

Equity and Cash in Intercorporate Asset Sales: Theory and Evidence

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Abstract

We develop a two-sided asymmetric information model of asset sales, that incorporates the key differences from mergers, and allows the information held by each party to be impounded in the transaction. Buyer information is conveyed through a first-stage competitive auction. A seller with unfavorable information about the asset accepts the cash offer of the highest bidder. A seller with favorable information proposes a take-it-or-leave-it counteroffer that entails buyer equity. Thus, the cash-equity decision reflects seller, but not buyer, information in contrast to theoretical and empirical findings for mergers. The central prediction of our model is that there are relatively large gains in wealth for both buyers and sellers in equity-based asset sales, whereas cash asset sales generate significantly smaller gains that typically accrue only to sellers. Our empirical results are consistent with the predictions of our theoretical model.

Keywords: Asset sales, means of payment, auctions, two-sided asymmetric information.

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1. Introduction

Prior studies conclude that the sale of an operating asset, such as a production facility, a division, or a subsidiary, occurs when a corporation determines that it is no longer optimal for its strategic orientation and that another entity can generate more value from the asset. Maksimovic and Phillips (2001) provide evidence that asset sales allocate assets more efficiently across firms, and Jain (1985), Klein (1986), and Hite, Owers, and Rogers (1987) report positive valuation announcement effects for selling firms. In an asset sale the parties face a choice about the financial structure of the transaction, a decision that applies to other corporate investment decisions. This paper explains the choice between the use of equity versus cash in intercorporate asset sales. Our theoretical model provides valuable perspective as to why existing models of mergers, which generate predictions that are in sharp contrast to our model, are not useful for explaining intercorporate asset sales. The value of our model is heightened by the important empirical finding that equity as a means of payment in asset sales generates a more favorable market reaction than the use of cash (Slovin, Sushka, and Polonchek (2005)),¹ a finding corroborated in our empirical work, which uses a separate sample of equity-based asset sales, and that is contrary to the results reported in empirical studies of mergers.

Our analysis explains the choice of financial structure as an informationally efficient mechanism for the sale of an operating asset given that the seller and potential buyers possess private information. In our theoretical model, the private information held by each party is impounded in the transaction: the buyer's information through competitive bidding, and the seller's information through the financial structure of the transaction. As a result, the asset is allocated efficiently to the highest-value use. The model generates a rich set of predictions about the pattern of the overall wealth gains from intercorporate asset sales, the distribution of gains between buyers and sellers, and the determinants and valuation effects of the financial structure of the transaction. More specifically, the model predicts that the use of buyer equity in an asset

¹ Although empirical analyses almost uniformly study cash transactions, Slovin, Sushka, and Polonchek (2005) report that equity-based asset sales account for approximately one-quarter of large intercorporate asset sales in the United States during the period 1982 to 2000.

sale signals favorable information that enhances combined wealth gains and that the use of cash conveys less favorable information. Buyers and sellers obtain larger gains in value in equity-based asset sales than in cash transactions. Sellers obtain gains in both types of deals, but buyers can sustain losses in cash transactions. As to the distribution of gains, the model predicts that buyers obtain a significant share of overall gains in equity-based deals, but not in cash deals. Our work demonstrates that in an environment characterized by two-sided asymmetric information, equity as a means of payment in an asset sale has value-enhancing consequences, a finding that at first may seem at odds with conventional wisdom about equity issuance, and with the well-documented negative share price effects for equity-financed mergers or corporate investments (Myers and Majluf (1984)).

Our theoretical model incorporates important features that distinguish asset sales from mergers and related corporate control transactions. One, unlike mergers, asset sale decisions are governed by contract law and the business judgment rule, which obviates participation by shareholders. Thus, corporation law gives seller and buyer managers broad discretion to devise sales mechanisms and transaction structures. Moreover, an asset sale transaction entails a voluntary, definitive agreement between managers of the two firms. This treatment of asset sales is in contrast to the explicit role that target shareholders play in mergers because corporation law and statutes mandate that in a merger target shareholders have irrevocable voting and appraisal rights. Two, in an asset sale it is typically the seller that initiates the sale, in contrast to mergers, transactions that are typically initiated by buyers. Three, the seller in an asset sale fosters conditions for competitive and coetaneous bidding. Thus, the bidding in the initial phase of an asset sale can be characterized as an auction-like process that is followed by private negotiations between the seller and the selected buyer. In contrast, mergers are typically initiated by a single buyer, although there may be subsequent entry of other potential acquirers.

In an asset sale, each party can be expected to hold a fundamental and complementary set of private information. The seller holds detailed private information concerning factors such as the intrinsic quality and condition of the operating asset (including its contingent liabilities) that is material to valuing the asset,

and is not readily available to potential buyers. Each potential buyer has private information about its assets and about the value obtained when the asset-to-be-sold is conjoined with the buyer's existing assets. Our theoretical model captures this situation in a double signaling game that entails an auction-type procedure followed by a bilateral negotiation between the seller and the buyer that proposes the highest bid. In response to the seller's initiation of the selling process, buyers submit bids that can encompass any combination of cash and/or equity. In equilibrium, however, buyers submit only pure-cash bids because inclusion of an equity component would signal negative information to the seller and lessen the probability of winning the auction. Equilibrium bids signal each buyer's full set of private information. This signaling mechanism allows the seller to initiate an exclusive bilateral negotiation with the bidder that offers the highest value for the asset, that is, the highest (cash) bid. The negotiation stage takes the form of a take-it-or-leave-it counteroffer by the seller that encompasses buyer equity alone or in combination with cash.

We show that in the equilibrium of this negotiation stage when the seller's private information is that the asset value is of low quality, a cash transaction takes place with the bidder that makes the highest offer. However, when the seller privately observes that the asset is of high value, it makes a counteroffer that calls on the buyer to pay for the asset with buyer equity, thus credibly signaling the seller's favorable information about the high value of the asset. To ensure that a seller with a low-value asset does not imitate such an equity-based counterproposal, the seller of the high-value asset allows the buyer to gain a share of the value generated (i.e., the seller "leaves money on the table"). As a result, equity-based asset sales lead to greater expected gains in wealth for the buyer as well as for the seller, as reflected in a positive market valuation for both parties. In contrast, since a cash transaction occurs when the seller's private information indicates a low asset value, the market response can be non-positive for buyer value, while the market response for the seller is unambiguously positive, though lower than for equity deals.

Thus, the model predicts that cash asset sales generate small gains in combined wealth relative to equity-based asset sales, and that the gains from cash asset sales accrue predominantly to sellers. The model also predicts that the greater combined gains in value in equity-based transactions are shared by the buyer

and the seller, resulting in an increase in the market value of each firm. When viewed globally, that is, taking into account both cash and equity-based asset sales, buyers are expected to obtain a share of the gains from trade that corresponds to their information rent, which is the reward that elicits their willingness to participate in the game and to convey private information in the first-stage auction. Thus, a buyer's lack of profit in cash asset sales is more than compensated for by its positive expected return in equity-based transactions, reflecting the price a bidder is prepared to pay to win the first-stage auction and to obtain access to the greater expected profits that characterize equity-based deals.

Concerning the choice between cash and equity, the model predicts that equity transactions are more likely when the information held by the seller is important. In contrast, the model predicts that the probability of an equity transaction is not affected by a change in the importance of buyer information.

The predictions of the theoretical model are tested by analyzing samples of intercorporate sales of operating assets from 1989 through 2002. Because the model provides unambiguous predictions about combined wealth gains and the distribution of the gains, the samples of cash and equity-based asset sales consist of events in which both parties to the transaction are publicly traded companies. Since the wealth effects of an equity-based asset sale could reflect the valuation effects of creating a corporate equity blockholder in the buyer (Allen and Phillips (2000) and Slovin, Sushka, and Polonchek (2005)), the predictions of the model are tested by analyzing the share price effects of the set of equity-based asset sales that do not create a corporate blockholding in the buyer. In these transactions, the buyer common stock that represents consideration paid for the asset is distributed directly to the seller's shareholders.

For the equity-based asset sales, we find significant positive average excess returns of 6.9% for sellers and 3.4% for buyers, with combined gains of 4.2%. In contrast, for cash asset sales average excess returns are 1.4% to sellers and there are small negative returns to buyers that are not significant. For the full sample of asset sales, that is, equity-based plus cash asset sales, there is a positive average return to the set of all buyers and to the set of all sellers. When the combined gains are measured relative to the size of the transaction, the average combined excess return for asset sales is a significantly positive 40.2% for equity-

based deals compared to a negative, but not significant, average combined excess return for cash deals. Sellers capture about 60% of the total wealth gains in equity-based deals, but all of the gains in cash deals. We also find significant improvements in the subsequent industry-adjusted operating performance of buyers in equity-based deals, but not in cash deals. We estimate a logit model for the choice of the means of payment in asset sales. We model this decision as a function of firm characteristics that serve as proxies for asymmetric information. Consistent with the predictions of our theory, we find that it is asymmetric information about the seller, and not about the buyer, that influences the choice of equity versus cash in intercorporate asset sales. Overall, our work supports the importance of taking into account two-sided asymmetric information in analyzing intercorporate asset sales and demonstrates the importance of the link between the gains to an asset sale and the financial structure of the transaction.

The remainder of the paper is organized as follows. In Section 2 related literature is discussed, including a detailed comparison to merger models. In Section 3 the structure of the asset sale game is presented, and in Section 4 the major results are developed for the two-stage auction model wherein both parties have asymmetric information. In Section 5 sample development is described. In Section 6 empirical results that test the model's predictions are reported. Conclusions are offered in Section 7.

2. Related literature

2.1. Comparison with merger models

Asset sales have conventionally been considered a component of the theory and empirical work on mergers. There is, however, a striking contrast in theoretical predictions and empirical findings between mergers and asset sales regarding the financial structure of the transaction. In this section we discuss the key elements that drive these differences by comparing our theoretical model to important merger models, and we explain the economic background behind the different underlying assumptions.

Our theoretical and empirical finding that buyer equity is entailed in high-valued asset sales implies a hierarchy for cash and equity that is distinctive from that of mergers, contravening the presumption that asset sales can be viewed and modeled as a subcategory of mergers without a significant loss of

understanding. Empirical studies of mergers (Travlos (1987), Franks, Harris, and Mayer (1988), Asquith, Bruner, and Mullins (1983), and Servaes (1991)) show that cash offers are associated with significantly higher valuation effects than equity offers, results that are consistent with several theoretical studies of mergers that consider means of payment.

The theoretical merger models closest in spirit to our model of asset sales are Hansen (1987), Fishman (1989) and Eckbo, Giammarino, and Heinkel [EGH] (1990). As in the case of our model, in these merger models both acquirer and target have relevant private information about the value generated by the transaction. However, these models, and models based on one-sided private information held by acquirers (such as Berkovitch and Narayanan (1990)), predict a less favorable market reaction to equity-based transactions compared to cash transactions. This prediction is consistent with empirical work on mergers, but is opposite to empirical work on asset sales and to the predictions of our theoretical model.

There are two central differences between these mergers models and our model of asset sales that parallel important differences in the institutional and legal frameworks that govern these corporate transactions. One, corporation law requires that mergers be approved by a majority of target firm shareholders, whereas asset sales are a managerial decision governed by contract law and the business judgment rule which gives broad discretion to managers. Two, in asset sales the seller typically initiates the transaction, and encourages competition among bidders. As a result, we view asset sales as entailing a process of bidding that occurs through an auction-type structure where buyers make contemporaneous or coetaneous bids, followed by bilateral negotiations between the seller and the selected winning bidder. In contrast, in a merger one buyer typically initiates the process, and other bidders may emerge later, which has implications for the means of payment as shown in Fishman (1989). We argue that these two key differences and their respective representation in the theoretical models of asset sales versus mergers generate a systematic divergence in the choice of means of payment and its predicted effects.

