

# Getting to Know Each Other: The Role of Toeholds in Acquisitions

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# Getting to Know Each Other: The Role of Toeholds in Acquisitions

## Abstract

We analyze the role of toeholds (non-controlling but significant equity stakes) in a takeover target. Our focus is on a toehold as a source of information for a bidder, providing an opportunity to interact with the target and its management and in the process get a sense of the possible synergies from a merger or takeover. We analyze a model of competitive bidding, in which one bidder has a toehold and is therefore better informed about possible synergies. We find that toeholds are more beneficial for bidders that are considering a full takeover of a target if they find it harder to value potential synergies with the target. Toeholds are also more beneficial if a bidder initially finds it harder than others to assess the value of potential synergies. That incremental benefit is less important, however, if the target is opaque. Finally, the benefits are smaller if the number of potential rival bidders is higher. We test the predictions of the model using a large sample of majority acquisitions of private and public companies for which we have information regarding whether the acquirer had a toehold in the target company prior to the majority acquisition. We find evidence consistent with our hypotheses, and thus with the idea that toeholds improve a bidder's information about possible synergies with the target.

Keywords: *Mergers & Acquisitions; Takeovers; Toeholds; Auctions*

JEL codes: *G34, G24, G32, D44*

# 1 Introduction

The main threat to the successful execution of a takeover or merger is that synergies expected from a combination are not realized. Targets and acquirers hope to realize synergies from combining operations or distribution networks, because of complementarities, economies of scale and scope, market power, or because of overlaps that can be eliminated. Synergies are also expected from increased bargaining power when negotiating with upstream firms. Predicting the value of synergies is far from trivial. Acquisitions are therefore high-risk decisions, and potential acquirers would benefit from being able to improve estimates of possible synergies.

In this paper, we study the use of toeholds to improve the assessment of possible synergies. Toeholds are non-controlling equity stakes (less than 50% of the outstanding equity of the target), which can give their owner the opportunity to interact with the target or its management in ways that are not available to other bidders. For example, a toehold may have the right to nominate a director on the target's board, helping her get a better sense of the target's operations and management. A toehold may also cooperate with the target on the development of a product, or they may combine parts of their distribution networks. After cooperating for a while, the parties should find it easier to tell whether a full combination promises significant synergies, or whether the prospects are bad and a combination should not be attempted.

We propose a simple model of competitive bidding in which a potential acquirer can make her estimate of the possible synergies from an acquisition more reliable by first taking a toehold in the target. We study under what conditions a potential acquirer, considering a full takeover of the target, benefits most from having a toehold. We test the predictions of the model using a large sample of majority acquisitions of private and public companies for which we have information regarding whether the acquirer had a toehold in the target company prior to the majority acquisition. To the extent that toeholds are more beneficial for potential acquirers, we should also observe a higher proportion of acquirers having a toehold prior to a takeover.

The key assumption in our paper is that toeholds give their owners more reliable information about possible synergies with a target. An initial inspection of our data suggests that the basic conditions for a toehold to improve information are satisfied: toeholds are large — the average toehold in our sample is 27% — and they are held for fairly long periods of time (75% of the toeholds are held for at least 8 months prior to the majority acquisition).

We derive and test several results. Our first result is very intuitive: Toeholds are more beneficial

if it is hard to value the possible synergies from an acquisition. For example, when targets are more opaque and thus generally harder to analyze for outsiders. Consistent with this prediction, we find that acquisitions are more likely to be preceded by toeholds if the target is younger and when it operates in an R&D-intensive industry.

Our second result concerns situations in which a potential acquirer is initially at a disadvantage, because her information about possible synergies with the target is less precise than other potential acquirers' information. We show that the benefit of acquiring a toehold prior to a takeover attempt is higher for such a disadvantaged bidder. The data supports this prediction. We find that acquirers operating in different industries or originating from other countries than the target are more likely to have a toehold.

Next, we ask how sensitive a disadvantaged bidder's benefit from a toehold is to the opaqueness of the target. We find that although a less well-informed bidder benefits more from a toehold, the benefit is relatively less important when the target company is opaque. The intuition is that the initial disadvantage of the bidder is less important when the target becomes harder to evaluate for other bidders. Consistent with this prediction, we find that the likelihood that an acquirer from another country and other industry than the target has a toehold decreases when the target is younger and operates in an R&D-intensive industry.

We also consider how the intensity of competition affects our results. We find that the benefits of having a toehold are less important when there are more potential bidders. Intuitively, it is harder to exploit the benefits of more accurate information in a bidding contest, when the number of competitors is larger. We use two measures to test this prediction empirically. First, we construct a measure of potential number of bidders, using data on past acquisitions, both within an industry and across industries, and the number of public companies that operate in each industry. We use the *potential* number of bidders and not the *realized* number of bidders, because the realized number of bidders is endogenous to the toehold decision and because there is no comprehensive source of information for the real number of interested bidders (see Boone and Mulherin (2007)). Our measure of the potential number of bidders tries to capture the fact that a target should attract more potential bidders if it operates in an industry with many companies, or if its industry has historically seen many acquirers from *other* industries with many companies. We also use the target's size as a proxy for the number of potential bidders: The larger a target, the smaller the number of potential bidders, since acquirers are usually larger than their targets. Using either

measure, the empirical evidence suggests that more competition makes it less likely that an acquirer has a toehold.

In our empirical analysis, we control for the ownership status (publicly traded vs. privately owned) of the target company. Not surprisingly, we find that private companies are less likely to be purchased sequentially (i.e., first a toehold and later on a full takeover). Simply for liquidity reasons, it is harder to obtain a minority equity stake in a private company. Nevertheless, if being private reflects opaqueness, we can test our theoretical prediction that the benefit of a toehold for an ex-ante less well-informed bidder is lower when the target is more opaque. Consistent with this prediction, we find that the likelihood that an acquirer from another country or another industry than the target has a toehold decreases when the target is private.

We also use the ownership status of the targets to test whether alternative explanations exist for our findings. Specifically, we test whether agency considerations can explain our results. Agency problems should be less of a concern in privately held firms, compared with publicly traded firms. Thus, if agency considerations were to explain the coefficients we find on the targets' characteristics, we should expect more significant coefficients for publicly traded firms in our regressions. We find, however, that the coefficients on the targets' characteristics tend to be larger for privately held firms. This suggests that informational concerns, and not agency considerations, are a more significant factor in the decision of taking a toehold.

Our theoretical and empirical results shed new light on the role of toeholds as “strategic stakes” in acquisitions. Most of the literature has focused on the role of toeholds in making a bidder more aggressive. In Burkart (1995) and Singh (1998), a toeholder bids higher because by forcing up the price at which she possibly loses the auction, she increases the price at which she will sell her shares if she does indeed lose. Their results are derived using auction models with perfectly informative signals.<sup>1</sup> Our focus is on the role of the information structure, which requires a model in which bidders are not perfectly informed about their valuation. However, we also allow for the strategic effect analyzed in the literature.

Later papers have focused on the size of the toehold that is acquired, trading off the benefits of a larger strategic effect (as described in Burkart (1995) and Singh (1998)) against various possible drawbacks: The cost of accumulating a large stake if markets are illiquid (Ravid and Spiegel

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<sup>1</sup> Bulow et al. (1999) derive similar results for common value auctions. For empirical tests of overbidding predictions, see Betton and Eckbo (2000). Mathews (2007) shows that this overbidding effect can be used to implement an optimal reserve price for a coalition between one bidder and a target. For a model in which bidders have equity stakes in other *bidders*, see Dasgupta and Tsui (2004).

(1999)); negative signals about the target that reduce the value of a toehold after failed negotiations (Goldman and Qian (2005)); or the possibility that entrenched managers resist a takeover and instead sell out to a “white knight” in a friendly deal (see Betton et al. (2009), who also test their results empirically). We treat the size of a toehold as exogenous in this paper, which allows us to focus on the information structure and how it changes if one bidder takes a toehold. Our aim is to study takeovers that are expected to product synergies, not “hostile” takeovers aimed at resolving agency problems (see, e.g., Shleifer and Vishny (1986)). Such toeholds are usually built up secretly but must be revealed in SEC or FTC filings if they exceed 5% or certain nominal values, usually triggering takeover resistance from the target. The toeholds we observe in our data tend to be much larger.

The importance of information acquisition for successful takeovers has been documented in Higgins and Rodriguez (2006), who study strategic alliances in the pharmaceutical industry and find that they improve an acquirer’s cumulative abnormal return (CAR) around acquisitions, and in Cai and Sevilir (2012), who find similar results if acquirers and targets have directors in common. These findings are consistent with our theoretical predictions and empirical evidence if toeholds (as we assume) allow their owners to get a better sense of possible synergies with a target.

Earlier papers on minority stakes have focused on their role in mitigating incentive problems: With an equity stake in a partner, the incentive to act opportunistically can be reduced. Allen and Phillips (2000) study cumulative abnormal returns (CAR) and changes in operating cash flow and investments of targets after a minority stake is taken. Fee et al. (2006) study equity stakes in upstream firms, allowing them to compare firm pairs with and without minority stakes. Ouimet (2011) compares minority stakes with full takeovers, arguing that full takeovers can create new incentive problems inside the target. The underlying assumption in these papers is that the optimally sized stake should be held indefinitely. In contrast, our focus is on toeholds that are meant to be temporary in nature: the final goal of a potential acquirer is either the full takeover of a target, or a disposal of the toehold.

