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Stapled Finance

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ABSTRACT

"Stapled finance" is a loan commitment arranged by a seller in an M&A setting. Whoever wins the bidding contest has the option (not the obligation) to accept this loan commitment. We show that stapled finance increases bidding competition by subsidizing weak bidders, who raise their bids and thereby the price that strong bidders (who are more likely to win) must pay. The lender expects not to break even and must be compensated for offering the loan. This reduces but does not eliminate the seller's benefit. It also implies that stapled finance loans will show poorer performance than other buyout loans.

"STAPLED FINANCE," a tool that is increasingly common both in the United States and in Europe (see the next section for institutional details) is a loan commitment that is "stapled" onto an offering memorandum, by the investment bank advising the seller in an M&A transaction. It is available at pre-specified terms to whoever wins the bidding contest for the asset or firm that is being put up for sale, but the winner is under no obligation to accept the loan offer. Practitioners and observers regard stapled finance as a tool that reduces transaction frictions: It makes financing available to all parties, if needed, thereby reducing risk and delays to the sale process and potentially increasing the pool of bidders.

In this paper, we show that stapled finance also affects the bidding itself by making it more competitive. We begin by showing that an appropriately designed stapled finance package increases the expected price that will be paid to the seller. Three characteristics are crucial for this to be beneficial for the seller. First, the offer is optional: The winning bidder has the right, but not the obligation, to accept a loan whose terms were fixed before the takeover contest started. Second, the stapled finance is a nonrecourse claim, that is, the debt is supported only by the target's assets and cash flow, not by the other

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assets and operations that the winning bidder owns. Third, there exist bidders who plan to hold the target as a portfolio company, that is, they do not plan to integrate it into their other operations if they win. (Private equity (PE) funds often structure their holdings this way.) Notice that our arguments do not rely on financial constraints of any sort; stapled finance is accepted by bidders for *strategic* reasons, even if they have sufficient internal or outside funds to pay for an acquisition.

We also show that if the stapled finance package is designed optimally, then the investment bank providing it expects *not* to break even. The reason is that stapled finance is optional, so it is accepted only if the terms are attractive to the bidder—and therefore unattractive to the lender. This suggests that a stapled finance package that benefits the seller can be arranged only if it is possible to compensate the investment bank for its expected loss, for example, by paying an up-front fee or by retaining the bank for other fee-based services. This also suggests that stapled finance loans that investment banks and other financial institutions retain on their balance sheets should perform worse than buyout loans that are negotiated independently.

We analyze a simple auction model in which two financial buyers compete for the target firm. Financial buyers plan to hold the target firm as a portfolio firm, separate from their other operations and assets. The availability of stapled finance makes the bidders compete more aggressively, leading to a higher expected price (which benefits the seller). However, this distorts the allocation of the target firm, since the highest-valuation bidder does not necessarily win. Less value is created in the auction, which harms the seller since her aim is to extract as much value as possible from the bidders. Also, the winner will sometimes accept the stapled finance, in which case the seller must compensate the lender for the expected loss. Nevertheless, the seller benefits from *any* stapled finance package that has a positive probability of being accepted by the winner. That is, the increased competition among the bidders more than compensates for the drawbacks of arranging stapled finance. The availability of stapled finance invites bidders to act opportunistically (if they win with a low signal, they accept the stapled finance), but the seller is able to turn this opportunism against the bidders themselves, creating a bidding environment that resembles a prisoners' dilemma.

A simple intuition for the benefits that accrue to the seller is to regard the option to accept the stapled finance as a subsidy whose value to a bidder depends on her signal. More precisely, its value is decreasing in the realized signal. The subsidy therefore makes weaker bidders (bidders with lower signals and valuations) more competitive (they increase their bids by their valuation of the subsidy), but being weak bidders they are less likely to win than strong bidders. So the seller benefits from the more intense competition, and the risk of actually having to provide the stapled finance (which would cause a loss) is limited.

As we discuss in Section I, the institutional details about stapled finance are consistent with our results. In Section V, we discuss how our results differ from predictions that follow from informal practitioners' explanations for the popularity of stapled finance. In short, our model generates cross-sectional predictions that are novel and unique. Some of these predictions are consistent with stylized facts but others will need to be tested by empirical researchers in the future.

Being a fairly recent creation, stapled finance has not yet entered the academic mainstream. An exception is Boone and Mulherin (2008), who find that M&A contests with stapled finance offers are more competitive. The role of debt in takeover settings has been analyzed previously; see, for example, Jensen (1986), Harris and Raviv (1988), Stulz (1988), Israel (1991, 1992), Clayton and Ravid (2002), and Müller and Panunzi (2004). These papers do not analyze debt that is arranged by the seller; rather, they focus on debt that is present on either the target's or a bidder's balance sheet before the bidding starts, or on debt that is taken on after the bidding contest is over. Similarly, auction models have been used previously to analyze takeover contests. Our model is most closely related to Povel and Singh (2004, 2006, 2007), who analyze the role of information asymmetries between bidders on optimal auction design, and the role of sale-backs in bankruptcy.[1]

Closer in spirit to our study are papers on "bidding with securities."[2] These papers analyze auctions in which the seller requires bids in the form of a specific security (royalties in the case of oil lease auctions, for example, or debt in the case of spectrum auctions). DeMarzo, Kremer, and Skrzypacz (2005) provide the most detailed analysis of such auctions. They show that the expected price is higher if the bids are submitted in the form of one specific type of security (such as debt, equity, call options, etc.), which requires a commitment from the seller to decline all bids in the form of securities other than the required security, especially cash bids. The seller benefits because the winner's price is a state-contingent security, that is, the ultimate value of the winner's payment depends on the value that she realizes from the target. Similarly, stapled finance, as modeled in our paper, benefits the seller because the value of the debt payment to the lender depends on the value realized by the winning bidder, and since this debt payment is part of the winner's overall price, stapled finance links the value of the winner's price to the target value that she eventually realizes. Importantly, however, we do not *require* the bidders to accept the stapled finance. In fact, high-value bidders in our model optimally choose to decline the offer. This distinction is important given that DeMarzo, Kremer, and Skrzypacz (2005) show that, if given a choice, bidders prefer "flatter" securities. Thus, when the bidders can choose whether to bid cash or shares (a common choice in takeover contests), they prefer cash bids. Our paper shows that even with cash bids, it is possible to extract a higher price from the bidders by making stapled finance available, which is accepted by the winning bidder voluntarily, if at all.

[1] Earlier contributions that analyze takeover contests as auctions include (among others) Fishman (1988, 1989), Bhattacharyya (1992), Daniel and Hirshleifer (1992), Burkart (1995), Singh (1998), Bulow, Huang, and Klemperer (1999), Ravid and Spiegel (1999), and Rhodes-Kropf and Viswanathan (2004).

[2] See Hansen (1985), Samuelson (1987), Crémer (1987), Riley (1988), Zheng (2001), Rhodes-Kropf and Viswanathan (2000, 2005), DeMarzo, Kremer, and Skrzypacz (2005), and Board (2007).

The rest of the paper proceeds as follows. We discuss institutional details and how they relate to our results in Section I. In Section II, we present the model. In Section III, we derive the equilibrium bidding strategies, given the details of the stapled finance offer. In Section IV, we show that the seller benefits from arranging any stapled finance package when facing two financial buyers. In Section V, we discuss other benefits the seller enjoys when arranging stapled finance. Section VI presents robustness tests and model extensions. Section VII concludes. Some proofs are in the Appendix at the end of the paper; additional proofs and robustness checks are in the Internet Appendix.[3]

I. Stapled Finance: Institutional Details

Stapled finance refers to a type of financing that is made available through the seller's efforts in an M&A transaction. Stapled finance can consist of a single loan or a package of term loans, bond placements, bridge loans, and other securities. The details of the package are negotiated between the seller and the investment bank before potential buyers are contacted. The term itself derives from the idea that the loan commitment is "stapled" onto an offering memorandum by the investment bank advising the seller in an M&A transaction.[4]

Information about stapled finance can be drawn mainly from practitioner publications, newspapers, and SEC filings by firms that needed shareholder approval for M&A transactions.[5] Useful practitioner-oriented overviews include Kevin Miller, "In Defense of Stapled Finance," *Boardroom Briefing*, Vol. 3(3), Fall 2006, pp. 44–49 (published by *Directors & Boards* magazine) and *The Vernimmen.com Newsletter*, No. 20, November 2006. See also the discussion of stapled finance in a recent textbook by Rosenbaum and Pearl (2009).