Concerning the first difference, a fundamental precept of corporation law is that when there is a change in a corporation's charter, as is the case for the target of a merger, target shareholders hold an

irrevocable right to approve or reject any change. In formal terms, the transaction can occur only after the target shareholders have voted in favor of a valid (public) offer made by an acquirer firm. Any attempt by target managers to merge the firm into an acquirer is, in legal terms, only a non-binding recommendation to its shareholders. Moreover, corporation statutes provide a legal remedy in the form of appraisal to dissenting target shareholders.² An acquirer can also conduct the takeover of a firm via a tender offer to target firm shareholders who individually choose whether or not to tender their shares. This process is subject to the complex regulatory structure established by the Williams Act of 1968, which requires, among its many protective provisions, that bidders disclose considerable information, including plans for the target once the firms are merged, a minimum tender offer period, and a shareholder's right to withdraw tendered shares during the offer period.

A direct implication of corporate merger statutes is that when a final (public) bid is made, target shareholders then vote to accept or reject the offer. The analytical framework used in theoretical models in the merger literature closely accords with this legal and institutional structure by assuming that the final stage of the game entails a take-it-or-leave-it offer from the acquirer to the target. Thus, the acquirer necessarily formulates the structure of the last offer, and the only (although pivotal) decision target shareholders make is to accept or reject the offer. As a result, an acquirer's private information will, to a major extent, only be released through the structure of its public offer. Therefore, it is mainly buyer private information that determines the financial structure of the transaction. These merger models conclude that an acquirer prefers to pay with equity when it has unfavorable private information, implying that target shareholders are paid with overpriced securities, and an acquirer prefers to use cash when its private information is favorable.

²Appraisal is a judicial hearing that determines the fair cash value that dissenting shareholders are to be paid for their shares. From an economic point of view, these legal provisions serve to protect shareholders from managerial opportunism in a situation where final period problems could be severe since the target firm will cease to exist after the transaction and target managers would no longer be subject to the constraints and monitoring of financial markets (Fischel (1983)).

The sale of an asset, in contrast, is governed by contract law and the business judgment rule, a legal framework that gives managers and directors a mandate and broad legal authority to conduct the firm's activities, including the selling of assets, which limits disclosure, and insulates managers from shareholder voting and ultimately from shareholder litigation,³ confining dissenting shareholder to selling their shares if dissatisfied with a managerial decision. Thus, an asset sale is a legally binding contract between teams of buyer and seller managers.

Our theory of asset sales with two-sided asymmetric information accords with the law and practice of these intercorporate transactions, by allowing both buyer and seller managers to play active roles in influencing the terms of the transaction. Our model incorporates an auction-type mechanism followed by typical bilateral negotiations between the seller and the selected buyer. As a result of the first-stage competitive bidding process, the seller is able to extract each buyer's private information about its value contingent on having control of the asset for sale. The seller retains significant bargaining power after the initial auction stage. In particular, the seller can decide to conclude the auction or to open negotiations with a buyer that it selects. At this point in the process, the seller is the only party that still holds relevant private information. Our model reflects this characteristic of seller bargaining power given that it can terminate the game by accepting a buyer's initial offer, or can proceed to a second stage by making a take-it-or-leave-it counteroffer to a buyer in which the seller determines the financial structure of the deal. Our prediction that a seller with favorable private information will prefer to be paid with buyer equity rather than cash is a result of this structure. The possibility that an asset sale can conclude with a seller counteroffer is an essential element of our model that cannot be applied to the case of a merger where it is the buyer that must submit the last offer to target shareholders who then make the final decision to accept or reject it.

³ From an economic perspective, the *laissez-faire* approach of corporate law to asset sales is justified since both seller and buyer managers continue to operate after an asset sale and remain subject to the discipline and monitoring of financial and product markets (Gilson (1981)). As a result, the concern about final period problems that pervades the legal treatment of mergers is not applicable to asset sales. The rule operates to prevent courts from providing unnecessary constraints on managerial discretion in the form of judicial review of such business decisions.

The decisive role of the seller's final offer stage, from the point of view of our theory, can be corroborated with the following counterfactual. Suppose that intercorporate asset sales were to be made subject to the same corporate statutes and laws that govern mergers. Such a rule would take the form of another stage in our model to encompass this part of the game, specifically a third round in which the buyer makes the final offer to seller shareholders after the seller's second-stage counteroffer. However, since the seller firm is not competing with other potential sellers, it has no incentive to disclose private information through a counteroffer since such information would be exploited by the buyer in its third-stage final offer to provide buyer shareholders with the greatest profit. It is possible to show that in this scenario the asset will always be sold for cash and the seller's revenue will be lower than the revenue the seller would gain with the two-stage procedure of our model.

The second important difference concerns the nature of competition. In asset sales, bidding is typically simultaneous or coetaneous whereas in mergers, acquirers typically enter the bidding process sequentially, often after observing another bid. Our analysis shows that bidders for an asset in an auction-type setting will have no interest in distinguishing themselves from competitors by offering a mix of equity and cash because equity weakens their competitive position, given that equity is taken as a negative signal of firm valuation (Myers and Majluf (1984)). Thus, when bidding is simultaneous or coetaneous, as is typical in asset sales, buyers reveal their private information via cash offers. In contrast, the sequential nature of entry into bidding in mergers may create a rationale for the initial bidder to make a preemptive cash bid to discourage (costly) entry by other potential bidders, thus limiting bid competition as shown in Fishman's (1989) merger model.

We can identify the specific building blocks in the three aforementioned merger models that are responsible for the result that cash offers rather than equity offers reflect favorable news. A shared characteristic of these models is that target shareholders can only choose between accepting the best take-it-or-leave-it offer and rejecting all offers.⁴ In the models of Hansen and EGH, a monopsonic acquirer makes

⁴ In Hansen's and EGH's model the acquirer makes a take-it-or-leave-it offer to the target, whereas in Fishman the target accepts or rejects the outstanding bid of competitive acquirers.

a take-it-or-leave-it offer to the target. In the EGH model, the acquirer's offer can consist of a mixture of cash and buyer equity. It is also assumed that the level of synergy, which is known privately to the acquirer, is always sufficiently large to induce the acquirer to make an offer that will be accepted by the target, regardless of the target's private information. Thus, the equilibrium outcome reflects only the acquirer's private information, with the result that the market reaction to the transaction becomes more favorable as the cash component of the offer increases. A similar result is generated in Hansen's model which imposes the restriction that an acquirer's bid must be either pure cash or pure equity, with an acquirer preferring cash when it has favorable private information about its own value, but offering equity when its private information is unfavorable.

As in the case of the EGH merger model, bidders in our asset sale model may offer any mixture of cash and equity, but in equilibrium there are only cash bids in the initial stage. In our model selling firm managers have the option to react to an offer by formulating a counteroffer with a new equity-cash mix. In addition, the first stage consists of a competitive bidding process that allows the seller to fully extract all bidder private information. Thus, at the end of this bidding process, the seller is in a position to select the bidder with which to finalize the sale, and it is only the selling firm that still retains some private information about the value created by the deal. Since the financial structure of the seller's counteroffer signals the nature of the seller's private information, the market reacts more favorably to news of an equity-based deal than a cash deal.

In Fishman's model, a bidder with favorable information makes a large cash bid to preempt other bidders from making bids, and this offer will be accepted by the target. Bidders with less favorable information make a small non-preemptive, pure equity bid to trigger a competitive equity auction.⁵ In this case, the outstanding offer will be accepted by the target only if the target has favorable private information. In Fishman's model there will be a more favorable revaluation of the acquirer's shares when cash is the

⁵ In Fishman's paper bidders can offer pure cash or pure debt backed by the target. Since the debt is a risky security with its value dependent on the value created by the deal, the choice between cash and debt is broadly analogous to that of cash and equity.

means of payment rather than a value-sensitive security. However, the target's share price response to the means of payment is ambiguous since an equity-based merger provides mixed signals, given that the market observes this case when an acquirer with negative information makes an equity offer that is accepted by a target with positive information.

Our model differs from Fishman's model in two major ways. First, in Fishman's (and other) merger models, the seller has no opportunity to respond to a final bid by making a take-it-or-leave-it counteroffer to the bidder that is related to seller private information. In equilibrium the target will always accept the preemptive cash bid and reject all competing equity offers when it has unfavorable private information. By making an equity-type bid, acquirers ease the adverse selection problem of merging with a low value target. In our model of asset sales, after selecting the highest bid, the seller can propose to the buyer an alternative mix of equity and cash that signals the nature of the seller's private information. Thus, contrary to Fishman's merger model, in our model buyers do not need to offer equity to solve the adverse selection problem of buying a low-value asset. In particular, we show that each bidder prefers to submit an initial pure-cash bid because introducing an equity component into its offer signals negative information to the seller and worsens the bidder's competitive position in the auction (DeMarzo, Kremer, and Skrzypacz (2004)). Second, in Fishman's model the sequential nature of the decision to acquire information to enter the bidding process is decisive as it allows the first acquirer to preempt other potential acquirers from gathering information and competing for the target. If acquirers were to make simultaneous bids, leaving no role for preemption, there would be no role for distinct cash or equity bids.

2.2. Other related literature

Our model is related to earlier work on corporate divestitures that emphasizes the role of asymmetric information. In the theoretical models by Nanda and Narayanan (1999) and Habib, Johnsen, and Naik (1997), a basic assumption is that one of the parties, specifically the parent (seller) firm, has access to private information. Such models conclude that parent private information allows managers to initiate asset sales that increase parent firm value. However, these models do not incorporate any role for buyers,

and do not consider how variations in the financial structure of an asset sale influence the wealth gains from these divestitures. In contrast, our model allows the private information of both sides, buyers and sellers, to be reflected in the terms of the transaction.

While a Myers and Majluf (1984) perspective that equity is a negative signal pervades the literature, there are papers that consider the case of informed investors (i.e., outside investors with private information about issuing firms) and the implications for the valuation of debt and equity and the choice between them. Aghion, Bolton, and Tirole (2004) argue that investors capable of generating valuable information or providing monitoring services can be incentivized by receiving equity rather than debt. Axelson (2004) finds that when a firm knows less than its investors, debt is optimal when the firm can vary its security issuance as it obtains information, but when the security design must be fixed a priori, equity can be optimal. Fulghieri and Lukin (2001) show that allowing for information acquisition by investors can invert the pecking order, so that high-value firms use equity issuance to attract information acquisition activity, a view empirically supported in Gomes and Phillips' (2005) study of a large sample of public and private issuance of debt and equity. Nevertheless, there are no previous models that consider the joint problem of selling an asset and establishing the financial structure of the transaction.

In the literature on auctions that entail bids in the form of securities, Crémer (1987) extends work by Hansen (1985) to show an equity offer plus a cash side-payment allows an uninformed seller to extract all value from the information held by bidders, while De Marzo, Kremer, and Skrzypacz (2004) find that the optimal structure for the seller is a first-price auction with levered equity. Considering non-cash payments in bankruptcy auctions, a legal environment with pervasive asymmetric information problems, Bhattacharyya and Singh (1999) argue that such payments can enhance the efficiency of the procedure, while Rhodes-Kropf and Viswanathan (2000) contend that such payments can introduce inefficiencies into the debtor firm's subsequent capital and management structure. However, such auction models do not take account of the implications of an asset sale when there is two-sided asymmetric information about the asset, the central issue that we address in our model.

3. A theoretical model of asset sales

3.1. Basic assumptions

A firm that we refer to as the seller wants to sell an indivisible, tangible, productive asset. There are $N > 1$ potential buyer firms. We denote by x_i the value of a buyer firm i if it does not purchase the asset. The random variable x_i represents the intrinsic value of buyer firm i 's existing assets, including potential synergies, and is privately known by buyer i . We assume that buyers' types are i.i.d. on the interval $[x_L, x_H]$ with cumulative density function F . The value of a buyer firm if it operates the asset depends on both parties' private information. The seller possesses non-public information about the intrinsic qualities and various uses of an asset that it currently owns, while a buyer holds an advantage in knowing the intrinsic value of its existing assets and the potential synergies of the asset for sale when combined with the buyer's operations. We denote by $w(v, x_i)$ the value of buyer firm i if it operates the asset, where $w(\cdot)$ is strictly increasing in both arguments and differentiable in x_i . The random variable v represents the intrinsic quality of the asset and is privately known by the seller. We assume that v takes value v_L with probability p and $v_H > v_L$ with probability $1 - p$. We denote by y the value of the asset to the seller and we assume that $w(v_L, x_i) - x_i \geq y \geq 0$. Thus, an asset sale generates overall value equal to $w(v, x_i) - x_i - y \geq 0$. Moreover, we assume that synergies are increasing in buyer and seller private information. More precisely, $w_2(v, x_i) \geq w(v, x_H)/x_H$, and $w_2(v, x_i) x_i / w(v, x_i)$ is nondecreasing in v , where $w_2(\cdot)$ is the derivative of w with respect to x_i , its second argument. The last two assumptions indicate that the value created by a deal is sufficiently sensitive to the quality of the buyer's existing assets x_i and that this sensitivity does not decrease with the quality of the asset for sale. For simplicity, we assume that y is common knowledge.⁶

3.2. Selling procedures

⁶ It is possible to show that the predictions of the model do not depend on this assumption. If the seller's value from using asset y depends monotonically on the intrinsic quality of the asset v , the seller will require higher revenue for a high quality asset and lower revenue for a low quality asset. At the same time, as shown below, the seller obtains higher revenue in equilibrium when a high quality asset is sold. The seller's equilibrium revenue will meet its own value whatever the intrinsic quality of the asset v .

