The Role of Liquidity Constraints and Verification Costs in the Acquisition of Private Firms

Brian Cadman, Mark Jansen, and Thomas Noe*

November 2024

ABSTRACT

This paper examines how costly verification and liquidity constraints affect contracting features in private firm acquisitions. We theoretically compare two forms of target performance-sensitive consideration: seller debt, which is enforced by asset foreclosure, and earnouts, which are enforced by costly verification of performance and cash flows. Our empirical results from a broad sample of private deals support the models' empirical predictions that seller debt financing increases with liquidity and verification costs. When acquirer liquidity constraints are relaxed and verification costs decline, earnouts become more common. These results suggest that market uncertainty and contingency verification through accounting systems are important determinants of post-acquisition capital structure.

JEL classification: D82, G29, G32, G34, M41, M42

keywords: Mergers and Acquisitions, Mergers, Earnout, Seller Debt, Verification, Liquidity Constraint

*Cadman: University of Utah, Eccles School of Business, brian.cadman@utah.edu; Jansen: University of Utah, Eccles School of Business, mark.jansen@utah.edu; Noe: Saïd Business School and fellow at Balliol college, University of Oxford, Thomas.Noe@sbs.ox.ac.uk. We are grateful to the management team at Business Valuation Resources that provided the data for this research, and we thank Judson Caskey, Mark Garmaise, Qiang Chen (discussant) Mirko Heinle, Arthur Korteweg, Christian Laux, Marcus Opp, Ivo Welch and seminar participants at CUHK Accounting Research Conference, UCLA Anderson School of Management, Federal Reserve Bank of San Francisco, Marshall School of Business at USC, and the Eccles School at the University of Utah for helpful comments.

1 Introduction

A mature stream of research investigates the mix of debt and equity that the acquirer uses to finance an acquisition (e.g., Eckbo, 2009; Cumming et al., 2023). Most of this research focuses on mergers and acquisitions (M&A) of diffusely held public companies. We consider acquisitions of *private* companies where debt and equity claims are typically contingent on the performance of the acquired asset.[1] We examine the role of liquidity constraints and costly verification on the choice between two contingent claims commonly used in private firm acquisitions: earnout agreements and seller debt financing.[2]

Earnouts and seller debt financing reduce adverse selection costs in acquisitions by making payments contingent on the performance of the acquired asset. Earnouts signal firm quality because the buyer only receives the earnout payment if the target firm achieves performance contingencies. Seller debt is a costly and credible signal of target firm quality because sellers of firms with poor prospects anticipate that their firms' cash flows will not meet the debt repayment schedule and will bear the cost of foreclosure. Because these contingent payments impose risk on the seller and reduce adverse selection costs they both are superior to cash or "cash equivalent" consideration.[3] Consistent with these benefits, Jansen (2020) finds that seller debt or earnouts are used in 49.6% of the private seller transactions.

Although both earnouts and seller debt defer payments to the seller and help resolve adverse selection problems, these claims differ in important ways. Earnouts provide sellers with payments, conditional on meeting financial performance measures, such as revenue and earnings targets, or nonfinancial performance hurdles, such as Food and Drug Administration (FDA) approval, which requires costly monitoring and verification. These costs are evidenced by frequent litigation over earnout payments, commonly involving allegations of accounting manipulation (Wolf and Fox, 2010; Liebnick, 2011; Allee and Wangerin, 2018). Unlike earnouts, seller debt does not involve

[1]While our work concentrates on private targets, the economic forces observed also apply to acquisitions of public subsidiaries, resulting in a collective M&A volume reaching trillions of dollars (Jansen et al., 2024).

[2]Retained equity stakes are uncommon in private firm buyouts, outside of venture capital. One reason is because minority stakes in private firms are illiquid and have no clear exit path.

[3]M&A agreements often use the term "cash equivalent consideration" to denote the combination of cash and acquirer equity. Moreover, Chen et al. (2022) shows that only 24% of acquirer equity packages include a lock-up period; when a lock-up is included, it usually has a short duration (median of four months) and involves few shares (median of 7%). Consequently, acquirer equity is effectively comparable to cash for sellers.

explicit contracting on financial outcomes, so it does not impose verification costs. Rather, it represents a claim, held by the seller, that is secured by the assets of the target firm and enforced through asset foreclosure.[4]

Building on the differences in these contract features, we develop a theoretical model of the choice between seller debt and earnouts contingent on liquidity constraints and the cost of post-acquisition verification. Our model extends Jansen et al. (2024), who develop a framework for optimal security design, where seller debt is often the preferred financing tool in a setting focused on belief divergence and adverse selection. We extend the analysis to consider how verification costs and the buyer's liquidity constraints affect the use of earnouts over seller debt. In doing so, we provide new insights that incorporate these additional frictions. Our model also aligns with the sellers' common preference for liquidity as an explanation for the observed prevalence of cash consideration, which cannot be explained solely by private information about the target asset as in other studies.[5]

We incorporate the relative seller liquidity preference by assuming that the seller's marginal rate of substitution of future project cash flows for immediate cash payments is smaller than the acquirer's. Due to financial constraints imposed by capital market imperfections, typical sellers (i.e., small private firms) face higher discount rates than typical acquirers (i.e., private equity funds and large public companies) (Hubbard, 1998; Fuller et al., 2002; Greene, 2017). This creates an opportunity for the acquirer to profitably provide liquidity to the seller (Garmaise, 2008).[6] We show that the acquirer's funding advantage favors all-cash offers, a result consistent with the empirical finding in Jansen (2020) that most private firm acquisitions involve a cash consideration.[7]

We then expand on that model to consider the conditions under which earnouts are preferable

[4]As shown by Hart and Moore (1994) and other *incomplete contracting* papers, even when cash flows cannot be verified, debtor repayment can be enforced by granting lenders foreclosure rights if certain conditions are met. However, this enforcement mechanism restricts the size and timing of performance-contingent payments and thus the acquirers' ability to provide liquidity to sellers.

[5]Liquidity preference has been documented in the empirical M&A literature (e.g., Officer, 2007) and incorporated into numerous models of security choice and capital structure (e.g., DeMarzo and Duffie, 1999; Biais and Mariotti, 2005; DeMarzo and Sannikov, 2006; Yang, 2020).

[6]Differences in marginal rates of substitution could also result from acquirer confidence, leading to different beliefs about expected future cash flows (Jansen et al., 2024) or from different stochastic discount factors (Panageas, 2020).

[7]Because of information asymmetry, all-cash offers impose adverse selection costs. When these costs are sufficiently large, Jansen et al. (2024) show that outcome-contingent contracting, either through seller debt financing or earnouts, dominates all-cash offers, even though these contracts delay payments to the seller and thus forgo the sellers liquidity advantage.

to seller debt financing by introducing the cost of verifying post-acquisition performance in combination with liquidity constraints. We show that the choice between seller debt and earnouts hinges on the trade-off between liquidity provision and verification costs. Seller debt imposes higher liquidity provision costs on acquirers, which increase with acquirer's funding advantage, but has the benefit of lower verification costs. Conversely, earnouts become preferable when liquidity constraints and verification costs are lower. Ultimately, the decision between seller debt and earnouts is driven by this balance between liquidity constraints and the cost of verification.

We empirically test our predictions in a sample of 12,829 US private company sales from 1997 to 2014. We measure liquidity provision costs with capital liquidity, a well-established factor in M&A (Shleifer and Vishny, 1992; Harford, 2005; Eisfeldt and Rampini, 2006). Capital liquidity, reflected in higher credit spreads, signals increased uncertainty and impacts private M&A financing (Beber et al., 2009). Bernanke et al. (1996) and Holmstrom and Tirole (1997) predict that, during flights to quality, banks fail to monitor firms with high agency costs. Acquirers with better access to capital markets than targets are more adversely affected by credit shocks (Kudlyak and Sanchez, 2016). Seller debt, by supporting senior bank debt, helps alleviate the acquirer's financial constraints. Consistent with our model's predictions that seller debt is favored to earnouts when liquidity is more constrained, we find that seller debt financing is more prevalent and earnouts are less so as credit spreads widen.

We measure verification costs with financial statement transparency and additional inspection and governance. First, we consider whether the buyer is a public firm, which has audited financial statements and faces analyst and regulatory scrutiny that increases transparency (e.g., Leuz and Verrecchia (2000); Armstrong et al. (2010)). Second, we examine whether the target firm restated its earnings prior to the acquisition, where restated earnings indicate a higher likelihood that the private target had audited financial statements and additional scrutiny of the financial statements (Lobo and Zhao, 2013). We also measure whether the target firm had debt on its balance sheet prior to the acquisition, which suggests that pre-acquisition financial statements were verified, monitored, and determined to be debt-worthy—providing external validity (Demerjian, 2017). Our fourth measure considers employment agreements, where the target CEO, who is also the firm's owner, remains on the management team for a contracted period post-acquisition. This allows the owner-CEO to more effectively monitor earnout-related performance. Consistent with our predictions, we find that earnouts are more common as verification costs decrease using all four of these measures.

As an additional measure of verification costs, we examine the role of financial reporting requirements. Statement of Financial Accounting Standards (SFAS) 141(R) (FASB [2007]) requires acquirers to estimate and recognize the fair value of earnouts at the acquisition date and subsequently in each reporting period, as uncertainty and the probability of achieving the earnout hurdles resolve. Before the adoption of SFAS 141(R) in 2009, acquirers did not recognize earnouts in their financial statements at the time of acquisition. Rather, they did so when the corresponding contingencies had been resolved and payments made. Consistent with enhanced disclosure that reduce verification costs and increase the use of earnouts, we find that more deals include earnouts after the adoption of SFAS 141(R).

Moreover, using a difference-in-differences framework, we find that, after the standard's adoption, private buyers that are unlikely to have audited financial statements (Minnis, 2011) and therefore less likely to follow 141(R), are less likely than their public counterparts to include an earnout. We also find weak evidence that earnouts are *less* likely to be used in transactions after 141(R) when transactions include an employment agreement. Given our finding that employment agreements reduce verification costs and increase the use of earnouts, this result suggests that 141(R) *increased* the transaction cost of earnouts in cases where costly reporting required by 141(R) offered little additional benefit to the contract. Overall, the evidence on the adoption of 141(R) supports our hypothesis that regulatory changes mandating greater financial disclosure related to earnout liabilities facilitate the use of earnouts in the acquisition of private targets when the buyer is public, but also raise the costs.

Our analysis of seller compensation in private firm acquisitions builds on the literature on adverse selection and contingent compensation in acquisitions (Hansen, 1987; Fishman, 1989). Previous research has examined the choice between earnouts and cash compensation (Chang, 1998; Kohers and Ang, 2000; Datar et al., 2001; Cain et al., 2011; Cadman et al., 2014; Allee and Wangerin, 2018) and between seller debt and cash compensation (Jansen, 2020). We address a different problem: the choice between earnouts and seller debt. Since adverse selection alone cannot explain this choice, we incorporate features of the contracting environment that are critical for choosing between these different forms of contingent payments, but may be less relevant for contingent versus non-contingent compensation (i.e., cash equivalent compensation versus earnouts and seller debt).

The key distinction between seller debt and earnouts lies in their enforcement costs. Most adverse selection models assume a complete contracting environment, where cash flows are verified and contracts enforced without cost. In such settings, neither earnouts nor seller debt impose contracting costs. The only relevant feature is how these contracts allocate cash flows between sellers and buyers. Earnouts offer flexibility, allowing any desired cash flow division, while seller debt is more rigid, adhering to debt contracting rules like absolute priority and limited liability.[8]

However, both Jansen's (2020) and our data indicate that seller debt is the preferred form of contingent compensation in private firm acquisitions. Thus, an explanation for the choice between seller debt and earnouts must go beyond theories based solely on asymmetric information or complete contracting models (Jansen, 2020; Jansen et al., 2024). In this paper, we incorporate contracting costs, particularly liquidity constraints and the cost of post acquisition verification, into our framework. Unlike earnouts, seller debt does not require cash flow verification, making it preferable when such costs are high. We account for the flexibility of earnouts by assuming sellers are more liquidity constrained than acquirers, benefiting from the intertemporal allocation of compensation that earnouts offer. Our approach ties these contracting costs and benefits to observable variables with time series and cross-sectional variation in our data.

Our focus on cash flow verification costs, typically provided by accounting firms, highlights how accounting systems, financial transparency, and monitoring shape financial contracts and capital structures. We show that acquisition capital structure favors seller debt as liquidity constraints and verification costs rise, while earnouts become more common when verification costs fall. This choice significantly impacts the capital structure of private firms, which account for over two-thirds of U.S. private sector employment (Asker et al., 2015).

We contribute to the literature on the effects of comprehensive M&A disclosures (Titman and Trueman, 1986; Datar et al., 1991). We expand on those studies by showing that the choice between seller debt financing and earnouts—two means of mitigating the same microeconomic contracting problems—is substantially affected by liquidity constraints, capital market efficiency, governance,

[8]Under the right conditions, seller debt could be optimal, as shown by Jansen et al. (2024), but in these cases, earnouts would be viewed as equivalent. If those conditions are not met, earnouts would be preferred. Thus, when contracting is costless, seller debt becomes, at best, a redundant mechanism.

and the effectiveness of accounting systems.

We also extend the theoretical literature on optimal contracting in a setting where agents can choose between complete and incomplete contracts versus settings where contracting is complete (zero-cost verification) (DeMarzo and Duffie, 1999; Nachman and Noe, 1994) or complete contracting is impossible (infinite cost verification) (Hart and Moore, 1994; Bolton and Scharfstein, 1990). Our study expands on those studies by considering and explaining the coexistence of complete and incomplete contracts. Finally, we contribute to understanding private firm acquisitions by considering the differences between seller financing and earnouts. We provide analytical predictions of how liquidity constraints and costly verification drive these two contracting choices—predictions supported by our empirical tests.

2 Numerical Example

In this section, we present and discuss a numerical example based on a general model of asset acquisitions from the online appendix. The model is constructed from standard corporate finance theory building blocks, e.g., private information, differential liquidity preferences, and incomplete contracting. We provide the intuition underlying the formal model and illustrate its consistency with the empirical hypotheses tested in this paper. The online appendix provides the full model with detailed proofs and more discussion of the model's assumptions, predictions, and robustness.

2.1 Setting

General framework Consider the problem of an acquirer aiming to purchase an asset from a seller. The acquirer plans to increase the asset's value, but the plan's efficacy depends on the asset's condition. To implement the plan, the asset must be acquired at date 0. An acquirer offer is a menu of contracts offered to the seller at date 0. Accepting any contract results in the seller transferring control of the asset to the acquirer. The asset produces cash flows at dates 1 and 2. The acquisition does not affect date-1 cash flows, called earnings, e, but does affect date-2 cash flows, called v, *continuation value*.

Both the acquirer and seller have risk-neutral preferences. We assume that the acquirer is less financially constrained than the seller. We implement different financial constraints through a commonly used device: different discount rates. Since there are only two agents in our model, the seller and the acquirer, we use the acquirer's valuation of cash flows as our numeraire, The acquirer assigns a value of \$1 to cash flows, regardless of when they are received. The seller values \$1 of cash flows at date 0 at \$1 but values \$1 of date-1 and date-2 cash flows at $\phi \times \$1$, where $0 < \phi < 1$. Thus, the seller prefers immediate liquidity more than the acquirer, and therefore ϕ can be interpreted as an illiquidity discount applied by the seller to cash flows. Under this interpretation, $1 - \phi$ represents the acquirer's liquidity advantage relative to the seller.

The acquirer's plan depends on the asset's condition, the asset's condition depends on the *state* of the world. There are two possible states: state H with high asset value and an effective value-add plan and state L, with low asset value and an ineffective plan. The prior probability of these two states is the same, i.e., $\mathbb{P}[H] = \mathbb{P}[L] = 1/2$. We subscript variables that depend on the state with H or L and superscript variables that depend on whether the asset is acquired with A if the asset is acquired and S if the seller retains control.

The complication faced by the acquirer is the seller's private information. Before the acquirer makes an offer, the seller receives a noisy private *signal* correlated with the state, H or L. The signal has two possible values, G or B. The unconditional probability that the seller receives signal G equals the unconditional probability that the seller receives signal B. The probability of each signal, G or B, conditioned on the state, H or L, is given by $\mathbb{P}[G|H] = \mathbb{P}[B|L] = \gamma$; $\mathbb{P}[B|H] = \mathbb{P}[G|L] = 1 - \gamma$, where $1/2 < \gamma < 1$. Because the two states, H and L, are equally likely, Bayes' rule implies that the probability of the signal conditioned on the state equals the probability of the state conditioned on the signal. Hence, conditioned on the signal received, the seller's belief about the probabilities of H and L is given by

$$
\begin{aligned}
\mathbb{P}[H|G] = \gamma, \quad \mathbb{P}[L|G] = 1 - \gamma, \\
\mathbb{P}[H|B] = 1 - \gamma, \quad \mathbb{P}[L|B] = \gamma, \quad \gamma > 1/2.
\end{aligned}
\tag{1}
$$

Receiving signal G (B) increases (decreases) the seller's assigned probability of state H from $1/2$ to $\gamma > 1/2$ ($1 - \gamma < \frac{1}{2}$). We refer to a seller receiving signal G (B) as the G-seller (B-seller).

