perform two separate checks. In the first, we reduce the two coefficient estimates of -0.881 and -1.134 by 44 percent. Leaving the standard error unchanged, the null hypothesis that the reduced coefficients are equal to zero is rejected on a 1% level with t-values of -2.63 and -3.02, respectively. Thus, the overbidding variable R_L has a significant impact on auction premiums even after accounting for the simple correlation between V_L^a and V_L.

Second, when the going-concern value is close to zero, the theory predicts that the auction will result in piecemeal liquidation with zero overbidding. In Panel A of Table 7, we estimate the coefficient β_2 (on R_L) for the sample of piecemeal liquidations. As reported earlier (Table 3), the final auction premium in the sample of piecemeal liquidations averages 8% with a standard deviation of 56%. With an estimated coefficient of $\beta_2 = -0.124$ and a p-value of 0.741, the regression in Table 7 rejects the proposition that the overbidding variable R_L helps explain the cross-sectional variation in this premium. Importantly, the insignificance of β_2 emerges despite the fact that the correlation between V_L^a and V_L is at work in this regression as well. In sum, our overall statistical inference regarding the impact of overbidding on auction premiums is unlikely to be confounded by the correlation between V_L^a and V_L.

The driving force in our overbidding theory is the impact of R_L at the beginning of the auction on the incentive to overbid. The coalition forms the optimal bid $p_c(v_1)$ ex ante, while the ex post outcome of the auction depends on the realization of Bidder 2's private value v_2. This suggests two additional implications of the theory. First, there should be evidence of overbidding (via the variable R_L) whether the coalition wins or loses the auction. Second, holding v_1 constant in the cross-section, the auction premium paid by the winner should on average be greater when the coalition overbids and loses (the winner pays $p_c(v_1)$) than when it overbids and wins (paying $p_2 < p_c(v_1)$). Note that the latter prediction strongly depends on v_1 being constant across subsamples of winners and losers. Alternatively, if the bank forms a partnership with a relatively high-v_1 bidder, it increases both the expected auction premium and the probability of winning, even without overbidding.[24]

Panel B of Table 7 addresses these issues using the sample of 84 going-concern auctions. Here, the indicator variable $Bankfin$ replaces the earlier indicator variable $Piecemeal$ in Table 6. We

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[24]When the coalition wins, it pays $p_2 = v_2$. Greater values of v_1 means v_2 can be higher and the coalition still wins. Thus, the expected premium paid by the winner increases as well.

exclude piecemeal liquidations, since no single bidder wins the auction (there is a winner for each separate asset sold). Since there should be overbidding regardless of the ex post outcome, we predict the coefficients on R_L, $R_L * Bankfin$, and $R_L * Non-Bankfin$ to be negative. The prediction is supported at the 1% level of significance for all coefficients. Notice also that $Bankfin$ receives a positive and significant coefficient. Thus, auction premiums are on average greater when the coalition wins. As indicated above, this is consistent with our theory provided the bank has some ability to search out and form a coalition with relatively high-value bidders.

6 Auction premiums and fire-sale conditions

In the overbidding theory, the focus is on the incentive of the bankrupt firm's major creditor to supply liquidity and produce greater bid prices in the auction. In contrast, Shleifer and Vishny (1992) and others conjecture that bankruptcy auctions may suffer from illiquidity and lack of competition due to fire-sale conditions. Fire-sale conditions occur when bankruptcy filings are correlated with conditions of low auction demand, e.g. due to industry-wide financial distress. We examine this hypothesis next.

6.1 Nesting the fire-sale and overbidding hypotheses

Hypothesis 2 (Fire-sales): *Auction premiums tend to be lower for bankruptcies that occur when markets are relatively illiquid and outside demand for the firm's assets is low, as indicated by conditions of severe industry-wide financial distress and a business cycle downturn.*

Table 8 shows the effect on the auction-premium regressions in Table 6 of adding the two key variables capturing fire-sale conditions. The first variable is the degree of industry distress ($Distress$). It is measured as in Thorburn (2000) and represents the fraction of all firms in the industry of the bankrupt firm that is financially distressed in the year of the bankruptcy filing. Financial distress is defined as either having an interest coverage ratio (EBITDA plus interest income divided by interest expense) of less than one or filing for bankruptcy in the same calendar year. The source of this information is financial statements from UC for the entire population of more than 15,000 Swedish firms with at least 20 employees. The industry is defined on a 4-digit level. *Distress*

equal-weighs the firms in the same industry. We also computed $Distress$ as the fraction of the assets in a given industry that is distressed. Results when using the asset-weighted distress indicator are indistinguishable from the results reported in Table 8.

The second fire-sale variable is the business cycle index change $\Delta Cycle$, measured as the change in a quarterly index $Cycle$. This index is an equal-weighted sum of the producer price index, the gross national product, aggregate consumption, rate of unemployment, and total number of bankruptcy filings. All index components are normalized with their mean and standard deviation. The first three components enter the index with a positive sign, and the remaining two with a negative sign. $\Delta Cycle \equiv (Cycle_0 - Cycle_{-1})/Cycle_{-1}$, where 0 is the quarter ending with the month of the bankruptcy filing. Information on the components used to construct $Cycle$ is collected from Statistics Sweden. Over the sample period, Sweden went through a general business upturn (1988-1990) followed by a deep recession in 1991. Thus, the variable $\Delta Cycle$ has substantial variation across the sample.

The pairwise Pearson correlation coefficients between the two fire-sale variables and either the overbidding variable R_L or the firm-specific control variables is insignificant (Table 5). The parameter estimates in Table 8 also shows that inclusion of fire-sale variables in the premium regressions does not add explanatory power. Specifically, we cannot reject the hypothesis of zero coefficients for $Distress$ and $\Delta Cycle$ in any of the nine regression specifications. This conclusion holds also when we exclude the overbidding variable R_L from the regression (which results in a significant decline in the regression R^2). When included, the sign and significance of the overbidding variable R_L is virtually unchanged from Table 6. A similar conclusion holds for the miscellaneous control variables in the regression.

Panel B of Table 8 excludes piecemeal liquidations. This allows us to focus on bank financing ($Bankfin$), salebacks ($Saleback$), and the number of bids ($Bids$) in the sample of going-concern auctions. The pairwise correlations between these variables and the fire-sale variables $Distress$ and $Cycle$ are all small and insignificantly different from zero (Table 5). As in Table 7, $Bankfin$ receives a significantly positive coefficient when R_L is included.[25] $Saleback$ receives an insignificant coefficient in all specifications, indicating that premiums in salebacks do not differ systematically from premiums paid in sales to outside investors. Finally, we include the variable $Bids$ as an in-

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[25] The Pearson correlation coefficient between $Bankfin$ and R_L in Table 5 is an insignificant 0.07.

strument for the degree of competition in the auction. Competition among bidders presumably counteracts fire-sale tendencies.[26] *Bids* receives an insignificant coefficient. One consistent explanation is that the typical auction is competitive (reflected in premiums) and does not depend on the cross-sectional variation in the number of bidders nor on fire-sale conditions.[27]

The regression results in Table 8 fail to support the fire-sale argument. We address two main robustness issues concerning this finding. The first is the potential for fire-sale conditions to directly impact the piecemeal liquidation value estimate V_L. The second concerns the potential for a bias in the coefficient estimates due to the exclusion of auction prepacks (where premium information is unavailable). Finally, we provide evidence on the determinants of the various auction outcome probabilities more generally.