We model the negotiation among the seller and the potential buyers as follows. First, the seller collects confidential offers for the asset from potential buyers. A potential buyer's offer encompasses any combination of cash and buyer common stock. Let (B_i, C_i) be the offer from potential buyer i , where C_i is the cash component of the offer and B_i denotes the fraction of the buyer's total equity that is offered to the seller. We require that the cash component C_i be nonnegative, and that the equity component B_i not exceed a fraction of ownership in the buyer, i.e., $C_i \geq 0$, and $0 \leq B_i \leq 1$. These offers are firm and the seller can decide to (i) accept the offer of one of the buyers as is, (ii) enter into further exclusive negotiation with one of the buyers, or (iii) not sell the asset at all. In case (i) or (iii) the game ends with the seller's decision, with either a transaction on the buyer's terms or no transaction. When the seller chooses option (ii), it then proceeds to conduct an exclusive negotiation with one selected buyer. At the onset of this negotiation, the seller provides a contractual letter of intent to the selected buyer indicating that it intends to sell the asset and that the terms of any final agreement will be at least as favorable to the buyer as in the case in which the buyer's original offer (B_i, C_i) is accepted. The seller then makes a take-it-or-leave-it counteroffer to the buyer. If the buyer accepts this counteroffer, the transaction is concluded on the terms of the counteroffer. If the counteroffer is rejected, then there is no transaction, but the seller fulfills its commitment by paying as compensation for the breach what the buyer would expect to obtain if the initial offer had been accepted.⁷ Nevertheless, in equilibrium it will be in the buyer's and the seller's interests to conclude the deal.

Let bidder i be the buyer that submitted the offer selected by the seller. If the seller chooses option (i), then the buyer's original shareholders will receive an expected profit of

$$\Pi_B(x_i, B_i, C_i) = (1 - B_i) (E[w(\mathbf{v}, x_i) \mid \text{seller accepted } (B_i, C_i)] - C_i) - x_i ,$$

and, when $\mathbf{v} = v \in \{v_L, v_H\}$, the seller's expected profit is

⁷ The derivation of this factor is found in Section 4.1.

$$\Pi_S(v, B_i, C_i) = B_i (E[w(v, x_i) | \text{offer } (B_i, C_i)] - C_i) + C_i - y.$$

The counteroffer if the seller chooses option (ii) can encompass any combination of cash and buyer equity. We denote by c the cash component of the counteroffer while β denotes the fraction of the buyer's total equity that the seller receives if its counteroffer is accepted. Similar to a buyer's offer, we require $c \geq 0$ and $0 \leq \beta \leq 1$. If the buyer accepts the counteroffer, then it purchases the asset in exchange for a cash payment c and a proportion of its equity β . Thus, if buyer i accepts the counteroffer (β, c) , the expected profit to the buyer's original shareholders will be

$$\Pi_B(x_i, \beta, c) = (1 - \beta) (E[w(v, x_i) | \text{counteroffer } (\beta, c)] - c) - x_i$$

and the seller's expected profit will be

$$\Pi_S(v, \beta, c) = \beta (E[w(v, x_i) | \text{offer } (B_i, C_i)] - c) + c - y$$

Finally, if the buyer rejects the counteroffer (β, c) , then no transaction takes place but the buyer will be appropriately compensated for the breach, receiving $(1 - B_i)(w(v, x_i) - C_i) - x_i$, that is, the buyer's equilibrium gain in the case when its initial offer is accepted, as we demonstrate in the next section.

4. Equilibrium

4.1. Central results

We solve the game by backward induction. Consider first the stage where buyer firms have submitted their offers, the seller firm has selected one offer and must decide whether to accept it as is or make a counteroffer to the selected buyer. Let (B, C) be the selected offer, and denote by $x(B, C) = E[x_i | \text{offer } (B, C)]$ the seller's expectation regarding the type of a potential buyer i that offered (B, C) . We claim that, in equilibrium, after observing buyers' bids, the seller will be able to deduce all buyer private

information on x_i . In other words, at this phase of the game all of the buyer's private information about its existing assets and their potential value when combined with the seller's asset, is revealed, leaving the seller's private information as the only remaining source of uncertainty. We also claim that the selected offer provides the seller at least y , that is, its reserve value for the asset. We verify these claims in Proposition 2. Fix $x = x(B, C)$ and let v be the intrinsic value of the asset. Then the seller will make a counteroffer if it can find (β^*, c^*) such that

$$(\beta^*, c^*) = \arg \max_{c \geq 0, 0 \leq \beta \leq 1} \beta(w(v, x) - c) + c$$

subject to

$$\beta(w(v, x) - c) + c > B(w(v, x) - C) + C$$

$$\Pi_B(x, c, \beta) \geq \max\{(1 - B)(w(v_L, x) - C) - x, 0\}$$

The first constraint states that a counteroffer is made only if, when accepted, it provides the seller with strictly more than the buyer's initial offer. The second constraint implies that the buyer accepts the counteroffer only if it provides a nonnegative profit and more than what the buyer could claim in the case that the negotiation fails. If no (β^*, c^*) satisfying both constraints exists, then the seller will accept the buyer's offer as is.

As the seller has the initiative to make a counteroffer and has private information on v , this phase of the negotiation is a signaling game that as usual exhibits multiple equilibria. In order to restrict the set of equilibria of this game, we use the refinement known as D1 to define a buyer's out-of-equilibria beliefs when it observes a counteroffer that was "unexpected" in equilibrium. The refinement D1, introduced by Cho and Sobel (1990), states that if the buyer observes an out-of-equilibrium counteroffer, it surmises that this counteroffer comes from the seller type that is "more eager" to make it. This refinement leads to a unique separating equilibrium where the seller makes a counteroffer only if $v = v_H$. To credibly signal that the intrinsic quality of the asset is high, the seller's counteroffer includes payment in the form of buyer

equity. Such a counteroffer maximizes seller revenue if $v = v_H$, under the constraint that the seller would prefer the buyer's original offer if $v = v_L$. This constraint limits the fraction of equity that the high-value seller can demand when $v = v_H$. More precisely we obtain the following result:

Proposition 1: *Suppose the seller selects offer (B, C) that uniquely identifies the type $x = x(B, C)$ of the buyer that submitted this offer. Then the signaling game has a unique separating equilibrium outcome satisfying the D1 criterion, which has the following structure :*

if $v = v_L$, then the seller accepts the offer (B, C) ;

if $v = v_H$, then the seller makes an all-equity counteroffer $(\beta^, c^*) = (B + (1 - B)C/w(v_L, x), 0)$ and the buyer accepts the counteroffer.*

Thus, the equity component in the structure of the deal is lower for low quality assets than for high quality assets.

Proof: See Appendix A.

Let us develop the intuition for the particular form of the counteroffer, (β^*, c^*) . First, to establish that the equilibrium counteroffer must be an all-equity offer ($c^* = 0$), consider a hypothetical mixed counteroffer with a positive cash component. If this offer were to satisfy the incentive constraints necessary for a separating equilibrium, then the seller with a high-value asset could propose a counteroffer with more equity and less cash from which it derives a strictly higher payoff and that would still satisfy both incentive constraints. The reason for this result is that more equity leads to a greater payoff differentiation between the two types, thus allowing the high-type to appropriate more value without risking imitation by the low-type. Thus, any mixed offer is dominated by another offer with less cash, and only an all-equity offer is robust against this argument. Second, for an all-equity offer to be separating, we need to ensure that the incentive constraint for the seller with the low-value asset is satisfied:

$$B(w(v_L, x) - C) + C - y \geq \beta^* w(v_L, x) - y.$$

This result implies that $\beta^* = B + (1 - B)C/w(v_L, x)$ is the maximum equity participation for the seller with the high-value asset that does not violate incentive constraints. As a result, the seller will have to “leave money on the table”.

Now, we turn to the first phase of the two-stage sales procedure where potential buyers compete in making offers for the asset. To keep the discussion simple, we disregard for the moment the possibility that buyers make any offers other than pure-cash offers (which will be the equilibrium offers as we will argue). Moreover, each bidder anticipates that upon winning the auction, if the intrinsic quality of the asset is v_L , it will pay its bid C_i , whereas if the intrinsic quality of the asset is v_H , then the consideration paid for the asset will entail buyer equity.

We focus on symmetric equilibria where a potential buyer's offer is a differentiable increasing function $C: [x_L, x_H] \rightarrow \mathbb{R}^+$ of its type, as is standard in auction theory. Let $C(\cdot)$ be the bidding function in a symmetric equilibrium. Note that in equilibrium, $x(\theta, C)$ is the inverse of the bidding function $C(\cdot)$. With bids in the form of cash, the buyer will select the bidder that submits the highest bid, as this will be the bidder that most values the asset. Then the best pure-cash bid for a potential buyer of type x will be the solution to the following maximization problem:

$$\max_{g \in [x_L, x_H]} \left(p(w(v_L, x) - x - C(g)) + (1 - p)((1 - \beta(g))w(v_H, x) - x) \right) F_N(g)$$

subject to

(1)

$$\beta(g) = \frac{C(g)}{w(v_L, g)}$$

where $F_M(g) = F(g)^{N-1}$ is the probability that the highest type among the potential buyer's competitors is smaller than g . This expression provides the expected payoff to a buyer of type x if it behaves like a buyer of type g . Note that the submission of an offer $C(g)$ instead of $C(x)$ affects the potential buyer's expected profit in three ways. First, it affects the probability of the bidder being selected by the seller. Second, it affects the cash payment when its offer is accepted, i.e., whenever $v = v_L$. Third, it affects its equity

payment that will be made whenever $v = v_H$. In fact, by bidding $C(g)$ the bidder induces the seller to believe that its type is g , information that will affect the seller's counteroffer in case $v = v_H$. This third factor makes this competition different from that of a standard first-price sealed-bid auction. In equilibrium, bidder i must find it optimal to choose $g = x$.

By substituting $\beta(g)w(v_L, g)$ into $C(g)$, the buyer's objective function (1) can be rewritten as

$$\pi(x, g) = (E[w(v, x)] - x - \beta(g)(pw(v_L, g) + (1 - p)w(v_H, x))F_N(g) \quad (2)$$

The first order condition, using the derivative of expression (2) with respect to g , is $\pi_2(x, g)|_{g=x} = 0$, which leads to the following differential equation in $\beta(x)$:

$$E[w(v, x)] (f_N(x) (1 - \beta(x)) - \beta'(x) F_N(x)) = f_N(x)x + \beta(x) F_N(x) p w_2(v_L, x) \quad (3)$$

where $f_N = F_N'$.

