Asset Sales and the Role of Buyers: Strategic Buyers versus Private Equity

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by

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Abstract

We model bidding behavior and the interaction of private equity and strategic buyers in corporate asset sales. Private equity bidding and in turn seller gains, and type and time of exit, are determined by private equity's ability to enhance the asset's value. Our empirical results show excess returns to sellers are greater for sales to private equity than strategic buyers. Seller gains in private equity deals are related to subsequent increases in asset values and type and time of exit. Value increases during private equity ownership significantly exceed those of benchmark firms.

KEYWORDS: PRIVATE EQUITY, ASSET SALES, RESTRUCTURING, CORPORATE AUCTIONS, SECONDARY BUYOUTS.

JEL: G32, G34.

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Abstract

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1. Introduction

Since the early 1990s, private equity funds have been frequent bidders in corporate asset sales, a market previously dominated by strategic buyers (operating firms), and asset sales have become an important facet of private equity activity.[1] In this paper, we present a model of bidder competition and provide empirical work to understand the bidding behavior and strategic interaction of private equity and strategic buyers in corporate asset sales. Asset sales are an appropriate venue for our auction-based analysis, because unlike mergers, they are invariably non-hostile, typically seller-initiated, and leave the selling firm's managers in place. Moreover, corporation law gives managers full latitude to identify assets for sale and set rules for an auction without shareholder involvement or concern about judicial second guessing the merits of seller or buyer decisions.[2] Since it is reasonable for a parent firm to structure the sale process to foster competition among potential bidders, an auction framework is well suited to the institutional environment governing corporate asset sales.

We consider the following key questions. One, how does private equity decide whether to enter the bidding for an asset, and how do the bidding behaviors of private equity and strategic buyers interact? Two, what are bidder valuations of private equity relative to strategic buyers, and what explains this hierarchy? Three, how do private equity bids relate to expected exits, that is, the expected change in asset value and the choice of exit route: IPO, sale to a strategic buyer, or secondary buyout (SBO)? Our theoretical analysis generates implications about asset sales, based on the premise that

[1] Eckbo and Thorburn (2008) report that on average asset sales make up 38% of all merger and acquisition transactions over the period 1970 to 2006. Kaplan and Stromberg (2009) report that corporate divestitures are on par in deal values with stand-alone targets in the acquisition flow of private equity firms from 1995 to 2004.

[2] The business judgment rule governs asset sale decisions, which gives managers broad discretion about the conduct of the sale and insulates the transaction from shareholder voting and shareholder litigation. The laissez-faire approach of corporate law to asset sales is justified since both seller and buyer managers continue to operate subject to the discipline and monitoring of financial markets (Gilson, 1981).

private equity plays a different role than strategic buyers in enhancing the value of the assets it acquires. We obtain evidence from large corporate asset sales to evaluate the model's predictions. Our empirical findings suggest that private equity bids aggressively for assets that are expected to generate important subsequent gains as gauged by asset value at exit. The link between wealth gains to parent seller firms and the ensuing growth in asset values that we observe supports the view that the entities acquired by private equity increase in value relative to benchmark firms and that the prices parent firms receive reflect a capitalization of these gains. Overall, we find close correlation between the gains in wealth to the original seller, the asset's performance under private equity ownership, the type of exit transaction, and the time to exit.

Our model applies the usual assumption that strategic bids reflect the (exogenous) value of synergies between bidder assets and the asset for sale. Our theory endogenizes private equity's decision to enter the bidding, with the aggressiveness of its bidding reflective of its ability to enhance the asset's value and exit successfully. Despite an absence of the synergies intrinsic to strategic bidders, private equity may be able to improve an operating asset in ways not feasible for strategic firms or the parent seller. For example, managers of less well-performing subsidiaries within a parent organizational structure have an incentive to lobby parents to secure additional resources to protect their unit, costly activities - referred to as influence costs - that harm parent firm value (Meyer, Milgrom, and Roberts 1992). After acquiring control, private equity can eliminate these costs, implement restructuring plans, and enforce managerial discipline. Our analysis suggests that when such gains are expected to be large, private equity is more likely to enter the auction and bid aggressively, while assets with less potential for such gains are more likely to go to strategic buyers. Since prior empirical studies consistently report modest share price effects (and thus weak synergistic gains) at asset sales

to strategic buyers, our model suggests that under reasonable parametric assumptions, seller revenue is higher at news of a sale to private equity compared to a sale to a strategic buyer.

A key element of our model is that private equity's bidding behavior is endogenously determined by the asset's expected value at exit, which in turn takes account of the future bidding competition for the asset among synergistic bidders (trade sales) and private equity bidders. Thus, gains to parent firms at news of asset sales to private equity should be positively correlated with the asset's subsequent performance. In addition, asset performance should exceed that of benchmark firms and lead to a hierarchy in the type of, and time to, exit transaction. Greater gains in value and shorter times to exit should occur for IPOs, followed by sales to strategic buyers, and then SBOs. There are larger value increases for exits via trade sales compared to SBOs because SBOs only occur when competing strategic bids are relatively low. In this exit setting, private equity bidders act as a liquidity provider or a form of buyer of last resort.

We examine large asset sales from 1994 through 2004. In practice, a strategic buyer may be either a public or a private operating firm since both have synergistic possibilities. Since private firms are exempt from public reporting and often have equity-based links between managers and owners, they have some aspects of private equity. Thus, we analyze the effects on seller gains for each type of buyer. Our main findings are consistent with the implications of the theory. One, at asset sales to private equity, sellers earn large positive excess returns, 3.78%, that are significantly greater than at sales to public operating firms, 1.25%, or private operating firms, 0.95%. Public strategic buyers obtain positive excess returns, 0.48%, suggesting some extraction of rents for their private information about expected synergies. However, in deals with public buyers, the combined wealth gains, and thus expected synergies, are low, consistent with prior asset sale studies. There is no evidence of the

overbidding by public buyers that Bargeron, Schlingemann, Stulz, and Zutter (2008) find in their study of mergers.

As of year end 2011, 83% of the assets have an exit. We confirm the type of exit and calculate the annualized change in enterprise value over the period the asset is owned by the original private equity buyer. We find this gain to be significantly greater than that of public benchmark firms (matched by SIC code and enterprise value). Although these gains are not a direct measure of profitability for investors in private equity funds, they provide a useful metric of the business success of the entity while owned by private equity. We find that parent seller gains at the original sale are related to the subsequent gains in the asset's enterprise value and to the type of exit. This evidence suggests that sellers to private equity obtain significantly larger gains in sales of assets that later prove to be a rich source of exit value, typically via an IPO or trade sale (rather than a SBO). These links support the view that corporate asset sales can be modeled as auctions, that private equity bids reflect expected gains from owning and preparing an asset for exit, and that both the expected method and time to exit are related to the size of these gains.

Our work contributes to the asset sale literature by analyzing the role of an informed buyer and differentiating private equity versus strategic buyers, a departure from prior studies that do not provide an analytical treatment of type of buyer and instead focus on the effects on sellers (Jain, 1985; Hite, Owers, and Rogers, 1987; John and Ofek, 1995; Sicherman and Pettway, 1992; Maksimovic and Phillips, 2001). These studies are generally based on synergistic-type hypotheses that provide an effective framework for explaining intercorporate asset sales but little basis for explaining the participation of private equity as buyers. The few papers that compare financial buyers and strategic buyers study only acquisitions of listed firms, not subsidiaries, with Bargeron et al. (2008) reporting

greater gains to shareholders of targets taken over by public acquirers, which they attribute to agency problems at listed acquirers. Gorbenko and Malenko (2010) also find that winning strategic bids have a higher mean than PE bids. Rhodes-Kropf and Martos-Vila (2011) develop a theoretical model of differences in the merger waves of private equity and strategic acquirers due to debt misvaluation.

Our analysis of how subsequent changes in asset value and the pattern of exit are related to parent firm gains contributes to the private equity literature in a manner that differs from prior work. The studies on the operational performance of firms controlled by private equity or on returns to fund investors, which are susceptible to selection bias in the data, tend to report ambiguous findings. Some studies show firms controlled by private equity improve operating performance, reduce employment, and lower capital investment relative to public firms (Kaplan, 1989a, 1989b; Muscarella and Vetsuypens, 1990; Lichtenberg and Siegel, 1990; Liebeskind, Wiersema, and Hansen, 1992). Other studies find that productivity changes at such firms are little different from comparable public firms, R&D investment is greater, and employment tends to increase (Cornelli and Karakas, 2011; Lerner, Sorensen and Stromberg, 2011; Leslie and Oyer, 2009; Guo, Hotchkiss, and Song, 2011). The evidence on returns to limited partners net of fees is mixed (Kaplan and Schoar, 2005; Phalippou and Gottschalg, 2009; Robinson and Sensoy, 2011).

The paper is organized as follows. In Section 2, our theoretical model is presented. Section 3 describes sample construction. Section 4 contains empirical results for the valuation effects of asset sales, detailing the differential effects of alternative buyers. Conclusions are in Section 5.

2. Theoretical analysis

2.1. *The model set-up*

The model is in discrete time with an infinite horizon. At time $t = 0$, a parent firm sells an asset

with a potential value of $v_1 = \frac{\delta}{1-\delta} c_1$, where c_1 is a constant perpetual cash flow and δ is the discount factor. As a division of the parent, however, the asset has a present value of only $v_0 = \frac{\delta}{1-\delta} c_0$, where $c_0 < c_1$, due to inefficiencies in the current organizational form.[3] We denote by $Z = v_1 - v_0 > 0$ the loss in value due to these inefficiencies. The asset is sold in an ascending bid auction where two different populations of potential buyers participate: m private equity firms, henceforth PEs, and n operating firms (strategic bidders), henceforth SBs. Within each population category, the composition of the buyer pool may vary over time.