6.2   Does V_L vary with fire-sale conditions?

The dependent variable in Table 8 is the final auction price scaled with the trustee's piecemeal liquidation value estimate V_L. If this estimate varies with fire-sale conditions in the same way as the auction price itself, the regression will not reveal a premium impact of the fire-sales variables. To examine this possibility, we present in Table 9 the same basic regressions as in Table 8. In panels A and B, the dependent variable is $ln(V_L)$, while in panels C and D it is V_L/A, where A is the prefiling book value of total assets used earlier to define $Size = ln(A)$. Scaling with book assets has the advantage of controlling for firm size using a measure that itself is not affected by fire-sale conditions during the auction. The regressions exclude the overbidding variable $R_L = V_L/B$.

The main conclusion from Table 9 is that neither *Distress* nor $\Delta Cycle$ receive statistically significant coefficient estimates. That is, V_L does not vary systematically with changes in fire-sale conditions. Our rejection of the fire-sale hypothesis using the premium regressions in Table 8 is evidently not driven by an offsetting cross-sectional variation in the piecemeal liquidation value estimate itself.

Not surprisingly, Table 9 also shows that V_L is significantly lower for piecemeal liquidations

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[26]In the model of Section 3, it is optimal to bid the full private value regardless of the number of rival bidders. However, increasing the number of bidders raises the probability that one of the bidders has a high valuation and thus may increase the premium.

[27]Replacing *Bids* with the number of interested bidders (*Interest*), or a dummy indicating multiple bids, does not alter the conclusions. Furthermore, as Strömberg (2000), we also included a binary variable indicating that the buyer is neither a direct (3-digit SIC) competitor nor an owner of the auctioned firm. This variable is highly correlated with both *Saleback* and *Bankfin*, but its inclusion does not alter the empirical results of Table 8.

(*Piecemeal*) and for firms with low prefiling industry-adjusted profitability (*Profmarg*). In panels A and B, V_L is positively related to *Size*, also as expected. There is some evidence that when the bank finances the winner in the auction (*Bankfin*), V_L tends to be greater (provided the regression also includes the number of bids *Bids*). Finally, there is no systematic impact of either *Saleback* or *Bids* on V_L in going-concern auctions.

6.3 Selection bias from the prepack decision?

Our regressions with the going-concern premium as dependent variable necessarily exclude auction prepacks since V_L^a is unavailable for this filing category. A firm approaching bankruptcy must decide whether or not to work out a prepackaged sale. This decision is possibly driven by the firm's view of current fire-sale conditions. The negotiated auction prepack effectively sets a minimum selling price, subject only to a fairness test by the bankruptcy trustee. Thus, creditors and owner/managers may prefer a negotiated prepackaged bankruptcy filing if they view market conditions as likely to produce low auction prices.

Let the prepack decision for company i be a function of $\gamma' Z_i$, where Z_i is a vector of firm- and market characteristics and γ' is the corresponding vector of coefficients. Moreover, let β denote the parameter vector in the auction premium model estimated above (tables 6 and 8). We earlier estimated

$$ln(\frac{P}{V_L^a}) = \beta' X_i + u_i \tag{6}$$

although the data are generated by

$$ln(\frac{P}{V_L^a}) = \beta' X_i + u_i \quad \text{if} \quad \gamma' Z_i \geq u_{zi} \quad (\text{non} - \text{prepack filing}). \tag{7}$$

Here, u_{zi} is the residual in a probit regression of the prepack decision with explanatory variables Z_i, where the firm selects a prepack filing if $\gamma' Z_i < u_{zi}$. If the regression error term u_i is correlated with u_{zi}, Eq. (7) is misspecified and produces biased estimates of β_1. The standard correction for this selection bias involves a two-step procedure.[28] The choice model $\gamma' Z$ is estimated in the first

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[28]See, e.g., Heckman (1979), Maddala (1983), and Eckbo, Maksimovic, and Williams (1990).

step, while in the second step β is estimated as

$$ln(\frac{P}{V_L^a}) = \beta' X_i + \eta \frac{\phi(\gamma' Z_i)}{\Phi(\gamma' Z_i)} + u_i, \tag{8}$$

where ϕ_i and Φ in the selectivity correction term (inverse Mill's ratio) are the values of the standard normal density and the cumulative normal distributions, respectively, evaluated at $\gamma' Z_i$.

Since we are interested in whether prepacks are selected to avoid expected costs of fire-sale conditions, the selection model includes the variables $Distress$ and $\Delta Cycle$ as well as our three control variables:

$$\gamma' Z_i = \gamma_0 + \gamma_1 Distress_i + \gamma_2 \Delta Cycle_i + \gamma_3 Size_i + \gamma_4 Profmarg_i + \gamma_5 Secured_i \tag{9}$$

In the probit regression, the dependent variable takes the value 0 if firm i selects a prepack filing (53 cases) and 1 if it selects a regular filing (207 cases). Importantly, the estimation does not produce a statistically significant coefficient for either of the two fire-sale variables. Of the control variables, $Secured$ and $Size$ receive statistically significant coefficients. The greater the proportion secured debt (tangible assets) and the smaller the firm, the lower the probability of a prepack choice. The probit regression as a whole is statistically significant only at the 16% level (using a standard χ^2 test).

In the second step, we form the inverse Mill's ratio and include this in the regressions of Table 8. The results are reported in Table 10. The coefficient estimates of the Mill's ratio are statistically insignificant in all but the first regression of Panel B (where the sample includes going-concern auctions only). Whenever the Mill's ratio receives an insignificant coefficient, there is no change in the key statistical inferences from Table 8.[29] Comparing the first regression of Panel B across Table 8 and Table 10, the Mill's ratio receives a coefficient of -11.1 (p-value of 0.09) and it produces a marginally significant coefficient for $Distress$, $Size$ and $Profmarg$. The coefficient for $Distress$ changes from 0.2 (p-value of 0.66) in Table 8 to 2.0 (p-value 0.07) in Table 10. The positive premium effect of $Distress$ is puzzling and cannot be explained by fire-sale arguments. Moreover, inclusion of the Mill's ratio does not alter the sign, magnitude or statistical significance of the overbidding

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[29]In these regressions, the only change from including the inverse Mill's ratio is to make the variable $Bids$ and $Secured$ consistently insignificant.

variable R_L. Overall, there is no evidence that the estimates of Table 8 reflect a selection bias from the prepack choice.

6.4 Do fire-sale conditions drive salebacks and bank financing?

In the previous section, we performed a Heckman correction for prepacks because premium data is unavailable for these outcomes. Saleback and bank-financing of the winning bidder are also interesting choice variables. Since these subsamples are already represented in the premium regressions above, they do not give rise to selection bias issues. However, the determinants of the probabilities of these auction outcomes are interesting in their own right. To identify potential effects of fire-sale conditions, we separate out piecemeal liquidation outcomes using a multinomial logit technique.

Let $\pi_n(Z_i)$ denote the probability of auction outcome $n = 1, 2, 3$ conditional on the model $\gamma' Z$ given by Eq. (10). We estimate $\pi_n(Z_i)$ using multinomial logit:

$$\pi_n(Z_i) = \exp(\gamma'_n Z_i) / \sum_{n=1}^{3} \exp(\gamma'_n Z_i). \tag{10}$$

A change in the value of the single characteristic z_k in Z changes all probabilities simultaneously. For each outcome probability, we compute the partial derivative as

$$\partial \pi_n / \partial z_k = \pi_n(\gamma_{kn} - \sum_{e=1}^{3} \gamma_{ek} \pi_e). \tag{11}$$

The partial derivatives and the corresponding asymptotic p-values are listed in Table 11 for three sets of three auction outcomes. The three outcomes always include piecemeal liquidation. In Panel A, the two remaining outcomes are auction prepack and going-concern auction. Panel B focuses on saleback versus non-saleback, and Panel C on whether the old bank versus a new bank finances the winning bidder.