The seller's accept or reject decision in response to the acquirer's offer depends on the standalone value of the asset. We call the payment that the acquirer would have to make at date 1 to acquire the asset from the G and B sellers the seller's *date-1 reservation value* and denote these reservation values by r_G and r_B respectively. Because the seller discounts date-1 and date-2 payments from the acquirer by the same factor, ϕ, as their standalone cash flows, the date-1 payment required to relinquish control is the expected standalone cash flows at dates 1 and 2. Thus, the date-1 reservation values of the G and B seller are given by

$$\begin{aligned} r_G &:= (e_H + v_H^S)\,\mathbb{P}[H|G] + (e_L + v_L^S)\,\mathbb{P}[L|G] &&= (e_H + v_H^S)\,\gamma + (e_L + v_L^S)\,(1-\gamma) \\ r_B &:= (e_H + v_H^S)\,\mathbb{P}[H|B] + (e_L + v_L^S)\,\mathbb{P}[L|B] &&= (e_H + v_H^S)\,(1-\gamma) + (e_L + v_L^S)\,\gamma. \end{aligned} \tag{2}$$

The acquirer's objective is to minimize the acquisition costs, which include the acquirer's valuation of cash flows paid to the seller and any dissipative cost borne by the acquirer. The optimal offer design aims to minimize acquisition costs while ensuring the seller accepts the offer. Throughout our analysis, we assume that (a) the acquirer has the needed funds to acquire the asset for cash at date 0, and (b) the acquirer makes a first-and-final offer to the seller, which the seller either accepts or rejects.[9]

We consider the optimality of acquisition mechanisms under different assumptions about the contracting environment. We first consider acquisitions in an incomplete contracting environment where cash flows are not verifiable, so contracting on cash flows is infeasible. In this setting, we examine the choice between all-cash offers and seller-debt offers. Next we add the option of costly cash flow verification. Costly verification permits the acquirer to use earnout offers that condition payments on the ex post performance of the asset. Finally, we illustrate the conditions under which all-cash, seller debt, and earnout offers are optimal.

Numbers for the numerical example In the numerical scenarios, we fix $\gamma = 4/5$. We also fix the cash flow at date 1, e, and date 2, v, which are shown in Table 1, Panel A. Using equations (1) and (2) and our choice of γ, we compute the seller's posterior distribution over states and the seller's date-1 reservation values and present them in Panel B.

2.2 Seller debt

We first consider the acquirer's acquisition problem under the assumption that asset cash flows cannot be verified. When cash flows cannot be verified by third parties, it is impossible to write

[9] In the online appendix, we show that, when an acquirer faces extreme financial constraints and is unable to use date-0 cash, the trade off determining the optimal choice between seller debt and earnouts is the same as the model's trade off in the limiting case where $\phi \to 1$.

Table 1. *Parameters for numerical example.*
Panel A presents cash flows at dates 1 and 2, which depend on the state, H or L. Date 2 cash flows also depend on whether ownership is transferred to the acquirer, A, or remains with the seller, S. Panel B presents the seller's posterior distribution over the states conditioned on the signal the seller receives, G or B, as well as the seller's signal-conditioned date-1 reservation values.

(Panel A) Cash flows

		date 1	date 2	
States	Prob.	e	A	S
H	$1/2$	$e_H = 1$	$v_H^A = 5$	$v_H^S = 3$
L	$1/2$	$e_L = 0$	$v_L^A = 2$	$v_L^S = 2$

(Panel B) Seller's beliefs and valuations

	Seller's posterior beliefs	
Signals	G	B
Probability	$1/2$	$1/2$
$\mathbb{P}[H\|\cdot] =$	$\gamma = 4/5$	$1-\gamma = 1/5$
$\mathbb{P}[L\|\cdot] =$	$1-\gamma = 1/5$	$\gamma = 4/5$
Seller's date-1 reservation values:	$r_G = 3.6$	$r_B = 2.4$

cash-flow-contingent contracts. In this setting, we consider two scenarios that vary only with respect to the seller's illiquidity discount, ϕ.

Scenario 1: $\phi = 4/5$. Contractual incompleteness imposes no impediments to acquisition through an all-cash offer. The acquirer's cost of an all-cash offer is the minimum cash payment needed to ensure the seller's acceptance, where the seller is indifferent between accepting the cash consideration at date 0 or capturing the standalone value. If compensation were offered at date 1, the seller's reservation value would equal r_G or r_B for the G and B seller, respectively. However, the acquirer can offer a contract equivalent to the seller's value, making cash payments at date 0 that exploit the seller's illiquidity discount. Using the numbers from Table 1, Panel B, we calculate that the minimum date-0 cash offer acceptable to the G-seller is $\phi\, r_G = 2.88$ and the minimum offer acceptable to the B-seller is $\phi\, r_B = 1.92$. Thus, offer acceptance is a best response for the seller, regardless of the signal if and only if the cash offered at least equals $\phi\, r_G = 2.88$. Hence, the optimal cash offer is 2.88 at date 0, costing the acquirer the cash payment to the seller. Thus, we see that

$$\text{Acq. cost: Optimal all-cash offer} = \overbrace{\phi\, r_G}^{\frac{4}{5}\times 3.6} = 2.88. \tag{3}$$

The virtue of an all-cash offer is that it fully exploits the seller's illiquidity discount. Its vice is that the B-seller receives a cash payment, 2.88, far in excess of the B-seller acceptance threshold,

$\phi\, r_B = 1.92$. Is it possible to do better? Contractual incompleteness blocks contracts that tie seller payments to cash flows. However, it does not block contracts whose payoffs depend on cash flows because cash flows affect the ex post actions of the contracting parties.

Consider an alternative simple financing mechanism: seller debt, i.e., a nonrecourse debt claim payable to the seller and secured only by the acquired asset. The acquirer's payment to the seller is enforced by foreclosure: if the acquirer defaults, the seller reclaims the asset. Contract enforcement does not depend on any mechanism to verify cash flows. In fact, the contracting mechanism used in seller debt offers—loans to ventures secured only by the venture's revenue-producing assets—predates the emergence of accounting systems for verifying cash flows by at least 1,500 years.[10]

Consider a seller debt contract with face value, $k^* = e_H + v_H^S = 4$ due at date 1. The cash flows of the firm at date 1 vary with the state. At date 1 both the acquirer and seller learn whether the state is H or L. At date 1, the acquirer will decide whether to default. Because cash flows are not verifiable, a defaulting acquirer will expropriate the date-1 cash flow, e. Thus, if the state is H, the acquirer's date-1 payoff from defaulting is $e_H = 1$. If the acquirer repays the seller debt, the acquirer's date-1 payoff is the date-1 and date-2 cash flows less the debt repayment, i.e.,

$$e_H + v_H^A - k^* = \overbrace{e_H + v_H^A}^{1+5} - \overbrace{(e_H + v_H^S)}^{k^*=4} = \overbrace{v_H^A - v_H^S}^{5-3} = 2.$$

Thus, the acquirer will not default in state H. Similarly, in state L, the acquirer's date-1 payoff from defaulting is $e_L = 0$; the acquirer's date-1 payoff from repaying is $e_L + v_L^S - k^* = e_L + v_L^S - (e_H + v_H^S) = -2$, so the acquirer will default in state L.

The seller, being rational, anticipates that the acquirer will repay in state H and default in state L. The value of the payments, which are made on dates 1 and 2 to the seller under the seller debt contract, equals the cash flows produced by the payments discounted by ϕ, If state H is realized, the seller will receive the face value of debt $k^* = e_H + v_H^S = 4$ at date 1. If state L is realized, the seller will foreclose and receive the date-2 cash flow under seller ownership, $v_L^S = 2$. Hence, the date-0 value of these payments equals

$$\text{Seller date-0 valuation of SD:}G = \phi\,(\gamma k^* + (1-\gamma)\, v_L^S) = \phi \times 3.6 = 2.88,$$

$$\text{Seller date-0 valuation of SD:}B = \phi\,((1-\gamma)\, k^* + \gamma v_L^S) = \phi \times 2.4 = 1.92.$$

[10]Hoover (1926) and Ziskind (1974) date the sea loan, typically a nonrecourse loan secured by ships and ship cargo, back to at least the middle of the first century BC. Double-entry accounting was developed in the fifteenth century.

The seller's date-0 valuation of these cash flows equals the seller's date-0 reservation values, $\phi\, r_G = 2.88$ and $\phi\, r_B = 1.92$. Thus, if the acquirer simply financed the acquisition with this seller debt contract, accepting the offer would be a best response for both the G and B seller. The acquirer's cost is the acquirer's valuation of the seller debt contract, which equals expected payments to the seller $r_G = 3.6$ if signal G is realized and $r_B = 2.4$ if signal B is realized.

The advantage of this seller debt offer over an all-cash offer is that it holds both the G- and B-sellers' payoffs to their date-0 reservation values. Its disadvantage relative to an all-cash offer is that payments to sellers G and B are delayed until date 1, so the acquirer cannot capture any rents from exploiting the seller's liquidity disadvantage.

However, note that, for the B-seller, the date-0 value of the seller debt contract equals $\phi\, r_B$, and thus the B-seller is indifferent between a cash payment of $\phi\, r_B$ at date 0 and the seller debt contract. The G-seller prefers the seller debt offer to a cash payment of $\phi\, r_B$ at date 0 because $r_B < r_G$, and thus the seller's date-0 valuation of the seller debt contract, $\phi\, r_G$, exceeds $\phi\, r_B$, the date-0 value of a cash payment of $\phi\, r_B$. This reasoning leads to our candidate seller debt offer design.

Remark 1 (Seller debt offer)**.** *The candidate optimal seller debt offer consists of two contracts.*

a. All cash: A cash payment of $\phi\, r_B = 1.92$ *or*

b. Seller debt: a seller debt security, due at date 1, with a face value of $k^* = e_H + v_H^S = 4$.

Accepting seller debt with face value $k^* = 4$ is a best response for G-seller, while accepting the cash payment of $\phi\, r_B = 1.92$ is a best response for B-seller, making this seller debt offer feasible. Can a different seller debt offer reduce acquisition costs even more than the candidate offer design?

To answer this question, first note that it is never optimal to offer the G-seller a contract that provides that seller with value in excess of its date-0 reservation value, $\phi\, r_G$. An offer that is even more generous to the G-seller than the candidate offer might encourage the B-seller to accept this offer, which would result in both the G- and B-sellers earning more than their date-0 reservation values. Increasing the face value of the seller debt higher than $k^* = 4$, will make the date-0 value of the seller debt contract larger than the G-seller's date-0 reservation value, so face values greater than $k^* = 4$ are not optimal.

What about $k < k^*$? If the offer featured a seller debt contract with a face value less than k^*, unless the reduction in face value is accompanied by an increase in some other form of consideration, the seller debt contract will provide the G-seller with less value than the G-seller's date-0 reservation value, and the G-seller will reject the offer. To ensure acceptance by the G-seller when k is less than k^*, a cash component must be added to the seller debt offer. So when $k < k^*$, an offer consists of (1) an all-cash payment targeted at the B-seller and (2) a seller debt contract featuring both seller debt and a positive cash component targeted at the G-seller.

Under the candidate offer, the B-seller is indifferent between the cash payment and the seller debt contract. Modifying the offer by lowering the face value of the seller debt and adding a cash component makes the contract less performance sensitive and thus more attractive to the B-seller. If the cash payment targeted at the B-seller is not increased, the B-seller would mimic the G-seller. So, to ensure that the B-seller accepts the cash payment, the cash payment to that seller under the modified $k < k^*$ seller debt contract would have to exceed the cash payment to the B-seller under the candidate seller debt contract. The candidate seller debt contract provides the B-seller a payoff equal to its date-0 reservation value, $\phi\, r_B$. However, a seller debt offer with $k < k^*$ would give B-seller a payoff exceeding its reservation value, providing the seller with rents. Thus, the candidate seller debt offer is the only offer design that (a) fully exploits the B-seller's liquidity disadvantage, (b) ensures acceptance by both G- and B-sellers, and (c) provides no rents to the B-seller.

As we have seen, the all-cash offer (a) fully exploits the acquirer's liquidity advantage by providing all consideration to the B-seller and G-seller at date 0 and (b) makes accepting the offer a best response for both sellers. Neither the all-cash offer nor the candidate seller debt offer provide rents to the G-seller. The all-cash offer fully exploits the acquirer's liquidity advantage but concedes rents to the B-seller. The seller debt offer does not concede rents to the B-seller but because payments to the G-seller are made at date 1, it does not fully exploit the acquirer's liquidity advantage. Thus, if the cost to the acquirer of not fully exploiting its liquidity advantage is less than the cost of conceding rents to the B-seller, the candidate seller debt offer is optimal. Otherwise, the all-cash offer is optimal. Thus, to verify the optimality of candidate seller-debt offers, we need only compare the cost of the candidate seller-debt offer, detailed in Remark 1, with the cost of an all-cash offer.

In the seller debt setting without cash flow verification costs, the offer's cost is the acquirer's valuation of the cash flows received by the seller under the candidate seller-debt offer. The acquirer's valuation equals the sum of the expected cash flows received by the seller. Under the candidate offer, when the seller receives signal B, which occurs with probability 1/2, the seller accepts the cash offer and receives the cash payment $\phi\, r_B = 1.92$.

When the seller receives signal G, which occurs with probability 1/2, the seller accepts the seller debt offer. In this case, with probability $\gamma = 4/5$, the state is H, and the acquirer pays the face value of debt $k^* = 4$ to the G-seller. With probability $1-\gamma = 1/5$, the state is L, the acquirer defaults, and the seller forecloses, in which case the G-seller receives the date 2 cash flows from the asset $v_L^S = 2$. Therefore, the acquirer's valuation of the cash flows received by the seller under the candidate seller debt contract is

$$\text{Acq. cost: Optimal SD offer} = \frac{1}{2} \times \overbrace{(\phi\, r_B)}^{\frac{4}{5}\times 2.4 = 1.92} + \frac{1}{2} \times \overbrace{(\gamma k^* + (1-\gamma)\, v_L^S)}^{\frac{4}{5}\times 4 + \frac{1}{5}\times 2 = 3.6} = 2.76. \tag{4}$$

Comparing equations (3) and (4), we see that the acquisition cost using seller debt is less than that of an all-cash offer. Thus, in this scenario, the optimal acquisition mechanism is seller debt.

Scenario 2: $\phi = 2/5$. The difference between Scenario's 1 and 2 is that ϕ is smaller in Scenario 2. Repeating the acquisition cost calculations with the changed value ϕ shows that

$$\text{Acq. cost: Optimal all-cash offer:} = \overbrace{\phi\, r_G}^{\frac{2}{5}\times 3.6} = 1.44.$$

$$\text{Acq. cost: Optimal SD offer} = \frac{1}{2} \times \overbrace{(\phi\, r_B)}^{\frac{2}{5}\times 2.4} + \frac{1}{2} \times \overbrace{(\gamma k^* + (1-\gamma)\, v_L^S)}^{\frac{4}{5}\times 4 + \frac{1}{5}\times 2} = \frac{1}{2} \times 0.96 + \frac{1}{2} \times 3.6 = 2.28.$$

Comparing costs reveals that the optimal all-cash offer minimizes the acquirer's cost, due to the acquirer's larger liquidity advantage in Scenario 2. Thus, the optimal acquisition mechanism is all cash.

Similarly, reducing the precision of the seller's signal, γ, favors all-cash offers. Reducing signal precision reduces asymmetric information, which reduces the gap between G- and B-seller valuations. The gap determines the rents that the B-seller earns under an all-cash offer. Thus, the benefit of seller debt offers—eliminating B-seller rents—shrinks. In the online appendix, we provide precise conditions for all-cash offers being optimal that depend solely on the seller's illiquidity discount and the degree of information asymmetry.

Observations Recall that, in our numerical example, we needed to verify that the acquirer will actually repay the seller debt in state H. As we showed in our discussion, honoring the debt contract when the state is H is only optimal if the date 1 cash flow in state H, e_H, (which under incomplete contracting can be appropriated by a defaulting acquirer) is no greater than the continuation value added by the acquirer in state H, $v_H^A - v_H^S$. When applying the model to real-world data, this assumption appears to be reasonable—most acquirers expect gains from their acquisitions over longer horizons than the maturity of seller debt (typically four to eight years). In the online appendix, we show that, when short-term cash flows from the asset exceed long-term value added, acquisition costs through seller debt are higher.

Note also that, in reality, the "asset" being acquired is typically a firm that has assets and cash flows whose value is not contingent on the seller's private information, e.g., bank deposits and accounts receivable. Absent private information, the seller's liquidity preference ensures that optimal offers compensate the seller for such assets with cash. If we incorporated such assets into our analysis, consistent with real-world practice, seller debt offers would always feature some, possibly large, cash component. We omit modeling such assets because it adds complexity without affecting the choice between offer mechanisms.

Finally, we do not include any dissipative foreclosure costs in our analysis. In fact, enforcement of nonrecourse secured debt contracts typically requires obtaining a writ of possession to foreclose. Including dissipative foreclosure costs in our analysis would reduce the advantage of seller debt. However, our focus is on comparing seller debt with earnout contracts, where the channel for ex post enforcement—typically a lawsuit—is more costly. We also do not include ex post enforcement costs in our analysis of earnouts. Thus, it is unclear whether incorporating ex post contracting costs for both earnouts and seller debt would favor earnouts over seller debt.

2.3 Earnouts

As we have seen, when the conditions discussed above are satisfied, contracting through seller debt financing can implement cash-flow-contingent contracting, even in an incomplete contracting setting where, because of unverifiability, contracting on cash flows is impossible. However, the range of cash flow allocations that is feasible under seller debt contracting is restricted because cash flow contingency must be produced by the ex post actions of the seller and acquirer and these actions must be incentive compatible.[11]

In this section, we compare the rigid seller debt approach to implementing cash flow contingency to the more flexible and refined earnout contracting method. Earnout contracts can specify payments at any date that can depend on realized cash flows at the current date and all previous dates. Earnouts are only feasible in a complete contracting environment with verifiable cash flows. We assume that verifying cash flows involves a cost, κ_{ve}. Regardless of which party bears this cost, this dissipative cost increases the acquirer's cost of acquisition. So, when computing the acquisition cost, we simply add verification costs to the acquirer's valuation of cash flows received by the seller. We examine earnout contracting in Scenario 3.