In every period $t = 0, 1, ...,$ there is random draw of $n > 1$ potential strategic buyers from a constant population, so the distribution of potential buyer characteristics is i.i.d. across time, capturing the idea of a time-varying set of SBs with synergies between their assets and the asset for sale. For a given present value of cash flows $v \in \{v_0, v_1, v_2\}$, the valuation of the asset to SB i is equal to $v + \widetilde{x}_i$, where $\widetilde{x}_i$ denotes the idiosyncratic operating synergies between the assets of SB i and the asset for sale. We assume the synergies, $\widetilde{x}_i \in [x_L, x_H]$, with $x_L \leq 0 < x_H$, are exogenous and private information to SB i and that synergies are i.i.d. among the SBs with c.d.f. F in the initial auction or any subsequent contest for the asset. We denote by $\widetilde{x}^{(1)}$ and $\widetilde{x}^{(2)}$ the first and second highest synergies among n SBs, respectively. Let $F^{(\tau)}$ be the c.d.f. of $\widetilde{x}^{(\tau)}$, for $\tau = 1, 2$. We assume $E[\widetilde{x}_i] > 0$, implying that the expected synergies of SBs are positive. We allow for $F(0) \geq 0$, so there is a strictly positive probability that in a given period t there are no SB bids for the asset.

PEs do not have operating synergies but have a comparative advantage at implementing a reorganization of the asset. PE ownership is transitional, so a PE that buys an asset will first restructure and then divest it via an *exit IPO* or a sale to interested parties via an *exit auction*. We denote

[3] These inefficiencies can encompass influence costs that are generated by a subsidiary that undertakes non-productive activities, such as lobbying the parent for resources to benefit the unit, that do not contribute to the value of the firm as a whole.

by $v_0 + x_{PE}$ the asset's value to a PE bidder, where x_{PE} is endogenous and depends on the asset's potential operating performance after restructuring and on expectations about the asset's value at exit.

PEs can enhance the asset's value by, one, eliminating the loss in value Z, increasing per-period expected cash flows from c_0 to c_1, and two, improving the asset's operations, leading to a further increase from c_1 to $c_2 > c_1$. The first component entails the elimination of influence costs; that is, a restructuring potential, Z, specific to separating the asset from a parent firm. The second component captures the perspective that PE owners offer some capabilities of creating value. Neither component can be replicated by strategic buyers (or the parent). The elimination of Z is realized with certainty in the first period of PE ownership so for simplicity, uncertainty about restructuring outcomes is centered on the second component. In the first and any subsequent round of PE ownership, with probability p cash flow can be permanently increased to c_2, and hence its present value to $v_2 = \frac{\delta}{1-\delta}c_2$. With probability $1-p$ the cash flow remains at c_1. Once v_2 is attained no further improvement is possible. Thus, the first round of PE ownership generates at least $Z = v_1 - v_0$ whereas the expected number of rounds required to improve the asset's performance to v_2 is $1/p$. It is during the initial round of PE ownership that the asset undergoes the reorganization of being transformed from a subsidiary into an independent firm, unlocking the potential value v_1. Although subsequent rounds may also generate positive benefits, they involve lesser degrees of organizational improvement. A PE incurs a one-off cost of $e < Z$ for the initial restructuring, and we normalize to 0 the cost of restructuring that occurs in any subsequent round of PE ownership.

Since the stand-alone asset is private, we assume that only the PE owner knows whether restructuring has achieved v_2; that is, at exit, the PE privately knows whether the present value of the asset's

cash flow is v_1 or v_2. To keep the theory more tractable we assume that the restructuring abilities of different PEs are identical; that is, the parameters p, c_0, c_1, c_2 and e do not depend on the identity of the PE. The main results of the model are not altered if we allow heterogeneity among PEs.

Before bidding in the initial auction at $t = 0$, a PE must first spend $\alpha > 0$ to identify and evaluate the asset and its potential p for restructuring and further value improvement. Each PE simultaneously decides whether to invest α and participate in the auction, or abstain from bidding. Strategic buyers know their operating synergies and can participate without cost. If the asset is sold to SB i, it becomes part of the buyer's operating structure and generates cash flows with a present value of $v_0 + \widetilde{x}_i$. If the asset is sold to PE j, it will be reorganized and then sold via an an *exit IPO* or an *exit auction* with an ascending bid format, where potential buyers are SBs and PEs. At the exit stage, the first PE's reorganization has already increased the asset's value to $\widetilde{v} \in \{v_1, v_2\}$. If $\widetilde{v} = v_1$, a subsequent PE buyer has the potential to further improve the asset's value to v_2, and then resell it through a new exit auction or an IPO. Since the asset had been identified as restructurable, PE bidders do not need to invest α before bidding in an exit auction.

If PE j decides to exit via an IPO, then extensive disclosure requirements, business reporting, and analyst activity lead to a substantial reduction in asymmetric information. We capture this effect by the simplifying assumption that the asset's true value becomes transparent in an IPO. Thus, in an IPO the revenue to PE j, denoted as $V_{IPO}(\widetilde{v})$, will reflect the asset's true profitability, v_1 or v_2,[4] and may incorporate an increment reflecting the possible future premium that would be paid should there be a subsequent acquisition by a SB or a PE. Thus, we assume $V_{IPO}(\widetilde{v}) \geq \widetilde{v}$.

2.2. *Equilibrium and exit decision*

[4]Note that in the case of an IPO, PE j will typically retain ownership of a fraction β of the asset; however, since the IPO occurs at a fair price, PE j's gain does not depend on β.

We solve the game by backward induction. To proceed, we first determine the revenue that PE j expects to receive if it owns an asset with performance $\widetilde{v} = v_1$. Second, we deduce $v_0 + x_{PE}$, i.e., PE j's valuation of the asset in the initial auction. Third, we compute bidders' expected equilibrium profit in the initial auction. Fourth, we compute the equilibrium PE entry decision. Thus, we can analyze the parent seller's expected revenue in the initial auction, conditional on the winning bidder being a PE or a SB. We focus on symmetric equilibria.

The analysis is based on the observation (*Claim 1* henceforth) that if a PE buys the asset, then at exit it will conduct an IPO if $\widetilde{v} = v_2$ and it will auction the asset if $\widetilde{v} = v_1$, and that PE j's revenue from an IPO will be $V_{IPO}(\widetilde{v}) \geq \widetilde{v}$. We show in the Appendix (Lemma 1) that *Claim 1* is correct in equilibrium, based on the assumption that a takeover of the asset after the IPO is possible among the same (random) set of buyers that participate in the exit auction.

Let V_{PE} denote the expected cash flow to PE j from owning an asset whose current performance is $\widetilde{v} = v_1$, and who proceeds to sell it in one time period. This value is computed at the beginning of a given period t and just after the asset has paid the cash flow. Note that V_{PE} also represents PE j's expected continuation payoff just after acquiring the asset from the initial seller and investing e for restructuring it, but before observing the outcome of the restructuring. Then V_{PE} must satisfy the following equation:

$$V_{PE} = \delta p(c_2 + V_{IPO}(v_2)) + \delta(1-p)\left(c_1 + \int_{x_L}^{\min\{x_H, V_{PE}-v_1\}} V_{PE} dF^{(2)}(x) + \int_{\min\{x_H, V_{PE}-v_1\}}^{x_H} (v_1 + x) dF^{(2)}(x)\right). \tag{1}$$

This equation says that with probability p the asset's operating performance improves in period t; the PE receives c_2 at the end of the period and immediately sells the asset via an IPO, yielding expected revenue of $V_{IPO}(v_2)$. With probability $1 - p$, the asset's performance does not improve in

period t, so the PE receives c_1 and then sells the asset via an (ascending bid) exit auction, where the potential bidders include PEs and SBs. Based on *Claim 1*, bidders will deduce that if PE j is exiting via an auction, then $\widetilde{v} = v_1$. The maximum amount a PE participating in the exit auction, i.e., PE k, is willing to pay is V_{PE}. If in fact, PE k wins the auction (i.e., there is a SBO), then it will be in exactly the same situation as PE j currently is. Note that PE j prefers to continue the restructuring, retaining the asset for one additional period rather than selling for strictly less than V_{PE}. Thus, the exit auction will be won by the SB with the highest synergies, provided that its synergies $\widetilde{x}_i$ lead it to value the asset at more than V_{PE}; i.e., $v_1 + \widetilde{x}_i \geq V_{PE}$. Otherwise, the asset will remain in the hands of a PE (either PE j or another PE buyer, PE k). Thus, the auction proceeds of PE j will correspond to the maximum of the second highest SB bid and V_{PE}. Let x denote the second highest synergy among the n SBs. Recall that its c.d.f. is $F^{(2)}$. The payoff to PE j is $v_1 + x > V_{PE}$ if the second highest SB values the asset more than PE bidders; otherwise, it is V_{PE}. This reasoning suggests that in equilibrium in an exit auction a SB winner pays more than a PE winner. Thus, when a PE-owned asset (a stand alone entity) is auctioned off, the return to the (PE) seller will be greater on average when the asset is sold to a SB (trade sale) rather than to another PE (SBO).