The final step of the analysis is to show that pure cash bids are indeed optimal and preferred by buyers to any combination of cash and equity. We show in Appendix B that if all but one potential buyers adopt the pure-cash bidding strategy $(0, C(x))$ that solves expression (1), then the remaining bidder's best response is $(0, C(x))$. We then obtain the following result:

Proposition 2: *There exists a symmetric equilibrium of the entire game, where all buyers are making fully revealing pure cash bids in the first phase of the game. A buyer of type x makes a pure cash offer $(0, C(x))$ that is strictly increasing in its type x and that is characterized by*

$$C(x) = \frac{w(v_L, x)}{F_N(x)} \int_{x_L}^x \phi(t, x) f_N(t) dt, \quad (4)$$

where

$$\phi(t, x) := \left(1 - \frac{t}{E[w(\mathbf{v}, t)]} \right) \exp \left(- \int_t^x \frac{pw_2(v_L, z)}{E[w(\mathbf{v}, z)]} dz \right) \quad (5)$$

and

$$C(x_L) = \left(E[w(\mathbf{v}, x_L)] - x_L \right) \frac{w(v_L, x_L)}{E[w(\mathbf{v}, x_L)]} \quad (6)$$

Moreover, $y < C(x) < w(v_L, x)$ for all $x \in [x_L, x_H]$.

Proof: See Appendix B.

In our proof that pure-cash bids are an equilibrium, we first establish that no pure-cash deviation can be profitable for this bidder. Then, to complete the proof, we only need to show that there is no profitable deviation (B, C) involving a strictly positive equity component. The seller's out-of-equilibrium beliefs regarding the type x of the bidder that made such an offer must satisfy the D1 criterion. Applying this criterion to this phase of the game, it follows that an equity component in the offer is a negative signal regarding the quality of the buyer's existing assets. In other words the seller's out-of-equilibrium belief after observing such an offer makes the buyer's offer less attractive relative to the offers of other buyers. More precisely, the buyer could always find an alternative deviating offer in pure cash that, if accepted by the seller, would provide the same payoff of the offer (B, C) . However, this pure cash deviation would have a greater chance of being selected by the seller from among the different offers, as it does not include the negative signal provided by the non-zero equity component in (B, C) . Thus, a deviating offer involving equity is always dominated by a pure-cash deviation that in turn is not profitable. The details of the proof of Proposition 2 are provided in Appendix B.

4.2. Empirical implications

For purposes of empirical testing, the implications of our model focus on the following metrics.

Value creation. One metric is the gain in the combined market value of the buyer and seller that arises from an asset sale. According to Proposition 1, assets with low intrinsic value should be sold for cash, so that cash asset sales should be associated with low wealth generation effects. In contrast, equity-based asset sales should be observed when the asset has a high intrinsic value, so these asset sales should be associated with strong wealth generation effects. Our model predicts that on average equity-based asset sales generate a greater increase in combined value than cash asset sales.

The cash-equity choice. In our model, the private information held by sellers plays a different role than that of private information held by buyers. Accordingly, the comparative statics of the two sources of adverse selection exhibit distinctive empirical predictions about the financial structure of the transaction, that is, the choice of equity versus cash. To develop comparative statics with respect to seller private information, consider the case of a seller that has no private information (that is, $v_L = v_H$). It is easy to show that the model predicts that there will be only cash deals since there is no incentive for the seller to make an equity counteroffer, while the reasons bidders prefer to submit cash offers remain unchanged. The importance of the seller's private information on the value of post-transaction buyer equity increases in the probability that the seller is privately informed. The comparative statics are as follows: an increase in the importance of the seller's private information increases the likelihood that the means of payment will be equity-based, which is our second metric. In contrast, in our model a change in the importance of the buyers' private information leaves the structure of the equilibrium unchanged with respect to the choice between cash and equity, implying no effect on the frequency of equity versus cash deals.

Value sharing. A third metric measures how the value created by the transaction is shared between the seller and the buyer's original shareholders. The model predicts that the proportion of the gains received by the buyer is greater in equity-based transactions than in cash transactions. To see this point, we denote as $\theta(v, x)$ the share of the value created by the asset sale that accrues to the original shareholders of the buyer,

for a given level of the intrinsic quality of the asset for sale and the buyer's existing assets. In equilibrium the observed profit to the buyer's original shareholders is $(1 - \beta(x))w(v, x) - E[x]$.⁸ So the observed $\theta(v, x)$ is

$$\theta(v, x) = \frac{(1 - \beta(x))w(v, x) - E[x]}{w(v, x) - E[x] - y}$$

which is increasing in v ,⁹ the intrinsic value of the asset that is private information of the seller. Thus, since a greater intrinsic value v is associated with equity-based deals and a smaller intrinsic value with cash deals, the model predicts that on average sellers will appropriate a smaller proportion of the value created by equity-based deals relative to cash deals.

Wealth gain vs wealth loss. A fourth metric is the sign and magnitude of buyer and seller profits across all asset sales (for cash asset sales as well as equity-based asset sales). This metric allows us to identify the party that has the most valuable information in an asset sale.

Buyer: The ex-ante expected profit (which is empirically proxied by averaging over cash asset sales plus equity-based sales) is positive because the buyer can extract an informational rent due to its private information about its synergy with the asset. The average profit in equity-based asset sales is larger than the ex-ante profit because the value created in these deals is greater, and the buyer appropriates a larger share of this value. Conversely, the buyer's profit in cash asset sales is smaller than the ex-ante profit. It should be noted that it is possible that buyers expect to lose money in cash asset sales. Namely, from Proposition 2 it follows that the ex-ante profit of a buyer of type x_L is equal to zero, which implies this buyer type will lose money in a cash asset sale, but make a positive profit in an equity-based asset sale. For the continuity of the bidding and objective functions, the same pattern will occur for buyers of types close to x_L . Note also that if

⁸ What we observe in practice is the difference in market values for the buyer and seller before and after the announcement of the transaction. The value and the financial structure of the deal convey buyer and seller private information accurately. However, prior to the transaction the market will price the buyer at $E[x]$ as there still is asymmetric information regarding the buyer's existing assets. Hence, if the true gain of buyer shareholders is $(1 - \beta(x))w(v, x) - x$, the empirical observation of this gain using stock prices will be $(1 - \beta(x))w(v, x) - E[x]$. The effect of this pricing error is an increase in the variance of the unexplained residual.

⁹ In fact, $\partial\theta/\partial v > 0$ iff $\beta(x) > y/(E[x] + y)$, which is true as $\beta(x) \geq 1 - x_L/E[w(v, x_L)]$ and $w(v, x_L) - x_L - y > 0$.

the importance of buyer private information narrows, its ex-ante payoff converges to zero. In this case, buyers on average will sustain losses in cash asset sales and gains in equity deals. Conversely, if the importance of buyer private information is large, the buyer informational rent will also be large and consequently the average profit for buyers will be positive for cash deals.

Seller: The ex-ante and ex-post profit of the seller are positive. More precisely, the seller's average profit in an equity-based asset sale is greater than its ex-ante expected profit (which is empirically proxied by averaging over cash asset sales plus equity-based sales), which in turn is larger than its average profit in a cash asset sale, which is greater than zero.

5. Sample development

We construct samples of intercorporate sales of operating assets from 1989 through 2002, using the Dow Jones News Retrieval Service (Factiva) and Lexis-Nexis. Ownership data for buyers and sellers are from proxy statements from Edgar or the SEC File from Q-Data Corporation. Other information is obtained from the Wall Street Journal, Standard and Poor's Stock Reports, Stock Guide, and Directory of Corporations, and SEC filings. The announcement date is the initial public report of the asset sale.

Testing the predictions of the theoretical model requires certain filters to be applied to the data to obtain the final samples of asset sales. One filter is that both the buyer and seller are corporations that are publicly traded on CRSP. This criterion eliminates transactions that involve a buyout firm or other private entity to ensure that the combined gains in wealth for each transaction and the distribution of these gains between the buyer and the seller can be evaluated. A second filter is that specific information about the terms of the transaction is publicly reported, including whether the consideration paid is cash or is equity-based. Three, to minimize reporting bias, and increase the likelihood that the transaction is material, we require that an asset sale have a transaction price of at least \$100 million, and that the seller is not in financial distress. Four, we require that the operating asset is wholly-owned by the seller prior to the sale, and the sale must transfer the seller's full ownership of the asset to the buyer. For equity-based asset sales we apply an additional filter that no shares of buyer stock are conveyed to the selling firm, but instead, the

shares are conveyed directly to the shareholders of the seller firm, a requirement that ensures that the asset sale does not establish the seller as a corporate blockholder in the buyer. This empirical strategy eliminates valuation effects induced by the creation of a corporate blockholding, generating a sample of transactions that has no overlap with previous studies (Allen and Phillips (2000) and Slovin, Sushka, and Polonchek (2005)). Our samples consist of 37 equity-based asset sale transactions and 93 cash transactions. The events for both groups are well distributed over the sample period.

Descriptive statistics are reported in Table 1. Dollar values are in constant (1997) dollars. Both cash and equity-based asset sales are major transactions between large capitalization firms with dispersed ownership structures. The average (median) value of cash asset sales is \$1.38 (\$1.01) billion compared to \$1.91 (\$1.20) billion for equity-based transactions. The mean (median) capitalization is large for both buyers and sellers in equity-based sales, \$9.30 (\$1.98) billion and \$7.69 (\$1.93) billion, respectively, but are smaller than firms in cash asset sales, \$20.85 (\$5.98) billion and \$14.85 (\$10.02) billion, respectively.

The mean (median) ratio of transaction price to seller market value is 0.77 (0.58) for equity-based sales, and is higher than the ratio of 0.31 (0.11) for cash sales, with the difference in means (medians) statistically significant. For buyers the comparable ratio has a mean (median) of 0.90 (0.45) in equity-based transactions, which is larger than the mean (median) ratio of 0.49 (0.13) in cash transactions, and the difference in the means (medians) is statistically significant. A broad range of industries is represented in the equity-based sample, with 33 4-digit SIC codes among the 37 buyers and 32 4-digit SIC codes among the 37 sellers. There is also a broad range of industries in the cash sample, with 64 4-digit SIC codes among the 93 buyers and 65 4-digit SIC codes among the 93 sellers. All-equity deals comprise 38% of the equity sample, and the mean (median) percent of buyer equity is 71.3% (70.3%). Thus, in equity-based asset sales, equity is the dominant form of consideration. The average (median) buyer equity conveyed to sellers as a proportion of buyer shares outstanding is 28.9% (24.1%).

Buyers and sellers in cash asset sales have dispersed ownership structures with mean (median) insider holdings by top executives and members of the board of directors as a percent of outstanding shares

of 5.0% (1.8%) for buyers and 5.3% (1.0%) for sellers. For equity-based asset sales, mean (median) insider holdings are 9.4% (1.6%) for buyers. Sellers in equity-based sales have significantly greater insider holdings, with a mean (median) of 11.5% (4.6%), than sellers in cash sales, whereas the differences between the two sets of buyers are not significant. In each sample there are similar mean (median) institutional holdings, with 50.7% (54.0%) for buyers and 48.7% (51.1%) for sellers in cash sales, and 52.0% (52.2%) for buyers and 53.9% (56.8%) for sellers in equity-based deals.¹⁰ These figures are well above average institutional holdings at NYSE/ASE firms (McConnell and Servaes (1990)).

In equity-based asset sales, the shareholders of the selling firm take immediate ownership of relevant buyer shares based on a pro rata distribution established in the transaction agreement. Seller blockholders, defined as a shareholder holding 5% or more of seller shares, are rare with only one among the 37 sellers, and in this one case, the size of the asset sale implies that this shareholder did not become a 5% blockholder in the buyer. We also examine proxy statements for each buyer in the subsequent year, and find that no additional blockholders emerge. Thus, the equity-based transactions do not induce the formation of blockholdings at buyer firms. Blockholders are also rare among the buyers, since there are only two cases. The modest reduction in the mean ratio of insider holdings to total outstanding shares at buyers, from 9.38% to 6.93%, a year after the transaction, is not unexpected since the shares issued as payment for an asset increase the buyer's total outstanding shares, but the change is not significant ($p=0.35$). There is a trivial and statistically insignificant ($p=0.87$) increase in the median ratio of insider holdings at buyers after the sale. Overall, the evidence indicates that equity-based asset sales have modest effects on buyer ownership structure.

6. Empirical results

6.1. Valuation effects on buyers and sellers

¹⁰ Institutions are investment firms, banks, insurance firms, college endowments, and 13F money managers.