Scenario 3: $\phi = 4/5$ and $\kappa_{ve} = 1/10$ First note that, although earnouts permit more flexible cash flow allocations, much of this flexibility is useless. For example, earnout contracting permits noncontingent payments by the acquirer at dates 1 and 2. However, given the seller's illiquidity discount, it is always optimal to make all noncontingent payments to the seller at date 0. Also note that the state, H or L, is revealed at date 1, the seller's date 1 and date 2 discount factor, ϕ, is the same for both dates. Therefore, contingent payments to the seller at dates 1 and 2 are equivalent. So, to simplify the discussion, we assume that the contingent portion of the earnout consideration offered to the seller is paid at date 1.

Under the optimal seller debt contract in Remark 1, in state H, the acquirer pays $k^* = 4$ to the seller; in state L, the acquirer defaults, and the seller receives $v_L^S = 2$. Note that the date-1 seller debt compensation can be decomposed into a fixed component $e_L + v_L^S = 2$ received in both states H and L and a variable component, which equals $k^* - (e_L + v_L^S) = 2$ if the state is H (or equivalently when earnings at date 1 equal $e_H = 1$), and equals 0 otherwise. The definition of the optimal seller debt contract (Remark 1) shows that $k^* = e_H + v_H^S$. So the fixed component of the optimal seller debt contract is $e_L^S - v_L^S$, and the variable component is $e_H + v_H^S - (e_L + v_L^S)$. The value of the fixed component is independent of the seller's private information. This suggests using verifiability to design a high-powered contract, moving the fixed portion of the seller's date-1 compensation to date 0 to better exploit the seller's illiquidity discount. This leads to the following offer design.

[11] For instance, because the threat of foreclosure is empty at the last date, date 2, seller debt can never implement payments to the seller at date 2.

Remark 2 (Candidate offer: Earnout)**.** *The candidate earnout offer consists of two contracts:*

a. a date-0 cash payment of $\phi\, r_B = 1.92$

b. an earnout plus cash contract with the following terms

Cash component: date-0 cash payment of $\phi\,(v_L^S + e_L) = 1.6$

Earnout component: if date-1 earnings equal 1, a date-1 payment of $(e_H + v_H^S) - (e_L + v_L^S) = 2$*; if date 1-earnings equal 0, no date-1 payment.*

The candidate earnout offer, from the seller's perspective, is payoff equivalent to the candidate seller debt offer detailed in Remark 1, and, as shown in the seller-debt section, the G-seller opting for seller debt and the B-seller opting for cash is a best reply to the candidate seller debt offer. Thus, it is incentive compatible for the G-seller to accept the cash plus earnout contract and the B-seller to accept the all-cash payment.

For the same reasons as presented in our discussion of seller debt offers, the candidate earnout offer presented in Remark 2 is the optimal earnout offer. Thus, we only need to compare the cost of the optimal earnout offer with an all-cash offer and the cost of the optimal seller debt offer. To compute the cost of the candidate earnout offer, note that, when the seller receives signal B, which occurs with probability $1/2$, the seller accepts the all-cash offer, receiving the cash payment $\phi\, r_B = 1.92$. When the seller receives signal G, which occurs with probability $1/2$, the seller accepts the earnout offer. In this case, the seller receives a cash payment at date 0 equal to $\phi\,(e_L + v_L^S) = \phi \times 2 = 1.6$ and receives an earnout of $e_H + v_H^S - (e_L + v_L^S) = 2$ if and only if date-1 earnings equal $e_H = 1$. The probability that earnings equal 1 is the probability that state H is realized, conditioned on signal G, which equals γ. Thus, the cost of an optimal earnout offer is

$$\begin{aligned}\text{Acq. cost: Optimal EO offer} &= \frac{1}{2} \times \overbrace{(\phi\, r_B)}^{\frac{4}{5}\times 2.4} + \frac{1}{2} \times \overbrace{(\phi\,(e_L + v_L^S) + \gamma(e_H + v_H^S - (e_L + v_L^S))}^{\frac{4}{5}\times 2+\frac{4}{5}\times 2} + \overbrace{\kappa_{ve}}^{\frac{1}{10}} \\ &= \frac{1}{2} \times 1.92 + \frac{1}{2} \times 3.2 + 0.10 = 2.66. \qquad (5)\end{aligned}$$

Because the parameters in Scenario 3 are identical to those of Scenario 1 but for verification costs, we see, using equations, (3), (4), and (5), that the optimal earnout produces a lower acquirer acquisition cost than seller debt or all-cash offers. Thus, earnouts are the optimal acquisition mechanism in this scenario.

2.4 Earnouts versus seller debt

Like seller debt offers, earnout offers are dominated by all-cash offers when the level of information asymmetry, parameterized by γ, is low and the acquirer liquidity advantage is small, i.e., ϕ is small. However, our analysis focuses on determining which mechanism, seller debt or earnouts, acquirers will use when they opt for contingent financing, rather than whether they will employ cash-flow-contingent financing. The advantage of the earnout contract is that it is more high-powered than the seller debt contract. In the latter, regardless of performance, the seller receives a date-1 payment at least equal to the value of the asset in the low state, L, under seller control, v_L^S. In the event the seller accepts the earnout, which occurs when the seller receives signal G, the date-1 payment to the seller under the earnout contract is reduced by $v_L^S + e_L$ from its level under seller debt. This payment reduction reduces the acquirer's acquisition cost by $v_L^S + e_L$. To compensate the seller for the reduction in date-1 payments, under the earnout contract, the seller receives a seller-value equivalent cash payment of $\phi\,(v_L^S + e_L)$ at date 0, which costs the acquirer $\phi\,(v_L^S + e_L)$. Thus, when the seller receives signal G, the seller's acquisition cost is reduced by using earnout contracting, gross of verification costs, by $v_L^S + e_L - \phi\,(v_L^S + e_L) = (1-\phi)\,(v_L^S + e_L)$. Because the seller receives signal G with probability $\frac{1}{2}$, the cost savings, gross of verification costs, of using the earnout mechanism instead of the seller debt mechanism is $\frac{1}{2}(1-\phi)\,(v_L^S + e_L)$. This savings is weighed against the verification costs, κ_{ve}. Hence, the advantage of earnouts over seller debt is simply

$$\text{Earnout advantage} = \frac{1}{2}\,(1-\phi)\,(v_L^S + e_L) - \kappa_{ve}.$$

In Scenario 3 for example, the earnout advantage is

$$\text{Earnout advantage} = \frac{1}{2}\,\overbrace{(1-\phi)}^{1-\frac{4}{5}}\,\overbrace{v_L^S}^{2} - \overbrace{\kappa_{ve}}^{\frac{1}{10}} = 0.10.$$

The earnout advantage is likely to be positive, and thus the acquirer is likely to prefer earnouts, when ϕ is small, κ_{ve} is small, and v_L^S is large. Because the acquirer's liquidity preferences are the numeraire, $1-\phi$ represents the gap between the illiquidity discount of the acquirer and the illiquidity discount of the seller. This gap is likely to be large when acquirers, typically large corporations or private equity firms, have a significant funding advantage over sellers, which are typically much smaller entities. The gap is likely to be smaller when acquirers themselves face significant financial constraints, e.g., in financial crises. κ_{ve} represents the marginal cost of verifying asset cash flows, which depends on the degree to which the seller and acquirer have already developed systems, e.g., accounting systems, that produce third-party verifiable project-specific assessments of inflows and outflows and whether sellers themselves can monitor and verify the performance of the asset post-acquisition. Finally, v_L^S depends on the value of the asset when an adverse contingency is realized. This term will be small when the adverse contingency is catastrophic, e.g., when large environmental liabilities exist, and large when the adverse contingency does not substantially reduce the asset's standalone value. Thus, seller debt typically dominates earnouts when the standalone value after the adverse event that the acquirer fears has profound downsides.

3 Implications

Our study focuses on the trade-offs underlying the choice between seller debt and earnout offers. We show that both types of contingent seller compensation can be effective in acquisitions when sellers possess more information on the post-acquisition value of the assets than acquirers. A key difference is that an earnout offers clearly defined payments to sellers based on specific outcomes, whereas seller debt offers do not.

Earnout offers rely on the ability to verify outcomes: a costly process. In contrast, seller debt offers do not require verification, since their dependence on outcomes is due to the acquirer's option to initiate foreclosure by not meeting the obligations of the (nonrecourse) debt contract. Acquirers are more prone to default when the acquisition's cash flows are low, which is more likely when sellers have negative private information. Thus, like earnouts, seller debt can help mitigate adverse selection costs but does so without incurring verification costs.

However, seller debt has two drawbacks. First, it can lead to inefficient liquidity provisioning, as sellers must retain the rights to asset cash flows in case of default, which limits the upfront cash the acquirer can offer. This is costly for acquirers, since they cannot fully exploit their funding advantage. When acquirers' funding advantage shrinks or vanishes, e.g., when acquirers are cash-constrained, this cost of seller debt financing shrinks or vanishes. Second, seller debt offers have limitations in addressing adverse selection. The deterrent to default is the expected cash flows after debt repayment. If the long-term asset value is low compared to current cash flows, this limits the size of the seller debt component of the offer, which increases adverse selection costs and, in some cases, can lead to inefficient contracting.

Inefficient liquidity provision is a cost inherent in seller debt, and the magnitude of the inefficiency depends on the acquirer's liquidity advantage over the seller. The costs of contracting with seller debt are high when acquirers have abundant cash and lower when their access to funding is constrained. Although the costs of inefficient contracting are likely large for some acquisitions, the high costs will likely be concentrated in a relatively small subset of acquisitions—those involving firms with strictly short-term cash flows or firms where long-term cash flows can easily be converted to short-term (e.g., financial services firms with liquid, fungible assets).

In contrast, the verification expenses associated with earnouts depend on the incremental costs of allowing sellers to verify post-acquisition cash flows. Factors influencing verification expenses include the quality of accounting systems, governance, and the monitoring and participation of sellers in the management of acquired assets. Our analysis suggests that the choice between seller debt and earnout contracting hinges on the balance between the contracting costs of each method. Earnouts incur verification expenses, while seller debt incurs costs related to inefficient liquidity provision and constrained contracting.

4 Empirical Specifications

4.1 Sample and measures of key variables

To empirically test our hypotheses, we extract data on private company sales transactions from Business Valuation Resources LLC (BVR). The BVR database contains 22,303 private company sales from 1996 to 2014. We limit our analysis to the 12,980 transactions involving US targets that report the data which is critical to our analysis (e.g., location, industry, transaction date). We winsorize continuous variables at 1% and 99%.

The BVR data, compiled from business intermediaries and SEC filings, is a widely used transaction database for the acquisition of private companies. It covers an estimated 3% to 8% of annual private firm sales, spanning 69 SIC2 industries in all 50 US states. The database includes private firms with clear pricing information and is used by investment banks on a subscription basis. Additional information on the database can be found in Jansen (2020).

The data include financial variables taken from the most recent financial statements before closing. The reported price is the total dollar value of the payment for the business sold. The selling price includes the value of any interest-bearing liabilities assumed and, if a non-compete agreement exists, any value afforded by that agreement. Appendix A provides definitions for the variables used in the study. Table 2 presents the summary statistics.

Table 2 shows the summary statistics for the target firms and the transaction characteristics. The mean (median) firm is 15.3 (12) years old and has mean (median) revenues of $3,631,000 ($525,000). This skewness toward larger revenue reflects the larger transactions completed by public buyers, which represent 10% of the sample. Firms acquired by private buyers report average revenue of $1.33 million versus $26.5 million for firms acquired by public buyers. The average target firm reports earnings before taxes divided by revenue of 0.09, while the median firm reports 0.10. The 25th percentile report 0.01, indicating that most targets are profitable.

To test our hypotheses about the choice of security used in the transaction, we consider whether the deal includes seller debt financing and whether the deal included an earnout. Although almost half (46%) of the transactions in the sample include seller debt financing, only 3% include an earnout. The percentage of deals that involve earnouts increases to 13.1% among those with public buyers, which resembles that found by Allee and Wangerin (2018) and Jansen (2020).[12] Our empirical tests distinguish between public and private buyers, which illuminates these differences on the use of earnouts. While earnouts are included in only 3% of overall deals, it's important to note that among deals involving public buyers and a form of contingent payment, 16.1% include earnouts. This indicates that while earnouts may appear rare in the broader sample, they play a significant role in specific contexts, particularly in transactions involving public acquirers where contingent payments are used.

We measure buyer liquidity constraints with the credit spread, which reflects the cost of risky debt capital, the supply of funds offered by banks and other financial intermediaries. The literature has established the use of credit spreads to forecast economic activity and as a measure of liq-

[12] Allee and Wangerin (2018) report an initial sample of 302 transactions involving an earnout among a total of 2,015 transactions (15.0%) in their analysis. Jansen (2020) reports earnout contracts in 10.8% among public buyers and 1.4% among private buyers.

uidity (Gilchrist and Zakrajšek, 2012; Longstaff et al., 2005; Beber et al., 2009). As discussed in Section 2, we assume that acquirers have a liquidity advantage, supported by the literature showing that liquidity provision increases acquirer returns. Given that in the private firm acquisition market, acquirers are typically much larger than targets, targets in our sample are likely to be persistently financially constrained and have a higher discount rate than acquirers.[13] In contrast, acquirers are more harmed by the aforementioned credit market shocks (Kudlyak and Sanchez, 2016).[14] The typical buyer, needing more leverage for buyouts than the target does for normal operations, is more impacted by financial shocks. Thus, higher credit spreads affect the availability of financing for private M&A (Beber et al., 2009).

The credit spread is calculated by the Federal Reserve Bank of St. Louis using the Bank of America-Merrill Lynch US High Yield CCC or Below Option-Adjusted Spread, matched to the date of sale for each transaction. The mean (median) credit spread in our sample is 0.12 (0.10). The standard deviation of 0.06 indicates significant variation throughout the sample period.

We consider several measures of the cost of verification, which we categorize as either financial statement transparency or verification through additional inspection and governance. We measure financial statement transparency in two ways. First, we identify whether the buyer is a public firm. Public companies have audited financial statements and face analyst, regulatory, and public scrutiny, resulting in greater transparency (e.g., Leuz and Verrecchia (2000); Armstrong et al. (2010)). Therefore, the cost of verifying the financial results after acquisition should be lower if the buyer is public. Ten percent of the deals in our sample involve public buyers. Second, we measure whether the firm restated its earnings, indicating additional scrutiny of the firm's financial statements (Lobo and Zhao, 2013). The added scrutiny should decrease the verification cost for the seller. Three percent of the target firms in our sample restated their financial statements prior to acquisition.

We then measure the cost of verification through additional inspection and governance. First, we measure whether the target firm had debt on its balance sheet prior to acquisition, in which case its financial statements would have been verified, monitored, and determined to be debt-

[13] Worse information asymmetries and financing constraints result when the acquisition target is private (Berger and Udell, 1998). In addition, the literature indicates that small firms are persistently financially constrained'(e.g., Hubbard, 1998).

[14] The authors find that large firms experienced a rate of decline in short-term debt financing during the 2007 financial crisis that was twice that of small firms.

worthy prior to the acquisition. Five percent of the target firms in our sample hold debt prior to acquisition. Second, we consider employment agreements, where the target CEO, who is also the firm's owner, remains on the management team for a contracted period post-acquisition. This arrangement enables the seller to observe the firm's financial performance and monitor earnout-related outcomes at a lower cost than would otherwise be possible.[15] 42% of the deals in our sample include an employment agreement.

4.2 Research design

To provide comprehensive evidence on the predictions from our analytical model, we employ both multinomial logit and ordinary least squares (OLS) models to evaluate the factors predicting the use of earnouts versus seller debt in acquisitions. We begin by examining the security choice of the deal as a function of liquidity constraints and the cost of verification using the measures described above and by estimating the following empirical model:

$$Security_i = \beta_1 Liquidity\ Constraints_t + \beta_2 Target\ Verifiability_i + \lambda_j + \lambda_s + \beta_i X_i + \varepsilon_i \qquad (6)$$

t captures the transaction year-month. i indexes the acquiring firm. We also include target-firm industry fixed effects, j, to capture time-invariant differences across industries that could bias the estimated relationships. In addition, we control for target-firm state fixed effects, s, to control for the regulatory environment at the time of the transaction. To account for serial correlation of residuals over time, we cluster estimation errors by year-month.[16]

Our analytical model predicts that liquidity constraints and verification costs determine the security choice in transactions. Applying the predictions of our analytical model to Equation (6), we hypothesize that seller debt financing is more common as liquidity constraints increase, which suggests a positive relation between seller debt financing and *Liquidity Constraints*. In contrast, we expect earnouts to be more common as the verification costs decrease, which implies a positive

[15] Compensation from employment agreements are typically orders of magnitude smaller than the consideration paid for the transaction, which suggests that the adverse selection problem dominates the moral hazard problem as a motivation for the employment agreement. Employment agreements vary widely in duration, typically ranging from three to five years, though the terms are not always included in the data.

[16] Switching to industry clusters in the OLS regressions would understate the standard errors on the yield spread, as it affects all transactions within the same month uniformly. However, double-clustering standard errors by industry and year-month in the OLS regressions shows that the statistical significance of our key variables remains unchanged.

relation between earnouts and *Target Verifiability*.