Panel A reveals that the probability of a going concern auction increases with $\Delta Cycle$, i.e., is higher following a business cycle upturn (p-value of 0.06). The coefficient estimate for $\Delta Cycle$ is greater for going-concern auctions than for either prepacks and piecemeal liquidations. Thus, prepacks are somewhat similar to piecemeal liquidations in terms of the impact of business cycle conditions, possibly reflecting the use of prepacks to reduce the risk of fire-sale. As before, prepacks

are more likely the lower the fraction secured debt.[30]

Panel B of Table 11 focuses on the saleback decision. Interestingly, salebacks are more likely following a business cycle upturn. There is no significant impact of *Distress*. Thus, there is no evidence that salebacks represent an endogenous response to the risk of fire-sale. A similar conclusion follows for the bank-financing decision in Panel C, where both fire-sale variables receive statistically insignificant coefficient estimates. In sum, while there is some evidence that prepacks emerge in response to low market conditions (as measured by $\Delta Cycle$), neither the saleback decision nor the bank financing decision appear to be driven by concerns with fire-sales.

7   Conclusions

The attractiveness of the auction mechanism for restructuring bankrupt firms as going concerns depends in general on market liquidity conditions and the degree of competition among bidders. With a sample of 263 Swedish mandatory bankruptcy auctions from the period 1/1988–12/1991, we investigate bidder frequencies and determinants of final auction premiums. Since the auction mechanism is automatic, the sample allows interesting tests of the potential for fire-sale conditions to lower auction premiums. We also develop and test a theoretical model which points to the incentive of the bankrupt firm's bank (effectively the residual claimant of the firm) to add liquidity and increase auction prices.

The theoretical analysis starts with the observation that in Sweden, banks are prohibited from bidding directly in the auction. However, the banks of the filing firms frequently finance a bidder. We show that the bank-bidder coalition effectively gets around the institutional constraint on bank bidding. The coalition optimally bids above the coalition-bidder's own private valuation of the bankrupt firm (coalition overbidding). Several factors affect the feasibility of coalition formation and the magnitude of overbidding:

> **Theoretical results:** *(1) The optimal coalition bid (i) equals the price of a monopolist seller if the bank is the sole senior creditor and it does not expect full recovery from the auction, (ii) is lower the greater the expected recovery rate, and (iii) is lower the greater the number of creditors in the same priority class as the bank. (2) Coalition*

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[30]Recall that the Heckman procedure of the previous section failed to identify a premium effect of this selection.

> *formation and overbidding is more likely when the bank's loan is personally guaranteed*
> *by the management of the bidder firm.*

As to item (1), maximum (unrestricted) overbidding occurs when the bank is the sole residual claimant, and it does not expect full recovery from the sale of the firm. The overbidding amount is lower if the bank expects full repayment, or if it must share the auction proceeds with members of its debt class. As to item (2), if the incumbent management has issued a personal loan guarantee to the bank, the management has its own incentive to overbid (to reduce its liability). This in turn reduces the minimum transfer from the bank necessary to induce bidder participation in the coalition.

The empirical analysis has two parts. The first describes bid frequencies, patterns in bank-financing of the winning bidder, and of average auction premiums. The results are summarized as follows:

> **Empirical results 1:** *(1) The average number of actual bidders (and bidders expressing serious interest in placing a bid) is 10 (and 11) in auctions resulting in piecemeal liquidations, 3 (6) across all going-concern auctions, and 3 (5) in going-concern auctions resulting in a saleback to the old owners/managers. (2) Bank financing of the winning bidder occurs in 48% of the going-concern sales in 49% of the salebacks. (3) The going-concern premium paid by the winning bidder (final price divided by the trustee's estimate of the firm's piecemeal liquidation value, minus one) averages 8% for piecemeal liquidations, 125% for going-concern sales, and 131% for going-concern auctions resulting in a saleback.*

Item (1) shows that the auctions generate bidder competition, also in salebacks. Item (2) shows that the propensity for the bank to finance the winning bidder is substantial, and no greater for salebacks than for going-concern auctions where the firm is sold to outside investors. Item (3) shows that the going-concern premium paid by the winning bidder is no smaller in salebacks than in sales to outside investors. Collectively, these three items indicate that the process leading to a saleback faces similar bidder competition and scrutiny as sales to outside investors. The premium evidence also runs counter to the argument that salebacks involve self-dealing.

The 8% average premium in auctions resulting in piecemeal liquidations indicates that the

trustee's estimate of the piecemeal liquidation value (which is announced at the beginning of the auction) is unbiased for the piecemeal liquidation price paid at the end of the auction. Thus, deflating the final price paid in a going-concern sale with the initial piecemeal liquidation value estimate provides an unbiased estimate of the going-concern premium paid. In the second part of our empirical analysis, we run cross-sectional regressions with this going-concern premium as dependent variable. The explanatory variables are given by our overbidding theory as well as by asset-fire sale arguments.

The key variable from the overbidding theory is the bank's recovery rate at the piecemeal liquidation value estimate, R_L, which is observable at the beginning of the auction. The lower R_L, the greater the bank's incentive to overbid and the greater the predicted going-concern premium paid by the winner in the auction. The key fire-sale variables are the degree of industry-wide distress and the recent (six-month) change in the business cycle.[31] If the auction is impacted by fire-sale conditions, we expect auction premiums to be lower the greater the industry-wide distress and following a business cycle downturn. The results are as follows:

Empirical results 2: *(1) In cross-sectional regressions with the auction premium as dependent variable, the coefficient estimate on R_L is significantly negative for going-concern sales, zero for piecemeal liquidation outcomes, and unaffected by whether or not the regression includes fire-sales variables. (2) Fire-sales variables receive insignificant coefficient estimates, also when using the piecemeal liquidation value estimate itself as dependent variable. (3) The conclusions concerning the overbidding theory and the fire-sale hypothesis are robust to a two-step (Heckman) correction for a potential self-selection bias due to the prepack filing choice. (4) Multinomial probability estimation indicates that going-concern auctions and salebacks are more likely following a business cycle upturn, while the probability of bank financing of the winning bidder is independent of fire-sale conditions. (5) There is little evidence of a conflict of interest between the bank and junior creditors in saleback transactions.*

The evidence in item (1) is consistent with the prediction of the overbidding theory. The evidence in items (2) and (3) fail to support the hypothesis that fire-sale conditions impact auction premiums.

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[31]The actual number of bids, and a dummy for case where the buyer is an industry outsider were also included but without affecting the conclusions.

This conclusion is robust with respect to the potential effect of fire-sale conditions on the piecemeal liquidation estimate itself, and to potential selection bias from a prepack filing decision. Multinomial logit estimation shows that going-concern auctions (relative to prepacks and piecemeal liquidations) are more likely following a business cycle upturn. This also suggests that prepacks in part are selected to counteract conditions of low market demand.