In Table 2, we report valuation effects on buyers and sellers at announcements of intercorporate asset sales, using standard market model methodology.¹¹ For cash transactions, the two-day average excess return for sellers is 1.43% (t-statistic of 5.31). The median return is also highly significant and the quartile data indicate that the average excess return is not the result of outliers. The five-day average excess return (not reported in the table) is 2.21% (t-statistic of 5.03). These returns are similar to those for sellers of assets reported by Klein (1986), Hite, Owers, and Rogers (1987), Lang, Poulsen, and Stulz (1995), John and Ofek (1995), and Slovin, Sushka, and Polonchek (2005). The returns to the buyers in cash sales are approximately zero, given a two-day average excess return of -0.03% (t-statistic of -0.12). The median return and the quartile figures indicate that the mean return is not the result of outliers. The five-day return is 0.48% (t-statistic of 0.82). As in previous studies, these results suggest that the market does not view cash asset sales as positive net present value transactions for buyers. The pattern of returns to buyers and sellers indicates that on average gains in value from cash asset sales accrue solely to sellers.

Although average excess returns to buyers and to sellers are the standard method of reporting event study results, we also report transaction returns (wealth gains as a fraction of transaction values) to take account of the size of the transaction, to draw an accurate comparison between cash versus equity-based asset sales and to test the predictions of the model. For cash asset sales, the two-day average transaction return to sellers is small, 0.21%, and not statistically significant (t-statistic of 0.02). However, the median figure of 6.50% is statistically significant ($p=0.01$). For buyers, the average (median) transaction return is negative, -14.15% (-1.01%), and not statistically significant given a t-statistic of -1.34 ($p=0.24$). Thus, at announcements of cash asset sales the lack of significant buyer transaction returns corroborates the non-positive average buyer returns, consistent with our model's prediction that buyer gains should be lower in cash asset sales than in equity-based asset sales.

From the perspective of our theoretical model, combined returns that weight announcement excess returns of buyers and sellers by pre-announcement market capitalization serve as a gauge of the combined

¹¹All univariate results reported in this paper are robust with respect to the use of three and four factor (Carhart (1997)) market models for the event study.

gain in value from an asset sale. Moreover, since investors hold diversified portfolios, our focus is on assessing the extent to which intercorporate asset sales enhance combined shareholder wealth and thus contribute to economic efficiency, as well as on the distribution of wealth gains between buyers and sellers. While prior studies include asset sales in which one participant is not publicly traded, our sample design requires that each buyer and seller is publicly traded. These combined returns measure the difference between pre-transaction versus post-transaction values of buyers and sellers, including the value of the relevant asset, and hence reflect the information that is conveyed by the financial structure of the deal.

For cash asset sales the combined mean (median) returns are small, 0.15% (0.28%), and not significant given a t-statistic of 0.58 ($p=0.41$), so for cash sales, the null hypothesis of zero gains cannot be rejected. In (constant) dollars, the average change in combined value for cash sales is a loss of -\$41.4 million, while the median change is a gain of \$33.2 million, both modest figures relative to the size of the transactions (mean (median) value of \$1,380.9 (\$1,010.7) million). Thus, we conclude that cash asset sales generate little overall gain in combined shareholder wealth. For the ratio of the combined dollar gains for cash sales relative to transaction values, the mean (median) combined excess transaction return is -13.94% (2.80%) and is not significant with a t-statistic of -1.06 ($p=0.67$). We conclude that there are only modest combined gains in value from cash asset sales, and any gains that occur accrue predominantly to sellers, results consistent with the predictions of our theoretical model.

For equity-based asset sales, the two-day average excess return to sellers is 6.92%, (t-statistic of 13.57); the five-day return is similar, 6.80% (t-statistic of 8.95). The average (median) transaction return to sellers in equity-based sales is 20.00% (9.48%), and is statistically significant. These results are not the result of outliers, since similar results are generated when the samples are compared at various percentile levels. The positive and significant seller returns suggest that equity-based asset sales, like cash sales, are positive net present value transactions for selling firms. Moreover, seller two-day average (median) excess returns and transaction returns in equity-based sales are significantly greater than the comparable returns in

cash sales, at the 1% (10%) level of significance. We conclude that equity-based asset sales generate greater gains to sellers than cash sales.

For buyers in equity-based sales, the two-day average excess return is positive, 3.44% (t-statistic of 6.11); the five-day average excess return is similar, 3.92% (t-statistic of 4.23), and the median return of 2.31% is also highly significant. These results indicate that equity-based asset sales are positive net present value transactions for buyers, in contrast to the non-significant returns to buyers in cash asset sales. The mean (median) two-day return to buyers is significantly greater than the buyer return in cash sales, given a difference in means p-value of 0.01 (0.00). Moreover, the mean (median) buyer transaction return of 20.15% (4.87%) is also statistically different from zero, and significantly different from the mean (median) transaction returns to buyers in cash sales. These results indicate that equity-based asset sales generate a significant increase in value for buyers that is significantly greater than the return to buyers in cash asset sales. Thus, the greater seller gains in equity-based asset sales do not represent a redistribution of wealth from buyers. Instead, there are greater gains to both sellers and buyers in equity-based asset sales relative to cash asset sales.

An estimate of the expected (ex ante) excess returns to buyers and sellers of assets is obtained by evaluating the average excess returns to buyers and to sellers over both samples of intercorporate asset sales. This global calculation is obtained by combining the cash and equity-based asset sales, resulting in a sample of 130 transactions. This global average excess return is 0.96% (t-statistic of 4.17) for buyers and 2.99% (t-statistic of 11.97) for sellers (not reported in the table). Thus, although buyers do not obtain positive average excess returns in cash asset sales, when considering all asset sale transactions, buyer average excess returns are positive, suggesting that buyers can extract an informational rent that is based on their private information about expected firm value, including the asset. From the perspective of our theory, these global results are consistent with the view that buyer information is valuable, but buyer information is not of sufficient magnitude to generate a positive average excess return in cash sales.

The mean (median) combined gains in value from equity-based deals relative to the market values of the participants are 4.17% (2.35%) with a t-statistic of 4.55 ($p=0.00$). Mean and median figures are significantly greater ($p=0.00$) than the comparable figures for cash transactions. The combined mean (median) transaction return to buyers and sellers in equity-based asset sales is 40.15% (17.63%), significantly different at a 1% level. The difference in means (medians) between the combined transaction returns for equity-based versus cash asset sales is statistically significant at the 1% (1%) level. Since the average gain in value at the announcement of an equity-based asset sale is greater than for a cash asset sale, even though no blockholding is formed, our evidence suggests that the large incremental change in shareholder wealth is due to the equity-based structure of the transaction, and not ownership structure. Thus, equity-based asset sales are associated with expectations of important improvements in economic efficiency. Moreover, dollar gains in combined value generated by equity-based asset sales are economically meaningful, given an average (median) gain of \$913.8 million (\$139.4 million) per deal.

Our findings complement empirical results reported by Allen and Phillips (2000) and Slovin, Sushka, and Polonchek (2005) who find positive effects on issuers of equity in transactions that create corporate blockholders. However, our evidence provides an unambiguous test of the favorable signal content of the transfer of assets through equity-based transactions given a sample design that excludes events that induce formation of corporate blockholdings. Thus, we conclude that equity-based asset sales contribute to economic value because they convey positive information about the value of the asset being sold and expectations of heightened future profitability from the buyer's use of the asset. As a result, our evidence is consistent with the central prediction of our theoretical model that an equity-based structure is associated with a greater gain in overall value for an intercorporate asset sale.

6.2. The choice between cash and equity and the effect of asymmetric information measures

We estimate a binomial logit model of the means of payment decision using the maximum likelihood method where the value function for the logit is specified as a linear function of firm characteristics that serve as proxies for asymmetric information, plus an error term. The coefficients of the

logit provide an estimate as to how an increase in a specified asymmetric information variable affects the marginal likelihood that an asset sale will involve buyer equity. As discussed in Section 4.2, our theory predicts that the private information characteristics of the buyer should be irrelevant to the choice of cash versus equity, while an increase in the probability that the seller has private information regarding the asset implies a higher frequency of equity-based deals. In contrast, merger models predict that it is buyer private information that is crucial for the choice of the means of payment. To test the predictions of our theory, we model the choice of whether equity is incorporated in the means of payment as a linear function of variables that are proxies for the degree of asymmetric information about participant firms.

We test several types of variables as proxies for asymmetric information. With respect to stock liquidity, which can be expected to be related to the degree of firm asymmetric information, we specify the average relative bid-ask spread (bid-ask spread divided by share price) and trading volume (relative to shares outstanding) during the month prior to the transaction, where a greater bid-ask spread indicates greater asymmetric information and a greater amount of trading indicates less asymmetric information. We test three variables that are based on the use of analyst earnings forecasts, taken from IBES analyst data. Two variables measure the magnitude of analysts' earnings surprises and the dispersion among analysts' earnings forecasts, on the assumption that each is positively correlated with the degree of information asymmetry between managers and investors (Lang and Lundholm (1996) and Gomes and Phillips (2005)). The analyst earnings surprise variable is computed as the absolute value of the difference between the median quarterly earnings estimates and the actual quarterly earnings per share of the relevant firm, normalized by stock price, averaged over the previous year. The analyst earnings dispersion variable is the standard deviation of earnings forecasts, normalized by stock price, averaged over the previous year. The third analyst variable is the number of analysts that follow the stock, on the assumption that an increase in analyst following is associated with a reduction in asymmetric information. We test two variables that measure a firm's investment alternatives, and thus are likely to be positively correlated with asymmetric

information. One variable is research and development expenditures divided by (lagged) property, plant, and equipment, and the other variable is the firm's market to book ratio.

The importance of seller private information for post-transaction value and the seller's gain is related to the size of the asset as a fraction of the post-transaction buyer.¹² Hence we expect a positive relationship between the probability of an equity-based deal and the ratio of the asset to the post-transaction buyer. As a result, we include in each specification the value of the relevant asset scaled by the value of the buyer plus the asset.

The results of the logit model are reported in Table 3 with p-values reported in parentheses, where the dependent variable is equal to one when a transaction involves buyer equity and zero for cash transactions. In the first logit, each corporate characteristic refers to the seller, in the second logit each corporate characteristic refers to the buyer, and the third logit includes both sets of variables. The results for equation (1) indicate that several asymmetric information variables for the seller have the correct sign and are statistically significant. More specifically, the estimated coefficients imply that the probability that the transaction will be equity-based rises with an increase in earnings surprises and an increase in research and development expenditures, and it falls with an increase in the number of analysts that follow the firm and an increase in trading volume. In addition, as predicted, the probability that an asset sale will entail buyer equity increases as the size of the transaction increases relative to the size of the buyer. Thus, the probability that an asset sale will entail informationally sensitive securities (buyer equity) is related to variables that proxy the extent of asymmetric information about the seller.

The results for equation (2) show that none of the asymmetric information variables for the buyer are significant. The lack of statistical significance for these variables is consistent with the prediction of our theoretical model, that is, the choice between cash and equity is governed by the seller's, and not the buyer's, asymmetric information. Equation (3) incorporates the full set of seller and buyer variables in the

¹² If the asset is small relative to the buyer, the seller information on v will have little impact on w and will not be large enough to justify the expense of any fixed costs incurred to pursue an equity transaction. Such fixed costs exist in form of the additional costs of negotiation and verification in the case of an equity deal.

specification. The results are broadly similar to the two other equations. Overall, these logit results are consistent with the conclusion that it is asymmetric information about the seller, and not the buyer, that influences the choice of equity versus cash in an intercorporate asset sale.

6.3. Distribution of wealth gains between buyers and sellers

With regard to the distribution of gains, our model predicts that the value of the variable θ , the share of the value created by the asset sale that accrues to the buyer's original shareholders, should be greater in equity-based deals than in cash deals. The values for θ (explained in Section 4.2) derived from the sample indicate that buyers sustain a significantly greater proportion of gains in equity-based deals than cash deals. The calculated mean (median) values of θ are 0.2580 (0.3311) in equity based deals, both statistically significant at the 1% level, and 0.0722 (-0.1069) in cash deals, neither statistically significant. The difference between these means (medians) is highly significant with $p=0.00$ ($p=0.00$).