There is no systematic evidence on the supply of and demand for stapled finance in M&A transactions. Investment banks started including the possibility of offering stapled finance in their sales pitches to potential sellers in 2001 (see "Bally calls in Deutsche for staple," *TheDeal.com*, May 4, 2006). Since then, stapled finance has become quite common. In 2004, 39% of the U.S. deals that involved PE firms saw the seller arranging stapled finance (although by the first half of 2008, this figure had decreased to 14%; see Julie MacIntosh, "Crunch boosts staple financing," *Financial Times*, July 29, 2008). Stapled finance seems to have become even more common in Europe: "Staple financing was offered by banks this year in about 90% of the auctions in Europe where buyout firms sold businesses to other buyout firms. ... Staple financing is rapidly becoming standard practice due to the increasing importance of

[3]An Internet Appendix for this article is online in the "Supplements and Datasets" section at http://www.afajof.org/supplements.asp.

[4]"Stapled finance" is also referred to as "stapled financing," "staple financing," "staple finance," or simply as "the staple."

[5]Recent SEC-filing examples include Wendy's (April 2008), Getty Images (February 2008), Radiation Therapy Services (October 2007), United Rentals (July 2007), Guitar Center (June 2007), CDW (June 2007), Alltel (May 2007), Primedia (May 2007), Bisys Group (May 2007), Alliance Data Systems (May 2007), Aeroflex (May 2007), and Servicemaster (May 2007) among many others.

private equity as buyers of businesses" ("'Stapled' loans create potential conflicts for merger advisers," *Bloomberg*, October 24, 2005). A survey of participants in the European PE industry found that nearly one in two PE funds had recently arranged stapled finance when putting assets up for sale ("Private equity in 2006: The year of living dangerously," *Financial News*, February 2006). For more articles discussing the popularity of stapled finance, see "Staple financing gains following in M&A deals," *Corporate Financing Week (Institutional Investor)*, June 27, 2004, and "Popular LBO staple financing raises eyebrows," *Dow Jones News Service*, January 10, 2005.

Large deals with seller-arranged financing include (besides the examples from SEC filings listed above) Reed Business Information ("Staple finance shortfall for Reed Business," *Financial Times*, September 26, 2008), Diageo's sale of Burger King in 2002 and Daimler's sale of Chrysler in 2007 ("Private equity widens search," *Financial Times*, October 31, 2007), Michaels Stores ("JPMorgan helps Michaels Stores to fast and favorable results," *Financial Times*, January 25, 2007), Bally Total Fitness Holding ("Bally calls in Deutsche for staple," *TheDeal.com*, May 4, 2006), and Dunkin Brands ("Bidders show strong appetite for a taste of Dunkin Brands," *Financial Times*, October 10, 2005). The non-recourse debt financing offered by the U.S. Treasury (and loan guarantees from the FDIC) as part of the Public-Private Investment Program (PPIP) also represents a form of stapled finance.[6]

The main features of stapled finance are that (i) it is a loan commitment arranged by the seller in an M&A transaction; (ii) it is optional; (iii) it is generally (with some exceptions) available to whoever wins the takeover contest; (iv) its terms are often regarded as being aggressive; and (v) it is often declined by the winning bidder, but sometimes accepted, primarily by PE funds.

These features are consistent with the results of our model. Stapled finance *should* be arranged by the seller (*i*) because it benefits the seller. Further, it *should* be optional (*ii*) because it is the optionality that induces certain bidders to self-select and submit higher bids. It *should* also be available to whoever wins the takeover contest (*iii*), in particular buyout funds, for it to be effective. In practice, the target's competitors have sometimes been excluded from the offer because sellers did not want to give them access to financial data about the firm; that is of no consequence to the seller in our model, however, since (as we show in Section IA.V of the Internet Appendix) trade buyers do not change their bidding strategy if stapled finance is available, so there is no loss from not making it available to them in the first place.

Next, the terms of stapled finance packages *should* be aggressive (*iv*), since unattractive loan terms would not affect bidders' strategies. Note that it is not necessary for our results that all details of the loan commitment be fully specified. All we require is that some terms be specified that the lender may regret after the auction has ended—in other words, as long as there is *some* option value in the loan commitment, our results will hold. For example, stapled finance

[6]The sellers are privately owned financial institutions, but given their poor financial health, the ultimate beneficiaries of a price increase induced by stapled finance are the U.S. taxpayers (who would fund the FDIC if it had to bail out more banks).

packages often include loan sizes that are above the bidders' (and observers') expectations: "Most buyout executives contacted for this article agree that the staple financing typically represents the most generous deal available" ("Popular LBO staple financing raises eyebrows," *Dow Jones News Service*, January 10, 2005). Indeed, "According to a general partner of a private equity fund, 'Banks are being pressured to come up with aggressive staple financing and sometimes it means they are not comfortable with the amount of debt they are putting forward. In one case recently, the bank actually told us it did not want to lend the amount included in the staple package. Inevitably, that made us nervous.'... Others agreed banks were sometimes being too aggressive in offering staple financing. David Silver at Robert W Baird said: 'With the advent of staple financing and leverage multiples where they've been, we have seen some transactions where banks are willing to lend and private equity firms are put off because the staple finance package implies a valuation they're not comfortable with'" ("Private equity in 2006: The year of living dangerously," *Financial News*, February, 2006). See also "Bidders show strong appetite for a taste of Dunkin Brands," *Financial Times*, October 10, 2005.

Finally, in many cases stapled finance *should* be declined by the winning bidder (v). Stapled finance packages are attractive to low-valuation financial buyers who are willing to use high financial leverage and potentially let the target firm default. But low-valuation bidders are less likely to win, so the realized acceptances should be less frequent than the *planned* acceptances, as the more likely winners, namely, the high-valuation buyers, plan to decline the stapled finance offer.

The main benefits of stapled finance are described by practitioners as follows. First, a stapled finance offer guarantees financing to firms that have difficulty arranging financing themselves or obtaining information about the terms of possible loan commitments. This reduces the risk that a deal would fall through simply because the winning bidder could not line up sufficient funds at a sufficiently low cost. Second, the sale can be negotiated more quickly because the due diligence for early round "indicative" bids is simplified. Third, the simplified process also makes it cheaper for bidders to prepare indicative bids, which potentially increases the pool of bidders. Fourth, for the same reason, the seller can restrict access to financial information early in the process (information that would be needed to negotiate financing), so confidentiality is preserved early in the process.

We are not claiming here that these explanations are invalid. In fact, many of the benefits suggested by practitioners are complementary to the ones we analyze. The aim of this paper is to analyze bidding effects that have been overlooked so far. This allows us to describe a novel mechanism that makes stapled finance attractive to a seller when certain bidders (financial buyers) are present; to explain why some bidders dislike stapled finance; and to explain why M&A financing that is part of a stapled finance package should be expected to perform poorly, compared with other M&A financing packages. These predictions are inconsistent with existing explanations but are easily understood based on our model.

We discuss below (in Section V) how the predictions from our model differ from predictions that the existing explanations would generate, if formalized. Specifically, we discuss how bid premia, bidder share price run-ups, post-takeover operating performance, and the performance of the loans themselves can be used to test our model's predictions and how certain features of the bidding environment (number of bidders, technological, or other execution risk) affect the likelihood of stapled finance being arranged.

Some practitioners have also identified possible drawbacks of arranging stapled finance. The fees that investment banks earn for arranging high-yield loans are much higher than the fees earned for advisory work, which may cause a conflict of interest if investment banks both advise the sellers on which bid is best and arrange the loans (investment banks may even coerce bidders into promising to accept the stapled finance). We abstract from this issue in our paper. First, as the conflict of interest is quite obvious, in practice sellers have started to split the lending and advisory functions between two independent investment banks. Furthermore, in practice the stapled finance offer is often declined or shopped around, which suggests that such abuse of power is not widespread.

II. The Model

Consider a target firm that is for sale, with two bidders, $i, j \in \{1, 2\}$, interested in buying it. These bidders have independent and uncertain value estimates of the target. We assume that the bidders' full information values of the target firm, t_1 and t_2, are independently and identically distributed on the support $[\underline{t}, \bar{t}]$, with density f and c.d.f. F. Denote the expected value of t_i by $E[t_i]$. We assume that f is continuous and differentiable on $[\underline{t}, \bar{t}]$, and strictly positive on $(\underline{t}, \bar{t})$.