A   Proof of Proposition 2

The proof involves showing that $\partial E(p_c)/\partial R_L < 0$ and that $\partial E(P - V_L)/\partial p_c > 0$.[32] First, using the integral limits defined in Proposition 1, we have that

$$E(p_c) = \int_0^{B-h(p_c)} [v_1 + h(p_c)]g(v_1)dv_1 + \int_{B-h(p_c)}^{B} Bg(v_1)dv_1 + \int_B^1 v_1 g(v_1)dv_1 \qquad (12)$$

Replacing B with $f(R_L) \equiv V_L/R_L$, and defining $k(R_L) \equiv f(R_L) - h(p_c)$:

$$E(p_c) = \int_0^{k(R_L)} [v_1 + h(p_c)]g(v_1)dv_1 + f(R_L)[G(f(R_L)) - G(k(R_L))] + \int_{f(R_L)}^1 v_1 g(v_1)dv_1 \qquad (13)$$

The first-order condition with respect to R_L is

$$\begin{aligned}
\frac{\partial E(p_c)}{\partial R_L} &= [k(R_L) + h(p_c)]g(k(R_L))k'(R_L) + f'(R_L)[G(f(R_L)) - G(k(R_L))] \\
&\quad + f(R_L)[g(f(R_L))f'(R_L)) - g(k(R_L))k'(R_L)] - f(R_L)g(f(R_L))f'(R_L) \qquad (14)
\end{aligned}$$

Since $f'(R_L) = k'(R_L) = -V_L/R_L^2 < 0$ and $f(R_L) > k(R_L)$:

$$\frac{\partial E(p_c)}{\partial R_L} = f'(R_L)[G(f(R_L)) - G(k(R_L))] < 0 \qquad (15)$$

Second, the expected going-concern premium paid in the auction, $E(P - V_L)$, equals the expected revenue to the bank from (unconstrained) coalition bidding (areas $C + D + E$ in Figure 1):

$$E(P - V_L) = \int_0^1 \left\{ \int_0^{p_c(v_1)} p_2 g(p_2)dp_2 + p_c(v_1)[1 - G(p_c)] \right\} g(v_1)dv_1 = \int_0^1 I(p_c)g(v_1)dv_1. \qquad (16)$$

To conclude that $\partial E(P - V_L)/\partial p_c > 0$ it is sufficient to show that $\partial I(p_c)/\partial p_c > 0$:

$$\frac{\partial I(p_c)}{\partial p_c} = p_c g(p_c) + [1 - G(p_c)] - p_c g(p_c) = 1 - G(p_c) > 0. \qquad (17)$$

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[32]The derivatives are equal to zero for the highest type, $v_1 = 1$, which we ignore.

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Table 1: Key provisions of the Swedish auction bankruptcy system

Provision	Rules under Swedish auction bankruptcy	Rules under U.S. Chapter 11
Right to file for bankruptcy:	The firm or any individual creditor.	The firm or a joint filing of minimum 3 creditors with unsecured claims exceeding $ 5,000.
Control right to firm in bankruptcy:	The independent court-appointed trustee. Firm is auctioned off either piecemeal or as a going concern. All contracts (including workers) are necessarily terminated, subject to continued operations throughout the auction procedure. If sold as a going concern, buyer negotiates contract continuation	Incumbent management. A trustee takes control only in case of mis-management or fraud. Management has an exclusive right to propose a reorganization plan during the first 120 days, plus an additional 60 days to seek acceptance. Termination of contracts is at the discretion of firm.
Voting rules to approve of reorganization:	None. Firm is auctioned off.	1/2 in number of votes and 2/3 in value of the claims in the debt class.
Payment method:	Cash only.	Cash and securities, including common stock.
Absolute priority rules::	No deviations allowed.	Deviations frequently observed.
Seizure of collateral by secured creditors:	No seizure, except in very limited circumstances when the collateral is in the creditor's physical possession.	No seizure. All creditors are stayed.
Debt service during the proceeding:	Yes, on secured debt if the value of collateral is sufficiently high.	Yes, on secured debt if the value of collateral is sufficiently high.
Accrual of interest during the proceeding:	No. Interest and principal payments stop.	No. Interest and principal payments stop.
Debtor-in-possession financing in bankruptcy:	Yes. New debt with super priority can be raised, however, is rarely observed.	Yes. New debt with super priority can be raised and is frequently observed.
Government wage guarantee:	Yes, up to a certain limit.	No guarantee.

Table 2: Swedish bankruptcy sample description, 1988-1991

| | Total sample | | Auction prepack | | | Going-concern auction | | | Piecemeal liquidation |
	All	(%)	All[1]	Saleback	Non-saleback	All[1]	Saleback	Non-saleback	All
Manufacturing	76	(29)	17	11	4	44	28	16	15
Wholesale and Retail	46	(17)	13	8	3	24	13	11	8
Construction	33	(13)	4	2	2	22	18	4	7
Transportation	29	(11)	3	2	1	12	8	3	14
Hotels and Restaurants	26	(10)	9	5	4	12	4	8	5
Consulting	21	(8)	1	1	0	14	8	5	4
Real estate	12	(5)	2	1	1	5	2	2	5
Miscellaneous	20	(8)	4	2	2	14	9	5	2
Total	263	(100)	53	32	17	147	90	54	60

[1] Due to missing information on the identity of the buyer, the category "All" contains more cases than the sum of the subcategories "Saleback" and "Non-saleback".

Table 3: Bid frequencies, bank financing, auction premiums, and recovery rates

		Total sample	Going-concern auction			Auction prepack			Piecemeal liquidation
		All	All [1]	Saleback	Non-saleback	All[1]	Saleback	Non-saleback	All
A: Bid information									
Number of interested bidders [*Interest*]	Average	5.5	5.7	5.3	6.1	1.2	1.2	1.1	11.4
	Median	3.0	3.0	3.0	4.0	1.0	1.0	1.0	5.0
	N	156	102	55	46	33	24	8	20
Number of actual bids [*Bids*]	Average	3.6	3.2	3.0	3.5	1.2	1.2	1.0	9.8
	Median	2.0	2.0	2.0	3.0	1.0	1.0	1.0	5.0
	N	146	95	52	42	33	24	8	17
B: Bank financing									
Cases where the old bank finances the winning bidder[2] [*Bankfin*]	Number	64	44	31	13	20	15	5	n/a
	Total	132	95	63	31	35	24	10	
	Percent	48%	46%	49%	42%	57%	62%	50%	
C: Premiums and recovery rates									
Going-concern premium[3,4] $[(P/V_L^a)-1]$	Average	0.92	1.25	1.31	1.20	n/a	n/a	n/a	0.08
	Std dev	2.47	2.82	2.69	3.10				0.56
	N	188	135	83	50				50
Debt recovery rate	Average	0.34	0.39	0.38	0.41	0.32	0.29	0.37	0.26
	Std dev	0.21	0.19	0.19	0.18	0.23	0.21	0.25	0.24
	N	263	147	90	54	53	32	17	60
Bank liquidation recovery rate[4] [R_L]	Average	0.60	0.66	0.67	0.63	n/a	n/a	n/a	0.45
	Std dev	0.36	0.35	0.34	0.37				0.35
	N	198	141	88	50				55

[1] Due to missing information on the identity of the buyer, the category "All" contains more cases than the sum of the subcategories "Saleback" and "Non-saleback".

[2] Proportion going concern-auctions and prepacks in which the filing firm's bank versus a new bank financed the winning bid.

[3] The difference between the price paid in the auction P and the trustee's estimate of the piecemeal liquidation value of the auctioned assets V_L^a.