Overall, our results suggest that equity-based asset sales generate positive and significant excess returns for both buyers and sellers, and that buyers obtain a substantial share of the gains generated by these deals. Consistent with the predictions of our model, for cash asset sales there are relatively small increases in shareholder wealth that accrue almost exclusively to sellers, while for equity-based asset sales there are significantly greater increases in wealth that are divided between buyers and sellers.

6.4. Cross-sectional regressions

We estimate two sets of cross-sectional regressions for the asset sale returns. The dependent variable in one set consists of buyer excess returns, and in the other set consists of seller excess returns. Independent variables reflect the proportion of the transaction price that is in the form of buyer equity, deal size relative to buyer and seller, and characteristics of the participating firms, including variables that reflect financial characteristics, performance, size of the two firms and our proxies for asymmetric information (see Section 6.2). Consistent with our theoretical model, the regression results indicate that the proportion of the transaction price paid in buyer equity has a positive and significant effect on buyer returns and on seller

returns, with this variable obtaining t-statistics of 3.84 and 3.00, respectively, corroborating our univariate results. However, all independent variables that reflect the deal size and the characteristics of the participating firms, including the proxies for asymmetric information, consistently fall short of statistical significance, suggesting that such variables do not provide additional explanatory power once the percentage of equity is specified in a regression. These independent variables are also not significant when transaction returns for buyers and sellers are the dependent variables. Since only the proportion of equity in the deal is statistically significant, the regression results are not reported in the tables.

6.5. Operating performance of buyers and sellers

We examine the subsequent operating performance of buyer and seller firms to assess whether the increase in value at announcements of equity-based transactions is a precursor to improved operating performance. We apply the Barber and Lyon (1996) adjustment methodology. The fiscal year in which the asset sale occurs is defined as year 0. The matching procedure selects benchmark firms based on data in year -1 for the criteria: same 4-digit SIC code, market capitalization within a 90% to 110% range of the sample firm, and operating performance within a 90% to 110% range of the sample firm. Accounting data are from the Compustat Industrial and Research database. The two performance measures are return on assets, ROA (operating income before depreciation, interest, taxes, and extraordinary items, divided by average total assets) and return on sales, ROS (same definition of operating income, but divided by total sales). After winsorizing the data, we obtain the mean and median of the changes in buyer operating performance relative to benchmark firm performance. Benchmark-adjusted percentage changes in operating performance are reported for five years (0, +4).

In Panel A of Table 4, for year zero, the year of the transaction, buyer firms in equity-based asset sales show normal performance relative to benchmark firms. However, in each year after the transaction, buyer firms significantly outperform benchmark firms. These improvements in subsequent operating performance for buyer firms are not reversed in subsequent years, suggesting that the positive returns to buyer firms at announcements of equity-based asset sales reflect the market's anticipation of an

improvement in buyer future performance as a result of the transaction, and that the gains in wealth generated by these transactions are shared between buyers and sellers. In contrast, buyers that acquire assets for cash do not show any improvement in subsequent operating performance relative to benchmark firms. This evidence is consistent with the event study results that indicate that cash asset sales generate little gain in combined wealth. Overall, the results indicate that equity-based asset sales are associated with an improvement in the subsequent operating performance of buyers, as well as a greater increase in shareholder wealth, relative to cash asset sales.

In Panel B, in year zero seller firms that engage in either equity-based or cash asset sales show normal operating performance relative to benchmark firms, and their operating performance remains similar to benchmark firms in subsequent years. Thus, there is no evidence of improvement in profitability for seller firms as a result of these transactions.

7. Conclusions

We develop a theoretical model of intercorporate asset sales based on the perspective that two-sided asymmetric information problems and their effects on the choice of the means of payment play central roles in these transactions. As a result of its ownership of the asset-to-be-sold, the seller has private information about the asset that is material to its value, while each potential buyer has private information about its own existing assets and about the value that can be generated if the asset is conjoined with them. Our theory generates a broad array of predictions about the overall gains in wealth from asset sales, the distribution of the gains between buyers and sellers, and the different roles that buyer and the seller private information have in determining the terms of the transaction. We model the asset sale process as a double signaling game with the result that the asset is allocated efficiently and each party's information is revealed: buyer information in competitive bidding, and seller information in establishing the financial structure of the transaction. Our results provide valuable perspective about why existing theoretical models of mergers are not adequate for explaining intercorporate asset sales, and explain why empirical results on the choice between the use of equity versus cash in asset sales are contrary to the results for mergers.

The structure of our model reflects two key characteristics of asset sales. First, asset sales entail auction-like procedures early in the process that are designed to select the best buyer from a pool of candidates. Second, asset sales are governed by the business judgment rule which gives selling firm managers the flexibility to make a final, take-it-or-leave-it counteroffer to the (selected) bidder. The latter feature is crucial for distinguishing asset sales from mergers and related corporate control transactions that are subject to disclosure requirements and a vote for approval or rejection by target shareholders. In our model, the selling firm commits to an auction-type procedure that enables it to elicit buyers' information about the asset and to choose the buyer with the highest post-transaction value. If the seller's private information indicates that the asset is of low value, a cash deal is concluded with the highest bidder. When the seller's private information indicates that the value of the asset is high, the seller makes a take-it-or-leave-it counteroffer to the highest bidder that entails the issuance of buyer equity to the seller which signals the positive information that the asset is of high value. The terms of this counteroffer insure that the seller of a low-value asset would not imitate the equity-based counteroffer. The model predicts strong gains in combined wealth, with positive excess returns for both buyers and sellers, for equity-based asset sales. In contrast, the model predicts only modest combined wealth gains in cash transactions, and these gains are appropriated by sellers. A central feature of our model is the prediction that asymmetric information about the bidder's existing assets has no impact on the determination of the means of payment in an asset sale since the financial structure of the deal reflects only seller private information.

We test the model by analyzing the share price effects for a sample of cash asset sales and the set of equity-based asset sales that do not create a corporate blockholding in the buyer. The empirical results are consistent with the predictions of our theoretical model. Cash asset sales generate positive returns to sellers, negative and not significant returns to buyers, and no significant change in combined wealth. In contrast, equity-based asset sales generate large combined gains in wealth, with large positive excess returns to both buyers and sellers, gains that are significantly greater than the gains in cash asset sales. Sellers capture about 60% of the combined gains in wealth in equity-based deals, but all of the gains in cash deals. When

viewed globally, buyers obtain a share of the overall gains generated by asset sales. The estimation results for a logit model of the choice of the means of payment indicate that asymmetric information about the seller, and not about the buyer, influences the choice of equity versus cash in intercorporate asset sales. We also find significant improvements in the subsequent operating performance of buyers in equity-based deals, but no changes in performance after cash deals. Overall, our findings demonstrate that selling firms establish a structure for intercorporate asset sales that ensures the informational efficiency of these transactions.

Appendix A.

Proof of Proposition 1

We construct the necessary structure of a separating equilibrium counteroffer. Suppose that x is common knowledge at this stage of the negotiation and that $C < w(v_L, x)$ (we will show in Proposition 2 that this is indeed the case). If the seller makes a counteroffer (β^*, c^*) only when $v = v_H$, the equilibrium is separating. It follows that

$$E[w(v, x) \mid \text{seller accepted } (B, C)] = w(v_L, x),$$

$$E[w(v, x) \mid \text{counteroffer } (\beta^*, c^*)] = w(v_H, x).$$

Thus, the buyer is willing to accept a counteroffer (β^*, c^*) if

$$\Pi_B(x, \beta^*, c^*) = (1 - B) \left(1 - \frac{C}{w(v_L, x)} \right) w(v_H, x) - x > \max \{ (1 - B) (w(v_L, x) - C) - x, 0 \}$$

Second, observe that when $v = v_L$, the seller weakly prefers the initial offer (B, C) to the counteroffer (β^*, c^*) as the latter would provide a profit equal to

$$\beta^* w(v_L, x) - y = B(w(v_L, x) - C) + C - y.$$

When $v = v_H$, the seller strictly prefers the counteroffer to accepting the offer (B, C) since

$$\beta^* w(v_H, x) - y > B(w(v_H, x) - C) + C - y,$$

where the right-hand side would be its profit from accepting the buyer's initial offer. We are left to show that (i) there is no counteroffer $(\beta', c') \neq (\beta^*, c^*)$ that provides a higher profit for the seller, and (ii) that the equilibrium is unique.

(i) In order to show that there is no better separating offer, we determine the buyer's out-of-equilibrium beliefs using the D1 criterion. First, we describe how the D1 refinement applies to this signaling game. Let $\Pi_S^*(v_L, x)$ and $\Pi_S^*(v_H, x)$ be the seller's equilibrium profit for $v = v_L$ and $v = v_H$, respectively. Suppose that the buyer observes an out-of-equilibrium counteroffer (β', c') . For each seller's type $v \in \{v_L, v_H\}$, let $q(v)$, be the minimum probability of acceptance that makes this counteroffer attractive to the seller:

$$q(v) := \arg \min_{q \geq 0} q(\beta'(w(v, x) - c') + c' - y) \geq \Pi_S^*(v, x)$$

Then, the D1 criterion requires that the buyer believe that the deviation (β', c') comes from the seller's type that would find it attractive for the smallest acceptance probability,¹³ i.e.,

$$E[v | (\beta', c')] = \arg \min_{v \in \{v_L, v_H\}} q(v)$$

First consider a deviation (β', c') that is potentially profitable for the seller when $v = v_H$, in the sense that $\beta'(w(v_H, x) - c') + c' - y > \Pi_S^*(v_H, x)$. It can be verified that the deviation (β', c') violates the seller's incentive compatibility constraint and therefore will also be potentially profitable for the seller when $v = v_L$. Thus,

$$\beta'(w(v, x) - c') + c' - y > \Pi_S^*(v, x) \tag{A1}$$

for $v \in \{v_L, v_H\}$. Then according to the D1 criterion, the buyer will believe that $v = v_L$ as $q(v_L) < q(v_H)$. To see this point, note that $\Pi_S^*(v, x) = \beta^* w(v, x) - y$ for $v \in \{v_L, v_H\}$, and so

¹³ If $q(v_L) = q(v_H)$, then the out-of-equilibrium path belief can be freely chosen between 0 and 1.

$$q(v) = \frac{\beta^* w(v, x) - y}{\beta'(w(v, x) - c') + c' - y}$$

Thus, $q(v_L) < q(v_H)$ if and only if $\beta^*(1 - \beta')c' + y(\beta' - \beta^*) > 0$, which is trivially verified for $\beta' \geq \beta^*$ and $c' > 0$. To verify that $q(v_L) < q(v_H)$ for $\beta' < \beta^*$ and $c' \geq 0$, observe that any (β', c') must satisfy expression (A1). Multiplying both sides of expression (A1) by β^* , adding $y(\beta' - \beta^*)$ to both sides and rearranging, we have $\beta^*(1 - \beta')c' + y(\beta' - \beta^*) > (\beta^* - \beta')(w(v, x) - y)$, which is strictly positive for all $\beta' < \beta^*$.

Thus, after observing an unexpected counteroffer (β', c') satisfying expression (A1), the buyer will believe that $v = v_L$ and will reject such a counteroffer. In fact, expression (A1) and $E[v | (\beta', c')] = v_L$ imply

$$\Pi_B(x, \beta', c') = (1 - \beta')(w(v_L, x) - c') - x < (1 - B)(w(v_L, x) - C) - x,$$

which means that the buyer prefers to reject the counteroffer (β', c') and to claim the compensation $(1 - B)(w(v_L, x) - C) - x$ instead. For the same reason, a deviating counteroffer that is potentially profitable for the seller only when $v = v_L$ will induce the buyer to believe $v = v_L$ and to prefer the compensation $(1 - B)(w(v_L, x) - C) - x$ rather than to accept such a counteroffer. Thus, the seller cannot find an alternative counteroffer (β', c') that is better than (β^*, c^*) and that is acceptable to the buyer.