There are two separate sources that lead a PE to value the asset at V_{PE}. One is the PE's ability to reorganize the asset so as to achieve v_2; this *restructuring potential* is measured by $v_2 - v_1$ and the probability p of achieving v_2. The other is the potential profit a PE can obtain from auctioning an asset with performance v_1 to SBs that have synergies with the asset at the exit. This *resale option value*, a form of intertemporal arbitrage, can be measured by $E\left[\max\{0, \widetilde{x}^{(2)}\}\right]$, the expected value of SB synergies in an exit auction. We obtain:

Proposition 1 *a) There exists $V_{PE} \geq v_1$ solving equation (1), where the inequality is strict whenever $p > 0$ or $x_H > 0$.*

b)The level of V_{PE} increases in the asset's restructuring potential and its resale option value.

c) At exit, the PE's expected revenue is higher when exit occurs through an IPO, next highest when the asset is sold to a SB, and lowest when sold to another PE.

An asset with performance v_1 is worth exactly v_1 to a bidder with no synergies that plans to hold the asset indefinitely. A PE has no synergies; hence statement (a) implies the presence of either a restructuring potential or a resale option value that is sufficient to explain $V_{PE} > v_1$. A PE values the asset at more than v_1 if there is some restructuring potential. Absent a restructuring potential, a PE values the asset at more than v_1 when it expects value from its option to sell to future SBs with positive synergies. The stronger each source of value, the larger V_{PE} (statement (b)). Assets with sufficient growth potential (p large) will tend to be sold via an IPO, at a price incorporating both the asset's enhanced intrinsic value v_2 and a premium reflecting the possibility of a subsequent acquisition (statement (c)). Assets with smaller growth potential (medium p) are more likely to be sold to SBs before PE restructuring achieves v_2. Thus, their resale value is lower than for IPOs because of the lower intrinsic value, v_1. Assets with low growth potential (low p) and few potential SB acquirers are likely to be sold to another PE. As a PE is indifferent between retaining the asset and selling to another PE, a SBO provides the lowest revenue to PE (statement (c)).

2.3. *PE entry decision, initial auction, and PE revenue*

From the previous section we are able to deduce that the maximum amount the PE is willing to pay in the initial asset auction is $V_{PE} - e$ described in Proposition 1 which corresponds to the present value of next period's expected cash flow and exit revenue, net of restructuring cost e. Since PEs are

homogeneous, they value the asset the same. We define

$$x_{PE} = V_{PE} - e - v_0 > 0$$

as the extra value a PE attaches to the asset compared to the value of the asset to the parent seller.[5]

The value of the asset for SB i is exogenous and equal to $v_0 + \widetilde{x}_i \in [v_0 + x_L, v_0 + x_H]$. Thus, in the symmetric equilibrium of the initial auction each bidder will increase its bid until it reaches its own valuation of the asset. Since all PEs value the asset the same, as long as there are at least two PEs in the initial auction they will bid up to their valuation and realize zero profit. Alternatively, a PE that does not face competition from other PEs will pay the maximum between v_0, the starting price, and the highest SB valuation as long as the amount does not exceed $v_0 + x_{PE}$. In this case, its expected profit is strictly positive and equal to[6]

$$\pi^*_{PE} = \int_0^{x_{PE}} (v_0 + x_{PE} - (v_0 + x))dF(x)^{(1)} + x_{PE}F^{(1)}(0) = \int_0^{x_{PE}} F(x)^{(1)}dx > 0.$$

We now consider the PE decision to invest α and bid for the asset in the initial auction. Let x^*_{PE} be such that $\pi^*_{PE} = \alpha$. The entry decision depends on whether or not other PEs enter the auction. We show in the Appendix (Lemma 3) that in the unique symmetric equilibrium, each PE participates in the initial auction with probability $q^* = 1 - (\alpha/\pi^*_{PE})^{\frac{1}{m-1}}$ if $\pi^*_{PE} > \alpha$, and 0 otherwise.

Since the valuation by PEs reflects both the asset's restructuring potential and the synergies with a future SB buyer that are incorporated into the exit value, the economic forces determining x_{PE} suggest that $x_{PE} > E[\widetilde{x}_i]$. Furthermore, we show (see Proposition 2 in the Appendix) that one, the

[5] Note that $V_{PE} \geq v_1$ implies that $x_{PE} = V_{PE} - e - v_0 \geq v_1 - e - v_0 = Z - e > 0$.

[6] Recall that the starting bid price is v_0.

probability of a PE winning the initial auction increases with x_{PE}; two, that for x_{PE} large, the parent seller's expected revenue from a winning PE bid is greater than its revenue from a winning SB bid; three, the same finding holds if we compare the seller's revenue from a PE bid when x_{PE} is large with the seller's revenue from a SB bid when x_{PE} is small. Thus, the underlying parameters that lead to an increase in x_{PE} will jointly increase the probability that a PE bidder wins the auction and make it more likely that winning PE bids are higher than winning SB bids, allowing a comparison of the average levels of winning SB bids and winning PE bids.

2.4. *Empirical implications*

Valuation hierarchy of SB buyers and PE buyers in the initial auction. To compare the average levels of winning SB and winning PE bids, we consider the comparative statics of a variation in any of the underlying parameters p, c_1, c_2, δ, n and $E[\widetilde{x}_i]$ that increase x_{PE}, variation that jointly explains the frequency of a PE outcome and the expected difference between a winning PE bid and a winning SB bid. As shown in Section 2.3., when p is positive and $E\left[\widetilde{x}^{(2)}\right]$ is not negligible, a PE obtains a gain from restructuring and the gain from the synergies of future SBs. Proposition 1 indicates that PE's endogenous value component, x_{PE}, is increasing in the restructuring potential and the resale option value. Moreover, the probability of a PE winning will increase in any of these parameters (Proposition 2 in the Appendix), and at the same time the expected level of the bid of a winning PE will also increase relative to that of a winning SB bid. Assets with a low PE value (low x_{PE}) are more likely to be sold to SBs, and to be sold at relatively low prices. Assets with a high PE value (high x_{PE}) are more likely to be sold to PEs, at relatively high prices. As a result, for a broad range of parameters, on average, expected parent firm seller revenue from winning PE bids should be larger than from winning SB bids. Since a measure of seller revenue is given by the seller's abnormal

return, this analysis suggests that the average abnormal return of a parent firm seller is higher when the asset is sold to PE rather than to SB.

Excess performance under PE control. In the model the improvement from v_0 to v_1 or v_2 is only available if an asset is PE-controlled, which by definition does not apply to a public benchmark firm. If PEs have restructuring potential, the performance of the asset under PE control should exceed that of a benchmark publicly traded firm.[7] This prediction and the previous one are related because it is this excess performance that allows PEs to outbid SBs, on average.

Relation between initial PE bid and asset performance. Our model implies that PE bids in the initial auction and the expected performance under PE ownership should be positively related. We, therefore, expect a positive relationship between seller gains generated by winning PE bids, and the value creation of the asset until PE exit.

Relation between initial PE bid, exit, and holding period. Assets for which PE owners realize additional growth potential beyond restructuring, will be sold relatively quickly via an IPO, and are the most valuable assets for PEs. The next most valuable assets are those with smaller growth potential but for which SBs will have high synergy-based valuations when the initial PE owner is to exit, so they will also be sold relatively quickly but via a trade sale. Assets for which SB interest at exit is expected to be low (i.e., weak synergies) are less valuable, will remain longer under PE ownership, and are either retained by the original PE owner or sold to another PE (SBO). Thus, bids in the initial auction are lower and the time until exit is longer for assets with exits via SBOs. Restructuring the asset will be more time consuming and there is also a higher probability that the acquisition of such an asset culminates in a Chapter 11 filing. Thus, the abnormal return of the

[7] Note that it is the excess performance of PE buyers and the valuation hierarchy in the initial auction that indicate that PEs have unique restructuring potential, not the fact that we observe winning PE bids. In our model, even in the absence of restructuring potential (i.e., $v_0 = v_1 = v_2$), x_{PE} is normally strictly positive because of the asset's resale option value, so PE bids will at times win auctions.

initial parent seller should be related to the hierarchy of exit routes, and negatively correlated with the average expected time to exit for the different types of exits.

A final implication of our model of asset sales is the predicted reversal in the hierarchy of bids of SBs and PEs in initial versus exit auctions. In exit auctions, an asset's further restructuring potential is small and PE bidding entry is inexpensive. A small restructuring potential reduces V_{PE} so SBs will more often outbid PEs. In exit auctions, the small cost of identifying worthwhile targets and their restructuring potential fosters more PE participation and induces the minimum expected winning bid to reach V_{PE}. Thus, when restructuring potential and participation costs are sufficiently low, a SB on average pays more than a PE.[8] By contrast, in the initial auction influence costs and the cost of gathering information about the (opaque) entity prior to a bid are sufficiently high that, for a broad range of parameters, the seller's expected revenue from winning PE bids is higher than from winning SB bids.

3. Sample

To evaluate the implications of the model we obtain sales of large operating assets that are wholly owned by publicly traded parent firms from the SDC Acquisition Database for 1994 through 2004.[9] We confirm that each event is a corporate asset sale, identify the initial announcement date, and obtain relevant transaction data from SEC filings, Factiva, Lexis-Nexis, the Wall Street Journal, and Standard and Poor's Stock Reports, Stock Guide, and Directory of Corporations. Events are categorized by type of buyer: private equity, public operating firm, and private operating firm.[10] We

[8] It is interesting to note that in our model the predicted hierarchy for exit auctions of (stand-alone) assets with small restructuring gains (higher bids on average by SBs relative to PEs) is consistent with empirical findings that firms that are targets of takeovers sustain greater returns from public acquirers (see, for example, Bargeron et al., 2008, and Gorbenko and Malenko, 2010).

[9] The sample ends in December 2004 to have sufficient time to observe private equity exits.