The bidders cannot observe the realizations of t_i. Instead, they (privately) observe signals s_i such that

$$s_i = \begin{cases} t_i & \text{with prob } \varphi \\ \tau_i & \text{with prob } 1 - \varphi, \end{cases} \tag{1}$$

where τ_1 and τ_2 are i.i.d. random variables that have the same distributions as t_1 and t_2. Thus, with probability φ the signal s_i is informative, and with probability $1 - \varphi$ it is pure noise. Since the signal is completely uninformative if $\varphi = 0$, we will assume in the following that $0 < \varphi \leq 1$.[7] Given the signal s_i, the bidder i's expected value of the target is

$$v(s_i) = \varphi s_i + (1 - \varphi)E[t_i]. \tag{2}$$

This is a private values auction model in which the bidders' signals are noisy estimates of their valuations. We have analyzed an alternative model of private

[7] Setting $\varphi = 1$ would simplify the algebra slightly, but the results would be less realistic: If a buyer accepted the stapled finance, she would default on it with certainty.

values in which the realized value is a continuous function of a bidder's signal and an unobserved random variable; the results are unchanged (see Section VI below and Section IA.IV of the Internet Appendix for details). We have also analyzed a model with common values in which the realized value is a weighted average of the two (independent) signals; again, the results are unchanged (see Section VI below and Section IA.I of the Internet Appendix for details).

The seller cannot observe the bidders' signals, and thus she plans to hold an ascending auction:[8] the bids are continuously raised, and the auction ends when only one bidder is left in the auction; the price at which the second-last bidder withdrew is the price that the winner, the last remaining bidder, has to pay. The ascending auction is a realistic model for takeover contests as these contests usually require that winning bids be exposed to overbids from third parties, so, strategically speaking, the bidders face the same incentives as in a standard ascending auction. The ascending auction has the additional benefit that it is easy to analyze (the bidders have dominant strategies). We also discuss alternative auction models (e.g., the first-price auction) and show that they lead to the same results (see Section VI below and Section IA.II of the Internet Appendix for details).

The timing is as follows. First, the seller asks an investment bank to prepare a loan commitment, available to the winner of the bidding contest irrespective of their identity. Second, the bidders compete for the target in an ascending auction in which the bids are raised continuously until one of the bidders decides to drop out. The remaining bidder is declared the winner and pays the price at which the other bidder dropped out.[9] We assume that if both bidders drop out simultaneously, a coin flip determines the winner. Third, the winning bidder decides whether to accept the stapled finance offer. If the winning bidder declines the stapled finance offer, then she pays the winning price out of her own funds or she raises financing from a third-party lender at competitive terms.[10] Finally, the winner realizes cash flows from the target (the random variable t_i) and makes payments to the investment bank if the stapled finance package was accepted.

Our aim is to analyze how stapled finance affects the outcome of a takeover contest if the bidders may accept the stapled finance for strategic reasons, rather than due to financial constraints. We isolate the strategic effects by assuming that the bidders have access to sufficient internal or external funds to finance an acquisition. As we show, even deep-pocketed bidders may accept the stapled finance if the terms are sufficiently attractive. This happens only if a bidder is a financial buyer, that is, a bidder who plans to hold the target as a portfolio firm separate from other holdings (e.g., a PE fund specializing in buyouts). "Trade" or "strategic" buyers plan to integrate the target into their

[8] Also known as an "open outcry" or "English" auction, in our setting equivalent to a second-price sealed-bid auction.

[9] A "bidding strategy" refers to the bid at which a bidder plans to drop out.

[10] That is, lenders only ask to break even in expected terms (to simplify this, assume that bidders can credibly reveal their signal realization; if only bids are observable, signal jamming complicates the analysis, see Liu (2008)).

operations if they win do not benefit from the availability of stapled finance, so their bids are unaffected (see Section VI). Thus, as long as there are financial buyers in the pool of bidders, the seller benefits from arranging stapled finance (see Section IA.V of the Internet Appendix for details).

The stapled finance is a simple loan in our model: The winning bidder can borrow an amount L if she promises to repay an amount D at a later stage. We assume that this is a non-recourse loan, that is, the lender's claim is supported only by the target firm's cash flow and assets. The winner is protected by limited liability: If the realized value is below D, she can just default on the loan. This limited liability makes the debt risky, and we allow for the possibility that the lender may not break even when offering stapled finance. We assume that since this can be anticipated in equilibrium, the seller has to compensate the investment bank ex ante for providing the loan. The investment bank thus expects to break even in expected terms, and strategically, the investment bank makes the decisions that the seller wants her to make. (The investment bank is passive in this model; the seller could actually provide the loan commitment herself, but that rarely happens in practice.)

As a benchmark, consider the ascending auction equilibrium if stapled finance is unavailable. The bidders' dominant strategy is to bid their own valuations, that is, to plan to drop out of the bidding once the bid reaches their valuation:

$$b^{noD}(s_i) = v(s_i) = \varphi s_i + (1-\varphi)E[t_i]. \tag{3}$$

The seller's expected price is then

$$\Pi^{noD} = \varphi E\left[\min\left\{s_i, s_j\right\}\right] + (1-\varphi)E[t_i] \tag{4}$$

(since the bidder with the higher signal submits the higher bid and wins, and her price is the bid submitted by the other, losing bidder).

If stapled finance is available, the bidding behavior changes because stapled finance is accepted only if it is beneficial, so its availability increases the bidders' valuations and therefore their bids. We analyze these effects in what follows.

III. Equilibrium Bidding Strategies

Suppose the bidding is over, and the winner has to pay the loser's bid. With limited liability, her expected payoff increase from accepting the stapled finance is

$$x(s_i) = L - \varphi \min\{s_i, D\} - (1-\varphi)E\left[\min\{t_i, D\}\right]. \tag{5}$$

(We omit the arguments L and D from x for simplicity.) The function $x(s_i)$ is positive if L is high enough, and if D and s_i are low enough. Recall that L is the loan size received upon accepting the loan; the remaining two terms are the expected repayment, which may be less than D (the promised repayment) because of limited liability.

In our auction setup, it is a dominant strategy to bid one's valuation of the target. This valuation includes the value of the option to accept stapled finance (the bidders know whether they will accept the stapled finance if they win), so the optimal bid is

$$b^D(s_i) = v(s_i) + \max\left\{x(s_i), 0\right\}. \tag{6}$$

PROPOSITION 1: *If the seller arranges stapled finance such that its terms seem attractive to some bidders, then the expected price is higher than if no stapled finance were arranged.*

Proof: From (3) and (6), we have that $b^D(s_i) \geq b^{noD}(s_i)\ \forall s_i$, with a strict inequality if $x(s_i) > 0$. If such a bidder (with s_i such that $x(s_i) > 0$) is defeated, then the winner's price is higher (the winner's price is the losing bid, which is higher). If she defeats a rival only because of the bid increase, the price paid by the winner is higher, too. Q.E.D.

The more generous the stapled finance offer is, the larger the increase in the seller's expected price will be. This increased competition is what makes arranging stapled finance attractive for a seller. However, it comes at a cost.

PROPOSITION 2: *The expected net payoff for the lender (who provides the stapled finance commitment) is negative. Without compensation from the seller, stapled finance will not be offered by any lender.*

Proof: The stapled finance offer is accepted if and only if $x(s_i) \geq 0$, that is, if the expected net payoff from lending is negative. Q.E.D.

This result follows from the option feature of the stapled finance offer: The winning bidder has the right, but not the obligation, to accept the loan. The lender (the investment bank providing the loan commitment) is the writer of this option and therefore expects to realize a loss whenever the stapled finance offer is accepted. She must therefore be compensated by the seller for offering to lend, which offsets the seller's benefit from offering stapled finance. In Section IV, we show that the seller's *net* benefit, incorporating the compensation to the lender, remains positive.