(ii) To show uniqueness, we demonstrate that any equilibrium where $(\beta_H, c_H) \neq (\beta^*, c^*)$ is the offer for type $v = v_H$, does not survive the D1 criterion. Consider an equilibrium where (β_L, c_L) and $\Pi_S(v_L, x)$ are the format of payment and the seller's profit, respectively, when $v = v_L$; similarly, let (β_H, c_H) and $\Pi_S(v_H, x)$ be the format of payment and the seller's profit, respectively, when $v = v_H$. The incentive compatibility constraint for the seller requires

$$\Pi_S(v_L, x) = \beta_L(w(v_L, x) - c_L) + c_L - y \geq \beta_H(w(v_L, x) - c_H) + c_H - y \quad (\text{A2})$$

In order to show that there are no separating equilibria surviving D1 that are different from the one described in Proposition 1, we proceed in two steps.

First, we show that in any separating equilibrium it must be that $\Pi_S(v_L, x) = B(w(v_L, x) - C) + C - y$. This is true for all equilibria where the seller accepts the buyer's offer when $v = v_L$. In a separating equilibrium where the seller makes a counteroffer (c_L, β_L) when $v = v_L$, the type v is revealed in $t=1$, and therefore the overall value created is $w(v_L, x) - x - y$. Note that the buyer's equilibrium payoff must not be smaller than what the buyer can obtain by rejecting the counteroffer, that is $(1 - B)(w(v_L, x) - C) - x$. It follows that what remains for the seller is $\Pi_S(v_L, x) \leq B(w(v_L, x) - C) + C - y$. However, the seller always has the option to accept the buyer's cash offer and receive $B(w(v_L, x) - C) + C - y$. Thus, $\Pi_S(v_L, x) = B(w(v_L, x) - C) + C - y$.

Second, we show that a separating equilibrium different from the one described in Proposition 1 does not survive the D1 refinement criterion. Consider an equilibrium where $(\beta_H, c_H) \neq (\beta^*, 0)$. Take a deviation for the seller that consists of making the counteroffer $(\beta' + \epsilon, 0)$, where $\epsilon > 0$ and is small, and β' satisfies $\beta' w(v_H, x) - y = \Pi_S(v_H, x) = \beta_H(w(v_H, x) - c_H) + c_H - y$. If such a counteroffer is accepted, this would clearly be a profitable deviation for the seller when $v = v_H$, thus $q(v_H) < 1$. Note that $\Pi_S(v_L, x) = B(w(v_L, x) - C) + C - y$ and the incentive compatibility constraint (A2) imply

$$\Pi_S(v_L, x) = B(w(v_L, x) - C) + C - y \geq \beta_H(w(v_L, x) - c_H) + c_H - y \geq \beta' w(v_L, x) - y \quad (\text{A3})$$

where the last inequality follows from the definition of β' implying

$$\beta_H(w(v_L, x) - c_H) + c_H - \beta' w(v_L, x) = c_H(1 - \beta_H)(w(v_H, x) - w(v_L, x))/w(v_H, x) \geq 0 \quad (\text{A4})$$

If $c_H = 0$, the first inequality in (A3) is strict because $(\beta_H, c_H) \neq (\beta^*, 0)$. If $c_H > 0$, the second inequality in (A3) is strict because of (A4). Therefore, when $v = v_L$ and for $\epsilon > 0$ but small, the seller strictly prefers the equilibrium payoff $B(w(v_L, x) - C) + C - y$ to the deviation obtained if counteroffer $(0, \beta' + \epsilon)$ is accepted. This implies $q(v_L) \geq 1$. Thus, according to the D1 criterion, when the buyer observes the out-of-equilibrium counteroffer $(0, \beta' + \epsilon)$, it believes $v = v_H$ and therefore will accept such a counteroffer. Hence, the seller has a profitable deviation for $v = v_H$. Thus, a contradiction. \square

Appendix B

Proof of Proposition 2

Proof: Consider a buyer whose competitors use the bidding strategy $(0, C(x))$ described in Proposition 2. First we show that $C(x)$ is the buyer's best pure-cash response. Second, we show that no bid including equity can provide this buyer with an expected payoff greater than a pure-cash bid.

The first order condition when the buyer is restricted to pure-cash bids can be verified by direct substitution of expressions (4), (5), and (6) into (3), taking into account that $\beta(g) = C(g)/w(v_L, g)$. In order to prove the second order condition we will show that the objective function is pseudoconcave, i.e., $\pi_2(x, g) \geq 0$ for $g < x$ and $\pi_2(x, g) \leq 0$ for $g > x$. First, we show that $\pi_{1,2}(x, g)$, the cross derivative of $\pi(x, g)$, is strictly positive. In fact,

$$\pi_{1,2}(x, g) = f_N(g)(pw_2(v_L, x) + (1 - p)w_2(v_H, x)(1 - \beta(g)) - 1) - \beta'(g)F_N(g)(1 - p)w_2(v_H, x) \quad (\text{B1})$$

Equation (3) leads to

$$\beta'(g)F(g) = f_N(g) \left(\frac{(1 - \beta(g))E[w(\mathbf{v}, g)] - g}{E[w(\mathbf{v}, g)]} \right) - \frac{\beta(g)F_N(g)pw_2(v_L, g)}{E[w(\mathbf{v}, g)]}$$

Substituting this expression into equation (B1), it results that $\pi_{1,2}(x, g) > 0$ provided that

$$g(1 - p)w_2(v_H, x) + (pw_2(v_L, x) - 1)E[w(\mathbf{v}, g)] > 0$$

It is easy to verify that the left hand side of this expression is strictly concave in p and that $w_2(\mathbf{v}, x_L) \geq w(\mathbf{v}, x_H)/x_H$ guarantees that the inequality is satisfied for $p = 0$ and $p = 1$. Consider now $g < x$, then $\pi_{1,2}(x, g) > 0$ implies $\pi_2(x, g) > \pi_2(g, g) = 0$, where the last equality follows from the first order condition. Similarly, for $g > x$, $\pi_{1,2}(x, g) > 0$ implies $\pi_2(x, g) < \pi_2(g, g) = 0$.

Notice the expression of $C(x_L)$ can be obtained as $\lim_{x \rightarrow x_L} C(x)$. In order to see that $C(x)$ is an increasing function, note first that $\phi(t, x)$ is strictly increasing in t as $w_2(v, x) \geq w(v, x_H)/x_H > 1$ guarantees that $(1 - t/E[w(v, t)])$ is increasing in t . Second observe that

$$C'(x) = \beta(x)w_2(v_L, x) \frac{(1-p)w(v_H, x)}{E[w(v, x)]} + w(v_L, x) \frac{f_N(x)}{F_N(x)^2} \int_{x_L}^x (\phi(x, x) - \phi(t, x)) f_N(t) dt$$

which is positive as the argument of the integral is positive for $\phi(t, x)$ increasing in t . Moreover $C(x) = \beta(x)w(v_L, x) < w(v_L, x)$. Finally, $C(x)$ is larger than y as $C(x_L) = w(v_L, x_L) - x_L w(v_L, x_L)/E[w(v, x_L)] > w(v_L, x_L) - x \geq y$ and $C(x)$ is increasing.

Now we show that the pure cash bidding strategy depicted in Proposition 2 is an equilibrium of the first stage of the game satisfying the D1 criterion when potential buyers can offer any combination of equity and cash. In order to prove this result, recall that $x(B, C)$ is the seller's expectation of the type of a potential buyer that makes an offer (B, C) . This expectation is derived from the equilibrium beliefs if an offer with $B = 0$ is observed and it is determined using the D1 criterion otherwise. Denote by

$$\beta(B, C) = B + (1 - B) \left(\frac{C}{w(v_L, x(B, C))} \right)$$

the counteroffer that, according to Proposition 1, a seller of type $v = v_H$ makes if it selects offer (B, C) and holds beliefs $x(B, C)$. Note that the seller's counteroffer to an offer (B, C) also depends on the belief $x(B, C)$ induced by this offer. In order to describe how the D1 refinement applies to this phase of the game, we introduce the variable $q(x, B, C)$ defined as

$$q(x, B, C) := \arg \min_{q \geq 0} q \left[p(1 - B)(w(v_L, x) - C) + (1 - p)\beta(B, C)w(v, x) - x \right] \geq \Pi_B^*(x)$$

where $\Pi_B^*(x)$ is the equilibrium expected payoff of a bidder of type x . Then for a deviating offer (B, C) the seller out of equilibrium path beliefs satisfy

$$x(B, C) = \arg \min_x q(x, B, C) \quad (\text{B2})$$

In other words, the seller believes that the deviation (B, C) comes from the buyer's type that would find it attractive for the smallest winning probability.

Consider a deviation (B, C) with $B > 0$. It is sufficient to show that this deviation is not profitable for the bidder of type $x = x(B, C)$, as this is the bidder type that will most profit from such a deviation. Upon being selected by the seller after offering (B, C) , this bidder's expected profit will be

$$(1 - B)E[w(\mathbf{v}, x(B, C))](1 - C/w(v_L, x(B, C)))$$

Consider now an alternative pure-cash deviation $(0, C')$, where C' is such that the bidder of type $x(B, C)$ is indifferent between winning the auction with offer (B, C) or with offer $(0, C')$. In other terms C' satisfies

$$p(w(v_L, x(B, C)) - C') + (1 - p)(1 - \beta(0, C'))w(v_H, x(B, C)) = (1 - B)E[w(\mathbf{v}, x(B, C))]\left(1 - \frac{C}{w(v_L, x(B, C))}\right)$$

with $\beta(0, C') = C'/w(v_L, x(0, C'))$, where $x(0, C')$ is the seller's expectation regarding the type of a buyer that offered $(0, C')$. Thus:

$$C' = \frac{E[w(\mathbf{v}, x(B, C))]w(v_L, x(0, C'))}{pw(v_L, x(0, C')) + (1 - p)w(v_H, x(B, C))} \frac{(Bw(v_L, x(B, C)) + C(1 - B))}{w(v_L, x(B, C))} \quad (\text{B3})$$

Lemma 1B: If $x(0, C') \geq x(B, C)$, then the seller prefers a buyer that offers $(0, C')$ to a buyer that offers (B, C) .

Proof: If $v = v_L$, then the seller's expected revenue from accepting the offer (B, C) is $B(w(v_L, x(B, C)) + C(1-B) \leq C'$, which is the seller's revenue if it accepts offer $(0, C')$, where the inequality follows from expression (B3) and $x(0, C') \geq x(B, C)$. If $v = v_H$, then the seller's expected revenue from making a counteroffer $(0, \beta(B, C))$ to a buyer that offered (B, C) is $(B + (1-B)C/w(v_L, x(B, C)))w(v_H, x(B, C)) < C'w(v_H, x(0, C'))/w(v_L, x(0, C'))$, which is its expected revenue by making a counteroffer $(0, \beta(0, C'))$ to a buyer that offered $(0, C')$. The inequality follows from expression (B3), $x(0, C') \geq x(B, C)$ and the fact that $w_2(v, x_i)x_i/w(v, x_i)$ is not decreasing in v . \square

Lemma 1B implies that if $x(0, C') \geq x(B, C)$, then the offer $(0, C')$ has higher probability of being accepted by the seller than the offer (B, C) . Therefore if a buyer of type $x = x(B, C)$ finds that deviating to offer (B, C) is profitable, then it must also be profitable to deviate to offer $(0, C')$ as the latter has higher probability of winning the auction and provides the same payoff of (B, C) . However, from the first part of the proof, we know that there is no pure-cash profitable deviation. Hence a contradiction. Thus, to complete the proof it is sufficient to show that $x(0, C') \geq x(B, C)$ is consistent with the D1 criterion. First, suppose that any bidder with synergy $x' < x(B, C)$ receives a higher payoff from offer (B, C) than from $(0, C')$, conditional on winning the auction. It then follows that

$$q(x', 0, C') \geq q(x', B, C) \geq q(x(B, C), B, C) = q(x(B, C), 0, C'),$$

where the second inequality follows from (B2) and the equality follows from the definition of C' . Thus,

$$x(0, C') = \arg \min_x q(x, 0, C') \geq x(B, C).$$

Finally, we show that if $x(0, C') \geq x(B, C)$ then any bidder with synergy $x' < x(B, C)$ receives a higher payoff from offer (B, C) than from $(0, C')$, conditional on winning the auction. We need to show that

$$p(1 - B)(w(v_L, x') - C) + (1 - p)(1 - \beta(B, C))w(v_H, x') \geq p(w(v_L, x') - C') + (1 - p)(1 - \beta(0, C'))w(v_H, x')$$

which can be rewritten as

$$- pBw(v_L, x') + p(C' - C) + (1 - p)p\beta(B, C) \left(\frac{w(v_L, x(B, C)) - w(v_L, x(0, C'))}{pw(v_L, x(0, C')) + (1 - p)w(v_H, x(B, C))} \right) w(v_H, x') \geq 0$$