The rest of the paper proceeds as follows. We present a model with two bidders in Section 2; we also derive the optimal bids and the expected equilibrium payoffs. In Section 3 we examine the benefits from taking a toehold, and we derive empirical implications. In Section 4 we consider the case of more than two bidders, and we ask how increased competition affects the benefits from a toehold. Section 5 describes the data used for our empirical tests. We present and discuss the

empirical findings in Section 6. Section 7 concludes.

## 2 The Model

In this section we introduce and analyze a simple model of competitive bidding to acquire a firm. One of the bidders can take a toehold before the bidding starts, making it easier for her to determine how beneficial the acquisition would be, and also changing her bidding incentives. We first present the model, then we describe the optimal bidding functions, which in turn allow us to describe the bidders' expected payoffs with different information structures. We use the payoffs in Section 3, where we ask under what circumstances a bidder finds it particularly beneficial to take a toehold before considering a full takeover of another firm.

A company (the “target”) is for sale, and the seller values the target at  $v_0$ . Two bidders,  $i = 1, 2$ , expect stochastic synergies  $t_i \in [\ell, h]$ ,  $\ell \geq 0$ , if they take over the target. For tractability, we assume that the synergies are uniformly distributed on  $[\ell, h]$ , with density  $\frac{1}{h-\ell}$  and expected value  $\frac{h+\ell}{2}$ . Bidder  $i$ 's true valuation depends on  $v_0$  (which is common knowledge) and her synergy with the target,  $t_i$ :

$$v_i(t_i) = v_0 + t_i.$$

Like many earlier papers in the takeovers literature (see, e.g., Fishman (1988), Burkart (1995), Singh (1998), Daniel and Hirshleifer (1998), and Ravid and Spiegel (1999)), we use a “private values” auction setup, i.e., we focus on “strategic” bidders, who hope to realize synergies that are idiosyncratic to each bidder.

The value of bidder  $i$ 's synergy  $t_i$  is not observable. Instead, bidder  $i$  privately observes a noisy signal  $s_i$ ,

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

where  $t_i$  and  $\tau_i$  are i.i.d., and  $\varphi_i \in [0, 1]$ . Given the realized signal  $s_i$ , bidder  $i$ 's expected valuation of the target is

$$v_i(s_i) = v_0 + \varphi_i s_i + (1 - \varphi_i) \frac{h+\ell}{2}.$$

The variable  $\varphi_i$  measures the informativeness of bidder  $i$ 's signal. The advantage of this specification is that changes in a signal's informativeness do not change the ex-ante riskiness of the bidder's

valuation: the ex-ante distribution of possible valuations is not affected by changes in  $\varphi_i$ .<sup>2</sup>

Bidder 1 has the opportunity to take a toehold in the target, i.e., to own a non-controlling fraction  $\alpha \in [0, \frac{1}{2}]$  of the target’s outstanding shares. We assume that the size of the toehold  $\alpha$  is exogenously given. That assumption allows us to focus on changes in the information structure, and it is also consistent with descriptions of cases in our data set: Toeholds become available when a firm needs a certain amount for investment purposes (“growth capital”), and issuing less shares would be useless while issuing more would represent an unnecessary dilution of the existing ownership. Similarly, toeholds sometimes become available because the current owner of a stake wants to liquidate it. Toeholds can also be built up by buying shares anonymously in the market, but in practice, “strategic buyers” (the focus of our empirical analysis) have refrained from doing that, possibly because it creates a counterproductive hostile atmosphere.

We assume that owning a toehold makes the toeholder’s signal more informative, i.e.,  $0 \leq \varphi_2 < \varphi_1 \leq 1$ . The underlying assumption is that the toehold has a significant size, such that the toeholder is one of the larger shareholders and therefore has access to information that would not be available otherwise.<sup>3</sup> Often, toehold acquisitions explicitly include the right to appoint a director. In other cases, toehold acquisitions are part of a plan to cooperate on some level, say, marketing the target’s or the toeholder’s products or services, giving both sides information about the promises of cooperation.<sup>4</sup> In many ways, we expect a toeholder to have access to information that helps her determine whether a combination with the target (a merger or an acquisition) would be beneficial or not. There may be large synergies, from cost-cutting (because of overlaps in production or marketing, say), from cross-selling, from access to new distribution channels, or from a realization that the two firms’ R&D efforts are highly complementary. If the toeholder’s interaction with the target suggests that significant synergies can be realized, the toeholder becomes a strong bidder. If she instead realizes that the potential for synergies is limited or inexistent, she will prefer to dispose of the toehold. One way to do so is to put the target “in play”, fail to put up resistance

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<sup>2</sup> Auction models with noisy valuations are relatively rare. Our information structure (private values, noisy signals) has been used in Povel and Singh (2010), to analyze stapled finance, i.e., optional seller financing in takeovers.

<sup>3</sup> That is consistent with what we observe in the data: as mentioned in the Introduction, the average toehold size is 27% (see below, in Section 5).

<sup>4</sup> Here are a few examples: (1) In 2009 *Standard Microsystems Corp. (SMSC)* provided growth capital for *Symwave Inc.* The president of *SMSC* joined *Symwave*’s board of directors; the majority acquisition was 15 months later. (2) In 2009 *Meredith Corp.* acquired a minority equity stake in *The Hyperfactory*; the parties agreed that *The Hyperfactory* would work with *Meredith*’s integrated marketing unit; the majority acquisition happened 1 year later. (3) In 2010 *Kinross Gold Corporation* made a PIPE investment in *Red Back Mining*; *Kinross* had the right to appoint one director; the majority acquisition happened 3 months later.

when other bidders show interest, and then lose the bidding contest.

Of course, a toehold needs time to discover information about the promises of an acquisition. While having a significant stake may give a shareholder access to confidential data, the synergies we have in mind require information of a softer nature: The firms need to cooperate for a while to find out how successful their cooperation is, for example. We thus expect that the *informational* benefits from a toehold accrue with a delay. That is not the case for the purely strategic effects emphasized in the literature: A bidder's incentives are changed immediately upon becoming the owner of a toehold. The empirical evidence we discuss below (in Section 5) supports our emphasis on the informational benefits, since the median delay between taking a toehold and the majority acquisition is 15 months (the 25th percentile is 8 months; similar findings are reported in Betton et al. (2009)).

After the bidders observe their signals, the target is sold in a second-price sealed-bid auction. If the toehold wins, she purchases the shares she does not yet own at a price that equals the second-highest (losing) bid. If the non-toehold wins, she buys all shares, including the toehold's. Ties are resolved in favor of the non-toehold (this is without loss of generality but simplifies the analysis).<sup>5</sup> The second-price sealed-bid auction has several benefits: it is easy to analyze (non-toeholders have dominant strategies), and in our private values setup, it is strategically equivalent to an ascending auction, in which bids are publicly raised until all but one bidder have withdrawn from the bidding. While takeover auctions often have more complicated structures, in practice, bidders can usually top any existing bid, and the current legal practice requires that a target's directors permit and consider unsolicited bids. In other words, for all practical purposes, takeover contests resemble ascending auctions, which can be analyzed using the language of second-price sealed-bid auctions.

In the following, we derive first the optimal bids, and based on that, the payoffs that the bidders can expect in different setups: with a toehold or without, and with both bidders equally well informed, or one of them better (or less well) informed. The aim is to determine under what conditions a bidder's expected payoff is higher with a toehold than without. After identifying the factors that make toeholds attractive, we develop testable implications, which we put to the data in Section 6.

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<sup>5</sup> Without this assumption, the toehold would sometimes prefer to bid an infinitesimal amount less than the equilibrium bids derived below, which requires that we introduce discrete currency units.

## 2.1 Optimal Bids

Bidders without a toehold have a dominant strategy:

**Lemma 1** *Without a toehold, it is a weakly dominant strategy to bid the valuation, given the observed signal.*

**Proof.** For the non-toeholder (bidder 2), bidding strictly less than her valuation is dominated by bidding her valuation. If she wins either way or loses either way, the payoff is unaffected. But she would be strictly worse off if she lost with the lower bid, since with a slightly higher bid she could have bought all shares at a price below her valuation, instead of losing. Bidding higher is a dominated strategy, too: If doing so makes her win, she will have overpaid; and if she loses, her payoff is unchanged. ■

Bidder 2's equilibrium bid is strictly increasing in her signal. Define the inverse to her bid function,

$$\beta_2(b) = \frac{b - v_0 - (1 - \varphi_2)\frac{h+\ell}{2}}{\varphi_2} \text{ if } b \in [v_2(\ell), v_2(h)].$$

The toeholder's bids should be more dispersed, since her signal is more informative:  $\varphi_2 < \varphi_1$  implies that  $v_1(\ell) < v_2(\ell) \leq \frac{h+\ell}{2} \leq v_2(h) < v_1(h)$ . The toeholder's valuation (with a signal  $s_1$ ) equals the nontoeholder's valuation with a signal  $s_2$  if  $s_1 = \sigma_1(s_2)$ ,

$$\sigma_1(s_2) = \frac{\varphi_2}{\varphi_1} s_2 + \frac{\varphi_1 - \varphi_2}{\varphi_1} \frac{h + \ell}{2}.$$

That creates a need for case distinctions, but it also allows for realistic problems: With a low signal, the toeholder is unlikely to win, since her less well-informed rival's expected valuation is likely to be higher than hers. On the other hand, with a high signal, the toeholder's valuation is willing to bid higher than the rival, and she wins with a high probability.