As discussed above, we estimate the choice of security used in the transaction, with an indicator for when the deal includes seller debt financing and an indicator of whether it includes an earnout. We measure credit spreads as a proxy for *Liquidity Constraints*. We capture variation in the cost of verification, *Target Verifiability*, with an indicator for public buyers and for when there was a restatement prior to the transaction. In these instances when the buyer faces greater scrutiny from market participants and regulators, the cost of verification is lower. We also test our other measures of *Target Verifiability* described above that capture the costs associated with verifying the target's post-acquisition performance. These include whether the target reported debt prior to the transaction and whether the deal includes an employment agreement. In all cases, the measure captures a reduction in verification costs.[17]

The control variables (X_i) include $ln(revenue)$, earnings before taxes scaled by revenue, and firm age. Revenue and earnings capture the target firm's size and profitability, respectively. The age of the target is included as a control for the life cycle, as more established firms with more stable cash flows can service more debt.

We then provide evidence on the predictions using a multinomial logit model to evaluate the factors predicting the use of earnouts versus seller debt in acquisitions. The dependent variable indicates the type of acquisition financing used, focusing on comparing the choice of 0 for earnouts and 1 for seller debt. The estimates from the multinomial logit model provide insight into how each factor influences the likelihood of choosing earnouts over seller debt. This analysis specifically contrasts seller debt and earnouts, shedding light on the determinants of contracting choice in deals that involve non-cash components. While the model includes three possible outcomes (all-cash, earnouts, and seller debt), we only report results for the comparison between earnouts and seller debt, leaving out the irrelevant comparisons involving all-cash deals.

Applying the predictions to the multinomial logit model, we hypothesize that seller debt financing is more common as liquidity constraints increase, predicting a positive relation between seller debt financing and *Liquidity Constraints*. Conversely, we predict that earnouts are more common as verification costs decrease, suggesting a positive relation between earnouts and *Target*

[17] In the tests that include the other measures of *Target Verifiability* we also include the indicator for public buyers to control for the other dimensions along which public buyers may differ from private buyers.

Verifiability.

In summary, we estimate factors that we predict influence the choice between earnouts and seller debt in acquisitions. To achieve this, we estimate the choice of security used in the transaction using indicators for deals that include seller debt financing or earnouts. We also apply a multinomial logit model to examine the role of liquidity constraints and the cost of verification on the choice between seller debt and earnouts for deals that are not all-cash.

5 Empirical Results

5.1 Liquidity constraints and verification costs

In this section, we present the test results on the propensity of seller debt financing and earnouts as a function of liquidity constraints and the cost of verification. Table 3 presents the results of the estimation of Equation 6, focusing on the credit spread as the measure of liquidity constraints and on public buyer as a measure of the verification cost. Consistent with our hypothesis that seller debt financing prevails when the buyer is cash-constrained, our analysis in column (1) reveals an increased likelihood of seller debt financing as credit spreads widen. Furthermore, aligning with the notion that seller debt financing increases with escalating verification costs, we observe a negative relation between public buyers and seller debt financing. In column (2), we find that the probability of an earnout remains unaffected by credit spreads. Consistent with our hypothesis, we find that earnouts are more likely when the buyer is a public firm. When we estimate a multinomial logit model in column (3), we find that the propensity of earnouts to seller debt financing decreases with credit spreads and increases when the buyer is a public firm. These findings collectively support our hypothesis that, conditional on the deal including non-cash components, seller debt financing prevails over earnouts amid escalating liquidity constraints, and earnouts are more common when verification costs are lower, as is the case when the buyer is a public firm with more transparent financial statements.

We find that seller debt financing relates insignificantly to firm age but that earnouts are more common as firm age increases. Our analysis also reveals that seller debt financing increases with earnings and revenue. We also find that earnouts increase with revenue, which is consistent with the assumption in our analytical model that verification costs do not scale proportionally to the deal size.

Next we consider whether the target restated its financial statements. Although restatements may indicate financial reporting concerns, targets that restated their financial statements are more likely to have had audited financial statements, which is uncommon among private firms. Audited financial statements reduce verification costs post-acquisition, which our analytical model predicts reduce the advantage of seller debt financing and increase the use of earnouts.[18] We do not find evidence of a relation between restatements and seller debt or earnouts in the OLS estimation reported in columns (1) and (2). However, in our more targeted analysis focusing on non-all-cash deals, the multinomial logit model in column (3) of Table 4 shows that the likelihood of using earnouts relative to seller debt financing increases when the target firm has restated its earnings. This result is consistent with our prediction that earnouts are increasingly preferred to seller debt as the cost of verifying post-acquisition performance declines. The relations between the characteristics of the contract and *Credit Spread* and *Public Buyer* that we found in Table 3 remain consistent in this specification: seller debt financing is more common as credit spreads increase, and earnouts are more common when the buyer is a public firm. This suggests that *Restatement* is an incremental measure of verification costs in being a public buyer.

The collection of results presented in Tables 3 and 4 supports the hypothesis of our analytical model that seller debt financing is favorable when liquidity constraints and the cost of verification are high. We also find evidence to support the prediction that earnouts are increasingly favorable as the cost of verification declines through transparency of financial statements.

Table 5 provides the estimation results when we include an indicator for whether the target firm holds debt. Holding debt indicates that a creditor has examined the financial statements and monitors the firm. Verifying the firm's financial information post-acquisition declines when the firm has accounting processes in place that allow for better external monitoring. In this specification, we continue to include an indicator for public buyers to control for the variation in firm characteristics (beyond verification costs) captured by being a public firm.

We find in column (1) that seller debt financing relates positively to an indicator for the target

[18] Firms that restate earnings differ from those that do not restate on a variety of dimensions. Many of those dimensions increase scrutiny following the restatement increase transparency and the verifiability of financial statements.

holding debt. We also find in column (2) that earnouts are more common when the target firm holds debt. In support of the hypothesis from our analytical model, these results suggest that both seller debt financing and earnouts are increasing as the cost of verification declines. In column (3) of the multinomial logit model results, focusing on non-all-cash deals, we find that holding debt on the target's balance sheet prior to the acquisition has a greater positive effect on the use of earnouts compared to seller debt. This supports our hypothesis that the use of earnouts increases as verification costs decline. The relation between contract characteristics and *Credit Spread* and *Public Buyer* that we found in Table 3 remains in this specification, suggesting that the indicator of the debt held by the target is an incremental measure of the verification costs.

Our next test considers employment agreements, where the buyer contracts with the target firm's CEO to remain with the firm after the acquisition. In addition to working for the acquirer, these employment agreements allow target firm management to monitor the firm post-acquisition, thereby decreasing verification costs. The results reported in Table 6 column (1) show a positive relation between the likelihood of seller debt financing and an employment agreement. We also find in column (2) a positive relation between earnouts when there is an employment agreement. Also, consistent with our hypothesis from our analytical model that earnouts are more likely than seller debt financing as the cost of verification declines, when focusing on deals that are not all cash, we find in column (3) results from the multinomial logit model that employment agreement increase the use of earnouts more than seller debt.[19] As in the other specifications, we continue to find that the relation between the security choice, credit spread, and public buyers is consistent with the results in Table 3.

Taken together, the results in Tables 5 and 6 support our hypothesis that seller debt financing is optimal when liquidity constraints are high. We also find evidence to support the prediction that earnouts become increasingly favorable as the cost of verification declines.

5.2 SFAS 141(R) verification

To further illuminate the relation between acquisition capital structure and verification through financial statements, we consider the adoption of Statement of Financial Accounting Standards

[19] Employment agreements are common in private firm acquisitions because the CEO, often a key employee, plays a crucial role in transferring knowledge and business contacts to ensure a smooth transition to new ownership.

(SFAS) 141(R). SFAS 141(R) (2007) was adopted in 2008 and requires acquiring firms to estimate and recognize the fair value of earnouts at the acquisition date, include earnout fair values in the acquisition purchase price, and adjust earnout fair values in each reporting period as uncertainty is resolved. Prior to SFAS 141(R), misreporting was a violation against the seller. After the standard's adoption, misreporting was not only a violation against the seller but also constituted a violation against shareholders and other financial statement users. In addition, SFAS 141(R) requires earnout liabilities to be audited. As a result, the cost of misreporting increases due to higher enforcement costs.

Cadman et al. (2014) and Allee and Wangerin (2018) show that the adoption of 141(R) increased the verification of post-acquisition performance related to earnouts. This suggests that the adoption SFAS 141)(R) increased the quality of the disclosure related to earnouts and lowered the seller's cost of verifying earnout outcomes.[20] To test this hypothesis, we first consider the differential use of earnouts relative to seller debt financing between public and private buyers around the adoption of SFAS 141(R). We conduct a regression discontinuity test for the adoption of SFAS 141(R). As in our previous tests, these regressions include controls for target firm revenue, earnings before taxes/revenue, firm age, and credit spread. Figure 1 shows a striking difference in the increase of earnouts in the years following the adoption of SFAS 141(R) for public buyers. Additionally, there is no significant pre-trend, as the differences between 2005 and 2009 are not statistically significant. Jansen (2020) shows a significant increase in the use of earnouts in transactions involving public buyers after 2009, coinciding with the adoption of SFAS 141(R). We find that before the adoption of SFAS 141(R), public buyers used earnouts 20% to 35% more than private buyers. After the standard's adoption, this difference increased to 50% in 2010 and 65% by 2013, reflecting a rise from 11.1% before SFAS 141(R) to 17.9% after. This evidence supports our hypothesis that regulatory changes that require more disclosure and verification of earnout liabilities increase the use of earnouts in the acquisition of private targets by public buyers.

Next we examine the differences in the use of earnout agreements relative to seller debt financ-

[20] In a sample of public buyers and public and private targets, Allee and Wangerin (2018) find that firms employ earnouts less frequently in acquisitions completed under the new standard. Their results suggest that acquirers perceive the cost of monitoring the earnout to be higher after SFAS 141(R) adoption. Our sample of private targets show different results, which we conjecture are due to the lower verification costs resulting from the adoption. In additional tests, we show that the cost of earnouts increases for some deals in a way that is consistent with the findings of Allee and Wangerin (2018).

ing across contracts that also include an employment agreement. Recall the finding in Table 6 that earnouts are more common when there is an employment agreement with the acquisition, which suggests that the marginal cost of verification declines when the selling firm's CEO remains with the firm after acquisition. Therefore, we predict that the effect of the adoption of SFAS 141(R) on the cost of verification shrinks smaller for sellers who continue to work for the firm. That is, SFAS 141(R) increases the transaction cost but offers less verification benefit for sellers that remain with the firms after the acquisition and can verify information at a lower cost.

To test this prediction, we plot the regression discontinuity described above for the year in which 141(R) was implemented, across transactions that include and do not include an employment agreement. The results plotted in Figure 2 indicate that the difference in the use of earnouts decline for firms with employment agreements relative to other firms after the adoption of SFAS 141 (R). Specifically, firms with employment agreements include earnouts about 3% more frequently than acquisitions that don't have an agreement prior to adoption of SFAS 141(R). This confirms our earlier finding that the cost of verification declines when there is an employment agreement, which increases the use of earnouts. However, after the adoption of SFAS 141(R), firms with employment agreements are about 1% *less* likely to use earnouts than other firms. This result suggests that, SFAS 141(R) *increased* the transaction cost of earnouts but generated little additional benefit for the sellers with an employment agreement.

To provide more evidence on the relation between earnouts as a function of the adoption of SFAS 141(R) and whether the buyer is a public firm, we estimate Equation (6) using earnouts as the dependent variable while including an indicator for transactions that occurred after SFAS 141(R) adoption and interactions with the indicator for public buyers. Consistent with Figure 1, we find in Table 7 that earnouts are included in a greater proportion of deals after the adoption of SFAS 141(R). This result persists when we estimate the instance of an earnout in an OLS regression in column (1) and OLS estimation of earnouts relative to seller debt financing in column (3). We also continue to find that public buyers include earnouts in a greater proportion of their transactions. In support of our hypothesis that SFAS 141(R) increased the quality of earnout-related disclosures for public buyers, we find positive coefficients on the interaction of 141(R) and public buyer in columns (1) and (3).

We also consider whether the transaction includes an employment agreement in a regression analysis and present the results in columns (4), (5), and (6) of Table 7. We find that earnouts are included in a greater proportion of deals and are more likely after the adoption of SFAS 141(R), as suggested by the coefficients on the main effect, *Post 141(R)*. In support of our hypothesis that the reduced verification costs of earnouts following the adoption of SFAS 141(R) shrinks for sellers with employment agreements, we find that the coefficient on the interaction of *Post 141(R)* and *Employment Agreement* is negative and significant (p-value < 0.01) when estimating earnouts as a proportion of seller debt financing. This result supports our conjecture that SFAS 141(R) *increases* transaction costs associated with earnouts at the same time that it reduces verification costs.[21]

Collectively, the results support our hypothesis that acquirer financial constraints favor the use of seller debt financing and that, as verification costs decrease, earnouts become more likely.

6 Conclusion

The contractual arrangements for M&A vary with information asymmetry, verifiability, and agency problems. In a parsimonious model, we explain the choice between earnouts and seller debt financing based on differences in their contracting mechanisms and then test these predictions in a sample of private company acquisitions.

We show that seller debt financing dominates when the buyer is cash-constrained and when post-acquisition verification costs are high. We also find that, as verification costs decline, earnouts become more common, as evidenced by their increasing use in transactions where the buyer is public, when the seller has higher-quality financial information, and when a seller employment agreement exists. Finally, we find evidence that the adoption of SFAS 141(R) improves the quality of earnout-related disclosures, which reduces verification costs but also increases transaction costs. These findings demonstrate that contracting mechanisms are substantially affected by capital market efficiency and the effectiveness of monitoring and accounting systems.

Our findings illuminate how capital constraints and the cost of verification affect the choice of earnouts and seller-debt financing. These findings contribute to the literature on how sellers address adverse selection by sharing risk (Leland and Pyle, 1977; Hansen, 1987) and by providing

[21] This result is consistent with the finding of Allee and Wangerin (2018) that earnouts declined following the adoption of SFAS 141(R) in their sample.

comprehensive M&A disclosures (Titman and Trueman, 1986; Datar et al., 1991). We also contribute to empirical research on seller debt financing (Jansen, 2020) and earnouts (e.g., Kohers and Ang, 2000; Datar et al., 2001; Cain et al., 2011; Cadman et al., 2014; Allee and Wangerin, 2018). Seller debt financing is limited in that it can only provide debt-like contingent payments, while earnouts can be optimized to fit the cash flows of the acquired asset. However, as shown by Jansen et al. (2024), while earnouts help firms resolve agency problems, their enforcement is only possible via costly monitoring and verification of cash flows and earnings. We contribute by showing that these contracting solutions to agency problems depend on access to capital and information environments at the time of the transaction.

References

Allee KD, Wangerin DD. 2018. Auditor monitoring and verification in financial contracts: Evidence from earnouts and SFAS 141 (R). *Review of Accounting Studies* **23**: 1629–1664.

Armstrong CS, Guay WR, Weber JP. 2010. The role of information and financial reporting in corporate governance and debt contracting. *Journal of Accounting and Economics* **50**: 179–234.

Asker J, Farre-Mensa J, Ljungqvist A. 2015. Corporate investment and stock market listing: A puzzle? *Review of Financial Studies* **28**: 342–390.

Beber A, Brandt MW, Kavajecz KA. 2009. Flight-to-quality or flight-to-liquidity? Evidence from the Euro-area bond market. *Review of Financial Studies* **22**: 925–957.

Berger AN, Udell GF. 1998. The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking & Finance* **22**: 613–673.

Bernanke B, Gertler M, Gilchrist S. 1996. The financial accelerator and the flight to quality. *Review of Economics and Statistics* : 1–15.

Biais B, Mariotti T. 2005. Strategic liquidity supply and security design. *Review of Economic Studies* **72**: 615–649.

Bolton P, Scharfstein DS. 1990. A theory of predation based on agency problems in financial contracting. *American Economic Review* **80**: 93–106.

Cadman B, Carrizosa R, Faurel L. 2014. Economic determinants and information environment effects of earnouts: New insights from SFAS 141 (R). *Journal of Accounting Research* **52**: 37–74.

Cain MD, Denis DJ, Denis DK. 2011. Earnouts: A study of financial contracting in acquisition agreements. *Journal of Accounting and Economics* **51**: 151–170.

Chang S. 1998. Takeovers of privately held targets, methods of payment, and bidder returns. *Journal of Finance* **52**: 773–784.

Chen Z, Liu Y, Rossi S. 2022. The role of lockups in stock mergers. *Working Paper* .

Cumming D, Jindal V, Kumar S, Pandey N. 2023. Mergers and acquisitions research in finance and accounting: Past, present, and future. *European Financial Management* .

Datar S, Frankel R, Wolfson M. 2001. Earnouts: The effects of adverse selection and agency costs on acquisition techniques. *Journal of Law, Economics, and Organization* **17**: 201–238.

Datar SM, Feltham GA, Hughes JS. 1991. The role of audits and audit quality in valuing new issues. *Journal of Accounting and Economics* **14**: 3–49.

DeMarzo P, Duffie D. 1999. A liquidity-based model of security design. *Econometrica* **67**: 65–99.

DeMarzo PM, Sannikov Y. 2006. Optimal security design and dynamic capital structure in a continuous-time agency model. *Journal of Finance* **61**: 2681–2724.

Demerjian PR. 2017. Uncertainty and debt covenants. *Review of Accounting Studies* **22**: 1156–1197.

Eckbo BE. 2009. Bidding strategies and takeover premiums: A review. *Journal of Corporate Finance* **15**: 149–178.

Eisfeldt AL, Rampini AA. 2006. Capital reallocation and liquidity. *Journal of Monetary Economics* **53**: 369–399.

Fishman MJ. 1989. Preemptive bidding and the role of the medium of exchange in acquisitions. *Journal of Finance* **44**: 41–57.

Fuller K, Netter J, Stegemoller M. 2002. What do returns to acquiring firms tell us? Evidence from firms that make many acquisitions. *Journal of Finance* **57**: 1763–1793.