In the following, it will be convenient to work with the cutoff signal $\hat{s}$ that determines whether a bidder plans to accept or decline the stapled finance offer. For any values of L and D, the function x is well defined. Notice that $x(s_i)$ is weakly decreasing in s_i: It is strictly decreasing if $s_i < D$, and it is flat if $s_i > D$ (see (5) and Figure 1). So if L and D are such that $x(\underline{t}) < 0$, then $x(s_i) < 0$ for all $s_i \in [\underline{t}, \bar{t}]$. Similarly, if $x(\bar{t}) > 0$, then $x(s_i) > 0$ for all $s_i \in [\underline{t}, \bar{t}]$. Both cases can be ignored without loss of generality. First, if $x(s_i) < 0$ for all $s_i \in [\underline{t}, \bar{t}]$, then the bidders always plan to decline the stapled finance offer, in which case offering it has no effect on the outcome of the auction; this is equivalent to offering stapled finance such that $x(\underline{t}) = 0$ (this is achieved by increasing L to $L' = L - x(\underline{t})$). Second, if $x(s_i) > 0$ for all $s_i \in [\underline{t}, \bar{t}]$, then the bidders always plan to accept the loan offer and, absent discounting, the seller is indifferent between

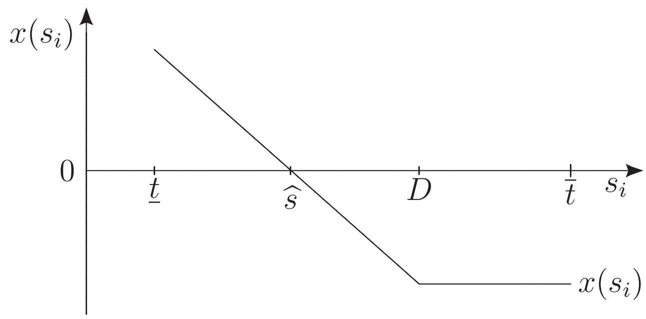

Figure 1. A financial buyer's expected net benefit $x(s_i)$ from accepting stapled finance, given a signal s_i. The support of the signals is $[\underline{t}, \overline{t}]$. For signals $s_i < \hat{s}$ the expected net benefit $x(s_i)$ is positive; for signals $s_i > \hat{s}$ it is negative. D is the promised repayment to the lender. The function $x(s_i)$ is decreasing in s_i since a loan with given terms is more attractive (with limited liability) if the signal is low, that is, if the bidder's expected valuation of the target is lower.

offering stapled finance at these terms and offering stapled finance such that $x(\overline{t}) = 0$ (this is achieved by reducing L to $L' = L - x(\overline{t})$). The allocation will not be changed by this, and the net effect on the seller's net payoff is zero: The prices will be reduced by $L - x(\overline{t})$ for any signal realization, but the loss to the lender will also be reduced by that amount. So without loss of generality, we can focus on stapled finance packages that set $x(\overline{t}) \leq 0 \leq x(\underline{t})$.

We can thus define a cutoff signal $\hat{s}$ such that a bidder plans to accept the stapled finance offer if and only if $s_i < \hat{s}$:

$$\hat{s} = \min_{s \in [\underline{t}, \overline{t}]} \left\{ s \mid x(s) = 0 \right\}. \tag{7}$$

Notice that the slope of x (downward sloping if $s_i < D$, flat if $s_i > D$) and the restriction that $x(\overline{t}) \leq 0 \leq x(\underline{t})$ together imply that $\hat{s} \leq D$. In other words, the cutoff signal lies in the interval of signals for which x has a negative slope (as shown in Figure 1).

When designing the stapled finance package, the seller must decide what values of L and D to offer. We now show that this problem is equivalent to choosing a cutoff signal $\hat{s} \in [\underline{t}, \overline{t}]$.

LEMMA 1: *The problem of choosing the optimal values of L and D is equivalent to the problem of choosing the optimal value of $\hat{s}$.*

Proof: L and D affect the outcome only if at least one of the bidders plans to accept the stapled finance, that is, if $\max\{x(s_i), x(s_j)\} > 0$. It is sufficient to show that the function x can be written as a function of $\hat{s}$ and s_i only (and not of L and/or D) on the interval $[\underline{t}, \hat{s}]$. Using $\hat{s} \leq D$, we can write

$$x(s_i \mid s_i < \hat{s}) = L - \varphi s_i - (1 - \varphi) E\left[\min\{t_i, D\}\right]. \tag{8}$$

Solving (5), evaluated at $s_i = \hat{s}$, for L, yields

$$L = \varphi\hat{s} + (1-\varphi)E\left[\min\{t_i, D\}\right] \tag{9}$$

since $x(\hat{s}) = 0$. Substituting into (8), we obtain

$$\begin{aligned} x(s_i \mid s_i < \hat{s}) &= \varphi\hat{s} + (1-\varphi)E\left[\min\{t_i, D\}\right] - \varphi s_i - (1-\varphi)E\left[\min\{t_i, D\}\right] \\ &= \varphi(\hat{s} - s_i). \end{aligned} \tag{10}$$

Thus, the function x can be written as a function of $\hat{s}$ and s_i, only. Q.E.D.

Given the optimal choice of $\hat{s}$, there is one degree of freedom in choosing the corresponding values of L and D: Given $\hat{s}$, the seller can choose any $D \in [\hat{s}, \bar{t}]$. We can then solve for L using (9).

We can now describe the equilibrium bids if the seller arranged stapled finance with a cutoff signal $\hat{s}$. If $s_i > \hat{s}$, then the bids are not affected since the bidders plan to decline the stapled finance offer (they regard it as overpriced, given their valuation of the target firm). If, in contrast, $s_i < \hat{s}$, then the terms are attractive so the bid is increased by $x(s_i)$, the value of the option to accept the stapled finance. In particular, the bid is increased to what a bidder would bid if her signal were exactly $\hat{s}$:

$$\begin{aligned} b^D(s_i \mid s_i < \hat{s}) &= v(s_i) + x(s_i) \\ &= v(s_i) + x(s_i) - x(\hat{s}) \\ &= \varphi s_i + (1-\varphi)E[t_i] - \varphi s_i + \varphi\hat{s} \\ &= v(\hat{s}). \end{aligned} \tag{11}$$

Thus, with stapled finance, the equilibrium bids are

$$b^D(s_i) = \max\{v(s_i), v(\hat{s})\}. \tag{12}$$

IV. The Optimality of Arranging Stapled Finance

If the seller arranges stapled finance, then bidders with signal realizations $s_i < \hat{s}$ increase their bids to $v(\hat{s})$ to incorporate their valuation of the option to accept the stapled finance, whereas bidders with signal realizations $s_i > \hat{s}$ do not change their bids because they plan to decline the offer if they win (see (12)). To analyze the seller's optimization problem (when evaluating the benefits and costs of arranging stapled finance), it is helpful to distinguish four types of signal realizations, which we depict in Figure 2.

As we can see from Figure 2, the availability of stapled finance does not affect the outcome in Region D, where both signal realizations are above $\hat{S}$. Both bidders plan to decline the offer, so their bids are unchanged and in turn the seller's expected net payoff is unchanged.

The seller's expected net payoff is increased in Regions B and C of Figure 2. Here, one bidder realizes a signal above $\hat{s}$, while the other bidder realizes a signal below $\hat{s}$. Both with and without stapled finance, the bidder who realized