[4] In prepacks, the trustee typically does not report the estimate V_L, hence the missing information on the auction premium and R_L.

Table 4: Variable definitions

Variable name	Definition

A: Variables for tests of overbidding

R_L — Bank's liquidation recovery rate $R_L \in [0,1]$, obtained if the auction produces proceeds equal to the trustee's estimate of the firm's piecemeal liquidation value (V_L).

Piecemeal — Binary variable indicating that the firm is liquidated piecemeal (x_j=1) vs. sold as going concern in the auction or in a prepack (x_j=0).

B: Variables for tests of 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 (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.

ΔCycle — Change in the equal-weighted quarterly 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 with the sign indicated in parenthesis.

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).

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).

Bids — Number of actual bids submitted in the auction.

Interest — Number of potential bidders expressing an interest for bidding in the auction.

C: Miscellaneous control variables

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 (EBITDA divided by sales) and the contemporaneous median operating margin for all 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.

Table 5: Sample (Pearson) correlations of firm and auction characteristics

A: Sample of going concern auctions and piecemeal liquidations

	Overbidding		Asset fire-sale		Misc. control variables		
	R_L	Piecemeal	Distress	ΔCycle	Size	Profmarg	Secured
R_L	1.000						
Piecemeal	-0.254***	1.000					
Distress	-0.086	0.082	1.000				
ΔCycle	-0.057	-0.134*	0.106	1.000			
Recovery	0.393***	-0.287***	0.040	-0.016			
Size	-0.049	-0.021	-0.048	-0.094	1.000		
Profmarg	-0.075	-0.077	0.016	0.029	0.023	1.000	
N	196	207	207	207	205	204	207

B: Sample of going concern auctions

	Over-bidding	Asset fire-sale variables					
	R_L	Distress	ΔCycle	Saleback	Bankfin	Bids	Interest
R_L	1.000						
Distress	-0.076	1.000					
ΔCycle	-0.070	0.131	1.000				
Saleback	0.054	-0.053	0.129	1.000			
Bankfin	0.068	0.040	-0.018	0.069	1.000		
Bids	-0.089	-0.089	0.011	-0.063	0.076	1.000	
Interest	-0.007	0.010	-0.029	-0.060	0.007	0.625***	1.000
N	141	147	147	144	95	95	102

1 ***, ** and * indicates significantly different from zero at the 1%, 5% and 10% level (two-tailed test), respectively.

Table 6: Tests of the overbidding hypothesis

The table reports OLS coefficient estimates in regressions with the auction premium $\ln(P/V_L^a)$ as dependent variable. p-values (and the degrees of freedom for R^2) are in parentheses.

| | Overbidding variables | | | | Misc. control variables | | | | | |
Constant	Piecemeal	R_L	R_L*Piecemeal	R_L* Concern	Size	Profmarg	Secured	Adj. R^2	F-value	N
A: Total sample of 173 going concern auctions and piecemeal liquidations										
0.913	-0.579	-0.881			0.018	-0.049	-0.647	0.142	6.748	173
(0.354)	(0.000)	(0.000)			(0.776)	(0.910)	(0.035)	(df=5)	(0.000)	
1.185	-1.122		-0.133	-1.134	0.013	0.028	-0.691	0.169	6.849	173
(0.225)	(0.000)		(0.704)	(0.000)	(0.836)	(0.948)	(0.023)	(df=6)	(0.000)	
1.185	-1.122	-1.134	1.001		0.013	0.028	-0.691	0.169	6.849	173
(0.225)	(0.000)	(0.000)	(0.013)		(0.836)	(0.948)	(0.023)	(df=6)	(0.000)	
B: Sample of 118 going concern auctions and piecemeal liquidations restricted to cases where $R_L<1$										
0.833	-0.716	-0.806			0.031	-0.138	-0.848	0.177	6.060	118
(0.490)	(0.000)	(0.003)			(0.697)	(0.768)	(0.025)	(df=5)	(0.000)	
0.885	-1.094		-0.182	-1.006	0.036	-0.035	-0.893	0.187	5.524	118
(0.461)	(0.000)		(0.704)	(0.001)	(0.639)	(0.940)	(0.018)	(df=6)	(0.000)	
0.885	-1.094	-1.066	0.885		0.036	-0.035	-0.893	0.187	5.524	118
(0.461)	(0.000)	(0.001)	(0.120)		(0.639)	(0.940)	(0.018)	(df=6)	(0.000)	

Table 7: Further tests of the overbidding hypothesis

The table reports OLS coefficient estimates in regressions with the auction premium $\ln(P/V_L{}^a)$ as dependent variable. p-values (and the degrees of freedom for R^2) are in parentheses.

| | Overbidding variables | | | | Misc. control variables | | | | | |
Constant	Bankfin	R_L	R_L* Bankfin	R_L*Non-Bankfin	Size	Profmarg	Secured	Adj. R^2	F-value	N
A: Sample of 44 piecemeal liquidations										
-0.620		-0.124			0.050	-0.103	-0.542	-0.076	0.219	44
(0.746)		(0.741)			(0.686)	(0.842)	(0.368)	(df=4)	(0.926)	
B: Sample of 84 going concern auctions										
1.695	0.362	-1.339			-0.023	-0.704	-0.457	0.261	6.940	84
(0.210)	(0.031)	(0.000)			(0.782)	(0.473)	(0.280)	(df=5)	(0.000)	
1.448	1.048		-1.870	-0.865	-0.028	-0.928	-0.447	0.299	6.967	84
(0.273)	(0.003)		(0.000)	(0.007)	(0.733)	(0.335)	(0.278)	(df=6)	(0.000)	

Table 8: Tests of overbidding versus fire-sales

The table reports OLS coefficient estimates in regressions with the auction premium $\ln(P/V_L^a)$ as dependent variable. p-values (and the degrees of freedom for R^2) are in parentheses.

| | Overbidding variables | | | Asset-fire sale variables | | | | Misc. control variables | | | | | |
Constant	r_L	Piecemeal	Bankfin	Distress	ΔCycle	Saleback	Bids[1]	Size	Profmarg	Secured	Adj. R^2	F-value	N
A: Sample of going concern auctions and piecemeal liquidations													
0.609	-0.862	-0.563		0.369	0.022			0.028	-0.087	-0.687	0.143	5.125	173
(0.546)	(0.000)	(0.000)		(0.365)	(0.317)			(0.662)	(0.843)	(0.026)	(df=7)	(0.000)	
-0.273		-0.474		0.265	0.022			0.040	0.055	-0.270	0.044	2.393	181
(0.795)		(0.001)		(0.520)	(0.345)			(0.549)	(0.905)	(0.354)	(df=6)	(0.030)	
B: Sample of going concern auctions													
1.237	-1.124			0.205	0.018	0.138		0.021	0.327	-0.781	0.154	4.276	126
(0.306)	(0.000)			(0.662)	(0.522)	(0.339)		(0.978)	(0.711)	(0.032)	(df=7)	(0.000)	
1.185				0.210	0.014	0.075		0.010	0.442	-0.238	-0.036	0.231	131
(0.888)				(0.687)	(0.646)	(0.636)		(0.903)	(0.647)	(0.507)	(df=6)	(0.966)	
1.446	-1.321		0.353	-0.477	0.005	0.118		0.001	-0.828	-0.505	0.267	4.818	84
(0.310)	(0.000)		(0.037)	(0.372)	(0.139)	(0.497)		(0.994)	(0.399)	(0.234)	(df=8)	(0.000)	
0.072			0.272	-0.363	0.005	0.197		0.013	0.273	0.186	-0.006	0.929	84
(0.965)			(0.164)	(0.561)	(0.169)	(0.331)		(0.898)	(0.808)	(0.695)	(df=7)	(0.489)	
1.434	-1.226			0.459	0.027	0.172	-0.011	-0.008	0.352	-0.926	0.151	2.850	83
(0.334)	(0.000)			(0.447)	(0.943)	(0.349)	(0.613)	(0.926)	(0.757)	(0.060)	(df=8)	(0.008)	
2.296	-1.611		0.476	-0.472	0.013	0.090	0.005	-0.028	-1.548	-1.265	0.300	3.625	55
(0.168)	(0.000)		(0.044)	(0.483)	(0.765)	(0.684)	(0.900)	(0.783)	(0.256)	(0.047)	(df=9)	(0.002)	
1.054			0.082	-0.271	0.062	0.374	0.100	-0.065	1.127	0.133	0.044	1.313	55
(0.579)			(0.742)	(0.729)	(0.222)	(0.134)	(0.030)	(0.576)	(0.422)	(0.829)	(df=8)	(0.260)	
C: Sample of piecemeal liquidations													
-0.938	-0.097			0.786	0.022			0.053	-0.182	-0.660	-0.096	0.360	44
(0.631)	(0.800)			(0.399)	(0.584)			(0.676)	(0.730)	(0.286)	(df=6)	(0.899)	