[10] We also require that the relevant fund of the private equity buyer of the asset does not own an operating firm that will be merged with the asset.

verify that the public parent is not in bankruptcy nor divesting the asset due to a regulatory or judicial mandate. The identity of the buyer and terms of the transaction must be publicly reported and the transaction must transfer full ownership of the asset. To minimize reporting bias, the minimum transaction price is $100 million, a condition that increases the probability that each asset is of sufficient size and stature to be material, and that for sales to private equity the business is likely to warrant sufficient interest in the business press to generate coverage of the date and type of exit transaction.

The final sample consists of 146 private equity deals, 287 deals with public strategic buyers, and 48 deals with private strategic buyers. Descriptive statistics are reported in Table 1; values are in constant (1997) dollars. The transactions are large deals with an average (median) value of $398 ($212) million for sales to private equity, $644 ($255) million for sales to public strategic buyers, and $308 ($222) million for sales to private strategic buyers. None of the differences in means (medians) is statistically significant. Median transaction values are almost identical, suggesting that private equity has been an effective competitor in asset sales. The mean (median) seller market capitalization is $22 ($4.6) billion, $21 ($5.2) billion, and $8 ($2.6) billion in the respective subsamples; for public buyers it is $22 ($2.7) billion. The median ratios of transaction price to seller market value are of similar magnitude. A broad range of industries is represented with 105, 156, and 38 different 4-digit SIC codes for the assets in the respective subsamples.

4. Empirical results

4.1. Valuation effects of corporate asset sales

In Table 2, two-day market model average excess returns, proportion of returns positive, and median returns at the initial sale announcement are reported. For asset sales to public strategic

buyers, seller excess returns are significantly positive, 1.25%, t-statistic of 6.10 (median of 0.27%), and similar to previously reported results (Jain, 1985; Hite, et al., 1987; John and Ofek, 1995; Sicherman and Pettway, 1992; Hege, Lovo, Slovin, and Sushka, 2009). The median transaction return, 2.85% ($p = 0.29$), is reported to provide a metric for the economic importance of seller gains. As in previous studies, the results show that the market views asset sales as value increasing for sellers, but the typical change in seller value is small relative to the size of the asset and is well below the premiums of 25% or more observed for targets in merger studies. For sales to private strategic buyers, seller excess returns are 0.95%, t-statistic of 2.19 (median of 0.46%), and are not significantly different from the results for public buyers. The median seller transaction return, 3.68%, is also similar to public buyer deals.

For asset sales to private equity, seller excess returns are positive and economically large, 3.78%, t-statistic of 12.42 (median is 2.06%); the proportion of returns positive is 82%. The mean and median seller returns are each significantly greater than seller returns in deals with public buyers ($p = 0.00$) and private operating firms ($p = 0.01$). The median seller transaction return, 22.25% ($p = 0.00$), is also significantly greater than in deals with public or private strategic firms ($p = 0.00$). This pattern of higher seller returns is consistent with the model and provides an indication of the value that is generated by private equity in the asset sale market.

Our finding of greater returns to sellers when assets are sold to private equity is opposite to Bargeron, et al. (2008) who report greater gains (premiums) to merger targets acquired by public firms, a result they ascribe to overbidding due to agency problems at public buyers. However, we find positive average returns to public acquirers in asset sales, 0.48%, t-statistic of 3.10 (median is 0.33%), implying that public buyers extract a modest rent for their private information about

expected synergies so their behavior in the aggregate does not reflect agency problems (such as hubris or empire building) as discussed in the merger literature (Thaler, 1988; Barberis and Thaler, 2003; Baker, Ruback, and Wurgler, 2007). On the whole, modest gains in combined shareholder wealth at asset sales to strategic buyers imply there are modest synergistic gains in these transactions, consistent with findings reported in prior asset sale studies.[11]

In our theoretical model the improvement in asset value from v_0 to v_1 and v_2 is only available for an entity controlled by private equity. On this basis, a winning private equity bid is not expected to have information content for other (benchmark) firms in the industry. To assess this, we evaluate the intra-industry effect by examining share price responses of public benchmark firms with activities similar to the asset sold. If a bid were to convey new industry common information, then share prices of the benchmark firms should increase at the sale announcement. We identify CRSP firms with the same 4-digit SIC code as the asset, use these firms to construct an industry portfolio for each event (equally weighting all rival firms per event), and obtain the average portfolio excess return over all of the events in each sample. For each of the three subsamples the intra-industry effects are small and not statistically significant, implying that there is little industry common information conveyed by an asset sale to private equity, or indeed any asset sale irrespective of buyer type. This finding supports the view that the gains from asset sales do not flow to other firms in the industry.

4.2. Exit transactions and economic performance for private equity deals

Our auction model indicates that private equity bids are related to future revenues from exit transactions, the type of exit, and the time to exit. Since the change in parent seller market value at the initial announcement is influenced by the difference between the price it is paid and the market's

[11] Gorbenko and Malenko (2010) analyze competitive auctions for firms (and not subsidiaries), and find that strategic buyers bid more than private equity, results that can be viewed as consistent with Bargeron, et al. (2008).

prior assessment of the asset's value to the seller, parent returns should be related to private equity's expectations about its ability to generate value and successfully exit the investment. Thus, if ex post realizations and ex ante expectations are related, seller returns should be related to type of exit, length of private equity ownership, and ex post gains in asset enterprise value.

We investigate these predictions by determining the exit status (through year-end 2011) of each asset acquired by private equity. Because the sample includes all large eligible operating assets sold by public firms from 1994 through 2004, our findings about subsequent outcomes are not subject to the selection bias problems intrinsic to many studies of private equity due to the lack of uniform disclosure and the secretive nature of private equity. Once acquired by private equity, the assets in our sample are not public entities and thus there is little disclosure about their operating performance or capital structure, although some information reported in the business press suggests they are highly levered. We identify the terms for the 121 exit transactions and confirm that the 25 assets without an exit are still owned by the original private equity buyers.

In Panel A of Table 3, the average time to exit is 3.4 years. We find that the time pattern of exits matches the implications of the theory, since exit is most rapid for IPOs (2.1 years), longer for trade sales (3.2 years), and longest for SBOs (5.0 years). SBO time to exit is significantly longer than for IPOs and strategic exits ($p = 0.01$), which suggests private equity sells an asset to another private equity firm when a timely exit by IPO or trade sale is not feasible. As a result, SBOs may be regarded as less successful outcomes, or cases of incomplete restructuring, consistent with our theory. In 20 cases, exit is by bankruptcy (4.4 years).

To determine the ex post (annualized) rate of increase in asset enterprise value during the period of private equity ownership, we obtain the transaction price, or market value of equity plus book

value of debt, depending on the type of exit, and compare it to the original sale price. This metric is not a direct measure of the profitability for fund investors, but it is a useful gauge of an entity's economic performance. Since our theory predicts that asset performance and type of exit mechanism are related, performance is expected to be highest for IPOs, next highest for trade sales, followed by SBOs. The data also allow us to examine whether there is a similar pattern of gains in wealth to the original parent firm seller and the type of exit.

The mean (median) annualized growth rate in enterprise value (EV) for the assets that exit is 48.45% (18.69%). To benchmark these results, the annualized growth rate in enterprise value over identical periods is calculated for public firms with the same 4-digit SIC code as the asset and closest in enterprise value to the original sale price. The mean (median) growth rate for the benchmark firms is 20.53% (6.12%) and the difference in sample and benchmark firm means (medians), Excess EV, is statistically significant, $p = 0.00$ ($p = 0.00$). Thus, while owned by private equity, the entities achieve considerable business success relative to benchmark firms, consistent with the view that private equity has valuable business skills. The changes in enterprise value at sample and benchmark entities are highly correlated, 0.74, consistent with the expectation that an asset's growth is related to growth in the relevant industry, but the overall pattern of results suggests that private equity skills contribute to asset value, a portion of which is received by the original sellers at the initial asset sale.

We disaggregate the results by type of exit. Entities that file Chapter 11 retain very little value, as reflected in an average (median) annual decline in enterprise value of -27.11% (-21.20%). Given 20 Chapter 11 filings, bankruptcy of private equity-owned assets is significantly ($p = 0.01$) more frequent than for benchmark firms (with seven filings). In principle, private equity ownership of an asset could still increase the enterprise value of an entity despite a bankruptcy filing. For example, a sustainable

business that becomes overlevered, may be reorganized as an ongoing concern through a negotiation between equity holders and creditors, either in the form of a prepackaged bankruptcy or under the guidance of a bankruptcy judge.[12] However, in our sample, bankruptcy typically occurs after almost complete business failure, resulting in the loss of the private equity stake and large losses to unsecured creditors. Liquidation occurs in ten cases, with minimal payments to unsecured creditors, and equity is cancelled (no payment to private equity). In eight other cases reorganization occurs but almost all enterprise value is lost, with unsecured creditors absorbing large losses and equity interests cancelled. In only two cases is there a reorganization in which some private equity interests are conveyed to debtholders, resulting in a less levered entity where private equity retains a minority stake.

The systematic pattern between business success and type of exit suggests a hierarchy with respect to gains in enterprise value that is consistent with our theoretical model. The highest mean (median) annual growth rate in enterprise value occurs for IPOs, 111.52% (43.64%), and is significantly greater than benchmark firms. The next highest mean (median) growth rate is for exit by sale to strategic buyers, 36.81% (24.78%), also significantly greater than their benchmarks. This estimate of the gains in enterprise value for trade sale exits understates the overall (global) economic gains since these transactions also add to buyer value. In 22 of the 37 trade sale exits, the strategic buyers have CRSP returns, and the buyer average excess return is 4.20% ($p = 0.00$); the average transaction return is 10.50% ($p = 0.05$); the relevant median returns are 2.96% ($p = 0.00$) and 7.75% ($p = 0.00$), respectively. The positive buyer excess returns indicate that there is no evidence of overbidding by public strategic buyers in exit sales, just as there is no overbidding in asset sales as a whole.