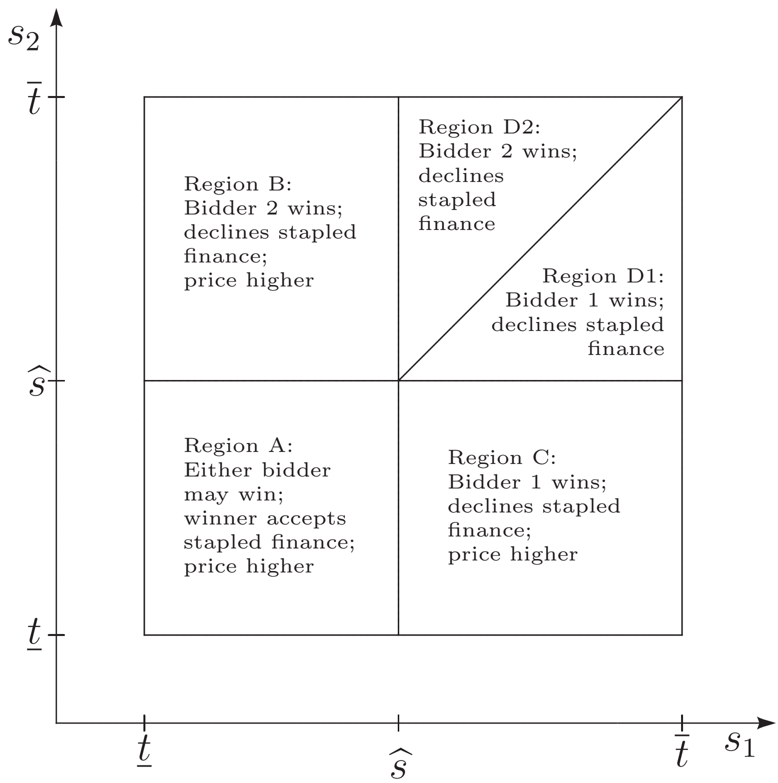

Figure 2. Auction outcomes with two financial buyers. The support of the bidders' signals s_1 and s_2 is $[\underline{t}, \bar{t}] \times [\underline{t}, \bar{t}]$. With a signal $\hat{s}$, a bidder's expected net benefit $x(s_i)$ from accepting stapled finance is equal to zero. This cutoff defines the four regions A, B, C, and D. A bidder with a signal $s_i < \hat{s}$ bids above her expected valuation of the target, which affects the outcome of the auction as described in the four regions.

a signal above $\hat{s}$ wins the auction (see (12)). However, if stapled finance is arranged, the bid of the losing bidder is $v(\hat{s})$ instead of $v(s_i) < v(\hat{s})$. The price the winner has to pay therefore increases from $v(s_i)$ to $v(\hat{s})$. This price increase is the only effect on the outcome, since the winner plans to decline the stapled finance offer. Thus, the seller clearly benefits from arranging stapled finance if the signal realizations are in Regions B or C.

The analysis is more involved in Region A of Figure 2, where both signal realizations are below $\hat{s}$. Arranging stapled finance has several effects. First, both bidders plan to accept the stapled finance if they win, so it is accepted with certainty. The lender thus expects a loss for all realizations in Region A, and the seller must compensate this expected loss when arranging the stapled finance.

Second, both bids equal $v(\hat{s})$, so a coin toss must determine the winner. This distorts the allocation since the winner is not necessarily the bidder with the higher valuation. Less value is created (in expected terms), which is bad for the seller, since it is her goal to extract as much value as possible from the bidders, and extracting value becomes harder if less value is being created to begin with.

Third, and offsetting the two earlier effects, the bidders both bid $v(\hat{s})$, that is, more than their valuation of the target firm alone. In fact, they compete away their entire rent. Since both bidders bid their entire valuation of winning, including the expected value of the stapled finance, and since both bidders bid the same amount, the winner's price equals her valuation.

The above discussion suggests that the bidders' rents are zero for signal realizations in Region A of Figure 2. The price paid is always $v(\hat{s})$ in Region A, but net of the compensation due to the lender, the seller's expected net payoff is equal to the winning bidder's valuation of the target firm alone (because for $s_i < \hat{s}$, we have $v(s_i) = v(\hat{s}) - x(s_i)$; see (11)). The seller's expected net payoff is therefore equal to the value created. If stapled finance is not arranged, the seller's expected net payoff is equal to the expected price, which equals the expected losing bid. Arranging stapled finance thus increases the seller's expected net payoff (for signal realizations in Region A) by

$$\begin{aligned} &E[v(s_i) \mid s_i < \hat{s}] - E[\min\{v(s_1), v(s_2)\} \mid s_1, s_2 < \hat{s}] \\ &\quad = \varphi E[s_i \mid s_i < \hat{s}] - \varphi E[\min\{s_1, s_2\} \mid s_1, s_2 < \hat{s}], \end{aligned} \tag{13}$$

which is strictly positive if $\hat{s} > \underline{t}$.

To summarize, the seller's expected net payoff *increase* is strictly positive in Regions A, B, and C of Figure 2, and is zero in Region D. We therefore conclude the following:

PROPOSITION 3: *The seller always strictly benefits from arranging stapled finance that is at least sometimes accepted (i.e., if L and D are chosen such that $\hat{s} > \underline{t}$).*

The arguments used to prove Proposition 3 rely on explicitly comparing net payoffs and allocations for all signal realizations. DeMarzo, Kremer, and Skrzypacz (2005) use the "linkage principle" to show that security-bid auctions are beneficial for sellers. We cannot use the same approach here, since, given a signal realization in Region A of Figure 2, the allocations with and without stapled finance are not the same with probability one. (With stapled finance, the bidder with the higher signal wins with probability one-half only.) Standard proofs using the linkage principle (see also Krishna (2002)) compare auctions that lead to identical allocations and therefore cannot be directly used to prove that arranging stapled finance is beneficial.

Stapled finance is beneficial for the seller because it allows her to play the bidders off against each other, increasing competition between them. The bidders are thus strictly worse off:

COROLLARY 1: *The availability of stapled finance reduces the bidders' expected net payoffs.*

Proof: The two financial buyers expect the same payoff before observing their signals. The sum of their payoffs and that of the seller equals the total value that is created. The total value creation is reduced (in Region A) by introducing stapled finance, but the seller's expected net payoff is increased. Consequently, the bidders' expected payoff must be lower. Q.E.D.

The financial buyers find themselves in a situation that resembles a prisoner's dilemma: They would prefer stapled finance not to be available, but once it is available their dominant strategy (with signal realizations $s_i < \hat{s}$) is to accept it. Notice that the winner of the bidding contest is not forced to accept the offer, since (by assumption) the bidders are not liquidity constrained. Instead, the bidders merely have the *option* to take advantage of the lender's offer, but the stapled finance package allows the seller to turn the financial buyers' opportunism against themselves.

It is instructive to compare stapled finance, a tool for increasing the seller's expected price, with an alternative tool, setting a reserve price. Offering stapled finance achieves a similar goal: high-signal bidders must pay a high price even if their rival has a very low signal realization. Unlike the case of a reserve price, however, the target firm is not permanently withdrawn from sale if the reserve price is not met (a commitment that is necessary for reserve prices to be effective). Instead, the target firm is sold and the two bidders compete away their rents (including the benefit they expect from the option to accept the stapled finance), so the seller's expected net payoff is positive instead of zero.

An important characteristic of stapled finance is that the value of the promised repayment to the lender depends on the winning bidder's private information. The benefits of state-contingency in extracting value from buyers have been analyzed previously, in different settings. Hansen (1985), Samuelson (1987), Crémer (1987), Riley (1988), Zheng (2001), Rhodes-Kropf and Viswanathan (2000, 2005), DeMarzo, Kremer, and Skrzypacz (2005), and Board (2007) assume that sellers can require bids in the form of a specific security, for example, royalties or debt owed to the seller by the winning bidder. They show that doing so is beneficial for the seller because it links the value of the payment (or bid) to the bidders' private information, and since bidders with higher value estimates are more likely to win, a state-contingent security is more attractive to the seller than an up-front cash payment.

To understand the linkage effect, it is useful to model auctions as a direct mechanism (see Myerson (1981)). In a direct mechanism, the bidders are asked to report their "type," that is, their signal s_i. Denote a bidder's report by s_i'. Depending on the vector of reports $\mathbf{s}'$, a bidder may win the auction and have to pay an amount $p_i(\mathbf{s}')$ to the seller. Notice that the outcome (which bidder wins, and the payment $p_i(\mathbf{s}')$) depends on the *reported* signals $\mathbf{s}'$ and not on the true signals. In equilibrium, however, the outcome does depend on the true signal, but only indirectly because usually the highest-signal bidder submits the highest bid.

Security auctions allow for a "linkage" between a bidder's true type and her payment if the security pays different amounts to its owner depending on the value that is eventually realized: The payment p_i now also depends on the true signal s_i. That holds for a variety of securities for which $p_i(\mathbf{s}', s_i)$ is increasing in s_i for some s_i, including debt. Security auctions thus create more competition between bidders because the value of their bid is more closely linked with their true valuation, and competition from lower-valuation bidders forces higher-valuation bidders to raise their bids.

DeMarzo, Kremer, and Skrzypacz (2005) provide the most general analysis of this type of auction. Comparing bids across different security types (e.g., cash and equity bids) is difficult, but if given the choice the sellers will always prefer the "steepest" security available: They prefer equity-bid auctions over debt-bid auctions over cash-bid auctions.[11] The reverse is true for the bidders: DeMarzo, Kremer, and Skrzypacz (2005) (see their Proposition 5) show that in "informal auctions," where the seller does not require bids in the form of a particular security, the bidders prefer participation in a cash-bids auction over a debt-bid auction over an equity-bid auction.