Garmaise MJ. 2008. Production in entrepreneurial firms: The effects of financial constraints on labor and capital. *Review of Financial Studies* **21**: 543–577.

Gilchrist S, Zakrajšek E. 2012. Credit spreads and business cycle fluctuations. *American Economic Review* **102**: 1692–1720.

Greene D. 2017. Valuations in corporate takeovers and financial constraints on private targets. *Journal of Financial and Quantitative Analysis* **52**: 1343–1373.

Hansen RG. 1987. A theory for the choice of exchange medium in the market for corporate control. *Journal of Business* **60**: 75–95.

Harford J. 2005. What drives merger waves? *Journal of Financial Economics* **77**: 529–560.

Hart O, Moore J. 1994. A theory of debt based on the inalienability of human capital. *Quarterly Journal of Economics* **109**: 841–879.

Holmstrom B, Tirole J. 1997. Financial intermediation, loanable funds, and the real sector. *Quarterly Journal of Economics* **112**: 663–691.

Hoover CB. 1926. The sea loan in Genoa in the twelfth century. *Quarterly Journal of Economics* **40**: 495–529.

Hubbard RG. 1998. Capital-market imperfections and investment. *Journal of Economic Literature* **36**: 193–225.

Jansen M. 2020. Resolving information asymmetry through contractual risk sharing: The case of private firm acquisitions. *Journal of Accounting Research* **58**: 1203–1248.

Jansen M, Phalippou L, Noe T. 2024. Seller debt in acquisitions of private firms: A security design approach. *Review of Financial Studies* **37**: 507–548.

Kohers N, Ang J. 2000. Earnouts in mergers: Agreeing to disagree and agreeing to stay. *Journal of Business* **73**: 445–476.

Kudlyak M, Sanchez JM. 2016. Revisiting gertler-gilchrist evidence on the behavior of small and large firms. *FRB St. Louis Working Paper* .

Leland HE, Pyle DH. 1977. Informational asymmetries, financial structure, and financial intermediation. *Journal of Finance* **32**: 371–387.

Leuz C, Verrecchia RE. 2000. The economic consequences of increased disclosure. *Journal of Accounting Research* : 91–124.

Liebnick A. 2011. Earnouts often result in disputes. `http://www.cpa2biz.com/Content/media/Producer_Content/Newsletters/Articles_2011/CorpFin/EarnoutsOftenResultinDisputes.jsp`.

Lobo GJ, Zhao Y. 2013. Relation between Audit Effort and Financial Report Misstatements: Evidence from Quarterly and Annual Restatements. *The Accounting Review* **88**: 1385–1412.

Longstaff FA, Mithal S, Neis E. 2005. Corporate yield spreads: Default risk or liquidity? New evidence from the credit default swap market. *Journal of Finance* **60**: 2213–2253.

Minnis M. 2011. The value of financial statement verification in debt financing: Evidence from private US firms. *Journal of Accounting Research* **49**: 457–506.

Nachman DC, Noe TH. 1994. Optimal design of securities under asymmetric information. *Review of Financial Studies* **7**: 1–44.

Officer MS. 2007. The price of corporate liquidity: Acquisition discounts for unlisted targets. *Journal of Financial Economics* **83**: 571–598.

Panageas S. 2020. The implications of heterogeneity and inequality for asset pricing. *Foundations and Trends in Finance* **12**: 199–275.

Shleifer A, Vishny RW. 1992. Liquidation values and debt capacity: A market equilibrium approach. *Journal of Finance* **47**: 1343–1366.

Titman S, Trueman B. 1986. Information quality and the valuation of new issues. *Journal of Accounting and Economics* **8**: 159–172.

Wolf D, Fox D. 2010. Earnouts-a siren song? *The Harvard Law School Forum on Corporate Governance and Financial Regulation* `http://blogs.law.harvard.edu/corpgov/2010/02/13/earnouts-a-siren-song`.

Yang M. 2020. Optimality of debt under flexible information acquisition. *Review of Economic Studies* **87**: 487–536.

Ziskind JR. 1974. Sea loans at Ugarit. *Journal of the American Oriental Society* : 134–137.

Figure 1. Event Study on 141(R) and Public Buyers This figure plots the differences in the annual usage of earnout agreements relative to seller debt financing across buyer types (i.e., public vs. private firm buyers). The figure shows a regression discontinuity for the year in which 141(R) was implemented. Controls include target firm revenue, earnings before taxes / revenue, firm age, and the BofA Merrill Lynch US High Yield CCC or Below Option-Adjusted spread. Standard errors are clustered by year with confidence intervals at 99%.

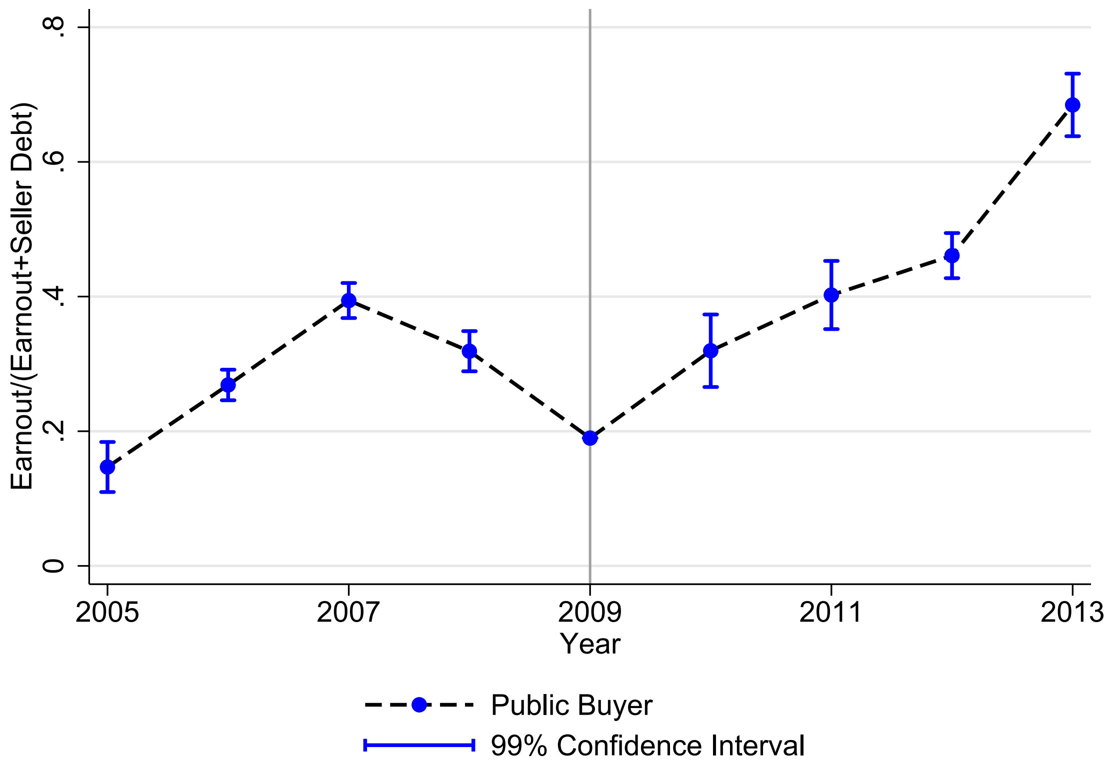

Figure 2. Event Study on 141(R) and Employment Agreements This figure plots the differences in the annual usage of earnout agreements relative to seller debt financing across contracts that include an employment agreement. The figure shows a regression discontinuity for the year in which 141(R) was implemented. Controls include target firm revenue, earnings before taxes / revenue, firm age, and the BofA Merrill Lynch US High Yield CCC or Below Option-Adjusted spread. Standard errors are clustered by year with confidence intervals at 99%.

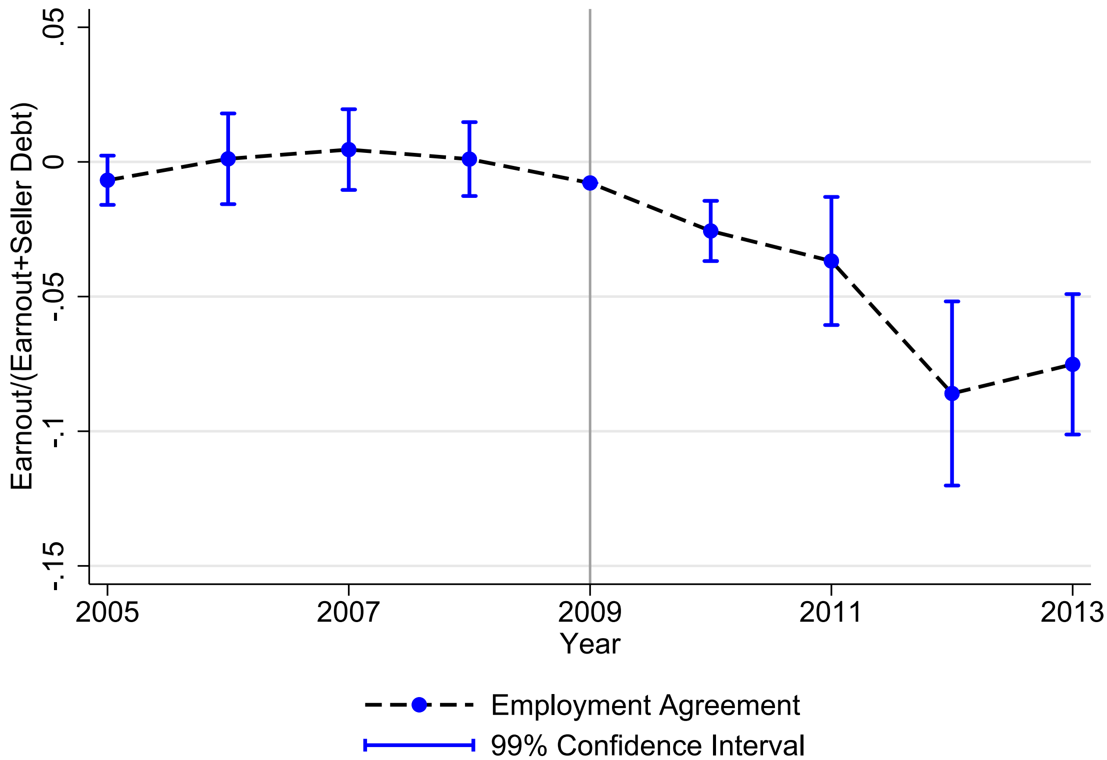

Table 2. Summary Statistics

This table describes the sample. The data represent 12,899 acquisitions of private firms from 1996 to 2014. Figures are taken from the most recent financial statements before the close of the transaction. Continuous variables have been winsorized at 1% and 99%.

Variable	**mean**	**sd**	**p25**	**median**	**p75**
Target Characteristics:					
Firm Age (yrs)	15.30	12.36	6.00	12.00	21.00
Revenue ('000s)	3631	16507	250	525	1332
Earnings before Taxes/Revenue	0.09	0.28	0.01	0.10	0.21
Restated Financials (Ind)	0.03	0.17			
Pre-acquisition Debt (Ind)	0.05	0.21			
Buyer Characteristics:					
Public Buyer (Ind)	0.10	0.30			
Transaction Characteristics:					
Earnout (Ind)	0.03	0.16			
Seller Debt (Ind)	0.46	0.49			
Employment Agreement (Ind)	0.42	0.49			
Transaction Environment:					
Credit Spread	0.12	0.06	0.08	0.10	0.13

Table 3. Effect of Credit Spreads and Public Buyers on Deal Structure.

This table presents the results of the regression analysis for the ordinary least squares (OLS) and multinomial logit models. The dependent variable is (1) an indicator for whether the deal included seller debt, or (2) an indicator for whether the deal included an earnout, and (3) an ML Logit model in which the baseline outcome is an earnout. The explanatory variables of interest are the credit spread (i.e., BofA Merrill Lynch US High Yield CCC or Below Option-Adjusted spread) and whether the buyer is a publicly traded firm. All regressions include target firm controls as well as industry (SIC-2) and state fixed effects. Standard errors (in parentheses) are clustered by year-month. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	OLS		Multinomial Logit
	SD (ind)	EO (ind)	EO vs. SD
	(1)	(2)	(3)
Credit Spread	0.379***	-0.047	-3.245**
	(4.72)	(-1.58)	(-2.01)
Public Buyer	-0.461***	0.069***	2.413***
	(-25.68)	(5.53)	(10.03)
Firm Age	0.000	-0.000***	-0.007
	(0.76)	(-2.01)	(-1.41)
EBT/Revenue	0.047***	0.001	-0.698***
	(3.59)	(-0.08)	(-3.82)
Revenue	0.025***	0.008***	0.268***
	(6.45)	(5.01)	(5.35)
R^2	0.089	0.080	
Pseudo R^2			0.063
Industry FE	Yes	Yes	Yes
State FE	Yes	Yes	No
Observations	12890	12890	12899

Table 4. Restated Financials on Deal Structure.

This table presents the results of the regression analysis for the ordinary least squares (OLS) and multinomial logit models. The dependent variable is (1) an indicator for whether the deal included seller debt, or (2) an indicator for whether the deal included an earnout, and (3) an ML Logit model in which the baseline outcome is an earnout. The explanatory variables of interest are whether the target firm restated its financial statements prior to the transaction, the credit spread, and whether the buyer is a publicly traded firm. All regressions include target firm controls as well as industry (SIC-2) and state fixed effects. Standard errors (in parentheses) are clustered by year-month. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	OLS		MLogit
	SD (ind)	EO (ind)	EO vs. SD
	(1)	(2)	(3)
Restated (Ind)	-0.030	0.012	0.868***
	(-1.26)	(1.24)	(2.84)
Credit Spread	0.382***	-0.048	-3.363**
	(4.73)	(-1.61)	(-2.06)
Public Buyer	-0.461***	0.070***	2.448***
	(-25.74)	(5.56)	(10.24)
Firm Age	0.000	-0.000**	-0.007
	(0.77)	(-2.02)	(-1.42)
EBT/Revenue	0.048***	0.001	-0.704***
	(3.68)	(-0.11)	(-3.86)
Revenue	0.025***	0.008***	0.266***
	(6.45)	(5.01)	(5.36)
R^2	0.090	0.081	
Pseudo R^2			0.063
Industry FE	Yes	Yes	Yes
State FE	Yes	Yes	No
Observations	12890	12890	12899

Table 5. Prior Debt on Deal Structure.

This table presents the results of the regression analysis for the ordinary least squares (OLS) and multinomial logit models. The dependent variable is (1) an indicator for whether the deal included seller debt, or (2) an indicator for whether the deal included an earnout, and (3) an ML Logit model in which the baseline outcome is an earnout. The explanatory variables of interest are whether the target firm had debt on the balance sheet prior to the transaction, the credit spread, and whether the buyer is a publicly traded firm. All regressions include target firm controls as well as industry (SIC-2) and state fixed effects. Standard errors (in parentheses) are clustered by year-month. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	OLS		Multinomial Logit
	SD (ind)	EO (ind)	EO vs. SD
	(1)	(2)	(3)
Debt (Ind)	0.093***	0.027***	0.372*
	(4.79)	(2.48)	(1.90)
Credit Spread	0.372***	-0.049	-3.304**
	(4.75)	(-1.63)	(-2.07)
Public Buyer	-0.455***	0.071***	2.434***
	(-25.09)	(5.65)	(10.24)
Firm Age	0.000	-0.000*	-0.008
	(0.80)	(-1.97)	(-1.47)
EBT/Revenue	0.049***	-0.000	-0.697***
	(3.71)	(-0.03)	(-3.71)
Revenue	0.022***	0.007***	0.256***
	(5.61)	(4.34)	(4.99)
R^2	0.092	0.081	
Pseudo R^2			0.064
Industry FE	Yes	Yes	Yes
State FE	Yes	Yes	No
Observations	12890	12890	12899

Table 6. Employment Agreements on Deal Structure.

This table presents the results of the regression analysis for the ordinary least squares (OLS) and multinomial logit models. The dependent variable is (1) an indicator for whether the deal included seller debt, or (2) an indicator for whether the deal included an earnout, and (3) an ML Logit model in which the baseline outcome is an earnout. The explanatory variables of interest are whether the transaction included an employment agreement for the seller to continue working for the target after the transaction, the credit spread, and whether the buyer is a publicly traded firm. All regressions include target firm controls as well as industry (SIC-2) and state fixed effects. Standard errors (in parentheses) are clustered by year-month. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	OLS		Multinomial Logit
	SD (ind)	EO (ind)	EO vs. SD
	(1)	(2)	(3)
Employment Agreement	0.050***	0.008***	0.289**
	(5.04)	(2.73)	(2.27)
Credit Spread	0.411***	-0.042	-3.447**
	(5.23)	(-1.38)	(-2.03)
Public Buyer	-0.450***	0.071***	2.453***
	(-24.81)	(5.64)	(10.48)
Firm Age	0.000	-0.000**	-0.007
	(0.90)	(-2.04)	(-1.35)
EBT/Revenue	0.048***	-0.001**	-0.714***
	(3.65)	(-0.08)	(-3.91)
Revenue	0.024***	0.008***	0.283***
	(6.34)	(4.97)	(5.69)
R^2	0.092	0.081	
Pseudo R^2			0.064
Industry FE	Yes	Yes	Yes
State FE	Yes	Yes	No
Observations	12890	12890	12899

Table 7. Effect of 141(R) on the Use of Earnout Contracts.