Although SBOs can be viewed as an alternative form of asset sale (where the buyer is another

[12] For example, Kaplan (1989a) has argued that Campeau's acquisition of Federated Department Stores added value even though it ended in bankruptcy.

private equity firm rather than a strategic firm), our theoretical model predicts that in equilibrium a strategic buyer pays more than private equity at the exit auction. The intuition for this prediction is that strategic bids encompass synergies that add value to the restructured asset, together with the expectation that the greatest improvements in restructuring have already been carried out by the original private equity buyer, leaving less scope for value creation by a second private equity owner, who in effect is a buyer of last resort. Our model suggests that a private equity firm is indifferent between keeping the asset or selling it to another private equity firm. In actuality, SBOs provide a means of exit when the termination date of a private equity fund draws near and strategic buyers are scarce (Kaplan and Schoar, 2005).

For the 23 SBOs, the mean (median) annualized growth rate in enterprise value is 20.48% (10.38%), significantly less than for assets sold to strategic buyers, $p = 0.09$ ($p = 0.05$). This finding suggests that exit by SBO is associated with poor performance of the asset relative to exit by IPO or strategic sale. Nevertheless, mean (median) performance is significantly ($p = 0.05$) more favorable than the gains achieved by benchmark firms. We note that the greater gains in enterprise value when assets owned by private equity (which like the target firms in a merger study are stand-alone entities) are sold to strategic buyers rather than other private equity firms, parallels results reported by Bargeron, et al. (2008) that there are greater gains (premiums) to merger targets acquired by public firms rather than private equity. While they attribute this result to overbidding by public buyers (due to agency problems), our theoretical model predicts this pattern of behavior for asset sale exits with no overbidding by public buyers.

Moreover, our model suggests that when a private equity firm wins the exit auction, it has less potential to improve the asset than the initial private equity owner. This reasoning implies that

the asset's performance during the second buyout period should be no better than that during the initial round of private equity ownership. To test this implication, we examine the outcomes when the SBO exits; as of year-end 2011, 11 of the 23 SBOs have such exits. In Panel B, performance during ownership by the second private equity firm is broadly similar to that of the initial private equity firm. The second private equity firm holds the asset for an average of four years and the mean (median) annualized growth rate in enterprise value is 15.19% (16.76%). Neither figure is statistically different from the gains for the first private equity round. Moreover, the second round gains differ little from the average (median) gains in enterprise value of their benchmark firms, 14.92% (10.00%). We conclude that SBOs are a less favorable form of exit relative to sales to strategic buyers or IPOs.

The overall pattern of the growth in enterprise value for benchmark firms shows the same hierarchy as the sample assets. This evidence suggests that expectations about future industry developments are a factor in determining bids by private equity. Nevertheless, for each exit category, except bankruptcies, the average (median) growth rate in enterprise value for assets originally acquired by private equity exceeds their benchmark firms, indicating the ability of private equity to generate business improvements.

The pattern of gains to parent firm sellers parallels the subsequent changes in asset enterprise value. Specifically, there are large statistically significant gains for parent firms that sell assets that subsequently exit via an IPO or a strategic asset sale, with median transaction returns of 45.05% ($p = 0.00$) and 24.72% ($p = 0.00$), respectively. By contrast, parent firms that sell assets that eventually sustain bankruptcy have a median transaction return of 7.15% ($p = 0.04$), a figure significantly smaller than for IPOs ($p = 0.05$) or strategic sales ($p = 0.10$). The median seller transaction return for SBO exits, 16.71% ($p = 0.00$), is smaller than exits by IPO or sale to strategic buyers, but greater than

exits by Chapter 11. These results suggest that private equity submits lower bids, resulting in weaker gains to sellers, when it expects to generate only modest gains.

To further test the relationship between the excess return of initial parent sellers and subsequent asset performance, we estimate regressions to control for other determinants of performance success, reported in Table 4, using a set of widely used measures. Our theory predicts that a private equity bid, and in turn seller excess returns, conveys information about expected future payoffs and ability to exit successfully. Our first dependent variable is the excess EV (i.e., the difference between the annualized growth rates in enterprise values of the asset and its benchmark). The coefficient of the seller transaction return is positive and significant, suggesting that the seller's share price reaction at a private equity deal provides a metric for the future success of private equity investments. Our second performance metric is a profitability index, for which we obtain similar results.[13] In these regressions, there is some evidence that deals that exited during the high tech bubble (1999-2001) generated lower gains in enterprise value.

Our third performance measure is a binary variable of the relative eventual success, IPO or strategic asset sale, versus relative failure, bankruptcy or SBO, using a binomial logit model. The coefficients for the seller transaction return are highly significant, providing an estimate as to how an increase in the transaction return for the parent firm seller affects the marginal likelihood of the type of exit. The qualitative variable for exit during the high tech bubble years, while associated with lower growth rates in enterprise value, has a positive coefficient in the logit regression, suggesting exits by IPO and strategic sales were more likely during this period. There is no evidence that success is related to the size of the transaction.

[13] The profitability index has been introduced in the literature to mitigate holding period biases typically present in private equity investments (e.g., Phalippou and Gottschalg, 2009).

Overall, the seller transaction return is significant in all three specifications. The results are consistent with a central implication of our theoretical model, namely, that private equity expectations about future payoffs affect its bidding for an asset, and the gains to selling firms.

4.3. Cross-sectional regression analysis

We use regression analysis to test whether other factors, specifically observable seller or asset characteristics, affect the statistically significant gains to sellers generated in deals with private equity buyers. The dependent variable is defined as seller transaction returns and alternatively, seller excess returns. In each regression, two qualitative variables for the type of buyer are specified. One variable takes on the value of unity for private equity and zero otherwise. A second variable takes on the value of unity for private strategic buyers and zero otherwise. We report a representative set of regressions in Table 5 in which the dependent variable is the transaction return. The pattern of results is similar when the dependent variable is seller excess returns.

The coefficients of the qualitative variable for private equity are positive and consistently large and significant, and are robust with respect to the inclusion of other variables that reflect characteristics of asset sales, including variables tested in other asset sale studies. Seller variables reported include the size of the transaction relative to enterprise value, seller market capitalization, prior cumulative stock price performance, operating performance (ROA), market to book ratio, insider holdings, and use of proceeds (equal to one for debt reduction or repurchase of equity, and zero for retention). The effect of the variable for private equity buyers remains positive and strongly significant, irrespective of the regression specification. We test a large array of other independent variables but find that they are not statistically significant; for economy of presentation they are not reported in the table.[14]

[14] The results are available upon request. Other seller variables tested but not statistically significant include leverage, dividend payout, time listed on CRSP, growth in intangible assets, and measures of R&D. Alternative measures of

Since Lewellen, Loderer, and Roenfeldt (1989) suggest that high insider ownership mitigates agency problems at buyers and Bargeron, et al. (2008) report greater returns to target firms acquired by publicly traded firms with low insider ownership, we also specified variables for insider ownership of public strategic buyers. We find no effect of buyer insider ownership on seller returns (results available upon request). Together with the positive excess return to strategic buyers, this result suggests that bids by public acquirers do not reflect agency problems.

Given private equity funding cycles and evidence that well-established funds benefit from market fluctuations (Gompers and Lerner, 1998; Gompers, Kovner, Lerner, and Scharfstein, 2008; Ljungqvist, Nanda, and Singh 2006), we assess whether greater seller returns in private equity deals are related to financial market conditions due to market timing opportunities.[15] None of the variables is statistically significant and the qualitative variable for private equity deals remains consistently significant, indicating the effect of the type of buyer for seller returns. We also test variables to reflect deals in which buyers are the large, best known private equity firms, but the coefficients are not statistically significant, suggesting that the identity of the private equity firm does not affect seller returns.

5. Conclusions

In this paper we provide a theoretical and empirical analysis of corporate asset sales, allowing for the participation of both private equity and strategic buyers. We develop an auction model of bidding competition that integrates the behavior of private equity interests with that of strategic

size and capital structure do not alter the results. Also tested are variables that gauge focus, complexity, and opacity, including whether the asset has the same SIC code as the parent (or public buyer), the number of seller business segments, the relative importance of the segment in which the asset is sold, and whether the seller is a conglomerate. Overall, there is no evidence that the greater gains to seller firms are affected by observable seller or asset characteristics.

[15] The variables tested are 1-year and 3-year lagged performance of S&P500 and Nasdaq indexes, S&P500 operating performance, and dividend yields; for debt markets, bond term spread and corporate credit spread; for exit markets, Fama-French book-to-market ratio, number of IPOs, IPO first-day returns, and percentage of positive first-day returns; and for the relationship of capital supply and capital disbursements, capital raised but not invested by funds over the past five years.

buyers, providing a theoretical framework that conforms to the institutional structure of the asset sales market and the business model of private equity. In our model private equity's valuation of the asset is endogenous, based on the ability of private equity buyer to restructure the asset and then exit the investment via an IPO or an auction to a strategic buyer or another private equity firm. Competitive bidding conveys private information held by strategic buyers as well as the value that private equity expects to generate contingent on having control of the asset. We show how gains in parent firm seller wealth are affected by the type of winning bidder.