Our paper contributes to this literature in two ways. First, the seller in our setup does not *require* that bids be made in the form of a particular security. In particular, bidders are allowed to submit cash bids, which, according to DeMarzo, Kremer, and Skrzypacz, (2005) are their favorite type of bid. However, bidders in our setup choose *voluntarily* to accept the stapled finance that is on offer if they win, and thus they effectively submit a security bid (cash plus debt). Assuming that cash bids are always permitted seems realistic when modeling takeover negotiations because rejected bidders can always extend their offer directly to the target firm's shareholders, and the target firm's directors may be violating their fiduciary duties if they reject a cash offer that is attractive to the shareholders.

Allowing for cash bids makes our model different from the setup in DeMarzo, Kremer, and Skrzypacz (2005) in several respects. First, in our model the seller does not know whether the winner plans to accept the stapled finance. Therefore, a bidder's intentions to accept or decline the stapled finance cannot affect their chances of winning (except indirectly, through the amount being bid). Nevertheless, the seller benefits from "linkage," because the winner's price is linked to her valuation if she accepts the stapled finance. Similarly, the losing bidder's plan to accept or reject does not imply that the winner must make the same decision. Finally, our results do not rely on an up-front investment that the winner has to make, unlike DeMarzo, Kremer, and Skrzypacz (2005) (see Che and Kim (2008) for a discussion).

As we suggested in the introduction, a simple way to understand the intuition is to regard the option to accept the stapled finance as a subsidy that the seller offers to the winning bidder. The bidder's valuation of the subsidy depends on her valuation of the target: Higher valuations of the target are associated with lower valuations of the subsidy. Thus, low-valuation bidders increase their bids, since they are being subsidized. However, they are less likely to win than

[11] Equity bids refer to shares in the target, not in the combined firm that arises if the winning bidder merges with the target. For asymmetric information problems that arise in the latter case, see Brusco et al. (2007).

high-valuation bidders, so the only effect of the higher bids from low-valuation bidders may be that they are defeated even with a higher bid, which increases the winner's price. Our model's contribution is to show how linkage or security-bid features can be introduced into an auction even if the seller is not in a position to *require* security bids: The winning bidder may use debt to finance her bid, but this decision is made (if at all) after the auction has ended and a winner has been declared. Thus, the bidders submit cash bids, bidding only indirectly using debt.[12]

A second contribution of our paper is that we analyze an institutional setup that is frequently observed in practice. Stapled finance has been used in many countries (including the U.S.) for several years (see Section I, above), and our analysis explains what forces make this type of M&A financing beneficial for sellers.

Corollary 1 describes the main benefit of arranging stapled finance, namely, the reduction in the bidders' expected net payoffs. This is possible, as we just discussed, because the seller can link the value of a bid with that bidder's valuation. The main drawback of stapled finance is that less value is created because the bidder with the highest valuation is not necessarily the winner. Reduced value creation is bad for the seller because there is less value that can be extracted from the bidders. Furthermore, if the winning bidder accepts the stapled finance, this causes a loss to the lender, so the seller needs to compensate the lender when asking her to arrange the stapled finance, to offset the expected loss from making it available.

Trading off these benefits and costs determines the optimal design of the stapled finance package. Proposition 3 shows that such a package always exists. We now show that under mild conditions on the distribution function f, the problem has a unique solution.

PROPOSITION 4: *If f is log-concave, then there exists a unique optimal value of $\hat{s} > \underline{t}$. It is the value of $\hat{s}$ that solves*

$$2(1 - F(\hat{s}))F(\hat{s}) = f(\hat{s}) \int_{\underline{t}}^{\hat{s}} F(s_i)\, ds_i. \tag{14}$$

Proof: See the Appendix. Q.E.D.

The log-concavity assumption is sufficient but not necessary for the uniqueness of an optimum. Log-concavity is satisfied by most commonly used distribution functions (see Bagnoli and Bergstrom (1989) and An (1998)). We can show that even with $N > 2$ bidders, the optimal $\hat{s}$ is unique and lies in the interior of the support if f is log-concave. Moreover, we can show that the optimal $\hat{s}$ is decreasing in the number of bidders. This result is not only important from a normative point of view, but it also allows us to compare the predictions of our

[12] Notice that the subsidy needs to be designed carefully. A flat subsidy, say a winning award with a fixed value, does not achieve anything for the seller, and as we show, a wrongly designed stapled finance package can reduce the seller's expected payoff when facing a trade buyer and a financial buyer (see Section IA.V of the Internet Appendix for details).

model with those from other informal explanations of stapled finance. (See the next section and Section IA.III of the Internet Appendix for details.)

V. Alternative Explanations

With the exception of Boone and Mulherin (2008), stapled finance has not been previously studied in academic work, so there are no well-developed alternative explanations for the popularity of this type of M&A financing. However, practitioners and journalists have described some of the benefits that sellers enjoy when arranging stapled finance. We now discuss these benefits and how our predictions differ from those that a more formal treatment of the practitioner explanations would deliver.

Practitioners emphasize that various transaction costs are reduced when stapled finance is arranged. For example, the bidders may be required to base their first-round indicative bids on leverage assumptions implied by the stapled finance, thereby saving due diligence costs. This benefits the seller because reduced bidding costs attract more bidders, thereby enhancing competition. Another benefit for the seller is that if first-round indicative bids are required to base financial assumptions on the stapled finance, then less information may be inadvertently disclosed to competitors.[13] Similarly, with a loan commitment available to any bidder, the chances are reduced that a deal will fall through simply because sufficient financing could not be lined up; this clearly benefits the seller, whose aim is not only to raise the highest price, but also to complete the deal.

We now discuss these (and other) alternative explanations, and how the predictions that follow from these informal explanations can be distinguished from the predictions that our model makes. Note that formalizing the alternative explanations requires the use of models that do not allow for the bidding effects that we analyze (since otherwise the effects cannot be isolated). The bidding effects are eliminated if all bidders value the option to accept stapled finance equally. That can be achieved either by removing the limited liability that financial buyers enjoy (see our discussion of trade buyers below, in Section VI), or by assuming that the bidders' valuations are identical and common knowledge. In either type of model, the stapled finance offer provides equal benefits to all bidders.

Consider one important implication of our model, that the stapled finance is accepted by low-valuation bidders only. In an alternative model based on transaction costs, and absent the bidding effects, all bidders benefit equally from the stapled finance offer. Therefore, the acceptance or rejection decision should not depend on the winner's valuation of the target. This has some direct empirical implications.

One frequently measured variable around takeover contests is the bid premium. For example, if the target is a listed company, one can compare the

[13] In fact, worries about information leaks often lead sellers to instruct their advisory investment bank not to share the stapled finance terms with the target's competitors.

winner's bid with the 52-week high price of the target. Our model predicts that acceptance of stapled finance should be more likely for lower bid premia and less likely for high bid premia. In contrast, if stapled finance is offered merely to reduce transaction costs, the bid premium should not have any explanatory power.

Another variable of interest is the long-term operating performance of the target after the takeover. If the target remains at least partly publicly traded, this should be easy to measure. If not, then using plant-level data, it may be possible to measure the profitability or productivity of its operations (following the methodology in Maksimovic and Phillips (2002)). If the winning bidder is a PE fund that does not disclose any information, then post-takeover performance information can only be gained at the time of a re-listing of the target (IPOs are common exit routes for PE funds) or at the time of a secondary (or tertiary, etc.) buyout (a sale to another buyout fund, another common exit route). Our model predicts that the target's post-takeover performance should be lower if the winning bidder accepts the stapled finance (since only low-valuation bidders accept it), while it should be higher if stapled finance was available but is declined. In contrast, if stapled finance is arranged only to reduce transaction costs, then the acceptance or rejection decision should not have any relation to the target's subsequent operating performance.

A third variable of interest is the abnormal return that a target's stock experiences around the time of a deal announcement (this is a variable used in event studies). If investors understand the bidding effects, then our model predicts that—since investors can predict the target's future performance—the cumulative abnormal return for a bidder should be lower if investors expect her to accept the stapled finance and higher if investors expect her to decline the offer. In contrast, if stapled finance is arranged only to reduce transaction costs, then the expected acceptance or rejection decision should not have any relation to the abnormal returns.