Table 9: Effect of fire-sale conditions on the piecemeal liquidation value estimate

The table reports OLS coefficient estimates in regressions with the trustee's piecemeal liquidation value estimate V_L as dependent variable. p-values (and the degrees of freedom for R^2) are in parentheses.

| | Overbidding variables | | Asset-fire sale variables | | | | Misc. control variables | | | | | |
Constant	Piecemeal	Bankfin	Distress	ΔCycle	Saleback	Bids	Size	Profmarg	Secured	Adj. R^2	F-value	N
A: Dependent variable $\ln(V_L)$. Sample of going concern auctions and piecemeal liquidations												
1.990	-1.006		0.118	0.002			0.769	-1.184	0.423	0.401	23.499	202
(0.131)	(0.000)		(0.817)	(0.935)			(0.000)	(0.031)	(0.233)	(df=6)	(0.000)	
B: Dependent variable $\ln(V_L)$. Sample of going concern auctions												
2.132			0.054	0.007	-0.036		0.765	-0.776	0.404	0.426	18.592	142
(0.101)			(0.916)	(0.817)	(0.816)		(0.000)	(0.368)	(0.244)	(df=6)	(0.000)	
1.662		0.187	-0.036	-0.001	-0.259		0.810	-2.008	-0.039	0.463	12.679	95
(0.306)		(0.325)	(0.955)	(0.968)	(0.193)		(0.000)	(0.066)	(0.932)	(df=7)	(0.000)	
1.399		0.512	-0.412	-0.072	-0.179	-0.056	0.837	-3.326	-0.222	0.535	10.046	63
(0.445)		(0.027)	(0.570)	(0.114)	(0.447)	(0.195)	(0.000)	(0.010)	(0.696)	(df=8)	(0.000)	
C: Dependent variable V_I/A. Sample of going concern auctions and piecemeal liquidations												
-1.600	-0.994		0.186	0.014				-1.170	0.101	0.129	6.997	202
(0.000)	(0.000)		(0.720)	(0.633)				(0.036)	(0.767)	(df=5)	(0.000)	
D: Dependent variable V_I/A. Sample of going concern auctions												
-1.493			0.039	0.020	-0.026			-0.839	0.062	-0.026	0.289	142
(0.000)			(0.941)	(0.507)	(0.870)			(0.344)	(0.852)	(df=5)	(0.918)	
-1.329		0.229	0.007	0.007	-0.207			-2.110	-0.380	0.005	1.083	93
(0.001)		(0.242)	(0.991)	(0.853)	(0.312)			(0.061)	(0.390)	(df=6)	(0.379)	
-1.176		0.548	-0.255	-0.076	-0.136	-0.067		-3.303	-0.554	0.091	1.870	61
(0.018)		(0.023)	(0.733)	(0.116)	(0.573)	(0.138)		(0.014)	(0.318)	(df=7)	(0.093)	

Table 10: Premium regressions with correction for auction prepack selection

The table reports OLS coefficient estimates in regressions with the auction premium $\ln(P/V_L{}^a)$ as dependent variable. The variable $\phi(\gamma'Z)/\Phi(\gamma'Z)$ is constructed from a probit regression for the decision to file a prepackaged bankruptcy filing.[1] p-values (and the degrees of freedom for R^2) are in parentheses.

		Overbidding variables			Asset-fire sale variables				Misc. control variables						
Constant	r_L	Piecemeal	Bankfin	Distress	ΔCycle	Saleback	Bids	Size	Profmarg	Secured	$\dfrac{\phi(\gamma'Z)}{\Phi(\gamma'Z)}$	Adj. R^2	F-value	N
A: Sample of going concern auctions and piecemeal liquidations														
-0.690	-0.879	-0.558		0.800	0.021			0.175	0.353	-1.599	-2.429	0.148	4.728	173
(0.816)	(0.000)	(0.000)		(0.377)	(0.344)			(0.599)	(0.729)	(0.458)	(0.651)	(df=8)	(0.000)	
-1.525		-0.463		0.685	0.020			0.179	0.483	-1.141	-2.279	0.040	2.061	181
(0.619)		(0.001)		(0.472)	(0.410)			(0.603)	(0.650)	(0.611)	(0.682)	(df=7)	(0.050)	
B: Sample of going concern auctions														
-4.488	-1.190			2.029	0.016	0.126		0.673	2.555	-5.140	-11.095	0.188	4.600	126
(0.201)	(0.000)			(0.068)	(0.540)	(0.366)		(0.092)	(0.090)	(0.050)	(0.087)	(df=8)	(0.000)	
-2.824				1.190	0.012	0.053		0.356	1.714	-2.457	-5.655	-0.039	0.313	131
(0.470)				(0.328)	(0.698)	(0.733)		(0.420)	(0.310)	(0.393)	(0.426)	(df=7)	(0.947)	
-0.765	-1.381		0.356	0.280	0.055	0.111		0.254	0.102	-2.075	-4.159	0.322	5.322	84
(0.872)	(0.000)		(0.027)	(0.843)	(0.079)	(0.495)		(0.638)	(0.960)	(0.563)	(0.629)	(df=9)	(0.000)	
-1.667			0.294	0.251	0.055	0.177		0.200	1.063	-0.916	-2.973	-0.002	0.981	81
(0.774)			(0.128)	(0.884)	(0.150)	(0.369)		(0.761)	(0.664)	(0.833)	(0.776)	(df=8)	(0.458)	
-2.714	-1.273			1.839	0.003	0.149	-0.031	0.486	2.136	-4.004	-8.347	0.205	3.319	83
(0.517)	(0.000)			(0.174)	(0.922)	(0.394)	(0.185)	(0.308)	(0.225)	(0.200)	(0.285)	(df=9)	(0.002)	
3.123	-1.781		0.491	-0.502	0.028	-0.017	-0.053	-0.089	-1.766	-0.770	0.811	0.390	4.388	55
(0.588)	(0.000)		(0.019)	(0.769)	(0.492)	(0.933)	(0.299)	(0.891)	(0.468)	(0.858)	(0.938)	(df=10)	(0.000)	
2.306			0.183	-0.623	0.071	0.308	0.047	-0.229	0.318	1.458	3.126	-0.049	0.726	55
(0.760)			(0.474)	(0.781)	(0.183)	(0.243)	(0.460)	(0.789)	(0.919)	(0.795)	(0.820)	(df=9)	(0.682)	

[1] ϕ_i is the standard normal density and Φ_i is the cumulative normal distribution function evaluated at $\gamma'Z_i$, where $\gamma'Z_i \leq 0$ is the probit choice model for auction prepack.