**Lemma 2** *Define  $\hat{s}_1 = \sigma_1(\ell - \alpha(h - \ell))$ . The function*

$$b_1^*(s_1) = \begin{cases} v_2(\ell) & \text{if } s_1 \leq \hat{s}_1 \\ v_1(s_1) + \frac{\alpha}{1+\alpha} (v_2(h) - v_1(s_1)) & \text{if } \hat{s}_1 < s_1 \leq \sigma_1(h) \\ v_1(s_1) & \text{if } \sigma_1(h) \leq s_1 \end{cases}$$

*describes optimal bids for the toeholder, given signals  $s_1$ .*

**Proof.** Bidder 1's probability of winning is zero with any bid  $b_1 \leq v_2(\ell)$ , so it is optimal to bid at least  $v_2(\ell)$ , to maximize the price she will receive for her shares if she loses. If  $s_1 > \sigma_1(h)$ , then the toeholder's valuation is higher than that of the nontoeholder, and it is optimal to bid the valuation,  $v_1(s_1)$ . With lower signals, the optimal bid is determined by a trade-off between the expected payoffs from winning and from losing (the stake  $\alpha$  is sold to the winner). The optimal bid lies in the interval  $[v_2(\ell), v_2(h)]$ . The objective function is

$$\max_{b_1} \int_{\ell}^{\beta_2(b_1)} \left( v_1(s_1) - (1 - \alpha)v_2(s_2) \right) \frac{1}{h-\ell} ds_2 + \int_{\beta_2(b_1)}^h \alpha b_1 \frac{1}{h-\ell} ds_2.$$

The F.O.C. is

$$0 = \left( v_1(s_1) - (1 - \alpha)v_2(\beta_2(b_1)) \right) \frac{1}{h-\ell} \frac{1}{\varphi_2} + \int_{\beta_2(b_1)}^h \alpha \frac{1}{h-\ell} ds_2 - \alpha b_1 \frac{1}{h-\ell} \frac{1}{\varphi_2}$$

(It is easily verified that the S.O.C. is satisfied.) Rearrange, and replace  $v_2(\beta_2(b_1)) = b_1$ ,

$$\begin{aligned} (b_1 - v_1(s_1)) \frac{1}{h-\ell} \frac{1}{\varphi_2} &= \alpha \frac{h - \beta_2(b_1)}{h-\ell} \\ (b_1 - v_1(s_1)) \frac{1}{\varphi_2} &= \alpha \left( h - \frac{b_1 - v_0 - (1 - \varphi_2) \frac{h+\ell}{2}}{\varphi_2} \right) \\ b_1 &= v_1(s_1) + \frac{\alpha}{1 + \alpha} (v_2(h) - v_1(s_1)) \end{aligned}$$

This function is continuous at  $s_1 = \sigma_1(h)$ : since  $v_1(\sigma_1(h)) = v_2(h)$ , we must have  $v_1(\sigma_1(h)) + \frac{\alpha}{1+\alpha} (v_2(h) - v_1(\sigma_1(h))) = v_1(\sigma_1(h))$ . Next, the function is increasing in  $s_1$ , and

$$\begin{aligned} &v_1(\widehat{s}_1) + \frac{\alpha}{1 + \alpha} (v_2(h) - v_1(\widehat{s}_1)) \\ &= \frac{v_0 + \varphi_1 \left( \frac{\varphi_2}{\varphi_1} (\ell - \alpha(h - \ell)) + \frac{\varphi_1 - \varphi_2}{\varphi_1} \frac{h + \ell}{2} \right) + (1 - \varphi_1) \frac{h + \ell}{2} + \alpha \left( v_0 + \varphi_2 h + (1 - \varphi_2) \frac{h + \ell}{2} \right)}{1 + \alpha} \\ &= v_0 + \varphi_2 \ell + (1 - \varphi_2) \frac{h + \ell}{2} \\ &= v_2(\ell). \end{aligned}$$

Thus, since it is optimal to bid at least  $v_2(\ell)$ , the optimal bid for all  $s_1 < \widehat{s}_1$  is  $v_2(\ell)$ . ■

Note that  $\varphi_2 > \frac{1}{1+2\alpha}\varphi_1 \iff \alpha > \frac{\varphi_1 - \varphi_2}{2\varphi_2}$  implies that

$$\begin{aligned}\widehat{s}_1 &= \frac{\varphi_2}{\varphi_1} (\ell - \alpha(h - \ell)) + \frac{\varphi_1 - \varphi_2}{\varphi_1} \frac{h + \ell}{2} \\ &< \frac{\varphi_2}{\varphi_1} \left( \ell - \frac{\varphi_1 - \varphi_2}{2\varphi_2} (h - \ell) \right) + \frac{\varphi_1 - \varphi_2}{\varphi_1} \frac{h + \ell}{2} \\ &= \ell,\end{aligned}$$

so there cannot be any signal realizations  $s_1 \leq \widehat{s}_1$  if  $\varphi_2 > \frac{1}{1+2\alpha}\varphi_1$ .

The toeholder bids more than her valuation if  $s_1 < \sigma_1(h)$ , because her toehold guarantees her a positive payoff even if she loses the auction. The larger the toehold  $\alpha$ , the more she receives for her toehold, and a higher bid increases this price. A higher bid is also attractive if she wins, because she must only buy the remaining  $(1 - \alpha)$  shares. So even if she overbids, the cost is reduced if  $\alpha$  is large.

The bid is also increased if the rival bidder's signal is more informative. An increase in  $\varphi_2$  increases the dispersion of the rival bidder's possible expected valuations, so she bids farther from the expected value. With more dispersed rival bids, the toeholder is more likely to either win against a low bid and earn a higher net payoff, or to lose against a higher bid from the rival and then to receive a higher price for her shares. In contrast, if the informativeness of the non-toeholder's signal is low, the toeholder is worried about accidentally winning if her signal is low, and she prefers to lose with certainty, but at the highest possible price, by bidding  $v_2(\ell)$ . Similarly, if the toehold  $\alpha$  is sufficiently small, the toeholder prefers to play it safe and lose with certainty if her realized signal is low.

## 2.2 Expected Payoffs

We now derive the expected payoffs in different setups: without or with a toeholder, and with symmetric information or asymmetric information, i.e., one bidder's signal is less or more informative than the other bidder's signal. Comparing these payoffs and how their differences change with certain parameters will help us understand when a toehold is particularly beneficial for a bidder. For simplicity, we assume that the price for a toehold  $\alpha$  is  $\alpha v_0$ , i.e., the value of the shares in the stand-alone target. Note that the price a toeholder pays for her initial stake is irrelevant for our results, which focus on comparing how beneficial a toehold of a given size is in different

circumstances. The price paid for the toehold cancels out in these payoff comparisons.

Consider first a symmetric setup, in which both signals are of equal informativeness ( $\varphi_2$ ) and no bidder has a toehold. A bidder's expected payoff is

$$\begin{aligned}\mathcal{U}_1^{\text{noTH}} &= \int_{\ell}^h \int_{\ell}^{s_1} (v_2(s_1) - v_2(s_2)) \frac{1}{h-\ell} ds_2 \frac{1}{h-\ell} ds_1 \\ &= \int_{\ell}^h \int_{\ell}^{s_1} \varphi_2 (s_1 - s_2) \frac{1}{h-\ell} ds_2 \frac{1}{h-\ell} ds_1 \\ &= \frac{1}{6} \varphi_2 (h - \ell).\end{aligned}$$

If bidder 1 is better informed ( $\varphi_1 > \varphi_2$ ), but no bidder has a toehold,

$$\begin{aligned}\mathcal{U}_{1,\varphi_1 > \varphi_2}^{\text{noTH}} &= \int_{\ell}^h \int_{\sigma_1(s_2)}^h (v_1(s_1) - v_2(s_2)) \frac{1}{h-\ell} ds_1 \frac{1}{h-\ell} ds_2 \\ &= \int_{\ell}^h \int_{\sigma_1(s_2)}^h (v_1(s_1) - v_1(\sigma_1(s_2))) \frac{1}{h-\ell} ds_1 \frac{1}{h-\ell} ds_2 \\ &= \int_{\ell}^h \int_{\sigma_1(s_2)}^h \varphi_1 (s_1 - \sigma_1(s_2)) \frac{1}{h-\ell} ds_1 \frac{1}{h-\ell} ds_2 \\ &= \frac{3\varphi_1^2 + \varphi_2^2}{24\varphi_1} (h - \ell).\end{aligned}$$

We will consider a situation in which bidder 1 is initially less well informed than bidder 2. If bidder 1's signal is of informativeness  $\varphi_0 < \varphi_2$ , and no bidder has a toehold,

$$\begin{aligned}\mathcal{U}_{1,\varphi_0 < \varphi_2}^{\text{noTH}} &= \int_{\ell}^h \int_{\ell}^{\xi_2(s_1)} (v_0(s_1) - v_2(s_2)) \frac{1}{h-\ell} ds_2 \frac{1}{h-\ell} ds_1 \\ &= \int_{\ell}^h \int_{\ell}^{\xi_2(s_1)} (v_2(\xi_2(s_1)) - v_2(s_2)) \frac{1}{h-\ell} ds_2 \frac{1}{h-\ell} ds_1 \\ &= \int_{\ell}^h \int_{\ell}^{\xi_2(s_1)} \varphi_2 (\xi_2(s_1) - s_2) \frac{1}{h-\ell} ds_2 \frac{1}{h-\ell} ds_1 \\ &= \frac{\varphi_0^2 + 3\varphi_2^2}{24\varphi_2} (h - \ell),\end{aligned}$$

where

$$\xi_2(s_1) = \frac{\varphi_0}{\varphi_2} s_1 + \frac{\varphi_2 - \varphi_0}{\varphi_2} \frac{h + \ell}{2} \iff v_0(s_1) = v_2(\xi_2(s_1)).$$