We use the model as a framework to analyze sales of large corporate operating assets from 1994 through 2004, and we follow the exit pattern of private equity buyers through year-end 2011. Increases in shareholder wealth at seller firms for sales to private equity are significantly greater than for sales to public or private strategic buyers. We find no intra-industry gains at news of asset sales, irrespective of buyer type, suggesting that the information conveyed is asset-specific. We evaluate the change in the enterprise value of assets acquired by private equity for the period from acquisition to exit. We find that the annualized growth rate in the asset's enterprise value is significantly greater than for public benchmark firms, suggesting the economic importance of private equity's business skills. We also determine the type of exit. The majority of exits are IPOs or strategic asset sales, with a lesser percentage of secondary buyouts and bankruptcies. We find that parent seller returns at original asset sale announcements are directly related to the subsequent gains in enterprise value and the form of exit, with sellers earning significantly greater gains for assets that exit by IPOs or sales to strategic buyers rather than by secondary buyouts. Thus, private equity generates large gains in wealth for selling firms in the case of assets that subsequently prove to be a rich source of value.

Appendix

Verification of Claim 1: Let $V_{Auc}(\widetilde{v})$ and $V_{IPO}(\widetilde{v})$, where $\widetilde{v} \in \{v_1, v_2\}$, denote the PE expected revenue from an exit auction and an IPO, respectively. We say that the takeover market for the asset after its IPO is *open* if in every period a takeover contest for the asset is possible among a set of buyers randomly drawn from the same buyer population as in the exit auction described in the model. It is sufficient to show that in equilibrium the following lemma holds:

Lemma 1 *If the takeover market for the asset after its IPO is open, then in equilibrium* $V_{IPO}(v_2) > V_{Auc}(v_2)$ *and* $V_{Auc}(v_1) > V_{IPO}(v_1)$. *Furthermore,* $V_{IPO}(v_2)$ *increases with expected synergies of future acquirers.*

Proof of Lemma 1: We first show that $V_{Auc}(v_1) > V_{IPO}(v_1)$. Note that PE bidders' value of the asset when $\widetilde{v} = v_1$ is V_{PE}, whereas SB i values the asset $v_1 + \widetilde{x}_i$. Hence, if PE j auctions the asset its expected revenue is

$$V_{Auc}(v_1) = E\left[\max\left\{V_{PE}, v_1 + \widetilde{x}^{(2)}\right\}\right] > v_1 \ ,$$

where the inequality follows from $V_{PE} > v_1$ and $E\left[\widetilde{x}^{(2)}\right] > 0$. If PE j sells the asset via an IPO, then its true value $\widetilde{v} = v_1$ will be publicly known at the time of the IPO. Then the asset will be subject to a takeover contest by the same expected set of PEs and SBs that would participate today if the asset were auctioned. Hence today's revenue from the IPO satisfies

$$\begin{aligned} V_{IPO}(v_1) &\leq \delta\left(c_1 + E\left[\max\left\{V_{PE}, v_1 + \widetilde{x}^{(2)}\right\}\right]\right) \\ &< E\left[\max\left\{V_{PE}, v_1 + \widetilde{x}^{(2)}\right\}\right] = V_{Auc}(v_1). \end{aligned}$$

To see that $V_{IPO}(v_2) > V_{Auc}(v_2)$ note first that $V_{Auc}(v_2) = V_{Auc}(v_1)$. This result follows from the fact that PE j auctions the asset, bidders deduce that $\widetilde{v} = v_1$, and their bids will reflect this belief. It is then straightforward to see that $V_{IPO}(v_2) > V_{Auc}(v_1)$. In fact, $V_{IPO}(v_2)$ reflects the expectation of the synergies of future strategic acquirers plus the present value of the asset's maximum possible cash flow, v_2. Similarly, the revenue $V_{Auc}(v_1)$ reflects the synergies of future strategic acquirers; however, at the moment of bidding the expected value of future cash flows is strictly less than v_2. □

Proof of Proposition 1: (a) Observe that the maximum PE revenue from selling to a SB is $v_1 + x_H$. Suppose $v_1 + x_H < V_{PE}x$, i.e., no SB would ever have synergies high enough to allow it to acquire the asset from a PE. In this case the asset will remain in PE hands until its operating performance has been improved to $\widetilde{v} = v_2$, at which point exit will be via an IPO. In terms of equation (1) this situation corresponds to the case where $V_{PE} - v_1 \geq x_H$ and it provides a V_{PE} equal to

$$\widehat{V}_{PE} = \frac{\delta\left(p(c_2 + V_{IPO}(v_2)) + (1-p)c_1\right)}{1 - (1-p)\delta} \geq v_1 \ , \tag{2}$$

where the inequality is strict whenever $p > 0$.[16] Consider now the case where $p = 0$, i.e., once v_1 is achieved there is no prospect for further restructuring. For $p = 0$, by rearranging equation (1) it can be shown that[17]

$$V_{PE}|_{p=0} > v_1 + \delta E\left[\max\{0, \widetilde{x}^{(2)}\}\right].$$

For $x_H < \widehat{V}_{PE} - v_1$, the maximum revenue from selling to a SB is less than $\widehat{V}_{PE}$. Hence the PE will never auction the asset and will sell it via an IPO as soon as $\widetilde{v} = v_2$.

Consider now the case $x_H > \widehat{V}_{PE} - v_1$. The result is an immediate consequence of the following lemma:

Lemma 2 *If $x_H > \widehat{V}_{PE} - v_1$, then equation (1) has a solution satisfying $\widehat{V}_{PE} < V_{PE} < v_1 + x_H$.*

Proof of Lemma 2: Introducing the notation $r_{auc} = \min\{x_H, V_{PE} - v_1\}$, equation (1) can be restated in terms of the following system of equations:

$$V_{PE} = \delta\left(p(c_2 + V_{IPO}(v_2)) + (1-p)\left(c_1 + \int_{x_L}^{r_{Auc}} V_{PE} dF^{(2)}(x) + \int_{r_{Auc}}^{x_H} (v_1 + x) dF^{(2)}(x)\right)\right), \tag{3}$$

$$V_{PE} = v_1 + r_{Auc}. \tag{4}$$

Solving (3) in V_{PE} leads to

$$V_{PE}(r_{Auc}) = \frac{\delta\left(p(c_2 + V_{IPO}(v_2)) + (1-p)\left(c_1 + \int_{r_{Auc}}^{x_H}(v_1 + x)dF^{(2)}(x)\right)\right)}{1 - (1-p)\delta F^{(2)}(r_{Auc})}.$$

By substituting $V_{PE}(r_{Auc})$ for V_{PE} in equation (4) we have

$$v_1 + r_{Auc} - V_{PE}(r_{Auc}) = 0. \tag{5}$$

Then it is sufficient to show that there exists $r_{Auc} \in [x_L, x_H]$ that solves equation (5) and leads to $V_{PE}(r_{Auc}) > \widehat{V}_{PE}$. Note that

$$\begin{aligned} V_{PE}(r_{Auc})|_{r_{Auc}=x_L} &= \delta\left(p(c_2 + V_{IPO}(v_2)) + (1-p)\left(c_1 + \int_{x_L}^{x_H}(v_1 + x)dF^{(2)}\right)\right) \\ &> \delta\left(c_1 + v_1 + (1-p)\int_{x_L}^{x_H} x dF^{(2)}\right) \geq v_1, \end{aligned}$$

where the inequalities follow from $c_2 > c_1$, $V_{IPO}(v_2) \geq v_2 > v_1$, $\int_{x_L}^{x_H} dF^{(2)} = 1$ and $\int_{x_L}^{x_H} x dF^{(2)}(x) = E[\widetilde{x}^{(2)}] \geq E[\widetilde{x}] > 0$. Thus, the LHS of equation (5) is strictly negative for $r_{Auc} = x_L \leq 0$. Observe now

[16] Note that $\widehat{V}_{PE} = v_1$ for $p = 0$, which means that the value of the asset to a PE that has no synergies, that will never be able to improve the asset's performance to v_2 nor to sell it to SBs is equal to the present value of a perpetuity paying c_1 in every period.

[17] In this case the level of $V_{PE} - v_1$ that solves equation (1) is equal to the V_{PE} solving $V_{PE} - v_1 = \delta E\left[\max\{V_{PE} - v_1, \widetilde{x}^{(2)}\}\right]$.

that $V_{PE}(r_{Auc})|_{r_{Auc}=x_H} = \widehat{V}_{PE}$. By substituting this expression into equation (5), we obtain that the LHS of equation (5) is strictly positive for $r_{Auc} = x_H$ if and only if $x_H > \widehat{V}_{PE} - v_1$. Hence, the system (3) - (4) has a solution for $r_{Auc} \in]x_L, x_H[$. Since $V_{PE}(r_{Auc})$ is decreasing in r_{Auc} and $V_{PE}(r_{Auc})|_{r_{Auc}=x_H} = \widehat{V}_{PE} > v_1$, it must be that the V_{PE} solving (1) satisfies $\widehat{V}_{PE} < V_{PE} < v_1 + x_H$.

(b) Clearly $\widehat{V}_{PE}$ is an increasing function of c_2 and p that are measures of the asset restructuring potential, it is also increasing δ and, because of Lemma 1 of SBs potential synergies. For the case $x_H > \widehat{V}_{PE} - v_1$, the result follows from straightforward computation from the implicit function theorem applied to (3) and (4).