Table 11: Multinomial estimates of auction outcome probabilities

Coefficient estimates in a multinomial logit estimation of the probability for bankruptcy outcomes prior to the bankruptcy. Table shows the partial derivatives of probabilities with respect to the vector of characteristics, computed at the variable means filing (p-value in parenthesis).[1]

Bankruptcy outcome:	Constant	Asset fire-sale variables		Miscellaneous control variables		
		Distress	*ΔCycle*	*Size*	*Profmarg*	*Secured*
A. Auction prepack						
Auction prepack (π_1)	-0.742 (0.100)	0.123 (0.436)	-0.005 (0.601)	0.043 (0.119)	0.147 (0.509)	-0.302 (0.025)
Going concern auction (π_2)	0.637 (0.210)	-0.297 (0.133)	0.023 (0.061)	-0.018 (0.560)	0.082 (0.736)	0.122 (0.370)
Piecemeal liquidation (π_3)	0.105 (0.807)	0.174 (0.288)	-0.018 (0.106)	-0.024 (0.371)	-0.228 (0.226)	0.018 (0.137)

N=257, Log likelihood=-244.28, LRT=16.58, df=10 (p=0.084). Probabilities at the mean vector are 0.198, 0.580, and 0.222, respectively [2]

B. Saleback						
Saleback (π_1)	0.255 (0.625)	-0.347 (0.107)	0.027 (0.042)	0.011 (0.736)	0.442 (0.138)	-0.236 (0.112)
Non-saleback (π_2)	-0.388 (0.418)	0.138 (0.459)	-0.008 (0.491)	0.016 (0.593)	-0.166 (0.463)	0.025 (0.843)
Piecemeal liquidation (π_3)	0.132 (0.759)	0.210 (0.224)	-0.019 (0.103)	-0.027 (0.331)	-0.276 (0.167)	0.211 (0.093)

N=250, Log likelihood= -255.12, LRT=13.59, df=10 (p=0.192). Probabilities at the mean vector are 0.484, 0.290, and 0.226, respectively [2]

C. Bank financing of the winning bidder						
Old bank financing(π_1)	0.111 (0.845)	0.029 (0.897)	0.002 (0.881)	0.003 (0.939)	0.486 (0.135)	-0.334 (0.066)
New bank financing (π_2)	-0.558 (0.346)	-0.240 (0.311)	0.018 (0.187)	0.040 (0.275)	-0.167 (0.499)	0.088 (0.599)
Piecemeal liquidation (π_3)	0.448 (0.420)	0.211 (0.332)	-0.020 (0.148)	-0.043 (0.227)	-0.319 (0.185)	0.246 (0.144)

N=188, Log likelihood= -199.94, LRT=12.63, df=10 (p=0.245). Probabilities at the mean vector are 0.338, 0.355, and 0.307, respectively [2]

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[1] The partial derivatives are given by $\partial \pi_n / \partial z_k = \pi_n (\gamma_{kn} - \sum_{e=1}^{3} \gamma_{ek} \pi_e)$, where the multinomial logit model has the form $\pi_n(Z_i) = \exp(\gamma'_n Z_i) / \sum_{n=1}^{3} \exp(\gamma'_n Z_i)$.

[2] The likelihood ratio test (LRT) compares the performance of the model to a model with only constants. The test is distributed χ^2 with degrees of freedom equal to the total number of estimated slope coefficient (two models with five estimated slope coefficients each).

v₁

Figure 1: Expected bidding profits

The figure is drawn assuming bidder valuations are distributed uniform, $v_i \sim U[0,1]$. $G(v)$ is the cumulative distribution over v. Bidder 2's optimal bid is $p_2=v_2$ and the coalition's optimal bid is p_c. Area A is the expected profits to Bidder 1 and C is the bank's expected profit under non-cooperative bidding. With coalition bidding, area E is bidder 1's expected cost of overbidding (when the coalition wins and pays $v_2>v_1$). Area A+C+D is the coalition's total expected profit, and area D is the coalition's expected net surplus from overbidding.
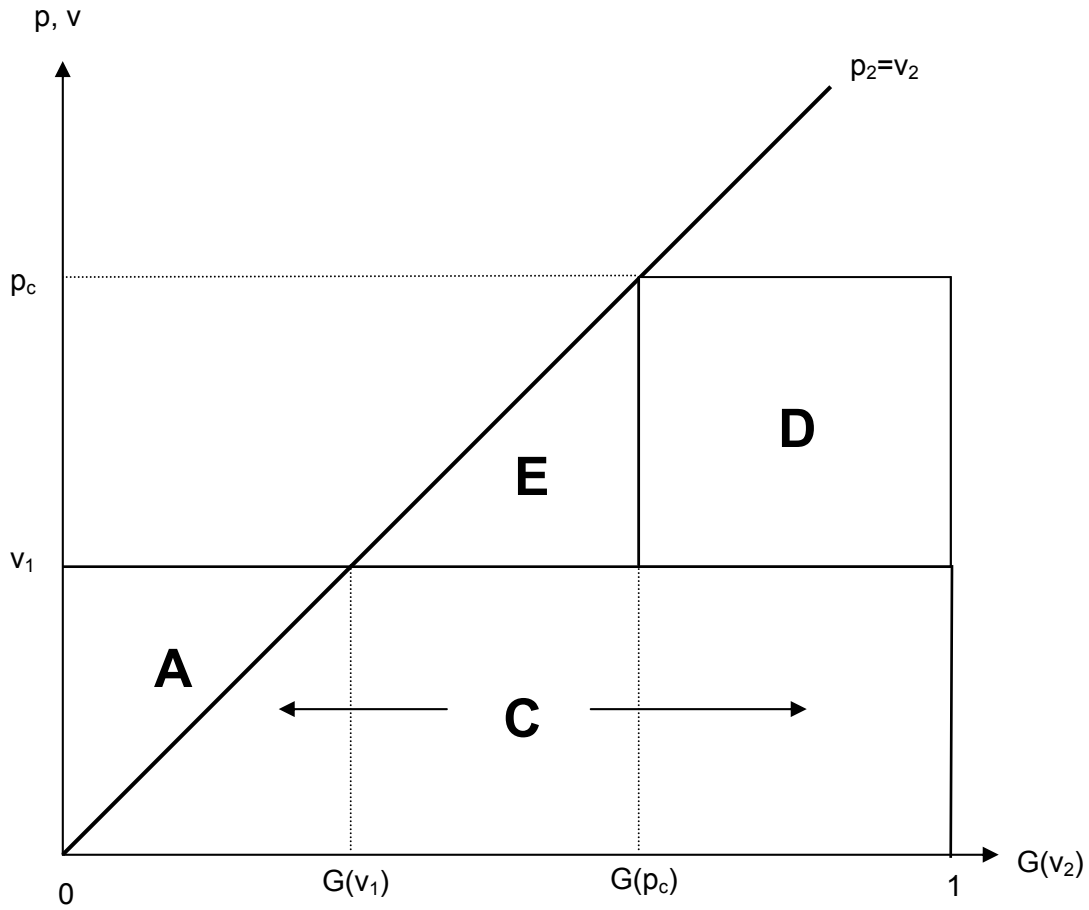
Figure 2: The bank-bidder coalition's optimal bid price $p_c(v_1)$