If bidder 1 is better informed because she has a toehold, and  $\varphi_2 > \frac{1}{1+2\alpha} \varphi_1$  (so  $b_1^*(s_1) > v_2(\ell)$ )

for all  $s_1$ ),

$$\begin{aligned}
\mathcal{U}_{1+}^{\text{TH}} &= -\alpha v_0 + \int_{\ell}^{\sigma_1(h)} \left( \int_{\ell}^{\beta_2(b_1^*(s_1))} (v_1(s_1) - (1-\alpha)v_2(s_2)) \frac{1}{h-\ell} ds_2 \right) \frac{1}{h-\ell} ds_1 \\
&\quad + \int_{\ell}^{\sigma_1(h)} \left( \int_{\beta_2(b_1^*(s_1))}^h \alpha b_1^*(s_1) \frac{1}{h-\ell} ds_2 \right) \frac{1}{h-\ell} ds_1 \\
&\quad + \int_{\sigma_1(h)}^h (v_1(s_1) - (1-\alpha)v_2(\frac{h+\ell}{2})) \frac{1}{h-\ell} ds_1 \\
&= \frac{(\varphi_1 + \varphi_2)^3}{48\varphi_1\varphi_2(1+\alpha)} (h-\ell) + \alpha \frac{h+\ell}{2}.
\end{aligned}$$

If bidder 1 is better informed because she has a toehold, and  $\varphi_2 \leq \frac{1}{1+2\alpha}\varphi_1$  (so  $b_1^*(s_1) = v_2(\ell) \forall s_1 \leq \widehat{s}_1$ ),

$$\begin{aligned}
\mathcal{U}_{1-}^{\text{TH}} &= -\alpha v_0 + \int_{\ell}^{\widehat{s}_1} \alpha v_2(\ell) \frac{1}{h-\ell} ds_1 \\
&\quad + \int_{\widehat{s}_1}^{\sigma_1(h)} \left( \int_{\ell}^{\beta_2(b_1^*(s_1))} (v_1(s_1) - (1-\alpha)v_2(s_2)) \frac{1}{h-\ell} ds_2 \right) \frac{1}{h-\ell} ds_1 \\
&\quad + \int_{\widehat{s}_1}^{\sigma_1(h)} \left( \int_{\beta_2(b_1^*(s_1))}^h \alpha b_1^*(s_1) \frac{1}{h-\ell} ds_2 \right) \frac{1}{h-\ell} ds_1 \\
&\quad + \int_{\sigma_1(h)}^h (v_1(s_1) - (1-\alpha)v_2(\frac{h+\ell}{2})) \frac{1}{h-\ell} ds_1 \\
&= \frac{(\varphi_1 + \varphi_2)^3 - (\varphi_1 - (1+2\alpha)\varphi_2)^3}{48\varphi_1\varphi_2(1+\alpha)} (h-\ell) + \alpha \frac{h+\ell}{2}.
\end{aligned}$$

After having described the payoffs that the toeholder can expect in various setups, we can now ask under what circumstances taking a toehold is particularly beneficial.

### 3 The Benefits of Taking a Toehold

A toehold has two effects on the toeholder's expected payoff: It improves the toeholder's information about possible synergies with the target; and the toeholder's bid increases because she is partly a seller, so her bid acts as a "reserve price" if she loses. The latter is the "strategic" effect analyzed in Burkart (1995) and Singh (1998), using setups with perfectly informative signals. Our aim is to explore the effects of changes to the information structure, while allowing for the "strategic" effect.

We can "switch off" the "strategic effect" temporarily, by assuming that the toehold is of

negligible size,  $\alpha \approx 0$ . Doing so allows us to focus entirely on changes in the information structure. A toehold improves a bidder's information about the benefits from taking over a target. More precise information improves a bidder's ability to earn rents, as we show in the next result. Interestingly, a bidder also benefits if her *rival* becomes better informed.

**Lemma 3** *Absent any toeholds, a bidder's expected payoff increases if either her own signal or her rival's signal become more informative.*

**Proof.** Note first that  $\lim_{\varphi_1 \rightarrow \varphi_2} \mathcal{U}_{1, \varphi_1 > \varphi_2}^{\text{noTH}} = \lim_{\varphi_0 \rightarrow \varphi_2} \mathcal{U}_{1, \varphi_0 < \varphi_2}^{\text{noTH}} = \mathcal{U}_1^{\text{noTH}}$ . If bidder 1's signal is initially more informative than the rival's,

$$\begin{aligned} \frac{\partial}{\partial \varphi_1} \mathcal{U}_{1, \varphi_1 > \varphi_2}^{\text{noTH}} &= \frac{3\varphi_1^2 - \varphi_2^2}{24\varphi_1^2} (h - \ell) > 0, \\ \frac{\partial}{\partial \varphi_2} \mathcal{U}_{1, \varphi_1 > \varphi_2}^{\text{noTH}} &= \frac{\varphi_2}{12\varphi_1} (h - \ell) > 0. \end{aligned}$$

If bidder 1's signal is initially less informative than the rival's,

$$\begin{aligned} \frac{\partial}{\partial \varphi_0} \mathcal{U}_{1, \varphi_0 < \varphi_2}^{\text{noTH}} &= \frac{\varphi_0}{12\varphi_2} (h - \ell) > 0, \\ \frac{\partial}{\partial \varphi_2} \mathcal{U}_{1, \varphi_0 < \varphi_2}^{\text{noTH}} &= \frac{3\varphi_2^2 - \varphi_0^2}{24\varphi_2^2} (h - \ell) > 0. \end{aligned}$$

■

The beneficial effect of increases in the informativeness of the *rival's* signal may initially seem counter-intuitive: A bidder benefits if her rival becomes better informed, irrespective of which bidder initially has the more informative signal. The intuition is (as explained above) that a better-informed rival has more dispersed possible valuations, so if bidder 1 wins, the price is likely to be lower; while if she loses, the payoff is unchanged (in the absence of a toehold).

In sum, taking a toehold is always beneficial, for two reasons: first, a toeholder has access to superior information, and second, if this information is not favorable, another bidder is likely to buy the toeholder's stake at a reasonable price. The better the toeholder's information, the better she can take advantage of this second benefit.

How attractive is it for firms to take a toehold in another firm, given different information structures? Arguably, taking a toehold involves costs, both financial and non-financial (costly negotiations, management distraction, risks of information leakage, etc.) A bidder will take a

toehold only if the benefits are larger than the costs; and the bidder for whom the benefits are largest is the most likely to take a toehold. We now analyze what determines the benefits of taking a toehold and thus what makes a bidder more likely to take a toehold.

**Proposition 1** *If both bidders initially have signals with equal informativeness  $\varphi_2$ , a reduction in  $\varphi_2$  makes it more beneficial for a bidder to take a toehold.*

**Proof.** Compare the expected payoffs  $\mathcal{U}_{1+}^{\text{TH}}$  and  $\mathcal{U}_{1-}^{\text{TH}}$  with  $\mathcal{U}_1^{\text{noTH}}$ , and take derivatives w/r/t  $\varphi_2$ .

If  $\varphi_2 > \frac{1}{1+2\alpha}\varphi_1$ ,

$$\frac{\partial}{\partial \varphi_2} (\mathcal{U}_{1+}^{\text{TH}} - \mathcal{U}_1^{\text{noTH}}) = \frac{-\varphi_1^3 - 5\varphi_1\varphi_2^2 + 2\varphi_2^3 - 8\alpha\varphi_1\varphi_2^2}{48\varphi_1\varphi_2^2(\alpha + 1)} (h - \ell),$$

which is negative. If  $\varphi_2 \leq \frac{1}{1+2\alpha}\varphi_1$ ,

$$\frac{\partial}{\partial \varphi_2} (\mathcal{U}_{1-}^{\text{TH}} - \mathcal{U}_1^{\text{noTH}}) = \frac{-2\varphi_1 + \varphi_2 - 3\alpha\varphi_1 + 2\alpha\varphi_2 + 4\alpha^2\varphi_2}{12\varphi_1} (h - \ell).$$

That is increasing in  $\varphi_2$  and negative for  $\varphi_2 = \frac{1}{1+2\alpha}\varphi_1$ , so it is negative for all  $\varphi_2 \leq \frac{1}{1+2\alpha}\varphi_1$ . ■

A change in  $\varphi_2$  affects the toeholder's payoff, but it also affects the payoff that this bidder could earn if no bidder had a toehold. If  $\varphi_2$  decreases, this alternative becomes less attractive, since less well-informed bidders find it harder to earn rents. The possibility of gaining better information through a toehold therefore becomes more important.

Thus, if outsiders find a target difficult to analyze, then taking a toehold becomes more attractive. And after taking into consideration the possible costs of taking a toehold, we are more likely to observe toeholders in targets that are more opaque and generally harder to analyze and value. Two standard proxies for the difficulty to analyze targets are firm age (younger firms have less data that can be analyzed) and R&D intensity (R&D projects may be hard to evaluate for outsiders). Thus, target age is an inverse proxy for  $\varphi_2$ , and industry R&D-intensity is a proxy for  $\varphi_2$ , and we can derive the following empirical implications:

**Hypothesis 1** *If a target is young or is operating in industries with high R&D ratios, then it is more likely that an acquirer has a toehold.*

In some cases, all non-toeholders have access to information of comparable quality. In other cases, some bidders may be at a disadvantage, because the information to which they have access is

less reliable than that of other bidders. Assume that bidder 1 has — in the absence of a toehold — access only to inferior information about the target. Specifically, the informativeness of her signal is  $\varphi_0 < \varphi_2$ . If bidder 1 takes a toehold, however, she leap-frogs her rival’s degree of informativeness (a toeholder’s signal has informativeness  $\varphi_1 > \varphi_2$ ).