(c) The fact that $V_{IPO}(v_2) > V_{Auc}(v_1)$ follows from Lemma 1. The fact that the revenue from a SBO is the minimum follows from the fact that it also reflects the selling PE's reservation price. □

Lemma 3 *In the unique symmetric equilibrium, the probability with which each PE participates in the initial auction is* $q^* = 1 - (\alpha/\pi^*_{PE})^{\frac{1}{m-1}}$ *if* $\pi^*_{PE} > \alpha$, *and* 0 *otherwise.*

Proof of Lemma 3: Note that if PE j does not participate in the initial auction its payoff is nil either because it will never buy the asset or because it will buy it at the fair PE value V_{PE} from another PE via an exit auction. If PE j invests α to participate in the initial auction, then its payoff is $-\alpha + \pi^*_{PE}$ if it is the only PE bidder and $-\alpha$ otherwise. If $\pi^*_{PE} < \alpha$, no PE will ever invest α and the resulting q^* is nil. Consider the case $\pi^*_{PE} \geq \alpha$ and let q be the mixed strategy entry probability adopted by each of the other $m-1$ PEs in a symmetric equilibrium. Then PE j is indifferent between entering or not, if and only if $-\alpha + (1-q)^{m-1}\pi^*_{PE} = 0$, which is true for $q = q^*$. □

For the next statement (Proposition 2), for a given level of x_{PE}, let $R_{PE}(x_{PE})$ and $R_{SB}(x_{PE})$ denote the seller's expected revenue conditional on the winner of the auction being a PE and a SB, respectively. Then we have,

Proposition 2 *The probability of a PE winning the initial auction is increasing in* x_{PE}. *There exist thresholds* $\underline{x}_{PE}, \overline{x}_{PE}$, *with* $0 < \underline{x}_{PE} < \overline{x}_{PE} < x_H$ *such that for* $x_{PE} < \underline{x}_{PE}$ *and* $x'_{PE} > \overline{x}_{PE}$ *we have* $R_{SB}(x'_{PE}) < R_{PE}(x'_{PE})$ *and* $R_{SB}(x_{PE}) < R_{PE}(x'_{PE})$.

Proof of Proposition 2: For a given x_{PE}, the probability of a PE winning the initial auction is $F^{(1)}(x_{PE})(1 - (1-q^*)^m)$, that is the probability that the highest of the SB bidders' synergies is less than x_{PE} times the probability that at least one PE participates in the auction.

Consider first $R_{PE}(x_{PE})$. The PE wins only if the highest value of synergies among SBs is less than x_{PE}. If the winning PE faces no competition from other PEs, then it will pay the highest of the SBs' valuations, for which the expectation, conditional on PE winning the auction, is $v_0 + E[\widetilde{x}^{(1)} \big| \widetilde{x}^{(1)} < x_{PE}]$. If there is at least one other PE bidder, then the winning PE will have to pay $v_0 + x_{PE}$. It immediately follows that $R_{PE}(x_{PE})$ can be expressed as

$$R_{PE}(x_{PE}) = v_0 + \theta E[\widetilde{x}^{(1)} \mid \widetilde{x}^{(1)} < x_{PE}] + (1-\theta)x_{PE} \ ,$$

where $\theta \in]0,1[$ only depends on q^*. Clearly, $R_{PE}(x_{PE})$ is continuous, increasing in x_{PE}, and equal to $v_0 + \theta E[\widetilde{x}^{(1)}] + (1-\theta)x_{PE}$ for $x_{PE} \geq x_H$. Consider now $R_{SB}(x_{PE})$. If a SB faces no competition from PEs, then it will pay the highest of the other SBs' valuations, which in expectation equals $v_0 + E[\widetilde{x}^{(2)}]$. If a SB wins in the presence of PEs, it will pay the maximum between the highest of the other SBs' valuations and x_{PE}, which in expectation is $v_0 + E[\widetilde{x}^{(2)} \mid \widetilde{x}^{(2)} > x_{PE}]$. Note, however, that when x_{PE} increases, a SB will tend to win only when facing no competition from PEs. Hence

$$R_{SB}(x_{PE}) = v_0 + \gamma(x_{PE})E[\widetilde{x}^{(2)}] + (1-\gamma(x_{PE}))E[\widetilde{x}^{(2)} \mid \widetilde{x}^{(2)} > x_{PE}] \ ,$$

where $\gamma(x_{PE})$ increases with x_{PE} and approaches 1 as x_{PE} approaches x_H. Thus, we have $R_{SB}(0) = R_{SB}(x_H) = v_0 + E[\widetilde{x}^{(2)}]$. Since $R_{SB}(x_H) < R_{PE}(x_H)$ the result follows from the continuity of R_{SB} and R_{PE}. $\square$

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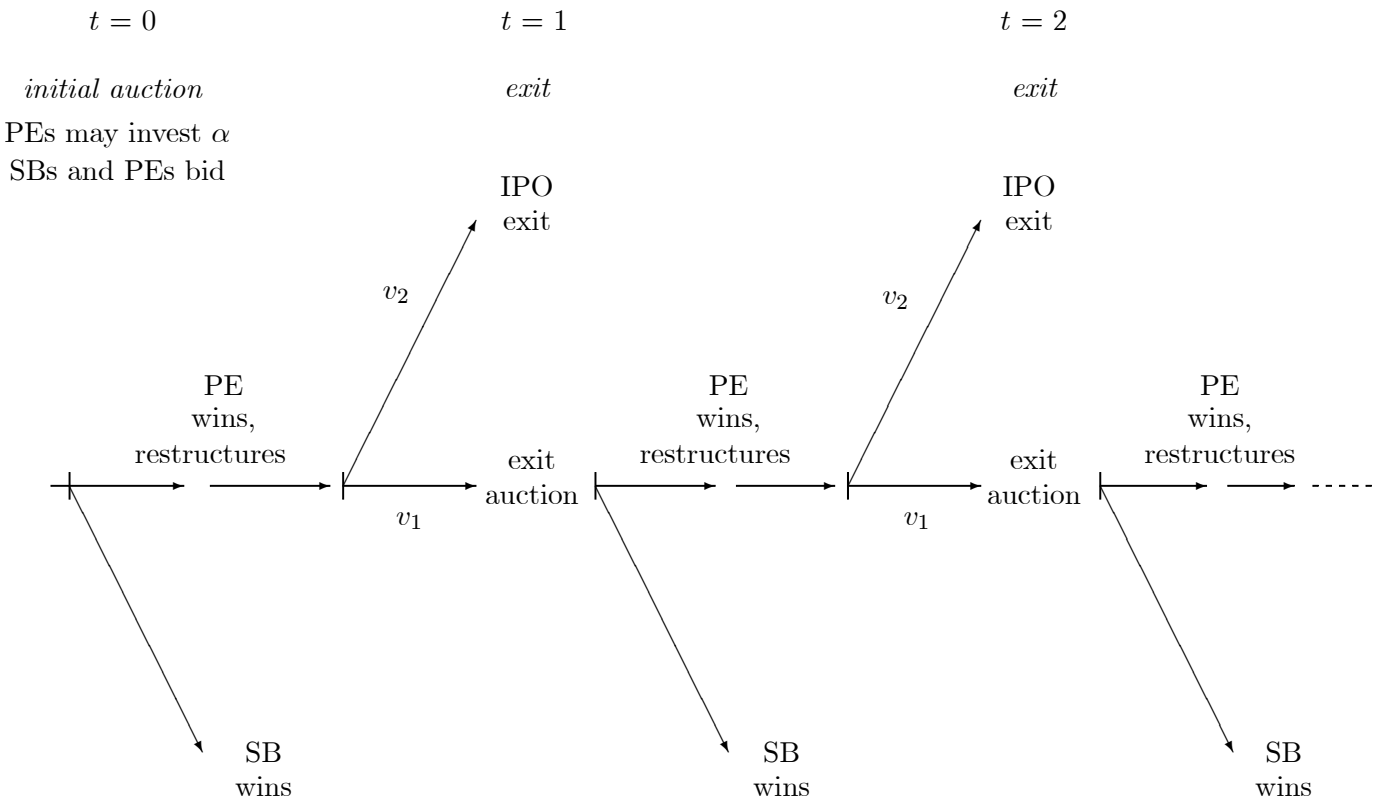

Figure 1. Time Line

Table 1
Descriptive statistics

Statistics for means, and medians in parentheses, are reported for asset sales of $100 million or more conducted by publicly traded sellers listed on NYSE/ASE/Nasdaq over the sample period 1994 through 2004, obtained from the SDC Acquisition Database. Transactions are disaggregated on the basis of the type of buyer into 146 asset sales to private equity buyers (PE), 48 asset sales to private strategic buyers (private operating firms), and 287 asset sales to publicly traded strategic buyers. The value of the transaction is reported in millions of constant (1997) dollars. Firm 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.

	Private equity buyer	Strategic private buyer	Strategic public buyer	
	Seller	Seller	Seller	Buyer
	N=146	N=48	N=287	N=287
Transaction value ($1997, m)	397.90	308.12	643.73	643.73
	(211.81)	(222.25)	(255.00)	(255.00)
Market value ($1997, m)	21,694.95	7,817.36	20,721.6	22,184.96
	(4,614.09)	(2,560.66)	(5,228.31)	(2,677.25)
Asset/MV	0.26	0.52	0.31	0.34
	(0.07)	(0.09)	(0.07)	(0.11)

Table 2
Empirical results for share price responses at asset sales

Empirical results are reported for excess returns at asset sales of $100 million or more conducted by publicly traded sellers listed on NYSE/ASE/Nasdaq over the sample period 1994 through 2004, obtained from the SDC Acquisition Database. The metrics are two-day (-1, 0) announcement cumulative excess returns (CARs) for sellers and for publicly traded buyers (Panel A) and two-day median transaction returns (TR), measured as the dollar gains in value scaled by transaction value (Panel B). Excess returns and transaction returns in percent are in response to 146 asset sales to private equity firms (PE), 287 asset sales to publicly traded strategic buyers (Public SB), and 48 asset sales to private strategic buyers (Private SB). To obtain rival CARs, CRSP firms with the same 4-digit SIC code as the asset are used to form an industry portfolio for each event (equally weighting rival firms per event), and then are averaged over all events. Combined returns weight the buyer and seller returns by market capitalization. Excess returns are calculated using market model methodology; t-statistics are in parentheses, proportion of returns positive is in brackets. Median returns are in braces. The statistical significance of median returns is based on the Wilcoxon signed ranks test. Statistical significance for the difference between types of buyers is 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 public announcement. Statistical significance is denoted as: *** for the 1% level, **, for the 5% level, and *, for the 10% level.