Empiricists can also study abnormal returns at the time when information about the first round of indicative bids is revealed to the public. If investors hear that stapled finance is being offered, then all bidders should experience abnormal returns that are lower than the abnormal returns they experience in auctions without stapled finance. This is because the availability of stapled finance enhances the competition between the bidders, whose rents are reduced. In contrast, if stapled finance is arranged only to reduce transaction costs, then its availability should not affect the bidders' share prices. In fact, if the bidders benefit from the reduction in transaction costs, then the abnormal returns may even be positive (compared with announcements of first-round bids without stapled finance).

Another variable that is used frequently by empiricists is the number of bidders participating in a takeover contest (see Boone and Mulherin (2007)). In Section VI, we discuss the results of an extended model that allows for $N > 2$ bidders. As before, it is always optimal for the seller to arrange stapled finance. We also show that the optimal stapled finance package becomes less "aggressive" as N increases: the cutoff $\hat{s}$ decreases (see Section IA.III of the Internet Appendix for details). Thus, as N increases, the probability that the stapled finance is accepted decreases, for two reasons: First, it becomes unattractive for some bidders with signal realizations close to $\hat{s}$; and second, the probability that the two highest signals are below $\hat{s}$ decreases. In contrast, consider a model based on transaction costs. For example, bidders may have to expend resources to perform due diligence on the possible financial structure of an acquisition. By arranging stapled finance, this duplication of effort can be avoided and more bidders can be induced to participate in the auction. Such a model also predicts that the seller benefits from arranging stapled finance (she benefits from increased competition). However, the probability of acceptance of the stapled finance may not depend on the number of bidders, or it may even increase, contrary to our model's prediction. (It may increase if the additional bidders are less experienced and have difficulties financing the acquisition if they win.) Similarly, an increasing number of bidders increases the chances of information leakages to the target's competitors, so arranging stapled finance becomes more beneficial because the seller can limit the information that is made available to the bidders.

Practitioners also emphasize how, by arranging stapled finance, the seller can make sure that a deal will not fall apart just because the winning bidder could not arrange the required financing. If this is the reason for arranging stapled finance, then it must be particularly beneficial (and hence more likely to be offered) in industries that experience fast-changing competitive or technological environments, or other sources of uncertainty that may change the winning bidder's appreciation of a deal before it is completed. Similarly, deals that are complex and therefore take longer to execute are exposed to a higher risk of not being completed. In contrast, while different degrees of uncertainty affect the aggressiveness of the stapled finance that the seller should offer, it does not change the result that offering stapled finance is always optimal.

Notice that we are not claiming that the alternative explanations above are not valid. Rather, our aim is to provide a novel explanation that goes beyond mere transaction-cost arguments and yields a richer set of cross-sectional predictions. Both our model's explanations and the existing practitioner explanations seem plausible and complementary. Empirically testing the relative importance of the different explanations is left for future research. However, given the many benefits that sellers enjoy when arranging stapled finance, it should not be surprising that this tool became popular in a very short period of time.

VI. Robustness

In prior sections we use a simple model to derive the optimality of stapled financing. In this section, we discuss how the model can be changed and extended in various directions. Specifically, we discuss alternative auction models (the first-price auction), different valuation models (a pure common values model, and a model with a smoother valuation function), setups with more than two bidders, and a setup in which one bidder is a trade buyer (who does not value the option to default inherent in a stapled financing package). Our results extend to all of these setups: The seller always benefits from arranging stapled finance.

As we argue earlier, in our main model we choose the ascending auction setup because of its realism and because it is easy to analyze. Now consider a first-price auction instead: The bidder who submitted the highest bid wins and she pays her own bid to the seller; ties are resolved with a coin toss. As before, the decision of whether to accept or decline the stapled finance offer is made after the winner's identity and the price to be paid have been declared. At this stage, the decision depends only on the bidder's signal s_i, the loan amount L, and the face value of the loan D. In fact, our analysis above remains valid, and we can use the same cutoff signal $\hat{s}$. It is straightforward to confirm that the following bidding functions form a Nash equilibrium:[14]

$$b_{FPA}(s_i) = \varphi E\left[\max\{s, \hat{s}\} \mid s < s_i\right] + (1 - \varphi)E[t]. \tag{15}$$

As before, the bidders compete away their rents if their signal realizations are below $\hat{s}$. This increased competition feeds competition with higher signals, and high-signal bidders (with signals above $\hat{s}$) shade their bids to a smaller extent.

The outcome of the first-price auction is quite similar to that of the ascending auction: The bids are constant for all $s_i < \hat{s}$, a coin toss determines the winner if both signals are below $\hat{s}$, and the allocation is not affected if at least one signal is above $\hat{s}$. In both auction setups, a bidder with a signal $s_i < \hat{s}$ expects a zero payoff, and the allocation is identical. Thus, using the arguments in Myerson (1981), it follows that the seller's expected price is exactly the same as in the ascending auction. (The same holds for other auctions that generate the same allocation and give bidders with a signal $s_i = \underline{t}$ a zero expected net payoff.)

Now suppose that we use a common values setup instead of a private values setup, that is, all bidders value the target firm equally, and each bidder privately receives some independent information about this value. Common values would not allow for the possibility of bidder-specific synergies with the target firm, which may be a reasonable assumption if the target firm is not unique. The seller's problem is simplified because allocative distortions do not destroy value if all bidders value the target firm equally. But the bidders must worry about the winner's curse. The rival's signal affects the expected value of both the target firm and the stapled finance offer, and the winning bidder must estimate the losing bidder's signal before deciding whether to accept the stapled finance. Just like in the setup with private values, the equilibrium bidding strategy is constant for low signal realizations and increasing for high signal realizations, and the seller benefits from any stapled finance package that is accepted with positive probability.[15]

We also analyze a setup with more than two bidders. The proofs are somewhat more involved, but a few mild assumptions on the distribution of the signals are sufficient to derive the same result, that the seller always benefits from

[14] For details, see Section IA.II of the Internet Appendix.

[15] Again, details are available in Section IA.I of the Internet Appendix.

arranging stapled finance. The new assumptions are that f is log-concave (see An (1998)) and that the density is strictly positive on the entire support $[\underline{t}, \bar{t}]$. The proofs are provided in Section IA.III of the Internet Appendix.

We provide both a direct proof and an indirect proof that relies on an intuitive argument using reserve prices. If the seller's valuation is equal to the lowest possible valuation by the bidders (that is, with a signal realization $\underline{t}$), then log-concavity of f implies that the seller always benefits from setting a reserve price. The analysis can be based on Figure 2: If $\hat{s}$ describes both the cutoff for accepting stapled finance and the signal that makes the reserve price binding, then in Regions B, C, and D the two rent extraction tools are equivalent (they have no effect in Region D, and in Regions B and C the winner's price is increased). In Region A, the reserve price is higher than both bids, so the target is not sold and the seller realizes only her own valuation; with stapled finance, in contrast, the target is sold to one of the bidders, whose valuation is higher than the seller's, so the seller can realize this valuation because the bidders compete away their rents in Region A. Therefore, if it is beneficial for the seller to post a reserve price, it must be even more beneficial to arrange stapled finance.

Another robustness check concerns the information "technology." In our model the true valuation depends either on an unobserved signal or on the winning bidder's signal, which simplifies the analysis. But we can derive the same results using a smoother information structure. More precisely, we analyze a model in which the realized valuation depends continuously on both the winning bidder's signal and an unobserved random variable. As before, the seller always benefits from arranging stapled finance. (For details, see Section IA.IV of the Internet Appendix.)