**Proposition 2** *The benefit from taking a toehold is larger for a bidder with inferior information.*

**Proof.** De-compose the payoff increase into going from  $\mathcal{U}_{1,\varphi_0 < \varphi_2}^{\text{noTH}}$  to  $\mathcal{U}_1^{\text{noTH}}$ , and then going from  $\mathcal{U}_1^{\text{noTH}}$  to  $\mathcal{U}_{1+}^{\text{TH}}$  or  $\mathcal{U}_{1-}^{\text{TH}}$  — i.e., going from a situation in which the informativeness  $\varphi_0$  of bidder 1’s signal is less than that of bidder 2’s signal ( $\varphi_2$ ) to a situation in which both signals are of informativeness  $\varphi_2$ , and then on to a situation in which bidder 1 owns a toehold and her signal’s informativeness is  $\varphi_1 > \varphi_2$ . Going from  $\mathcal{U}_{1,\varphi_0 < \varphi_2}^{\text{noTH}}$  to  $\mathcal{U}_1^{\text{noTH}}$  (both bidders’ informativeness is  $\varphi_2$ ) increases bidder 1’s expected payoff, cf. Lemma 3 ( $\frac{\partial}{\partial \varphi_0} \mathcal{U}_{1,\varphi_0 < \varphi_2}^{\text{noTH}} > 0$ ); improving the informativeness to  $\varphi_1 > \varphi_2$  additionally increases her payoff, cf. Lemma 3 ( $\frac{\partial}{\partial \varphi_1} \mathcal{U}_{1,\varphi_1 > \varphi_2}^{\text{noTH}} > 0$ ); and owning a non-zero toehold increases the payoff further, because a larger toehold increases the toeholder’s payoff. Compare two different toehold sizes,  $\alpha_1$  and  $\alpha_2 > \alpha_1$ . With a toehold  $\alpha_2$ , the toeholder could imitate the bids she would submit with the smaller toehold  $\alpha_1$ , yielding, *ceteris paribus*, a smaller cash outflow if she wins (she buys less shares) and a larger cash inflow if she loses (she sells more shares). Using the same bids, she is thus better off with a larger toehold. Choosing the bids optimally, given  $\alpha_2$ , can only increase her payoff further. ■

This is a very intuitive result: a bidder with particularly unreliable information will find it more beneficial to become informed than a rival whose information is more reliable to begin with. This suggests that after taking into consideration all costs of taking a toehold, the bidders most likely to benefit from it are bidders whose information is less reliable. Examples include bidders from different industries or bidders that are headquartered in different countries. Arguably, such bidders should find it harder to evaluate a target, and to assess the synergies that can be realized after a takeover, and they should thus be more likely to take a toehold than rival bidders that operate in the same industry or country as the target.

**Hypothesis 2** *Acquirers operating in different industries or originating from other countries than the target are more likely to have a toehold.*

We now ask how the incremental benefit from a toehold for an initially disadvantaged bidder depends on the informativeness of the other bidders’ signals. Figure 1 illustrates what we are

asking. First, bidders may initially be symmetric, i.e., both bidders' signals have informativeness  $\varphi_2$ , and bidder 1 can improve her information by taking a toehold (she can increase her signal's informativeness to  $\varphi_1 > \varphi_2$ ). Second, bidder 1 can initially be at an informational disadvantage, because her signal's informativeness is  $\varphi_0 < \varphi_2$  (the rival's signal has informativeness  $\varphi_2$ ), but, again, she can take a toehold and increase the informativeness to  $\varphi_1 > \varphi_2$ . We are interested in how the size of the benefit from a toehold changes in both cases, if we vary  $\varphi_2$ .

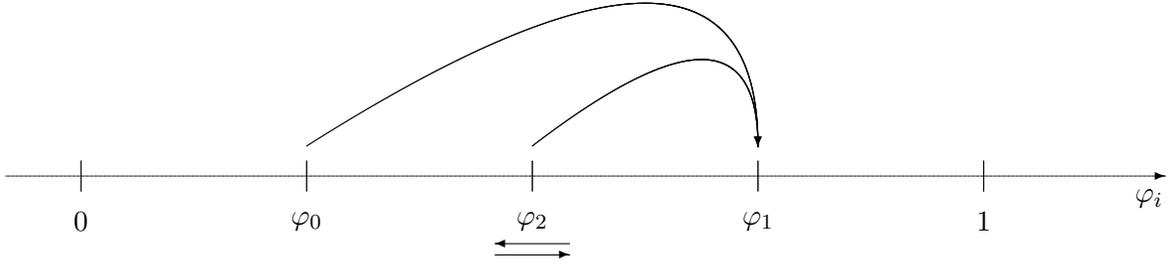


Figure 1: *Information Structure, Effects of Changes in  $\varphi_2$*

The informativeness of a bidder's signal improves from  $\varphi_2$  or  $\varphi_0 < \varphi_2$  to  $\varphi_1 > \varphi_2$  if she takes a toehold. The non-toeholding rival's informativeness remains at  $\varphi_2$ . An increase from  $\varphi_0 < \varphi_2$  to  $\varphi_1 > \varphi_2$  creates a larger benefit than an increase from  $\varphi_2$  to  $\varphi_1 > \varphi_2$ , but the effect is smaller if  $\varphi_2$  is low.

**Proposition 3** *Changes in  $\varphi_2$  have a stronger effect on the benefit from taking a toehold if the bidders are initially symmetric than if bidder 1 initially has a less informative signal.*

**Proof.** Compare the derivatives w/r/t  $\varphi_2$  of the benefits from taking a toehold. We have analyzed the initially-symmetric case in Proposition 1. The analysis of the setup in which bidder 1 is initially disadvantaged is similar. If  $\varphi_2 > \frac{1}{1+2\alpha}\varphi_1$ ,

$$\frac{\partial}{\partial \varphi_2} (\mathcal{U}_{1+}^{\text{TH}} - \mathcal{U}_{1,\varphi_0 < \varphi_2}^{\text{noTH}}) = \frac{-\varphi_1^3 - 3\varphi_1\varphi_2^2 + 2\varphi_2^3 + 2\varphi_0^2\varphi_1 + 2\alpha\varphi_0^2\varphi_1 - 6\alpha\varphi_1\varphi_2^2}{48\varphi_1\varphi_2^2(\alpha + 1)} (h - \ell),$$

which is negative. If  $\varphi_2 \leq \frac{1}{1+2\alpha}\varphi_1$ ,

$$\begin{aligned} \frac{\partial}{\partial \varphi_2} (\mathcal{U}_{1-}^{\text{TH}} - \mathcal{U}_{1,\varphi_0 < \varphi_2}^{\text{noTH}}) &= \frac{2\varphi_2^3 + 8\alpha^2\varphi_2^3 + 4\alpha\varphi_2^3 + \varphi_0^2\varphi_1 - 3\varphi_1\varphi_2^2 - 6\alpha\varphi_1\varphi_2^2}{24\varphi_1\varphi_2^2} (h - \ell) \\ &< \frac{2\varphi_2^3 + 8\alpha^2\varphi_2^3 + 4\alpha\varphi_2^3 + \varphi_2^2\varphi_1 - 3\varphi_1\varphi_2^2 - 6\alpha\varphi_1\varphi_2^2}{24\varphi_1\varphi_2^2} (h - \ell), \end{aligned}$$

which is increasing in  $\varphi_2$  and negative for  $\varphi_2 = \frac{1}{1+2\alpha}\varphi_1$ , so the derivative is negative for all  $\varphi_2 \leq \frac{1}{1+2\alpha}\varphi_1$ .

Now compare the derivatives w/r/t  $\varphi_2$  of the benefits from taking a toehold, recalling that these derivatives are negative. If  $\varphi_2 > \frac{1}{1+2\alpha}\varphi_1$ ,

$$\begin{aligned} \frac{\partial}{\partial \varphi_2} \mathcal{U}_{1+}^{\text{TH}} - \frac{\partial}{\partial \varphi_2} \mathcal{U}_1^{\text{noTH}} &< \frac{\partial}{\partial \varphi_2} \mathcal{U}_{1+}^{\text{TH}} - \frac{\partial}{\partial \varphi_2} \mathcal{U}_{1, \varphi_0 < \varphi_2}^{\text{noTH}} \\ &-\frac{1}{6}(h-\ell) < -\frac{3\varphi_2^2 - \varphi_0^2}{24\varphi_2^2}(h-\ell), \end{aligned}$$

which is satisfied since  $\varphi_0 < \varphi_2$ . If  $\varphi_2 \leq \frac{1}{1+2\alpha}\varphi_1$ ,

$$\begin{aligned} \frac{\partial}{\partial \varphi_2} \mathcal{U}_{1-}^{\text{TH}} - \frac{\partial}{\partial \varphi_2} \mathcal{U}_1^{\text{noTH}} &< \frac{\partial}{\partial \varphi_2} \mathcal{U}_{1-}^{\text{TH}} - \frac{\partial}{\partial \varphi_2} \mathcal{U}_{1, \varphi_0 < \varphi_2}^{\text{noTH}} \\ &-\frac{1}{6}(h-\ell) < -\frac{3\varphi_2^2 - \varphi_0^2}{24\varphi_2^2}(h-\ell), \end{aligned}$$

which, again, is satisfied. So the derivatives are more negative in the initially-symmetric case. ■

The intuition for this result is simple: If it becomes harder for non-toeholders to assess possible synergies, then the initial disadvantage of a less well-informed bidder becomes less relevant. With either initial degree of informativeness, the benefit from taking a toehold increases if  $\varphi_2$  decreases; but the benefit for an initially disadvantaged bidder increases by less, since the initial disadvantage is reduced (the initial degrees of informativeness,  $\varphi_2$  and  $\varphi_0$ , become more similar), so the *extra* benefit from taking a toehold is smaller.