This table estimates OLS regressions where the dependent variable is an indicator for whether the deal included an earnout in columns (1) and (4), and an ML Logit model in which the baseline outcome is an earnout in columns (2) and (5), and the ratio of deals that included seller debt versus the sum of seller debt in columns (3) and (6). The explanatory variables of interest are (A) whether the transaction occurred after 141(R) was implemented, (B) whether the buyer is a publicly traded firm, (C) the interaction of (A and (B); (D) whether the transaction included an employment agreement for the seller to continue working for the target after the transaction, and (E) the interaction of (A) and (D). All regressions include target firm controls, as described in Table 3, as well as industry (SIC-2) and state fixed effects. Standard errors (in parentheses) are clustered by year-month. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	OLS	MLogit	OLS	OLS	MLogit	OLS
	EO (ind)	EO vs. SF	EO/(SD+EO)	EO (ind)	EO vs. SF	EO/(SD+EO)
	(1)	(2)	(3)	(4)	(5)	(6)
Post 141(R)	0.008**	0.193	0.015***	0.016***	0.476***	0.036***
	(2.54)	(1.19)	(3.05)	(3.03)	(2.72)	(3.70)
Public Buyer	0.057***	2.376***	0.340***	0.071***	2.408***	0.382***
	(4.16)	(9.08)	(8.89)	(5.70)	(10.25)	(12.15)
Post 141(R) × PB	0.050*	0.184	0.129**			
	(1.95)	(0.61)	(2.11)			
Employment Agreement				0.009**	0.311*	-0.004
				(2.17)	(1.89)	(-0.59)
Post 141(R) × EA				-0.008	-0.333	-0.028***
				(-1.28)	(-1.30)	(-2.65)
R^2	0.084		0.338	0.082		0.333
Pseudo R^2		0.067			0.073	
Credit Spread Control	Yes	Yes	Yes	Yes	Yes	Yes
Target Firm Control	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	No	Yes	Yes	No	Yes
Observations	12890	12899	6186	12890	12899	6186

Internet Appendix for:

"The Role of Liquidity Constraints and Verification Costs on the Acquisition of Private Firms"

A Variable Definitions

Credit Spread: BofA Merrill Lynch US High Yield CCC or Below Option-Adjusted Spread matched to the date of sale. (Source: Federal Reserve Bank of St. Louis)

Earnout: Equals one (1) if the consideration includes a form of contingent payment with pre-specified performance standards. (Source: BVR)

EBT/Revenue: Earnings before taxes scaled by revenue from the most recent financial statement before closing. (Source: BVR)

Employment Agreement: Equals one (1) if the seller of the firm agrees to stay employed by the firm for some period of time after the acquisition. (Source: BVR)

Firm Age: Age of the target firm (in years) as of the date of sale. (Source: BVR)

Pre-acquisition Debt: Equals one (1) if the target had long-term liabilities greater than zero on the most recent financial statement before closing. (Source: BVR)

Post 141(R): Equals one (1) if the transaction occurred after the January 1, 2009, implementation of Statement of Financial Accounting Standards (SFAS) 141(R) (2007). This standard requires acquiring firms to estimate and recognize the fair value of earnouts at the acquisition date and to include earnout fair values in the acquisition purchase price.

Public Buyer: Equals one (1) if the buyer of the target is publicly traded. (Source: BVR)

Restated Financials: Equals one (1) if the certain items in the financial statements have been amended prior to the acquisition. (Source: BVR)

Revenue: Annual gross revenue, net of returns and discounts allowed from the most recent financial statement before closing. (Source: BVR)

Seller Debt: Equals one (1) if a portion of the consideration paid was in the form of a promissory note with the assets and/or stock of the firm as collateral. (Source: BVR)

B Data Appendix

The raw data were received from Business Valuation Resources, LLC via email on January 31, 2017. The data are available for purchase on a subscription basis at `www.bvresources.com/products/dealstats`. We supplemented the main data set with the Bank of America-Merrill Lynch US High Yield CCC or Below Option-Adjusted Spread calculated by the Federal Reserve Bank of St. Louis.

The data set was filtered according to specific criteria to ensure data quality and relevance. All observations where 'SaleCountry' was not "United States" (indicating transactions outside the United States) were removed from the dataset, resulting in a dataset that only includes sales occurring in the United States. Observations were retained only if the 'SaleState' variable was not missing. Records with missing values for 'SIC2' were excluded. Additionally, only entries with non-missing values for yield spread, age, EBT and revenue were kept. This process helped refine the dataset by removing incomplete data points. Finally, observations related to the financial services sector were removed from the dataset by excluding any entries where SIC1 was equal to 8. This step ensured that the dataset did not include data from the financial services industry.

C Theoretical Framework

C.1 Model

Agents We develop a two-period, three-date model in which an *acquirer* (she), A, attempts to buy an asset at date 0 from a *seller* (he), S, who currently owns the asset. Both the acquirer and seller are risk-neutral expected utility maximizers. We assume that sellers face more severe liquidity constraints than acquirers. To represent these constraints, we assign sellers a higher discount rate (lower discount factor) for future cash flows, a common approach to modeling liquidity preferences (DeMarzo and Duffie, 1999; Biais and Mariotti, 2005; DeMarzo and Sannikov, 2006; Yang, 2020). We normalize the acquirer's discount factor to 1 and assume that the seller's discount factor is given by $\phi \in (0,1)$.

In order to formally represent the utility of the seller and acquirer, let $\mathbb{E}_d$ represent expectations at date d, and let p_j^d represent the cash flow received at by agent $j = S, A$ at date d. Using this notation, the utility of the seller at dates d, $d = 0,1$ is given by

$$u_S^d = \begin{cases} p_S^0 + \phi\,\mathbb{E}_0[\tilde{p}_S^1] + \phi\,\mathbb{E}_0[\tilde{p}_S^2] & d = 0,^{22} \\ p_S^1 + \mathbb{E}_1[\tilde{p}_S^2] & d = 1, \end{cases}$$

$0 < \phi < 1$.

The utility of the acquirer at date d, $d = 0,1$ is given by

$$u_A^d = \begin{cases} p_A^0 + \mathbb{E}_0[\tilde{p}_A^1] + \mathbb{E}_0[\tilde{p}_A^2] & d = 0, \\ p_A^1 + \mathbb{E}_1[\tilde{p}_A^2] & d = 1. \end{cases} \tag{C-7}$$

The acquirer's *liquidity advantage* is measured by $1-\phi$, expressed in terms of a discount rate is

$$\iota = (1-\phi)/\phi. \tag{C-8}$$

Empirical evidence indicates that a significant portion of acquirers' gains in private firm acquisitions can be attributed to exploiting their liquidity advantage (Officer, 2007).

The cost of an acquisition to the acquirer, which we will henceforth refer to as the "acquirer's cost" of simply the "cost," consists of expected payments to the seller, and any dissipative costs, δ, required to effect the acquisition. So, the acquirer's cost, C_A, at date 0, the date when the offer is made, is given by

$$C_A := p_S^0 + \mathbb{E}_0[\tilde{p}_S^1] + \mathbb{E}_0[\tilde{p}_S^2] + \delta. \tag{C-9}$$

[22] We apply the same discount rate to date 1 and date 2 cash flows to simplify the notation. It is possible to interpret the cash flow on date 2 as the cash flow present value on date 1 without altering any of our results.

As the subsequent development will reveal, dissipative costs equal 0 in our model when the offer is either an all-cash offer or a seller debt offer, but are positive if the offer is an earnout offer.

Cash flows The asset's cash flows, $\tilde{a}_t$, for $t = 1, 2$, are contingent on a state variable, $\tilde{\omega} = H$ or L. The prior probability that $\tilde{\omega} = H$ is $\mathbb{P}[\tilde{\omega} = H] = 1/2$:

$$\tilde{a}_1(\tilde{\omega}) = \begin{cases} e_L & \text{if } \tilde{\omega} = L \\ e_H & \text{if } \tilde{\omega} = H, \end{cases} \quad \tilde{a}_2(\tilde{\omega}) = \begin{cases} v_L^j & \text{if } \tilde{\omega} = L \\ v_H^j & \text{if } \tilde{\omega} = H, \end{cases} \quad e_H > e_L \geq 0, v_\omega^j > 0,\ j = A, S. \tag{C-10}$$

Because only the difference between e_H and e_L affects the qualitative conclusions of our analysis, henceforth we assume that $e_L = 0$ and denote e_H simply by e, because $e_L = 0$, and, by assumption, $e = e_H > e_L = 0$, $e > 0$.

We refer to date 2 cash flows, v_ω^j, as *continuation values*. The continuation values depend on the state ω, and on who controls the asset at date 1: the acquirer, A, or the seller, S. We assume that

$$0 \leq v_L^S = v_L^A < v_H^S < v_H^A, \tag{C-11}$$

that is, *ceteris paribus*, the continuation value is greater in state H, and the benefits of acquisition are concentrated in state H.

Information At date 0, the seller receives a noisy private signal, $\tilde{s}$, which takes one of two values, G or B. The distribution of the signal conditioned on the state is

$$\mathbb{P}[\tilde{s} = G | \tilde{\omega} = H] = \gamma, \quad \mathbb{P}[\tilde{s} = B | \tilde{\omega} = H] = 1 - \gamma, \quad \gamma \in (1/2, 1).$$

A simple application of the Bayes rule shows that the seller's posterior distribution is

$$\begin{aligned} \mathbb{P}[\tilde{\omega} = H | \tilde{s} = G] = \gamma, &\quad \mathbb{P}[\tilde{\omega} = H | \tilde{s} = B] = 1 - \gamma, \\ \mathbb{P}[\tilde{\omega} = B | \tilde{s} = G] = 1 - \gamma, &\quad \mathbb{P}[\tilde{\omega} = B | \tilde{s} = B] = \gamma. \end{aligned}$$

Because earnings equal $e > 0$ if and only if the state is H, an agent who observes the date 1 cash flow, $\tilde{a}_1$ knows the state of the firm, $\omega \in \{H, L\}$ at date 1.

When the seller receives $\tilde{s} = s$, we refer to the seller as the s-seller, where $s = G, B$. The parameter $\gamma \in (1/2,\ 1)$ measures the precision of the seller's signal. The limiting case $\gamma \to 1/2$ corresponds to no private information, while $\gamma \to 1$ corresponds to a perfectly informative signal. An alternative measure of the signal's informativeness that simplifies some expressions developed in the subsequent analysis is

$$\alpha := \frac{\gamma - (1 - \gamma)}{\gamma} = \frac{\mathbb{P}[\tilde{\omega} = H | \tilde{s} = G] - \mathbb{P}[\tilde{\omega} = H | \tilde{s} = B]}{\mathbb{P}[\tilde{\omega} = H | \tilde{s} = G]}. \tag{C-12}$$

If the signal received by the seller is completely uninformative, i.e., $\gamma = 1/2$, then $\alpha = 0$; if the signal is perfectly informative, i.e., $\gamma = 1$, then $\alpha = 1$. Thus, $\alpha \in (0,1)$ measures the degree of informational asymmetry between the seller and the acquirer at date 0, the date of the acquisition proposal.

The s-seller's date-0 expectation of the asset's cash flows if control is *not* transferred to the acquirer, which we represent by r_s, is given by

$$\begin{aligned} r_B &= (1-\gamma)\,(e + v_H^S) + \gamma v_L^S, \\ r_G &= \gamma(e + v_H^S) + (1-\gamma)\,v_L^S. \end{aligned} \tag{C-13}$$

Note that r_s represents the expected standalone value of the seller at date 1 conditioned on the information available at date 0. Because the seller decides on whether to accept the offer at date 0, the seller's accept/reject decision depends on the standalone value at date 0, i.e., date 1 value discounted by ϕ, the seller's date-0 discount factor for date 1 cash flows. Thus, the seller's reservation payoff at date 0 equals $\phi\, r_s$.

Absent verification, the cash flows from the asset are observed only by the owner of the asset. Consequently, if ownership is transferred to the acquirer, the seller does not observe cash flows. If cash flows are verified, they are publicly observable.

C.2 Optimal offer designs

We assume that the acquirer presents the seller a menu of first-and-final offers. Each option delineates the compensation to be provided to the seller upon agreement with the acquirer's offer. The offer is designed to ensure that the acquisition succeeds with probability 1.[23]

The seller can accept one of the offers or reject all of them. If an offer is accepted, the asset's ownership is then transferred to the acquirer. Otherwise, the seller retains ownership. We consider three types of offers: all-cash, earnout, and seller debt. An all-cash offer includes only cash consideration. Offers that include an earnout or seller debt contract can also include some cash consideration.

Acquirers have bargaining power, so the seller receives his reservation demand. Thus, the seller's reservation demand will impound any costs (e.g., verification expenses) linked to the offer and incurred by the seller. Hence, no matter which party formally incurs these costs, the acquirer ultimately bears them.

The acquirer's payoff thus equals the total value under acquirer control, less the consideration paid to the seller and expenses linked to the offer. The total value under acquirer control is not

[23] Acquisition with probability 1 is optimal whenever $v_H^A - v_H^S$ is sufficiently large.

affected by the offer used to effect control transfer. Hence, the acquirer aims to minimize the cost of the acquisition, C_A, defined in equation (C-9).

C.2.1 All-cash offers

Because the acquirer has a liquidity advantage, i.e., $\phi \in (0,1)$, at date 0, the seller's valuation of 1\$ received at date 1 equals the seller's valuation of $\phi \times \$1 < \$1$ received at date 0. Thus, at date 0, the date the seller receives the acquirer's offer, the seller is willing to exchange the date 1 stand-alone value of the asset, r_s. for $s = G, B$, for a date-0 cash payment equal to $\phi\, r_s$. Thus, the cost of acquiring the asset from the s-seller via a cash payment is $\phi\, r_s$ if the payment is made at date 0 and r_s if the payment is made at date 1. Ceteris paribus, paying early, at date 0, reduces the payment the buyer must make to meet the seller's reservation demand. Thus, the acquirer can exploit her liquidity advantage by providing liquidity to the seller through date-0 cash payments.

However, liquidity provision comes at a cost—adverse selection. Since $r_B < r_G$, and the value of cash does not depend on the seller's private information, any all-cash offer acceptable to the G-seller will be accepted by the B-seller. Thus, to acquire the asset, the cash payment offered must be at least equal to $\phi\, r_G$, in which case accepting the offer is a best reply for both the $G-$seller and the $B-$seller. Hence, as detailed in the following lemma, acquisition through an all-cash offer entails paying the B-seller $\phi\, r_G > \phi\, r_B$, the B-seller's reservation demand.

Lemma 1. *The cost of the minimum-cost all-cash offer,* min(P:AC)*, is* $\min(\text{P:AC}) = \phi\, r_G$. min(P:AC) *is attained by the offer* $c^*_G = c^*_B = \phi\, r_G$.

C.2.2 Earnouts

Next, we consider earnout offers—offers in which payments to the seller depend on the project cash flows. The enforcement of payments based on cash flows requires cash flow verification, which is costly. Because the cash flow in the first period reveals the state of the firm, $\tilde{\omega}$, we can think of an earnout offer as one that specifies payments conditioned on the cash flows of the first period, $\tilde{a}_1$, or an offer conditioned on the state, H or L. Earnout offers can also include a non-contingent cash component, c, which is paid at date 0.[24]

The revelation principle ensures that an optimal earnout proposal can be found in the following form. The acquirer commits to a menu of two offers, one received by the seller if he reports signal G, called the G-offer, and another if he reports signal B, called the B-offer. Each offer is a triple, (c, h, ℓ), where c represents an immediate cash payment, h represents a payment at date 1

[24] Our definition of an earnout contracting entails cash flow verification. However, in some scenarios, the optimal earnout offer reduces to an all-cash offer. In these scenarios, verifying cash flows is pointless, so the earnout offer is dominated by an all-cash offer. Since the acquirer is not forced to employ an earnout offer, earnouts are not used, and the earnout offer solution in these cases does not affect our conclusions.

conditioned on $\tilde{a}_1 = e$, and ℓ represents a date 1 cash payment conditioned on $\tilde{a}_1 = 0$. We assume seller limited liability; i.e., the earnout contract (h, ℓ) must satisfy $h \geq 0$, $\ell \geq 0$, and $c \geq 0$.

If the seller reports G, the seller receives (c_G, h_G, ℓ_G); if the seller reports B, the seller receives (c_B, h_B, ℓ_B). Regardless of which offer the seller accepts, acceptance implies that ownership of the asset is transferred to the acquirer. The constraints on offer design are that truthful reporting is optimal for the seller and that the seller's payoff from accepting an offer is weakly greater than the seller's payoff from rejecting both offers and retaining ownership of the asset.

This problem can be simplified through some preliminary observations. First, note that an all-cash B-offer with $c_B = \phi\, r_B$ satisfies the B-seller's participation constraint and costs the acquirer $\phi\, r_B$, the minimum cost for any offer acceptable to the B-seller. In any solution, the G-seller's participation constraint is satisfied, so the value of the G-offer to the G seller must be at least equal to $\phi\, r_G > \phi\, r_B$. Hence, there exists a cost-minimizing solution in which $h_B = \ell_B = 0$ and the G-seller's non-mimicry constraint is not binding. Thus, the only possibly binding non-mimicry constraint is the B-seller's. Note that the difference between the G-seller's and B-seller's valuation of the G-offer depends only on the difference $h_G - \ell_G$. Any two offers featuring the same difference produce the same mimicry incentives for the B-seller. Thus, because of the acquirer's liquidity advantage, optimal offers will minimize the date 1 payments for any fixed difference, $h_G - \ell_G$; thus, G offers will set $\ell_G = 0$.

Hence, without loss of generality, we can focus on offers where $h_B = \ell_B = \ell_G = 0$ and the non-mimicry constraint for G is not binding. Because optimal B-offers are all cash, the participation constraint for the B seller can be eliminated from the problem by simply imposing the constraint $c_B \geq \phi\, r_B$. In the simplified problem, which we term P:EO, there are two incentive constraints: a non-mimicry constraint for the B-seller, denoted by EO:NM-B, and a participation constraint for the G-seller, denoted by EO:P-G.