Finally, in practice takeover contests include trade buyers (or strategic buyers) too, not just financial buyers. Trade buyers are interested in synergies that can be realized after incorporating the target's operations and assets into their other operations, for example, if the bidder is a competitor, a supplier, or a customer of the target. This is important in our setup because, after incorporating the target, it is difficult to distinguish the cash flows and assets of the target from the bidder's other operations. So the existing cash flows and assets would also support the debt if the bidder accepted the stapled finance, thereby reducing or eliminating the strategic benefits of limited liability that a financial buyer enjoys. We analyze a model with one trade buyer and one financial buyer in Section IA.V of the Internet Appendix. As before, the seller always benefits from arranging stapled finance, whose terms are optimally set such that a trade buyer always declines the offer. Not surprisingly, the seller's benefit of arranging stapled finance is smaller than when facing two financial buyers. The optimal stapled financing package is less aggressive, that is, the cutoff $\hat{s}$ is lower. However, the seller can improve her expected payoff by also setting a reserve price. Finally, the trade buyer's ex ante expected net payoff is reduced when stapled finance is offered: Her chances of winning are reduced, and if she wins her price may be higher. In contrast, the financial buyer's ex ante expected net payoff is increased: Her chances of winning increase, and she may benefit from the stapled finance. (These results may explain why trade buyers appear to overpay in takeover contests when competing with financial buyers; see Bargeron et al. (2008).)

VII. Conclusion

In this paper, we present a novel explanation for the benefits that accrue to sellers in M&A situations if they arrange stapled financing for the eventual buyer. Practitioners have described the benefits as savings in transaction costs, but as we show, there is more to it. Specifically, stapled finance affects the competition among the bidders in a takeover contest by strengthening the position of the weaker bidders, who become stronger competitors and thus force up the price that the eventual winner expects to pay. This can distort the allocation. Further, the lender of the stapled finance expects a loss on the loan, so she requires compensation from the seller. Nevertheless, the beneficial effect coming from increased competition more than compensates for these drawbacks, and the seller always benefits from arranging stapled finance.

We use a simple auction model to derive our results. This model has the benefit of being tractable, and it illustrates the intuition in a simple way. However, the results are quite robust. We show that the seller benefits from arranging stapled finance even if we relax various assumptions to generalize the model.

Our results are consistent with recent theoretical results on auctions using security bids. Our key theoretical contribution lies in showing that a seller can make bidders compete more aggressively simply by offering an option that some bidders find valuable and other bidders find worthless. Ex ante, the seller benefits from arranging stapled finance, and the bidders are made worse off because the bidders find themselves in a situation that resembles a prisoner's dilemma. Individually, they may benefit from accepting the option; but since they compete for the right to accept it, overall the bidders are worse off. Our model therefore predicts that the bidders should prefer that stapled finance never be offered, even though they sometimes (ex post) accept it and benefit from it.

Ours is the first academic analysis of an institutional arrangement—stapled finance—that has become popular very quickly in practice. As discussed earlier, investment banks started offering stapled finance only a few years ago. Initially, the intention may well have been to save transaction costs for the seller (the idea may have developed from the practice of frequently offering bridge financing in M&A transactions). However, as we have shown, other forces may have been responsible for its growth in popularity, forces that are understood only by formally analyzing the bidding incentives in the presence of stapled finance.

Judging the relative importance of the different explanations is left for future empirical work. We discuss here the elements that are needed for stapled finance to make bidding more competitive: It should be optional for the winner; it should be non-recourse; and some bidders should be financial buyers. We also discuss what predictions can be drawn from our model, and how these differ from predictions that transaction cost–based models (once formalized) may deliver. Importantly, our model predicts that, by design, stapled finance loans must perform poorly during their lifetime—worse than other loans used to finance M&A transactions. It also predicts that if the stapled finance is accepted by the winner, then the target firm should be expected to perform worse (say, in terms of profitability or productivity) than similar targets whose acquisitions were not financed using stapled finance. Given these predictions, over the next few years it will be interesting to track the performance of acquisitions that used stapled finance and of the stapled finance packages themselves.

Appendix: Proofs

Proof of Proposition 4: The seller's expected net payoff *increase* from arranging stapled finance equals the sum of the expected net payoff increases in the four regions of Figure 2. These four net payoff increases are

$$\begin{cases} \varphi\left(E[s_i \mid s_i < \hat{s}] - E[\min\{s_i, s_j\} \mid s_i, s_j < \hat{s}]\right) & \text{Region A} \\ \varphi(\hat{s} - E[s_i \mid s_i < \hat{s}]) & \text{Regions B and C} \\ 0 & \text{Region D.} \end{cases} \tag{A1}$$

For Region A, the expected net payoff increase is given in (13). For Regions B and C, the expected net payoff increase equals

$$\begin{aligned} & v(\hat{s}) - E[v(s_i) \mid s_i < \hat{s}] \\ & \quad = \varphi\hat{s} - \varphi E[s_i \mid s_i < \hat{s}]. \end{aligned} \tag{A2}$$

In Region D, the availability of stapled finance does not change the outcome. Let $\Delta\Pi$ denote the increase in the seller's expected net payoff if she decides to arrange stapled finance. This increase is equal to the sum of the probability-weighted expected net payoff increases in the four regions that we just calculated, that is,

$$\begin{aligned} \Delta\Pi = & \Pr\{A\}\varphi\left(E[s_i \mid s_i < \hat{s}] - E[\min\{s_i, s_j\} \mid s_i, s_j < \hat{s}]\right) \\ & + \Pr\{B \cup C\}\varphi(\hat{s} - E[s_i \mid s_i < \hat{s}]). \end{aligned} \tag{A3}$$

Substitute $\Pr\{A\}$ by $(F(\hat{s}))^2$, and $\Pr\{B\}$ and $\Pr\{C\}$ by $F(\hat{s})(1 - F(\hat{s}))$. After partial integration of both summands in (A3), we can rewrite (A3) as

$$\Delta\Pi = \varphi \int_{\underline{t}}^{\hat{s}} \int_{\underline{t}}^{s_i} F(s_j)\, ds_j\, f(s_i)\, ds_i + 2(1 - F(\hat{s}))\varphi \int_{\underline{t}}^{\hat{s}} F(s_i)\, ds_i. \tag{A4}$$

The first-order condition is

$$\frac{\partial}{\partial \hat{s}} \Delta\Pi = 2\varphi(1 - F(\hat{s}))F(\hat{s}) - \varphi f(\hat{s}) \int_{\underline{t}}^{\hat{s}} F(s_i)\, ds_i. \tag{A5}$$

Evaluated at $\hat{s} = \underline{t}$, the first-order condition is equal to zero. Evaluated at $\hat{s} = \overline{t}$, it is non-positive. Proposition 3 shows that choosing any $\hat{s} > \underline{t}$ is beneficial. Therefore, an interior optimum must exist. Rewrite (A5) as

$$2\frac{1 - F(\hat{s})}{f(\hat{s})} - \frac{\displaystyle\int_{\underline{t}}^{\hat{s}} F(s_i)\,ds_i}{F(\hat{s})} = 0. \tag{A6}$$

We now show that the first term in (A6) is decreasing in $\hat{s}$, and the second term is increasing in $\hat{s}$, which implies that the FOC can be satisfied (the two terms are equal) for only one value of $\hat{s} > \underline{t}$. The first term is decreasing if and only if

$$\frac{\partial}{\partial \hat{s}} \frac{f(\hat{s})}{1 - F(\hat{s})} > 0 \tag{A7}$$

$$\iff \frac{\dfrac{\partial f(\hat{s})}{\partial \hat{s}}(1 - F(\hat{s})) + f(\hat{s})f(\hat{s})}{[1 - F(\hat{s})]^2} > 0 \tag{A8}$$

$$\iff -\frac{\left[\dfrac{\partial^2}{\partial \hat{s}^2}\left(1 - F(\hat{s})\right)\right]\left(1 - F(\hat{s})\right) - \left[\dfrac{\partial}{\partial \hat{s}}\left(1 - F(\hat{s})\right)\right]\left[\dfrac{\partial}{\partial \hat{s}}(1 - F(\hat{s}))\right]}{[1 - F(\hat{s})]^2} > 0, \tag{A9}$$

which is satisfied because the log-concavity of f implies that $(1 - F)$ is also log-concave (see An (1998)). Next,

$$\frac{\partial}{\partial \hat{s}} \frac{\displaystyle\int_{\underline{t}}^{\hat{s}} F(s_i)\,ds_i}{F(\hat{s})} = \frac{F(\hat{s})F(\hat{s}) - f(\hat{s})\displaystyle\int_{\underline{t}}^{\hat{s}} F(s_i)\,ds_i}{[F(\hat{s})]^2}, \tag{A10}$$

which is positive since F and $\int_{\underline{t}}^{\hat{s}} F(s_i)\,ds_i$ are log-concave because f is log-concave (see An (1998)). Q.E.D.

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