**Hypothesis 3** *Acquirers operating in different industries or originating from other countries than the target are less likely to have a toehold if the target is younger or is operating in industries with higher R&D ratios.*

## 4 Multiple Rival Bidders

The benefit from a toehold should also depend on how many rival bidders a potential toeholder faces, since an increase in the number of rivals changes the strength of the pool of competitors. Specifically, the expected highest rival bid increases with the number of rivals. That should affect the toeholder's payoff, and therefore the benefits from taking a toehold. With a high (but not very high) signal, the chances of winning decrease if the number of rivals increases, and the chances of

winning at a low price also decrease. Both effects decrease the toeholder's payoff. On the other hand, the expected price at which the toehold is sold after losing the auction increases, which increases the toeholder's payoff.

We can adapt our analysis to the case with  $n \geq 2$  rival bidders (i.e.,  $n + 1$  bidders, including the toeholder), by focusing on the highest realized signals among the  $n$  rivals. Denote by  $G_n(s) = \left(\frac{s-\ell}{h-\ell}\right)^n$  the probability that with  $n$  rival bidders, all signals these rivals observe are below  $s$ . The corresponding density is  $g_n(s) = n \left(\frac{s-\ell}{h-\ell}\right)^{n-1} \frac{1}{h-\ell}$ . Probability mass for this highest signal realization by a rival is shifted to the right as  $n$  increases:  $G_{n+1}$  has first-order dominance over  $G_n$ .

**Lemma 4** *The toeholder's optimal bid does not depend on the number of rivals.*

**Proof.** The toeholder should always bid at least  $v_2(\ell)$ . Define  $\widehat{s}_{1,n}$  as the cut-off signal such that with any  $s_1 < \widehat{s}_{1,n}$ , the toeholder's optimal bid is  $v_2(\ell)$ . Consider a signal  $s_1 \in (\widehat{s}_{1,n}, \sigma_1(h))$ , such that the toeholder prefers to bid strictly above  $v_2(\ell)$ . The expected payoff, given a bid  $b_1$ , is

$$\begin{aligned} & \max_{b_1} \int_{\ell}^{\beta_2(b_1)} \left( v_1(s_1) - (1 - \alpha)v_2(s_2) \right) g_n(s_2) ds_2 \\ & + \alpha b_1 \left( n \cdot \frac{h - \beta_2(b_1)}{h - \ell} \cdot G_{n-1}(\beta_2(b_1)) \right) \\ & + \alpha \cdot n \cdot \int_{\beta_2(b_1)}^h \left( \int_{\beta_2(b_1)}^{s_2} v_2(s_3) g_{n-1}(s_3) ds_3 \right) \frac{1}{h - \ell} ds_2 \end{aligned}$$

The first term is the payoff if all  $n$  rivals realize signals below  $\beta_2(b_1)$ . The second term is the payoff if one rival realizes a signal above  $\beta_2(b_1)$ , but the others are below. The last term is the payoff if two or more rivals realize a signal above  $\beta_2(b_1)$ . The first-order condition is

$$\begin{aligned} 0 &= \left( v_1(s_1) - (1 - \alpha)v_2(\beta_2(b_1)) \right) g_n(\beta_2(b_1)) \frac{1}{\varphi_2} \\ & + \alpha n \left( \frac{h - \beta_2(b_1)}{h - \ell} G_{n-1}(\beta_2(b_1)) - b_1 \frac{1}{h - \ell} G_{n-1}(\beta_2(b_1)) \frac{1}{\varphi_2} + b_1 \frac{h - \beta_2(b_1)}{h - \ell} g_{n-1}(\beta_2(b_1)) \frac{1}{\varphi_2} \right) \\ & - \alpha n \int_{\beta_2(b_1)}^h v_2(\beta_2(b_1)) g_{n-1}(\beta_2(b_1)) \frac{1}{\varphi_2} \frac{1}{h - \ell} ds_2 - \alpha n \int_{\beta_2(b_1)}^{\beta_2(b_1)} v_2(s_3) g_{n-1}(s_3) ds_3 \frac{1}{h - \ell} \frac{1}{\varphi_2}. \end{aligned}$$

Replace  $g_n(s) = nG_{n-1}(s)\frac{1}{h-\ell}$  and  $v_2(\beta_2(b_1)) = b_1$ , and simplify,

$$0 = \left( v_1(s_1) - b_1 \right) \left( n \cdot G_{n-1}(\beta_2(b_1)) \frac{1}{h - \ell} \right) + \varphi_2 \alpha \left( n \cdot \frac{h - \beta_2(b_1)}{h - \ell} \cdot G_{n-1}(\beta_2(b_1)) \right)$$

$$0 = v_1(s_1) - b_1 + \varphi_2 \alpha \frac{h - \beta_2(b_1)}{h - \ell} (h - \ell).$$

(It is easily checked that the second-order condition is satisfied.) Replace  $\beta_2(b_1) = \frac{b_1 - v_0 - (1 - \varphi_2) \frac{h + \ell}{2}}{\varphi_2}$  and rearrange, to obtain

$$b_{1,n}^*(s_1) = \frac{v_1(s_1) + \alpha v_2(h)}{1 + \alpha} = v_1(s_1) + \frac{\alpha}{1 + \alpha} (v_2(h) - v_1(s_1))$$

That is the same bid function as  $b_1^*(s_1)$ , the optimal bid function when facing one rival (derived in Lemma 2), so the cut-off signal is the same,  $\widehat{s}_{1,n} = \widehat{s}_1 = \sigma_1(\ell - \alpha(h - \ell))$ . ■

The optimal bid function is the same as the optimal bid function in the case of only one rival. This may seem counter-intuitive at first, but a closer look at the toeholder's trade-off when choosing her bid can shed light on the result. If the toeholder's bid is either the highest bid or below the second-highest bid, then the bid itself is irrelevant: the bid affects her payoff only if it is the second-highest bid, because only then it determines the price at which shares are exchanged. Changing the bid changes the likelihood of the three types of outcome, but importantly, the relative probabilities of the payoff changes remain the same.

Suppose the toeholder is considering a small increase in her bid. If she ends up having submitted the highest bid instead of the second-highest bid, then she defeated a rival with a nearly identical bid. She gains the payoff from winning at that price, but she loses the cash she would have received for her shares at that same price. In other words, she gains her expected valuation given her signal, less the price she has to pay ( $(1 - \alpha)$  times her bid), less the lost cash from losing ( $\alpha$  times her bid). The toeholder's payoff is also changed if her bid was and remains the second-highest bid: the increased bid does not change the ranks of the bids, but it increases the price the toeholder receives for her shares. All other outcomes are unaffected by small changes in the toeholder's bid. The likelihood of attaining these outcomes changes if the number of rivals increases, but the marginal changes are proportional (they depend on the density of the rivals' highest-bid function at the toeholder's bid level). Therefore, while the payoffs of the various outcomes change if the number of rivals is increased, the proportions of the probability-weighted outcome payoffs are unchanged, and therefore increasing the number of rivals does not affect the toeholder's trade-off. Her expected payoff changes, but the optimal bid remains the same.

Even though the toeholder's optimal bid is easy to characterize, analyzing changes to her payoff as  $n$  increases is difficult. With  $n \geq 2$  rival bidders, the toeholder's expected payoff is  $\mathcal{U}_{1+,n}^{\text{TH}}$  (if

$\varphi_2 > \frac{1}{1+2\alpha}\varphi_1$ ) or  $\mathcal{U}_{1^-,n}^{\text{TH}}$  (if  $\varphi_2 < \frac{1}{1+2\alpha}\varphi_1$ ):

$$\begin{aligned}\mathcal{U}_{1^+,n}^{\text{TH}} &= -\alpha v_0 + \int_{\ell}^{\sigma_1(h)} \int_{\ell}^{\beta_2(b_1)} \left( v_1(s_1) - (1-\alpha)v_2(s_2) \right) g_n(s_2) ds_2 \frac{1}{h-\ell} ds_1 \\ &\quad + \int_{\ell}^{\sigma_1(h)} \alpha b_1 \cdot n \cdot \frac{h - \beta_2(b_1)}{h - \ell} \cdot G_{n-1}(\beta_2(b_1)) \frac{1}{h - \ell} ds_1 \\ &\quad + \int_{\ell}^{\sigma_1(h)} \alpha \cdot n \cdot \int_{\beta_2(b_1)}^h \left( \int_{\beta_2(b_1)}^{s_2} v_2(s_3) g_{n-1}(s_3) ds_3 \right) \frac{1}{h - \ell} ds_2 \frac{1}{h - \ell} ds_1 \\ &\quad + \int_{\sigma_1(h)}^h \int_{\ell}^h \left( v_1(s_1) - (1-\alpha)v_2(s_2) \right) g_n(s_2) ds_2 \frac{1}{h - \ell} ds_1,\end{aligned}$$

$$\begin{aligned}\mathcal{U}_{1^-,n}^{\text{TH}} &= -\alpha v_0 + \int_{\ell}^{\widehat{s}_1} n \cdot \int_{\ell}^h \alpha \left( \int_{\beta_2(b_1)}^{s_2} v_2(s_3) g_{n-1}(s_3) ds_3 \right) \frac{1}{h - \ell} ds_2 \frac{1}{h - \ell} ds_1 \\ &\quad + \int_{\widehat{s}_1}^{\sigma_1(h)} \int_{\ell}^{\beta_2(b_1)} \left( v_1(s_1) - (1-\alpha)v_2(s_2) \right) g_n(s_2) ds_2 \frac{1}{h - \ell} ds_1 \\ &\quad + \int_{\widehat{s}_1}^{\sigma_1(h)} \alpha b_1 \cdot n \cdot \frac{h - \beta_2(b_1)}{h - \ell} \cdot G_{n-1}(\beta_2(b_1)) \frac{1}{h - \ell} ds_1 \\ &\quad + \int_{\widehat{s}_1}^{\sigma_1(h)} \alpha \cdot n \cdot \int_{\beta_2(b_1)}^h \left( \int_{\beta_2(b_1)}^{s_2} v_2(s_3) g_{n-1}(s_3) ds_3 \right) \frac{1}{h - \ell} ds_2 \frac{1}{h - \ell} ds_1 \\ &\quad + \int_{\sigma_1(h)}^h \int_{\ell}^h \left( v_1(s_1) - (1-\alpha)v_2(s_2) \right) g_n(s_2) ds_2 \frac{1}{h - \ell} ds_1.\end{aligned}$$