Note that equality holds for $x' = x(B, C)$ because of the definition of C' , whereas the inequality is strict for $x' < x(B, C)$, as $x(B, C) \leq x(0, C')$ and $w(\cdot)$ is a strictly increasing function. \square

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Table 1
Descriptive statistics

Statistics for means and medians, in parentheses, are reported for buyer and seller firms listed on NYSE/ASE/Nasdaq that engaged in asset sales over the sample period 1989 through 2002, using as the means of payment cash or buyer equity that is conveyed immediately to seller shareholders. Statistical significance for the difference between cash versus equity-based transactions is obtained by the Satterthwaite test for the difference in means and by the Wilcoxon signed rank test for the difference in medians. The value of the transaction is calculated in millions of constant (1997) dollars. Buyer common stock used in payment for the asset is valued at the buyer's share price prior to the announcement of the transaction. Market value is calculated as the number of shares outstanding multiplied by stock price prior to the event announcement, and reported in millions of constant (1997) dollars. The seller's equity interest in the buyer is the percentage of the buyer's shares outstanding that seller shareholders gain as a result of the transaction. The percent of payment in equity is the percent of the transaction price that is paid in the form of buyer common stock. Insider ownership is the percentage of outstanding shares held by all officers and members of the firm's board of directors. Institutional ownership is defined as the percent of outstanding shares held by investment companies, banks, insurance companies, college endowments, and 13F money managers.

	Buyers		Sellers	
	Equity-based N=37	Cash N=93	Equity-based N=37	Cash N=93
	Mean (Median)	Mean (Median)	Mean (Median)	Mean (Median)
	(1)	(2)	(3)	(4)
Value of the transaction (\$1997, millions)	1,906.5 (1,205.0)	1,380.9 (1,010.7)	1,906.5 (1,205.0)	1,380.9 (1,010.7)
Market value (\$1997, millions)	9,305.4** (1,983.2)***	20,850.2** (5,978.4)***	7,686.5** (1,927.6)***	14,851.2** (10,024.1)***
Value of transaction/market value (%)	89.5** (45.0)***	48.8** (13.3)***	77.4*** (58.0)***	31.2*** (10.8)***
Seller's equity interest in buyer (%)	28.9 (24.1)	— —	28.9 (24.1)	— —
Percent of payment in equity (%)	71.3 (70.3)	— —	71.3 (70.3)	— —
Insider ownership (%)	9.4 (1.6)	5.0 (1.8)	11.5* (4.6)***	5.3* (1.0)***
Institutional ownership (%)	52.0 (52.2)	50.7 (54.0)	53.9 (56.8)	48.7 (51.1)

Significance is indicated by *, at the 10% level, **, at the 5% level, *** at the 1% level.

Table 2**Empirical results for testing the information structure of asset sales**

Empirical results are reported for metrics of asset sales predicted by the theoretical model. The metrics are (Panel A) two-day (-1, 0) announcement excess returns for buyers and sellers and for combined returns and (Panel B) two-day announcement excess returns relative to transaction size for buyers and sellers and combined returns. Average excess announcement returns in percent are in response to 37 equity-based asset sales and 93 cash asset sales over the period 1989 through 2002 for buyer and seller firms listed on CRSP. For combined returns, buyer and seller excess returns are weighted by their respective pre-announcement market values. Excess returns are calculated using market model methodology; t-statistics are in parentheses and the proportion of returns positive is in brackets. The statistical significance of the median and the proportion positive is based on the Wilcoxon signed rank test. The p-values indicate the significance level of the difference between cash versus equity-based deals and are obtained by the Satterthwaite test for the difference in means and by the Wilcoxon signed ranks test for the difference in medians. Market model parameters are estimated using least squares over the pre-event period, $t = -160$ to -41 , where day 0 is the date of the first announcement in the Wall Street Journal.

	Buyer		p-value Equity vs Cash	Seller		p-value Equity vs Cash	Combined		p-value Equity vs Cash
	Equity	Cash		Equity	Cash		Equity	Cash	
Panel A. Two-day excess returns									
Mean	3.44%	-0.03%	(0.01)	6.92%	1.43%	(0.00)	4.17%	0.15%	(0.00)
t-statistic	(6.11)***	(-0.12)		(13.57)***	(5.31)***		(4.55)***	(0.58)	
Proportion>0	[0.68]**	[0.49]	(0.05)	[0.78]***	[0.62]**	(0.04)	[0.86]***	[0.54]	(0.00)
Quartiles									
75%	7.90%	2.69%		11.33%	3.05%		6.98%	2.03%	
Median	2.31%**	-0.33%	(0.00)	4.45%***	1.09%***	(0.00)	2.35%***	0.28%	(0.00)
25%	-0.41%	-2.07%		0.40%	-0.66%		0.72%	-0.96%	
Panel B. Two-day transaction returns (wealth gains relative to transaction size)									
Mean	20.15%	-14.15%	(0.03)	20.00%	0.21%	(0.10)	40.15%	-13.94%	(0.00)
t-statistic	(2.05)**	(-1.34)		(3.93)***	(0.02)		(3.21)***	(-1.06)	
Proportion>0	[0.68]**	[0.49]	(0.05)	[0.78]***	[0.62]**	(0.04)	[0.86]***	[0.54]	(0.00)
Quartiles									
75%	24.11%	12.41%		26.08%	22.08%		46.60%	26.07%	
Median	4.87%***	-1.01%	(0.01)	9.48%***	6.50%***	(0.03)	17.63%***	2.80%	(0.01)
25%	-0.58%	-20.41%		1.15%	-3.66%		4.10%	-24.20%	

Significance is indicated by *, at the 10% level, **, at the 5% level, *** at the 1% level.

Table 3**Logit estimates for the choice of means of payment: equity versus cash**

This table presents coefficient estimates from logit regression models for the choice between cash versus equity-based asset sales. The dependent variable equals one for asset sales in which the means of payment entails buyer equity and zero for cash transactions. All firm specific variables are based on data prior to the announcement of the asset sale. Research and development expenditures (including advertising) are divided by property, plant, and equipment, calculated for the last fiscal year prior to the announcement date. Market/book is the market value of the firm divided by the book value of its assets. Analyst following is the number of analysts that generate an earnings forecast for the firm for the upcoming quarter. The analyst earnings surprise variable is the mean of the absolute value of the difference between the median quarterly earnings estimate and the actual quarterly earnings of the firms per share, normalized by the stock price, for the preceding year. Analysts earnings dispersion is the standard deviation of outstanding earnings forecasts normalized by stock price over the previous year. The bid ask spread is the stock's daily bid ask spread, divided by share price, average over the month prior to the announcement. Trading volume is the trading volume for the stock divided by shares outstanding averaged for the month prior to the announcement. The size of the asset is the value of asset divided by the sum of the value of the buyer firm plus the value of the asset, using share prices prior to the announcement of the transaction. The p-values are reported in parentheses below the estimated coefficient.

	(1)	(2)	(3)
Seller-Research & development	18.96 (0.03)		21.81 (0.10)
Seller-Market/book	-0.01 (0.66)		-0.02 (0.80)
Seller-Analyst following	-0.11 (0.01)		-0.10 (0.04)
Seller-Analyst earnings surprise	30.62 (0.08)		48.85 (0.03)
Seller-Analyst earnings dispersion	16.56 (0.80)		-25.44 (0.81)
Seller-Bid-ask spread	-31.73 (0.32)		-57.05 (0.18)
Seller-Trading volume	-267.80 (0.07)		-324.90 (0.05)
Buyer-Research & development		3.97 (0.66)	6.58 (0.23)
Buyer-Market/book		0.12 (0.30)	0.12 (0.39)
Buyer-Analyst following		-0.03 (0.37)	-0.01 (0.91)
Buyer-Analyst earnings surprise		-26.85 (0.58)	-18.85 (0.84)

Buyer-Analyst earnings dispersion		14.94 (0.90)	40.77 (0.82)
Buyer-Bid-ask spread		-7.99 (0.77)	-2.08 (0.96)
Buyer-Trading volume		84.78 (0.23)	173.70 (0.20)
Size of asset	4.96 (0.00)	2.35 (0.05)	6.28 (0.00)
Intercept	0.02 (0.99)	-1.77 (0.08)	-0.57 (0.75)
Proportion concordant	0.86	0.73	0.90

Table 4**Adjusted operating performance subsequent to asset sales**

Operating performance measures for buyer and seller firms that engaged in equity-based and cash asset sales over the sample period 1989 through 2002 for firms listed on NYSE/ASE/Nasdaq. Performance measures for each company are adjusted by subtracting the median (mean) performance measure for a group of matched companies benchmarked in year -1. Year 0 denotes the fiscal year in which the asset sale announcement is made. Return on assets, ROA, is operating income before depreciation, interest, taxes and extraordinary items divided by average total assets. Return on sales, ROS, is operating income divided by total sales. The statistical significance of the mean is based on the t-test and the statistical significance of the median is based on the Wilcoxon signed rank test.

Year	Buyers					Sellers					
	0	+1	+2	+3	4	0	+1	+2	+3	4	
<i>A. Equity-based asset sale transactions</i>											
Adjusted return on assets in percent, ROA											
Mean	1.84	3.63	4.24	5.31	4.07	Mean	-0.75	-0.95	-0.41	-0.45	0.27
(p-value)	(0.30)	(0.03)	(0.04)	(0.02)	(0.10)	(p-value)	(0.72)	(0.43)	(0.50)	(0.28)	(0.85)
Median	1.20	1.60	2.73	2.90	4.64	Median	-0.40	-0.13	-0.53	-0.87	-0.22
(p-value)	(0.33)	(0.06)	(0.05)	(0.02)	(0.07)	(p-value)	(0.85)	(0.89)	(0.56)	(0.56)	(0.81)
Adjusted return on sales in percent, ROS											
Mean	1.18	2.17	4.27	4.60	3.44	Mean	0.85	-0.08	0.72	-0.20	-0.59
(p-value)	(0.23)	(0.01)	(0.02)	(0.03)	(0.04)	(p-value)	(0.15)	(0.97)	(0.68)	(0.91)	(0.80)
Median	1.20	1.60	2.73	2.90	4.64	Median	0.68	0.31	0.13	-0.65	-0.49
(p-value)	(0.33)	(0.06)	(0.05)	(0.02)	(0.07)	(p-value)	(0.23)	(0.60)	(0.37)	(0.58)	(0.96)
<i>B. Cash asset sale transactions</i>											
Adjusted return on assets in percent, ROA											
Mean	-0.19	-0.77	0.54	0.14	0.01	Mean	-0.53	-0.11	0.72	0.47	-0.81
(p-value)	(0.68)	(0.16)	(0.20)	(0.64)	(0.76)	(p-value)	(0.43)	(0.81)	(0.23)	(0.49)	(0.28)
Median	-0.08	-0.29	0.19	0.36	-0.44	Median	-0.31	0.50	0.75	0.38	-0.13
(p-value)	(0.73)	(0.17)	(0.32)	(0.57)	(0.30)	(p-value)	(0.16)	(0.90)	(0.15)	(0.30)	(0.99)
Adjusted return on sales in percent, ROS											
Mean	0.32	0.67	0.66	0.46	-0.99	Mean	0.45	-0.41	0.80	0.45	-0.10
(p-value)	(0.65)	(0.44)	(0.25)	(0.37)	(0.31)	(p-value)	(0.60)	(0.54)	(0.15)	(0.51)	(0.92)
Median	0.40	0.15	0.59	0.13	0.33	Median	0.02	-0.38	0.55	0.32	0.36
(p-value)	(0.11)	(0.39)	(0.12)	(0.77)	(0.92)	(p-value)	(0.77)	(0.61)	(0.15)	(0.45)	(0.71)