The figure is drawn assuming bidder valuations are distributed uniform, $v_i \sim U[0,1]$, and that the piecemeal liquidation value is zero, $V_L=0$. The coalition's private valuation is v_1, B is the face value of the bank's debt, and $h(p_c)$ is the inverse hazard rate at p_c. When $v_1 \leq 2B-1$, the coalition fully overbids, $p_c=(v_1+1)/2$. When $B>v_1>2B-1$, the coalition partially overbids, $p_c=B$. When $v_1 \geq B$, the coalition does not overbid, $p_c=v_1$.
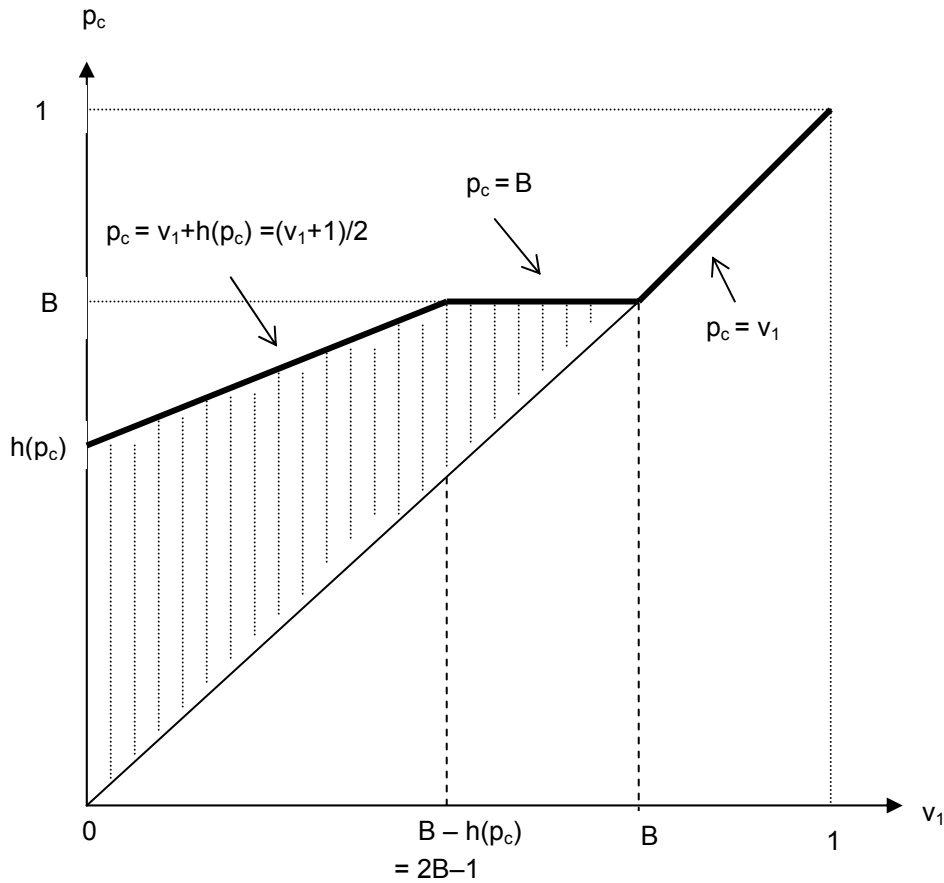
Figure 3: Frequency distributions of the number of interested bidders and actual auction bids

Sample consists of 102 (non-prepack) going concern auctions with available bid information. In the group of 13+, the maximum numbers of interested bidders and actual bids are 40 and 22, respectively.

Number of
bankruptcy auctions
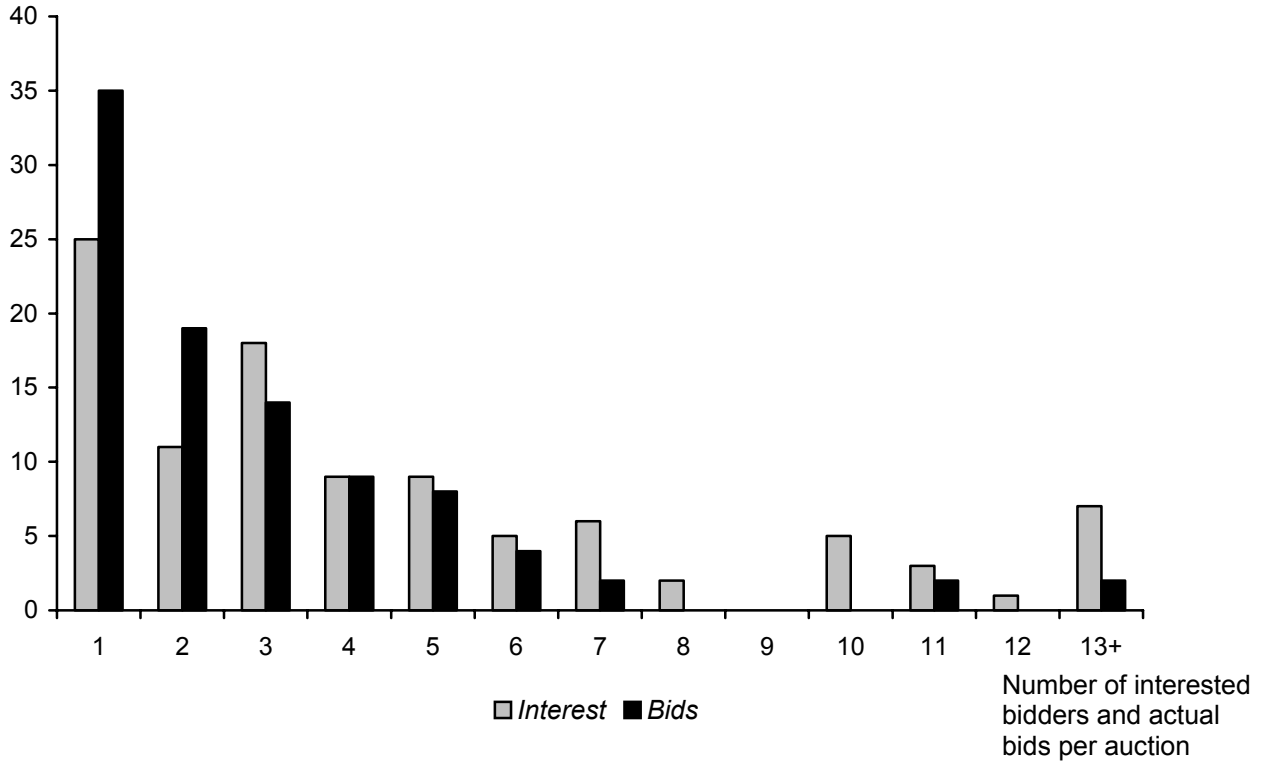
Figure 4: Frequency distribution of the piecemeal liquidation recovery rate

The piecemeal liquidation recovery rate is $R_L=\min[B/V_L, 1]*100\%$. Sample of 196 bankruptcy auctions, excluding auction prepack filings.