The expected payoff in the absence of any toeholds is

$$\mathcal{U}_{1,n}^{\text{noTH}} = \varphi_2 \int_{\ell}^h \int_{\ell}^{s_1} (s_1 - s_2) g_n(s_2) ds_2 \frac{1}{h-\ell} ds_1.$$

We would like to measure whether an increase in the number of rival bidders from  $n$  to  $n+1$  increases or reduces the benefit from having a toehold. It is increased if, for  $n \geq 2$ ,

$$\Delta_{n,n+1} = \begin{cases} (\mathcal{U}_{1^-,n+1}^{\text{TH}} - \mathcal{U}_{1^-,n+1}^{\text{noTH}}) - (\mathcal{U}_{1^-,n}^{\text{TH}} - \mathcal{U}_{1^-,n}^{\text{noTH}}) & \text{if } \varphi_2 \leq \frac{1}{1+2\alpha}\varphi_1 \\ (\mathcal{U}_{1^+,n+1}^{\text{TH}} - \mathcal{U}_{1^+,n+1}^{\text{noTH}}) - (\mathcal{U}_{1^+,n}^{\text{TH}} - \mathcal{U}_{1^+,n}^{\text{noTH}}) & \text{if } \varphi_2 > \frac{1}{1+2\alpha}\varphi_1 \end{cases}$$

is positive, and reduced if  $\Delta_{n,n+1}$  is negative.

We cannot derive general results algebraically, but we can study numerical examples. The examples we looked at suggest that adding a second or third rival increases the benefit from having

a toehold, and that the effect on the benefit of a toehold are ambiguous with more rivals. The initially positive effect (strongest when adding a second rival) arises because the change from one to two rivals changes the distribution of the expected highest signal from the rivals in a material way. The payoff after losing the auction becomes more relevant: Losing becomes a more likely outcome, and the expected losing bid is higher with two rivals. Also, the alternative payoff — bidding without any toeholds — is cut in half, so the benefit from having a toehold can increase even if the expected payoff with a toehold does not increase.

As more rivals are added, however, the changes to the distribution of the rivals' highest signal become smaller. The examples suggest that the variables  $\varphi_2$  and  $\alpha$  determine the effect on the benefit from a toehold. If  $\varphi_2$  and  $\alpha$  are not too large, the benefit decreases if another rival is added; if they are large, the benefit increases. That is consistent with our earlier results: A larger  $\varphi_2$  implies more dispersed bids from the rivals, from which the toeholder benefits; and with a larger toehold, she benefits from more competition because the chances of losing against high bids improve (so the toehold can be sold at a higher price).

The lesson from the examples is consistent with the limit case  $n \rightarrow \infty$ , which *can* be analyzed algebraically. As  $n$  increases, the rivals' highest and second-highest bids converge probabilistically to  $v_2(h)$ . So with a signal  $s_1 \leq \sigma_1(h)$ , the toeholder's chances of winning decrease in  $n$ , but the price that she expects to receive for her shares increases. If the realized signal is  $s_1 > \sigma_1(h)$ , the toeholder is certain to win with any  $n$  (with a bid that equals her expected valuation,  $v_1(s_1)$ ). The price she expects to pay for the remaining shares increases with  $n$ , so her payoff is reduced with high signals; but that price does not depend on her bid. In the limit as  $n \rightarrow \infty$ , the highest two bids from the rivals equal  $v_2(h)$  almost certainly, so the toeholder's optimization problem simplifies: if  $s_1 > \sigma_1(h)$ , she bids  $v_1(s_1)$  and wins; and if  $s_1 \leq \sigma_1(h)$ , she bids  $b_1^*(s_1)$  and loses against a highest bid of  $v_2(h)$ . Her expected payoff is

$$\begin{aligned} \mathcal{U}_1^{n \rightarrow \infty} &= -\alpha v_0 + \int_{\ell}^{\sigma_1(h)} \alpha v_2(h) \frac{1}{h-\ell} ds_1 + \int_{\sigma_1(h)}^h \left( v_1(s_1) - (1-\alpha)v_2(h) \right) \frac{1}{h-\ell} ds_1 \\ &= \frac{(\varphi_1 - \varphi_2)^2 + 4\alpha\varphi_1\varphi_2}{8\varphi_1} (h - \ell) + \alpha \frac{h + \ell}{2}. \end{aligned}$$

Without any toeholds, the payoffs for all bidders converge to zero as  $n \rightarrow \infty$ :  $\mathcal{U}_{\text{sym}}^{n \rightarrow \infty} = \mathcal{U}_{\varphi_0 < \varphi_2}^{n \rightarrow \infty} = 0$ . We can now compare the benefits of taking a toehold with either one or many rivals.

**Proposition 4** *If  $\varphi_2 < \frac{1-9\alpha}{(1+\alpha)(1-2\alpha)}\varphi_1$ , the benefit of having a toehold is smaller in the limit as  $n \rightarrow \infty$  than in the one-rival case.*

**Proof.** Note first that  $\frac{1-9\alpha}{(1+\alpha)(1-2\alpha)} < \frac{1}{1+2\alpha}$ . If  $\varphi_2 > \frac{1}{1+2\alpha}\varphi_1$ ,

$$\begin{aligned} & (\mathcal{U}_1^{n \rightarrow \infty} - \mathcal{U}_{\text{sym}}^{n \rightarrow \infty}) - (\mathcal{U}_{1+}^{\text{TH}} - \mathcal{U}_1^{\text{noTH}}) \\ &= -(\varphi_1 - \varphi_2) \frac{(\varphi_1 - \varphi_2)^2 + 4\varphi_2^2}{48\varphi_1\varphi_2} \frac{1}{1+\alpha} (h - \ell) + \frac{3\varphi_1^2 + 3\varphi_2^2 + 10\varphi_1\varphi_2 + 12\alpha\varphi_1\varphi_2}{24\varphi_1} \frac{\alpha}{1+\alpha} (h - \ell). \end{aligned}$$

That term is increasing in  $\alpha$ . The restriction  $\varphi_2 > \frac{1}{1+2\alpha}\varphi_1$  is equivalent to  $\alpha > \frac{\varphi_1 - \varphi_2}{2\varphi_2}$ . Substitute  $\alpha = \frac{\varphi_1 - \varphi_2}{2\varphi_2}$  in the equation, to find that it is positive, so it is positive for any larger  $\alpha$ . If  $\varphi_2 \leq \frac{1}{1+2\alpha}\varphi_1$ ,

$$(\mathcal{U}_1^{n \rightarrow \infty} - \mathcal{U}_{\text{sym}}^{n \rightarrow \infty}) - (\mathcal{U}_{1-}^{\text{TH}} - \mathcal{U}_1^{\text{noTH}}) = \varphi_2 \frac{\varphi_1(9\alpha - 1) + \varphi_2(1 + \alpha)(1 - 2\alpha)}{12\varphi_1} (h - \ell),$$

which is negative if  $\varphi_2 < \frac{1-9\alpha}{(1+\alpha)(1-2\alpha)}\varphi_1$ . ■

Both the limit case and the examples we looked at suggest that if the toeholder's signal is sufficiently more informative than those of her rivals, the benefit from taking a toehold is larger with less rivals. Under those conditions ( $\varphi_2$  significantly smaller than  $\varphi_1$ ) we also find that the benefit from taking a toehold are larger (see Proposition 1). Thus, assuming that taking a toehold is costly and therefore attractive only if the benefits are large, we are more likely to observe a toehold if  $\varphi_2$  is small, which also implies that we are less likely to observe a toehold if the number of rival bidders is large.

**Hypothesis 4** *An acquirer is less likely to have a toehold if she faced a larger number of rival potential bidders.*

In the following, we describe our data set and then test Hypotheses 1 to 4 empirically.

## 5 Data

Our main data source is Capital IQ, a web-based information service that provides information on companies' financials and deals. Capital IQ started their coverage of acquisitions in 1998. One important advantage over other traditional data sources, such as SDC, is that it contains more

information on private companies, such as the value of their assets and the year they were founded. We collect information on majority acquisitions of U.S. and Canadian targets —public and private — from Capital IQ for the years 1998-2010.<sup>6</sup> We exclude LBO deals, deals with missing data on the target or the acquirer’s industry, and deals in which the target is acquired out of bankruptcy (Chapter 11). There are 100,530 majority acquisitions that satisfy these criteria.