	Private equity buyer	Strategic public buyer	Strategic private buyer	p-difference in means {medians}			Strategic public buyer	
	Seller	Seller	Seller	PE / Public SB	PE / Private SB	Public SB / Private SB	Buyer	Combined
	N=146	N=287	N=48				N=287	N=287
Panel A: Excess Return								
Two-day CAR (-1, 0)	3.78%	1.25%	0.95%	0.00	0.01	0.81	0.48%	0.31%
	(12.42)***	(6.10)***	(2.19)**				(3.10)***	(1.40)
	{2.06%}***	{0.27%}**	{0.46%}	{0.00}	{0.00}	{0.78}	{0.33%}	{0.32%}
	[0.82]	[0.54]	[0.52]				[0.55]	[0.54]
Rival CAR (-1, 0)	0.05%	0.12%	-0.52%	0.93	0.66	0.61		
	(0.47)	(0.61)	(0.91)					
Panel B: Transaction Return								
Two-day median TR	{22.25%}***	{2.85%}	{3.68%}	{0.00}	{0.00}	{0.57}	{0.73%}	{2.46%}

Table 3
Excess returns to sellers at asset sales with private equity buyers and subsequent changes in asset enterprise value

Excess returns (CAR) and transaction returns (TR) to sellers at announcements of asset sales to private equity buyers over the period 1994 through 2004 for sellers and the annualized rate of change in enterprise value implied by the difference between the asset's enterprise value at exit and the value at the original asset sale. Average excess returns reported are the two-day (-1, 0) announcement average excess returns for sellers and the average two-day gain in seller value scaled by transaction size; median returns are in braces. Excess returns are calculated using market model methodology. The statistical significance of medians is based on the Wilcoxon signed ranks test. 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 announcement in the Wall Street Journal. The duration of the interval from the asset sale to the date of the exit transaction is reported as of end of 2009. Annualized changes in enterprise value are reported for benchmark firms which are public (CRSP) firms with the same 4-digit SIC code as the asset sold that are closest in enterprise value to the value of the asset. Excess EV is the difference between the growth rate of the relevant asset and its benchmark. Private equity exits are disaggregated into IPOs, sales to strategic buyers, secondary buyouts (SBOs), no exit, and Chapter 11 filings. Of the 23 SBOs, the second private equity firm exits the investment in 11 cases. N is the sample size and statistical significance is denoted as: *** for the 1% level, **, for the 5% level, and *, for the 10% level.

			Panel A: By type of exit by 1st private equity buyer					*Panel B: 2nd private equity buyer*
	Full sample	All exits	IPO	Strategic buyer	Secondary buyout	No exit	Chapter 11	2nd private equity buyer
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
N	146	121	41	37	23	25	20	11
%		100%	34%	30%	20%		16%	9%
Time in PE {years}		3.37	2.13	3.19	4.95		4.42	4.25
		{2.84}	{1.82}	{2.77}	{5.00}		{4.20}	{4.20}
Seller CAR	3.78%***	4.04%***	5.11%***	3.49%***	4.81%***	2.51%***	1.97%**	
	{2.06%}***	{2.16%}***	{2.38%}***	{1.93%}***	{2.40%}***	{2.06%}*	{0.73%}*	
Seller TR	135.93%***	153.55%***	230.89%***	181.08%***	70.89%	50.65%*	31.76%*	
	{22.25}***	{23.87%}***	{45.05%}***	{24.72%}***	{16.71%}***	{19.27%}	{7.15%}	
EV growth rate		48.45%***	111.52%***	36.81%***	20.48%***		-27.11%***	15.19%*
		{18.69%}	{43.64%}	{24.78%}	{10.38%}		{-21.20%}	{16.76}
Rival EV growth rate		20.53%***	37.03%**	17.88%**	9.48%		4.31%	14.92%
		{6.12%}	{9.45%}	{6.21%}	{2.10%}		{3.94%}	{10.00}
Excess EV		27.93%***	74.49%***	18.93%***	11.00%		-31.42%***	00.27%
		{13.96%}***	{45.88%}***	{18.64%}***	{14.90%}*	{4.04%}	{-28.59%}***	

Table 4
Analysis of private equity success

The first metric, Excess EV Annual Growth Rate, is the difference in the annualized rate of change in enterprise value (EV) implied by the difference between the asset's enterprise value at exit and its value at the original asset sale, minus the annualized rate of change in the enterprise value of the benchmark firm over the same period. The second metric, Excess EV Profitability Index, is the profitability index of the entity's enterprise value at exit and the value at the asset sale, calculated using a discount rate of 15%, (other discount rates generate similar results) minus the annual change of the enterprise value of the benchmark firm over the same horizon. The third metric, Exit Success, is a dummy variable that is equal to one if private equity exits from the asset via an IPO or a trade sale, and 0 otherwise. Regressions (1) through (4) are OLS regressions using (White) heteroskedasticity-consistent standard errors; regressions (5) and (6) are logit regressions. The independent variables are defined as follows: TR is the seller transaction return generated from event studies as described in Table 3; Ln TV is the log of the value of the asset sale transaction; and Year 1999-2001 is a qualitative variable that takes on the value of one for an asset that exits private equity during 1999-2001, years generally accepted as a period of hot IPO markets. The sample size is 121 and *t*-statistics are in parentheses, below the coefficients. Statistical significance is denoted as: *** for the 1% level, **, for the 5% level, and *, for the 10% level.

	Excess EV annual growth rate		Excess EV profitability index		Exit success	
	(1)	(2)	(3)	(4)	(5)	(6)
Seller TR	0.0012	0.0013	0.0031	0.0039	0.0092	0.0086
	(1.93)*	(2.21)**	(2.10)**	(2.38)**	(5.30)***	(4.61)***
Ln TV		-0.017		-0.007		0.165
		(-0.36)		(-0.04)		(1.16)
Exit in 1999-2001		-0.202		-0.953		2.899
		(-1.79)*		(-1.82)*		(4.81)***
Constant	0.1687	0.2872	0.0101	0.1510	-1.9587	-3.0626
	(3.64)***	(1.07)	(0.07)	(0.16)	(-12.84)***	(-3.58)***
R-squared/ Pseudo R-squared	0.0361	0.0641	0.0210	0.0741	0.0669	0.1343

Table 5
Regressions of seller announcement returns

Regressions explain excess returns to sellers of assets from 1994 through 2004. In regressions (1) – (4), the dependent variable is TR (transaction returns), and in regressions (5) – (8) seller CAR (cumulative excess returns). Qualitative variables, which take on the value of one for the relevant characteristic and zero otherwise, are defined as: PE is one for private equity buyers; POF is one for private operating firms; Focus is one when the seller and asset sold have the same 4-digit SIC code; Proceeds is one when the seller pays out the proceeds to reduce debt or repurchase equity. Quantitative variables are defined as: Enterprise value (log) is logarithm of the asset's sales price; Pre-return is seller six-month cumulative excess period prior to sale date; ROA is the seller's return on assets; Asset/EV is the value of the asset scaled by the seller's enterprise value; Insiders is the percentage of seller shares held by members of its Board of Directors and senior management; and M/B is the seller's market to book ratio. N is the sample size; *t*-statistics are in parentheses. Statistical significance is denoted as: *** for the 1% level, **, for the 5% level, and *, for the 10% level.

	Transactions return				CAR			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PE	112.74	101.51	99.30	100.06	2.43	2.52	2.52	2.44
	(4.51)***	(3.96)***	(3.86)***	(3.89)***	(4.20)***	(3.85)***	(3.96)***	(3.86)***
POF		-0.89	-3.83	-3.73		-0.40	-0.51	-0.58
		(-0.04)	(-0.17)	(-0.17)		(-0.36)	(-0.47)	(-0.55)
Focus				-10.10				0.44
				(-0.41)				(0.54)
Enterprise value (log)				4.57				-0.83
				(0.42)				(-3.87)***
Pre-return			-33.87	-33.44			-2.17	-2.23
			(-1.23)	(-1.21)			(-2.62)***	(-2.73)***
ROA		421.96	419.43	412.73		-8.02	-7.39	-6.04
		(1.93)*	(1.87)*	(1.84)*		(-1.62)	(-1.49)	(-1.25)
Asset/EV		5.62	4.38	10.17		-0.70	-0.77	-1.84
		(0.77)	(0.62)	(0.90)		(-0.30)	(-0.32)	(-1.09)
Insiders		-0.90	-0.90	-0.66		0.04	0.05	0.01
		(-1.38)	(-1.35)	(-0.98)		(1.32)	(1.47)	(0.37)
M/B		-0.16	-0.05	-0.10		-0.01	-0.01	0.01
		(-0.54)	(-0.13)	(-0.30)		(-0.78)	(-0.56)	(0.39)
Proceeds		-8.99	-13.40	-10.57		1.56	1.42	0.91
		(-0.42)	(-0.62)	(-0.54)		(2.50)***	(2.31)**	(1.53)
Constant	4.39	-42.14	-38.33	-81.43	1.23	1.36	1.31	9.41
	(0.34)	(-1.23)	(-1.10)	(-0.84)	(3.50)***	(1.74)*	(1.67)*	(4.00)***
N	481	448	444	444	481	448	444	444
R-squared	0.0440	0.0534	0.0551	0.0563	0.0318	0.0653	0.0874	0.1255
F	20.31	3.78	3.09	2.58	17.67	5.74	5.53	6.70