Finally, the objective function of this problem is to minimize expected payments to the seller. The seller accepts the s-offer if and only if the seller receives signal s. The prior probability that the seller receives signal $s = G$ equals the prior probability that the signal is $s = B$. The seller only receives h_G when the signal is G and the state is H. So the probability that the seller receives h_G is $\frac{1}{2}\gamma$. Thus, the cost of payments to the seller for a given earnout contract equals

$$\frac{1}{2} c_B + \frac{1}{2} \left(c_G + \gamma h_G \right).$$

Hence, the problem of identifying the minimum-cost earnout offer, gross of verification expenses, can be formulated as the following linear programming problem, P:EO.

$$
\begin{aligned}
\underset{c_B,c_G,h_G}{\text{Min}} \quad & \frac{1}{2}c_B + \frac{1}{2}(c_G + \gamma h_G), && \text{P:EO}\\
\text{s.t.} \quad & c_G + \phi\,\gamma h_G \geq \phi\, r_G, && \text{EO:P-G}\\
& c_B \geq c_G + \phi\,(1-\gamma)\,h_G, && \text{EO:NM-B}\\
& (c_B, c_G, h_G) \in [\phi\, r_B, \infty) \times [0,\infty) \times [0,\infty). && \text{EO:FS}
\end{aligned}
$$

The acquirer's cost is the sum of the expected cost of payments to the seller and the marginal verification expenses incurred when financing this acquisition through an earnout. Because we are only interested in marginal expenses, we now refer to marginal expenses simply as *verification expenses*, denoted by κ_{ve}. Verification expenses can vary according to the acquirer's accounting system (Cadman et al., 2014; Allee and Wangerin, 2018).[25] However, verification expenses do not vary with the specific earnout offer selected by the acquirer, so they do not affect the solution to problem P:EO. To find the cost-minimizing earnout, we solve P:EO and then add the verification expenses to calculate the minimum cost of an earnout offer. The results of our analysis are detailed in Lemma 2.

Lemma 2. *The minimizing value of P:EO, denoted by* min(P:EO)*, is*

$$
\begin{aligned}
&\min(\text{P:EO}) = \min[\lambda_o, 1]\,\phi\, r_G + (1 - \min[\lambda_o, 1])\,\phi\, r_B, \quad \textit{where}\\
&\lambda_o := 1 - \frac{1}{2}\left(1 - \frac{\iota}{\alpha}\right)
\end{aligned}
\tag{C-14}
$$

and the cost of a minimum cost earnout proposal equals $\min(\text{P:EO}) + \kappa_{ve}$.

Proof of Lemma 2. To prove the Lemma, we first form the Lagrange, $\mathscr{L}_{\text{EO}}$, associated with this constrained minimization problem P:EO:

$$
\mathscr{L}_{\text{EO}} = \frac{1}{2}\,(c_B + c_G + \gamma h_G) - \lambda_M\,(c_B - c_G - \phi\,(1-\gamma)\,h) - \lambda_R\,(c_G + \phi\,\gamma h_G - \phi\, r_G)\,. \tag{C-15}
$$

In equation (C-15), λ_M represents the multiplier associated with constraint EO:NM-B and λ_R represents the constraint associated with EO:P-G. First note that

$$
\partial_{c_G}\mathscr{L}_{\text{EO}} = \frac{1}{2} + \lambda_M - \lambda_R. \tag{C-16}
$$

Next note that setting $c_G = 0$ is never optimal: when $c_G = 0$ and the incentive constraints, EO:P-G, are satisfied, EO:NM-B is strictly satisfied. Thus, the acquirer can substitute cash compensation, c_G, for some contingent compensation, h_G, without violating EO:NM-B, in a fashion that leaves the payoff to the G seller fixed. Because of the acquirer's liquidity advantage, the cost to the

[25]For example, if the acquirer's current accounting system is insufficient, the additional expenses required to establish a specialized system for verifying post-acquisition performance could be substantial.

acquirer is less after the substitution. Because $c_G > 0$, in any optimal solution $\partial_{c_G} \mathscr{L}_{\text{EO}} = 0$. This fact and equation (C-16) imply that in any solution,

$$\lambda_M = \lambda_R - \frac{1}{2}. \tag{C-17}$$

Using equation (C-17) and some rather tedious algebra shows that we rewrite the Lagrange in a reduced form without λ_M as follows:

$$\begin{aligned} \mathscr{L}^o_{\text{EO}}(c_B, h_G; \lambda_R) &:= c_B\,(1-\lambda_R) + \phi\, r_G\, \lambda_R + h_G\,(\phi\,(2\,\gamma-1)\,(\lambda_o - \lambda_R)), \\ \text{where } \lambda_o &:= \frac{\gamma - \phi\,(1-\gamma)}{2\,\phi\,(2\,\gamma-1)}. \end{aligned} \tag{C-18}$$

Next note that

$$\partial_{c_B} \mathscr{L}^o_{\text{EO}} = 1 - \lambda_R.$$

So if $\lambda_R > 1$, then $1-\lambda_R < 0$ and thus $\inf_{c_B,h_G}\{\mathscr{L}^o_{\text{EO}}(c_B,h_G;\lambda_R) : c_B \geq \phi\, r_B, h_G \geq 0\} = -\infty$. If $\lambda_R < 1$, then $\partial_{c_B}\mathscr{L}^o_{\text{EO}} > 0$, so c^*_B, the minimizing choice of c_B, equals the smallest feasible choice, $\phi\, r_B$. So, $c^*_B\,(1-\lambda_R) + \phi\, r_G\, \lambda_R = \phi\, r_B\,(1-\lambda_R) + \phi\, r_G\, \lambda_R$. If $\lambda_R = 1$, then $1-\lambda_R = 0$ and so again $c^*_B\,(1-\lambda_R) + \phi\, r_G\, \lambda_R = \phi\, r_B\,(1-\lambda_R) + \phi\, r_G\, \lambda_R$.

Now notice that

$$\operatorname{sgn}[\partial_{h_G}\mathscr{L}^o_{\text{EO}}] = \operatorname{sgn}[\lambda_o - \lambda_R].$$

Using the same arguments as in the previous paragraph, we see that if $\lambda_R > \lambda_o$, then $\inf_{c_B,h_G}\{\mathscr{L}^o_{\text{EO}}(c_B,h_G;\lambda_R) : c_B \geq \phi\, r_B, h_G \geq 0\} = -\infty$, and if $\lambda_R \leq \lambda_o$, then

$$h^*_G\,(\phi\,(2\,\gamma-1)\,(\lambda_o - \lambda_R)) = 0. \tag{C-19}$$

Thus,

$$\inf_{c_B,h_G}\{\mathscr{L}^o_{\text{EO}}(c_B,h_G;\lambda_R) : c_B \geq \phi\, r_B, h_G \geq 0\} = \begin{cases} -\infty & \text{if } \lambda_R > \min[1,\lambda_o], \\ \phi\, r_G\, \lambda_R + \phi\, r_B\,(1-\lambda_R) & \text{if } \lambda_R \leq \min[1,\lambda_o]. \end{cases} \tag{C-20}$$

The basic duality theorem of convex programming implies that

$$\min(\text{P:EO}) = \max_{\lambda_R}\inf_{c_B,h_G}\mathscr{L}^o_{\text{EO}}(c_B,h_G;\lambda_R) \tag{C-21}$$

Equation (C-20) and the fact that $\phi\, r_G > \phi\, r_B$ imply that $\lambda^*_R = \min[1,\lambda_o]$. Thus,

$$\min(\text{P:EO}) = \phi\, r_G \min[1,\lambda_o] + \phi\, r_B\,(1-\min[1,\lambda_o]).$$

The equation in Lemma 2 expresses λ_o (defined in equation (C-18)) in terms of ι and α (defined in equations (C-8) and (C-12), respectively). □

Corollary 1. *If $\lambda_o > 1$, then earnout offers are dominated by all-cash offers. If $\lambda_o \leq 1$, then* $\min(\text{P:EO})$ *is attained by the proposal $c_G^* = \phi\, v_L^S$, $h_G^* = e + v_H^S - v_L^S$ and $c_B^* = \phi\, r_B$.*

Proof. Inspection of $\min(\text{P:SD})$, defined in the lemma, shows that when $\lambda_o > 1$, the cost of an earnout, $\min(\text{P:EO}) + \kappa_{ve} > \phi\, r_G$, the cost of an all-cash offer. The fact that the offers identified by this corollary attain the minimum in the lemma can be verified by substitution. □

Note that $\lambda_o \leq 1$ holds if and only if the cost of adverse selection imposed on the acquirer by asymmetric information, α, exceeds the acquirer's gains from exploiting her liquidity advantage (i.e., $\alpha \geq \iota$). Therefore, we expect that all-cash offers dominate earnouts when acquirers' liquidity advantage is large. In contrast, if the acquirers have no liquidity advantage, i.e., $\iota = 0$, then even a small degree of information asymmetry, $\alpha > 0$, ensures that earnouts dominate all-cash offers.

C.2.3 Seller debt offers

Seller debt is a contract feature in an acquisition agreement upheld exclusively through foreclosure rights. It stipulates that should the acquirer default, i.e. fail to make the agreed debt payment, the seller gains the right to foreclose on the asset. The acquirer's primary incentive to repay is to avoid losing the asset's future value through foreclosure. Since there are no anticipated future cash flows after date 2 (making repayment unfeasible at that stage), payments under seller debt are due on date 1. Seller debt offers can also include a cash component, c, which is a noncontingent amount paid at date 0.

As discussed above, at date 1, the state is known to the acquirer. If the acquirer prefers default over repayment in state H, then the acquirer also prefers default to repayment in state L. In this case, the stipulated seller debt payment, which we represent by k, has no effect on the payoffs to the seller or acquisition cost. If the acquirer prefers repayment to default in both states H and L, then the seller debt payment is not performance sensitive. In this case, seller debt reduces to a fixed payment to the seller at date 1. Since it is optimal for the acquirer to make fixed payments at date 0, offers that include seller debt contracts are not optimal. Thus, in order for inclusion of a seller debt payment in an offer to be optimal, it must be incentive compatible for the acquirer to default on seller debt when the state is L and to repay the seller debt when the state is H.

When is the seller debt incentive compatible? Suppose that the stipulated seller repayment (i.e., the face value of the seller debt) is k and the first-period asset cash flow $\tilde{a}_1 = 0$. Because $\tilde{a}_1 = 0$ reveals that the state is L, the acquirer's payoff for honoring the debt contract is $v_L^A - k$, and the acquirer's payoff from defaulting is $\tilde{a}_1 = 0$. Thus, honoring (defaulting) when $\tilde{a}_1 = 0$ is a best reply if and only if $v_L^A - k \geq (\leq)0$. Similarly, when $\tilde{a}_1 = e$, the payoff from default is $\tilde{a}_1 = e$, and the payoff from honoring the contract is $e - k + v_H^A$. Thus, when $\tilde{a}_1 = e$, honoring (defaulting) is a best reply if and only if $v_H^A - k \geq (\leq)0$.

Result 1 (Contracting constraint)**.** *Honoring the seller debt contract when $\tilde{a}_1 = e$ and defaulting when $\tilde{a}_1 = 0$ is a best reply for the acquirer if and only if the face value of seller debt, k, satisfies $k \in [v_L^A, v_H^A]$.*

The contracting constraint (Result 1) highlights an important difference between complete contracting with earnouts and incomplete contracting with seller debt. Because earnouts stipulate contractual payments based on verifiable information, the division of value between the acquirer and seller can be stipulated "up front," i.e. at date 0. In the seller debt setting, where cash flows are not verifiable, cash flow contingency must be introduced by variations in the ex post, date 1, actions of the acquirer. These actions must be incentive-compatible. This ex post incentive compatibility requirement makes the range of feasible value divisions under seller debt contracting smaller than the feasible range under earnout contracting.

A seller debt proposal, like an earnout proposal, consists of a menu of two offers: a G-offer conditioned on the seller reporting signal G and a B-offer conditioned on the seller reporting signal B. These offers include a date 0 cash payment and a face value for the seller debt contract. Similar to the previous section's discussion, we can focus on proposals where the B-offer is all-cash and the G-offer combines cash and seller debt. Thus, the seller debt proposals considered have a B-offer with a cash payment, c_B, and a G-offer with a cash component, c_G, and a seller debt face value, k_G. To maximize the welfare of the acquirer, we identify a contract that minimizes the cost to the seller.[26]

Seller debt contracts, which condition foreclosure rights on the acquirer's debt repayment instead of basing payments on verified cash flows, do not necessitate verification. Consequently, they do not incur verification expenses. However, the trade-off for bypassing verification expenses is that the acquirer's repayment decisions must be incentive compatible at date 1. As shown in Result 1, these constraints imply that honoring the contract when the state is H and defaulting on the contract when the state is L are only incentive-compatible when the face value of the seller debt k lies in the interval $[v_L^A, v_H^A]$ (Result 1). Additionally, considering that the allocation of non-cash consideration in state L is determined by the foreclosure mechanism, the design problem can be further simplified. Using a similar method to the one employed for analyzing earnouts, the problem

[26]Because $v_L^S = v_L^A$ (see equation (C-11)), foreclosure per se does not introduce any dissipative costs. If we permitted $v_L^S > v_L^A$ or simply imposed a cost related to foreclosure, this cost would affect the cost of seller debt, but because the size of this cost is independent of the specific seller debt contract selected by the acquirer, this would not affect the contract design. In addition, the costs of enforcement are likely to be much smaller than the cost of bankruptcy. In our model and, typically, in practice, seller debt is nonrecourse, and the return of the asset in the event of default can be enforced through a simple writ of possession.

can be reduced to the linear programming problem P:SD below.

$$\begin{aligned}
\underset{c_B, c_G, k_G}{\text{Min}} \quad & \frac{1}{2}\, c_B + \frac{1}{2}\, \left(c_G + \gamma k_G + (1-\gamma)\, v_L^S\right) && \text{P:SD} \\
\text{s.t.} \quad & c_G + \phi\, (\gamma k_G + (1-\gamma)\, v_L^S) \geq \phi\, r_G && \text{SD: P-G} \\
& c_B \geq c_G + \phi\, ((1-\gamma)\, k_G + \gamma v_L^S) && \text{SD: NM-B} \\
& (c_B, c_G, k_G) \in [\phi\, r_B, \infty) \times [0, \infty) \times [v_L^A, v_H^A] && \text{SD:FS}
\end{aligned}$$

The solution to the seller debt problem, P:SD, is described in the following lemma.

Lemma 3. *The cost of a minimum cost seller debt proposal,* min(P:SD)*, is*

$$\min(\text{P:SD}) = \phi\, \left(r_B\, (1 - \min[\lambda_o, 1])\right) + \phi\, r_G \min[\lambda_o, 1] +$$

$$\begin{cases} \frac{1-\phi}{2}\, v_L^S & \textit{if } \lambda_o > 1 \\ \underbrace{\max[e - (v_H^A - v_H^S), 0]\, \left(\phi\, (2\gamma - 1)\, (1 - \lambda_o)\right)}_{\text{Term 1}} + \underbrace{\frac{1-\phi}{2}\, v_L^S}_{\text{Term 2}} & \textit{if } \lambda_o \leq 1 \end{cases}$$

where λ_o is defined in Proposition 2.

Proof of Lemma 3. This derivation is quite similar to the derivation of Lemma 2, so we refer the reader to the derivation of Lemma 2 for many details. We start the proof by forming the Lagrange,

$$\mathscr{L}_{\text{SD}} = \frac{1}{2}\, \left(c_B + c_G + + v_L^S\, (1-\gamma) + \gamma k\right) - \lambda_M\, \left(c_B - \left(c_G + \phi\, \left((1-\gamma)\, k_G + \gamma v_L^S\right)\right)\right) - \lambda_R\, \left(c_G + \phi\, \left(\gamma k_G + (1-\gamma)\, v_L^S\right) - \phi\, r_G\right). \quad \text{(C-22)}$$

Seller debt contracting imposes the same constraint on c_G as earnout contracting, i.e., $c_G \geq 0$. So, using the same argument as in Lemma 3, one can show that, for any optimal contract, $c_G > 0$, and that this fact implies that

$$\lambda_M = \lambda_R - \frac{1}{2}.$$

As in the proof of Lemma 2, substituting this condition into equation (C-22) and performing some algebra yields the reduced Lagrangian, $\mathscr{L}^o_{\text{SD}}$:

$$\mathscr{L}^o_{\text{SD}}(c_B, k_G; \lambda_R) := c_B\, (1 - \lambda_R) + r_G\, \lambda_R\, \phi + \left(k_G - v_L^S\right)\, \left(\phi\, (2\gamma - 1)\, (\lambda_o - \lambda_R)\right) + \frac{1}{2}\, v_L^S\, (1 - \phi). \quad \text{(C-23)}$$

Noting that $v_L^S = v_L^A$ (equation (C-13)), inspection of the reduced Lagrange shows that

$$\inf_{c_B,k_G} \{\mathscr{L}^o_{\rm SD}(c_B,k_G;\lambda_R) : c_B \geq 0 \;\&\; k_G \in [v_L^A, v_H^A]\} =$$
$$\begin{cases} \phi\, r_B\,(1-\lambda_R) + \phi\, r_G\,\lambda_R + \frac{1}{2}(1-\phi)\, v_L^S & \text{if if } \lambda_R \leq \min[\lambda_o, 1], \\ \phi\, r_B\,(1-\lambda_R) + \phi\, r_G\,\lambda_R + \left(v_H^A - v_L^S\right)(\phi\,(2\gamma-1)\,(\lambda_o - \lambda_R)) + \frac{1}{2}(1-\phi)\, v_L^S & \text{if } \lambda_R \in (\lambda_o, 1], \\ -\infty & \text{if } \lambda_R > 1. \end{cases} \tag{C-24}$$

Substituting in the the definitions of r_G and r_B (equation (C-13) shows that the map

$$\lambda_R \hookrightarrow \phi\, r_B\,(1-\lambda_R) + \phi\, r_G\,\lambda_R + \left(v_H^A - v_L^S\right)(\phi\,(2\gamma-1)\,(\lambda_o - \lambda_R)) + \frac{1}{2}(1-\phi)\, v_L^S$$

is weakly decreasing when $e + v_H^S \leq v_H^A$ and increasing when $e + v_H^S > v_H^A$. Thus, if we define, to reduce the length of the expressions,

$$\boldsymbol{M}^* = \max_{\lambda_R} \inf_{c_B,k_G} \{\mathscr{L}^o_{\rm SD}(c_B,k_G;\lambda_R) : c_B \geq 0 \;\&\; k_G \in [v_L^A, v_H^A]\}, \tag{C-25}$$

we see that

$$\text{if } \lambda_o > 1 \Longrightarrow \lambda_R^* = 1 \text{ and } \boldsymbol{M}^* = \phi\, r_G + \frac{1}{2}(1-\phi)\, v_L^S, \tag{C-26}$$
$$\text{if } \lambda_o \leq 1 \;\&\; e + v_H^S \leq v_H^A \Longrightarrow \lambda_R^* = \lambda_o \text{ and } \boldsymbol{M}^* = \phi\, r_B\,(1-\lambda_o) + \phi\, r_G\,\lambda_o + \frac{1-\phi}{2}\, v_L^S, \tag{C-27}$$
$$\text{if } \lambda_o \leq 1 \;\&\; e + v_H^S > v_H^A \Longrightarrow \lambda_R^* = 1 \text{ and } \boldsymbol{M}^* = \phi\, r_G + \left(v_H^A - v_L^S\right)(\phi\,(2\gamma-1)\,(\lambda_o - 1)) + \frac{1}{2}(1-\phi)\, v_L^S. \tag{C-28}$$

Convex programming duality implies that $\boldsymbol{M}^* = \min(\text{P:SD})$. So, in some sense, the proof is complete. However, we want to write min(P:SD) in a way that facilitates comparisons with a solution to the earnouts problem, min(P:EO). For this reason, we rearrange equation (C-28) by using the definition of reservation demands (equation (C-13)). Rearrangement shows that

$$\phi\, r_G + \left(v_H^A - v_L^S\right)(\phi\,(2\gamma-1)\,(\lambda_o - 1)) + \frac{1}{2}(1-\phi)\, v_L^S =$$
$$\phi\, r_B\,(1-\lambda_o) + \phi\, r_G\,\lambda_o + \max[e - (v_H^A - v_H^S), 0]\left(\phi\,(2\gamma-1)\,(1-\lambda_o)\right) + \frac{1}{2}(1-\phi)\, v_L^S. \tag{C-29}$$

Equations (C-26), (C-27), and (C-29) provide the characterization of min(P:SD) in the lemma and complete the proof. □

Corollary 2. *If $\lambda_o > 1$, i.e., $\alpha < \iota$, then seller debt is dominated by an all-cash offer. If $\lambda_o \leq 1$, then* min(P:SD) *is attained by the proposal* $c_G^* = \gamma\phi\ \max[e-(v_H^A - v_H^S),0]$, $k_G^* = \min[e+v_H^S, v_H^A]$ *and* $c_B^* = \phi\left(r_B + \max[e-(v_H^A - v_H^S),0](2\gamma-1)\right)$.

Proof. Inspection of min(P:SD), defined in the lemma, shows that when $\lambda_o > 1$, min(P:SD) $>$ $\phi\, r_G$, the cost of an all-cash offer. The fact that the offers stated in this corollary attain the minimum in the lemma can be verified by substitution. □

The effects of incomplete contracting on the costs of seller debt contracting, when seller debt is not dominated by an all cash offer (i.e., $\lambda_o \leq 1$), are captured in terms 1 and 2 in the minimum cost function derived in Lemma 3. Term 1 captures the contracting constraint, Result 1. Absent the contracting restrictions imposed by incomplete contracting, the optimal face value of the debt for contract G in state H would be $e + v_H^S$, but the highest enforceable face value is v_H^A. When $e > v_H^A - v_H^S$, this restriction reduces the face value of debt to v_H^A, and the reduction in face value results in the B-seller receiving information rents.

This contracting constraint is likely to be binding when initial cash flows from the asset, e, exceed the long-term value added in state H, $v_H^A - v_H^S$. This situation might be realized to some real-world situations, but is unlikely to describe the majority of transactions. Typically, the maturity of seller debt is short and predates the realization of the bulk of the upside value-add.

The second effect on incomplete contracting, reduced liquidity provision by the acquirer, is captured by term 2. In state L, some of the consideration received by the seller—the value of the returned asset in the event of acquirer default on the seller debt contract—is delayed until after date 0. Deferred consideration received in state L does not mitigate adverse selection and, given the acquirer's liquidity advantage, is inefficient. In contrast to the contracting restriction on the face value of seller debt, this cost is always present under seller debt financing. However, the magnitude of the cost is proportional to the acquirer's liquidity advantage, $1-\phi$, and the value of the asset in the L-state. If either of these factors is negligible, the incomplete contracting costs of seller debt will also be negligible.

C.3 Alternative setting: Hard cash constraints

Our analysis aims to compare the choice between earnout and seller debt financing, focusing on their relative costs. We use a common modeling approach, relative liquidity preferences, to capture the effects of the liquidity provision efficiency of these two mechanisms (DeMarzo and Duffie, 1999; Biais and Mariotti, 2005; DeMarzo and Sannikov, 2006; Yang, 2020). Thus, in our baseline setting, financial constraints are "soft," the shadow price of liquidity is positive but not infinite. An alternative modeling to examining the effect of liquidity on the choice between earnouts and seller debt is to examine the effects of "hard" cash constraints, i.e. constraints that prevent the acquirer from obtaining any funding for cash offers to the sellers. Our findings indicate that, in terms of acquisition costs, hard cash constraints produce the same trade-off between seller debt and earnouts as the extreme $\phi = 1$ case of our baseline model.

Result 2. *In scenarios where the seller values liquidity, i.e., $\phi < 1$, but, because of hard cash constraints, the acquirer cannot provide liquidity, the minimum acquisition cost under both the earnout and seller debt mechanisms is the same as in the baseline model where the acquirer can fund cash offers and the acquirer has no liquidity advantage over the seller, i.e., $\phi = 1$.*

Proof. Proof of Result 2. Consider earnouts first. Let P:EO-phi=1 represent problem P-EO, when $\phi = 1$.

$$\begin{aligned}
\underset{c_B, c_G, h_G}{\text{Min}} \quad & \frac{1}{2} c_B + \frac{1}{2} (c_G + \gamma h_G), && \text{P:EO-phi=1} \\
\text{s.t.} \quad & c_G + \gamma h_G \geq r_G, && \text{EO:P-G} \\
& c_B \geq c_G + (1-\gamma) h_G, && \text{EO:NM-B} \\
& c_B \geq r_B \text{ and } c_G \geq 0 \text{ and } h_G \geq 0 && \text{EO:FS}
\end{aligned}$$

Now consider the problem of an acquirer who is cash constrained at date 0 and thus cannot make cash payments at date 0 when $\phi \in (0,1)$. Call this problem PO-CC. Let c_G^1 and c_B^1 represent the acquirer's cash payment to the seller at date 1 for the G and B offers respectively. In this case, all payments from the seller will be discounted by ϕ to reflect the fact that the payments are not made at date 0. In the baseline problem P-EO, when $\phi < 1$, cash payments to the seller are not discounted but date 1 and 2 payments are discounted.

$$\begin{aligned}
\underset{c_B^1, c_G^1, h_G}{\text{Min}} \quad & \frac{1}{2} c_B^1 + \frac{1}{2} (c_G^1 + \gamma h_G), && \text{P:EO-CC} \\
\text{s.t.} \quad & \phi\,(c_G^1 + \gamma h_G) \geq \phi r_G, && \text{EO:P-G} \\
& \phi\, c_B^1 \geq \phi\,(c_G^1 + (1-\gamma) h_G), && \text{EO:NM-B} \\
& \phi\, c_B^1 \geq \phi r_B \text{ and } c_G \geq 0 \text{ and } h_G \geq 0 && \text{EO:FS}
\end{aligned}$$

Next note that if $\phi > 0$

$$\begin{aligned}
\phi\,(c_G^1 + \gamma h_G) \geq \phi r_G &\Longleftrightarrow c_G^1 + \gamma h_G \geq r_G, \\
\phi\, c_B^1 \geq \phi\,(c_G^1 + (1-\gamma) h_G) &\Longleftrightarrow c_B^1 \geq c_G^1 + (1-\gamma) h_G, \\
\phi\, c_B^1 \geq \phi r_B &\Longleftrightarrow c_B \geq r_B.
\end{aligned}$$

Thus, problem P:EO-CC can be expressed as

$$\begin{aligned}
\underset{c_B^1, c_G^1, h_G}{\text{Min}} \quad & \frac{1}{2} c_B^1 + \frac{1}{2} (c_G^1 + \gamma h_G), && \text{P:EO-CC} \\
\text{s.t.} \quad & c_G^1 + \gamma h_G \geq r_G, && \text{EO:P-G} \\
& c_B^1 \geq c_G^1 + (1-\gamma) h_G, && \text{EO:NM-B} \\
& c_B^1 \geq r_B \text{ and } c_G \geq 0 \text{ and } h_G \geq 0 && \text{EO:FS}
\end{aligned}$$

Thus, problem P:EO-phi=1 and problem P:EO-CC are identical problems and have the same solutions, and thus min[P:EO:CC] = min[P:EO-phi=1].

Now consider the case where the acquirer is cash constrained at both dates 1 and 2. Let P:EO-CCC represent this problem. Because the same discount factor, ϕ, is applied to payments at both dates 1 and 2, the seller is indifferent between date 1 payments and date 2 payments. So, if required, the acquirer's offer can defer all payments to date 2 without affecting the solution. So, assume that in problem P:EO-CCC, payments under offer s, $s = G.B$, consists of a payment at date 2, h_i, if state H is realized and a payment at date 2, ℓ_i, if state L is realized. Due to cash constraints, total payments to the seller in both state H and state L must be less than the cash flow produced by the acquired asset. We refer to this constraint the acquirer limited liability constraint (ALL). Total cash flows under acquirer control equal $e + v_H^A$ in state H and v_L^A in state L

Problem P:EO-CCC can thus be stated as follows:

$$\begin{aligned}
\underset{h_G, h_B, \ell_G, \ell_B}{\text{Min}} \quad & \frac{1}{2} \Big(\big(\gamma h_G + (1-\gamma) \ell_G\big) + \big((1-\gamma) h_B + \gamma \ell_B\big) \Big), && \text{P:EO-CCC} \\
\text{s.t.} \quad & \phi \left(\gamma h_G + (1-\gamma) \ell_G\right) \geq \phi r_G, && \text{EO:P-G} \\
& \phi \left((1-\gamma) h_B + \gamma \ell_B\right) \geq \phi \left((1-\gamma) h_G + \gamma \ell_G\right), && \text{EO:NM-B} \\
& \phi \left((1-\gamma) h_B + \gamma \ell_B\right) \geq \phi r_B, && \text{EO:P-B} \\
& h_G \text{ and } h_B \in [0, e + v_H^A], \ell_G \text{ and } \ell_B \in [0, v_L^A]. && \text{EO:ALL}
\end{aligned}$$

We already know that problem P:EO-rho = 1 is equivalent to problem P:EO-CC, so, to show that P:EO-CCC also has the minimum acquisition costs as P:EO-rho = 1 and P:EO-CC, we need to show that a solution of P:EO-CCC yields the same minimum acquisition cost as the minimum P:EO-rho = 1.

To do this, consider the candidate optimal offer, $h_G^* = h_B^* = e + v_H^S$ and $\ell_G^* = \ell_B^* = v_L^S$. Inspection of problem P:EO-CCC shows that the offer satisfies the constraints of P:EO-CCC. A simple calculation shows that the cost of this offer is $(1/2)(r_G + r_B)$. The participation constraints, P-G and P-B, imply that the cost of any feasible offer is at least $(1/2)(r_G + r_B)$. Thus, $(h_G^*, h_B^*, \ell_G^*, \ell_B^*)$ is a solution to P:EO-CCC and min[P:EO-CCC] $= (1/2)(r_G + r_B)$. Lemma 2 shows that when $\rho = 1$, min[P:EO] $= (1/2)(r_G + r_B)$. Thus, when the seller has a preference for liquidity, i.e., $\phi < 1$, and the acquirer is cash constrained either only at date 0 or at dates 0, 1, and 2, the minimum cost of acquisition equals the minimum acquisition cost in the baseline model when the acquirer is not cash constrained but the seller has no liquidity preference, i.e., $\phi = 1$.

The same argument works for seller debt, with the cash component at date 0 component of the seller debt contract replaced by a cash payment at date 1 when the acquirer is cash constrained only at date 0 or a cash payment at date 2 when the acquirer is cash constrained at dates 0, 1, and 2. □

In situations where the acquirer is cash-constrained, the offers and the seller's payoff will differ from those in a non-constrained setting. However, these variations do not impact the cost of the offer and therefore do not influence the acquirer's decision between seller debt and earnouts. Thus, our analysis is also applicable to scenarios like the Great Financial Crisis, where acquisition funding was scarce and sellers preferred liquidity, but acquirers were unable to access the funds to provide that liquidity.

C.4 Comparisons

Our first observation on the relative costs of acquisition mechanisms is that both earnout and seller debt are dominated by all-cash offers whenever the degree of information asymmetry, measured by α (see equation C-12), is less than the acquirer's liquidity advantage, measured by ι (see equation C-8). In such cases, comparing seller debt and earnouts becomes irrelevant, as neither mechanism would be chosen.

Proposition 1. *If $\alpha < \iota$, the acquirer will never use either seller debt or earnouts and instead will make an all-cash proposal. If $\alpha \geq \iota$, the cost of a minimum cost seller debt proposal is less than the cost of a minimum cost earnout proposal if and only if*

$$\overbrace{\underbrace{\max[e + v_H^S - v_H^A, 0]}_{\textit{Term (a)}} \left(\underbrace{\phi\,(2\gamma - 1)\,(1 - \lambda_o)}_{\textit{Term (b)}} \right)}^{\textit{Contracting}} + \overbrace{\frac{1-\phi}{2}}^{\textit{Liq. provision}} v_L^S \; < \; \overbrace{\kappa_{ve}}^{\textit{Verif. Exp.}} \; .$$

Proof. Immediate from Lemmas 1 and 2 and their corollaries. □

Proposition 1 displays the tradeoffs that determine the acquirer's choice between seller debt and earnouts. Using seller debt reduces verification expenses, but incurs two other potential costs: reduced liquidity provision and contracting costs.

A. Verification expenses: Contracting with seller debt avoids the incremental expenses incurred from verifying earnout cash flows. As discussed in Section C.2.2, the expenses are likely to be large when verification requires developing a bespoke system of segregating, monitoring, and disclosing the cash flows specific to the sold asset and small when existing accounting systems provide this fine-grained information.

B. Reduced liquidity provision: As discussed in Section C.2.3, given the acquirer's liquidity advantage, foreclosure is inefficient because it ensures that some value will be transferred to the seller at date 2 rather than date 0. The magnitude of this cost is proportional to the acquirer's liquidity advantage, $1-\phi$, which depends on capital market conditions. When the acquirer's liquidity advantage is small, e.g., during flight-to-safety periods, this cost will be small.[27]

C. Contracting costs As shown in Result 1, the face value of seller debt is restricted by the need to ensure incentive compatible foreclosure, which is costly for the acquirer (see also Section C.2.3). The size of this cost is determined by two terms: Term (a) and Term (b). Term (a) captures the amount by which the optimal face value of seller debt without the contracting constraint, $e + v_H^S$, exceeds the upper bound on the face value imposed by the contracting constraint, v_H^A. If the contracting constraint is not binding, this term equals 0 and thus contracting costs equal 0.

Term (b) represents the the per dollar cost of the reduction in the face value of debt imposed by the contracting constraint (Result 1). Term (b) has three components: the seller's discount rate, ϕ, the precision of the seller's signal, $2\gamma-1$, and the reduction in offer cost involved by using any outcome contingent contract (seller debt or earnouts) rather than an all-cash offer, $1-\lambda_o$. Thus, when the acquirer's liquidity advantage, $1-\phi$, is small (large), precision of the seller's information $2\gamma-1$, is high (low), and the gains from outcome contingent contracting are large (small), the per dollar cost of distorting the optimal seller debt design to satisfy the contracting constraint is large (small).

Note that the components of Term (b) have a multiplicative effect and that Term (b) has no effect on the contracting costs when the contracting constraint is not binding. As discussed above, the contracting constraint can only bind when short-term earnings are large relative to the long-term value-add from the acquisition. As argued earlier, for most acquisitions, long-term value add greatly exceeds short-term earnings, and thus the contracting constraint is unlikely to bind. Thus, contracting constraint binding and all of the conditions on Term (b) required to insure that a binding contracting constraint imposes significant costs are an even less likely event. Thus, in practice, we believe that the verification costs of earnouts and the reduced liquidity provision costs of seller debt are the main determinants of the choice between seller debt and earnouts.

[27] The cost of reduced liquidity provision is also likely to be low when the L-state represents a material adverse event and thus the continuation value in the L-state, v_L^S, is quite small; for example, the target firm is a pharmaceutical research laboratory, and L represents the discovery that the drug tests the firm submitted to the FDA were fraudulent.