Capital IQ contains information regarding the nature of the acquisition. In case the acquirer had a toehold, prior to the acquisition of the majority stake, Capital IQ classifies the deal as “Minority Shareholders Purchasing remaining Shares” or “Minority Shareholders Increasing Ownership Stake” with “Change of Control.” There are 1,003 deals in which a prior minority ownership is reported. We supplement Capital IQ data with SDC data. In SDC we find another 242 majority acquisition deals that were preceded by toeholds. We restrict our final sample to observations for which there is information regarding the year target firms were founded, as without this information we cannot compute their age at the time they were acquired. The year the target company was founded is available in Capital IQ for 649 acquisitions where the acquirer had a toehold and for 48,066 majority acquisitions where the acquirer had no prior equity stake. We supplement the information on the year the target was founded for acquisitions preceded by toeholds through internet searches, finding information for an additional 297 observations. Our final sample consists of 49,012 majority acquisitions; for 946 of these acquisitions the acquirer had a toehold in the target company.<sup>7</sup> Our main variable of interest is the dummy Toehold, which takes a value of 1 if the acquirer had a toehold in the target company prior to the majority acquisition, and zero otherwise.

Our empirical tests focus on the likelihood that an acquirer (i.e., a winner of a takeover contest) had a toehold before an acquisition. In other words, we ask under what conditions the dummy Toehold is more likely to take a value of 1. If our explanatory variables affect the ratio of probabilities of winning — with and without a toehold — in a systematic way, this could introduce a bias in our estimates: our model makes predictions about the likelihood of having a toehold with the intention of acquiring the target in the future, while the dummy Toehold captures that likelihood times the ratio of probabilities of winning a takeover contest with and without a toehold. A more

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<sup>6</sup> We define a majority acquisition as one where the final stake of the acquirer is larger than 50%, and the acquisition implied a change of control in the target company. We only consider acquisitions where the buyer is catalogued as strategic buyer by Capital IQ.

<sup>7</sup> Capital IQ provides information about previous joint-ventures/strategic alliances between the target and the acquirer. In our final sample there are 231 majority acquisitions that were preceded by joint-ventures/strategic alliances. For 38 observations the acquirer has both a toehold and a joint-venture/strategic alliance with the target before the majority acquisition. All our results hold if we drop these observations.

comprehensive data set would include information about all companies that are potentially interested in a target, but such information is hard to obtain.<sup>8</sup> In the Appendix, we study whether there exists a bias in our estimates coming from changes in the probability of winning, and we study the direction of that bias. We find that for some of our predictions, there is no such bias; while for our other predictions, the probability ratio biases our results *against* finding the predictions of our model. Thus, if the empirical results we present support our theoretical predictions, it is in spite of a small bias towards accepting the null hypothesis of *no-effect* of some explanatory variables.

We classify the variables that affect the likelihood that an acquirer has a toehold into 3 categories. The first category relates to the opacity of the target firm. The benefit from having a toehold before a majority acquisition increases when the target is more opaque, as having a toehold increases the acquirer’s signal precision of the true synergies (Hypothesis 1). The second category is the initial informational disadvantage of the acquirer. Acquirers with a priori less precise information than other potential buyers are more likely to benefit from having a toehold before the majority acquisition and overcoming their initial informational disadvantage (Hypothesis 2). This effect, however, is expected to be less important when the target is more opaque (Hypothesis 3). The third category is the competitiveness of the contest. When a contest is highly competitive the benefit of having more precise information on the value of the synergies — by acquiring a toehold — is reduced (Hypothesis 4).

We use two variables that capture the difficulty in evaluating a target from the perspective of any potential acquirer (i.e., the target’s opacity). The first variable is the target’s age. The younger the target, the less likely it is that an acquirer has been able to gather valuable information about it. We construct this variable as the difference between the year of the majority acquisition and the year the target company was founded. The second variable that measures the difficulty in evaluating a target is the target’s industry R&D/Asset ratio. Firms that operate in industries where R&D plays an important role are more difficult to evaluate, as the values of projects depend largely on intangibles. We measure the R&D/Asset ratio at the industry level rather than at the firm level, as for many targets there is no information about assets or R&D expenses. We define

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<sup>8</sup> Traditional datasets, such as SDC, only reports official bids, although the number of companies with initial intentions of participating in a takeover acquisition can be much larger (see Boone and Mulherin (2007)). Actually, SDC reports that more than 90% of the acquisitions of publicly traded targets have only one official bidder (Betton et al. (2009)), and for private targets this number is close to 100%. Therefore, SDC bidding data would only provide a minimal improvement in our empirical setting, with the important drawback of having less information about the targets’ characteristics.

48 industries following Fama and French (1997). The industry-year R&D/Asset averages were constructed using all publicly traded companies in Compustat.

The second set of variables measure the acquirers' ex-ante informational disadvantage relative to other potential bidders. The first of these variables is a dummy that takes a value of 1 if the acquisition was cross-border, and zero otherwise. When the acquirer and the target are from different countries, it is more likely that the acquirer has more noisy information about the target (and possible synergies with it) than other potential acquirers that operate in the same country as the target. The second variable that measures the acquirer's ex-ante informational disadvantage is a dummy that takes a value of 1 if the target and the acquirer belong to different industries and zero otherwise. The intuition is that a potential buyer finds it easier to analyze the target when she is more familiar with the industry. As mentioned above, we use the 48 industry classifications defined in Fama and French (1997).

We use two variables to measure the ex-ante competitiveness of a potential takeover contest. Our first measure is the number of *potential* bidders in the takeover contest. The higher the potential number of bidders, the more competitive the takeover contest is (Boone and Mulherin (2008)). The potential number of bidders is more likely to capture the competitiveness of the takeover contest than the *realized* number of bidders for two reasons. First, the potential number of bidders is not endogenous to the selling procedure or the toehold decision. Second, the data reported by traditional datasets, such as SDC, on the number of bidders only reflects official bids, not the number of companies that were indeed interested in the target and did not submit official bids (see Boone and Mulherin (2007)).

We construct the variable "potential bidders" for each target at the industry level. The computation is as follows. First, we construct the probability that a company in industry "i" is acquired by a company from industry "j" using data on majority acquisitions from our sample. For example, we find that 44% of the acquirers of firms in the computer industry also belong to the computer industry; 28% belong to the business service industry; 4.5% belong to the electrical equipment industry, etc. Additionally, from Compustat, we obtain the number of public firms by industry-years.<sup>9</sup> Then, for each industry "i" we multiply the probability that an acquirer belongs to industry "j" times the number of public companies in industry "j" two years before the majority acquisition takes place. Summing these products across industries yields our proxy for potential bidders for

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<sup>9</sup> We use the world-wide number of public firms by combining Compustat North America and Compustat Global. When only considering North American companies all our results hold.

a target in industry “i” in year “t”. Implicit in its computation is the assumption that the real number of firms interested in a target is proportional to the number of public companies in the target’s industry and related industries. We construct our measure using the number of public companies from 2 years prior to the majority acquisition to better capture the scenario that the acquirer might be facing at the time he decides whether to purchase a toehold or not.

The second variable that measures competitiveness in a takeover acquisition is the size of the target. The number of firms interested in acquiring a target decreases with the target’s size: acquirers are typically larger than the target firm, thus, the larger the target, the less companies are capable of acquiring it. We obtain the target’s book value of assets for 8,607 firms in the sample. Assets are expressed in 2010 US\$ millions.

Finally, as a control, we also include a dummy variable that indicates whether the target company is privately held or publicly traded. Acquirers of private companies are less likely to have a toehold in the target for practical reasons: it is harder to acquire equity stakes in companies whose shares are not publicly traded. Additionally, toeholds are useful in hostile takeover attempts (see Shleifer and Vishny (1986)), but such uses are less likely if targets are privately held, for the above “practical” reasons, and because privately held firms do not face governance problems caused by dispersed ownership.

Private companies are also typically more opaque. Thus, the dummy Private could be capturing the confounding effect that the benefit of a toehold is higher for more opaque firms (Hypothesis 1), on top of what practical reasons would suggest. Whether practical reasons dominate informational issues in the estimation of the parameter of the dummy Private is an empirical issue. However, we can still shed some light on whether the dummy Private has informational implications regarding the acquisition of a toehold before a majority acquisition through a different channel. If indeed being private captures to some extent the target’s opaqueness, we should observe that the likelihood of an acquisition being preceded by a toehold is smaller for less informed acquirers when the target is private, according to Hypothesis 3. Thus, in some specifications, we also include the interaction between the dummy Private with the variables Cross-Border and Different Industry.

Targets’ age, assets and potential number of bidders are winsorized at the 5% level, to avoid obtaining results driven by outliers. Our results are not modified by this procedure. The summary statistics for the variables described above are presented in Table 1.

The first takeaway from Table 1 is that acquirers with a toehold in the target firms prior to

Table 1: Summary Statistics

This table shows descriptive statistics of our sample, which is composed of 49,012 majority acquisitions for US and Canadian targets, from 1998 to 2010. The data contains all majority acquisitions reported in Capital IQ, excluding LBO deals, deals in which the target company was bankrupt, and deals for which the target's founding year was not available, or its industry classification could not be obtained. This data was supplemented with data on acquisitions preceded by toeholds from SDC. The variable Toehold takes a value of 1 if the acquirer had a toehold in the target prior to the majority acquisition, and zero otherwise. The variable Private takes a value of 1 if the target company is a private company, and 0 if it is publicly traded at the time of the acquisition. The variable age shows the age of the target company, in years, at the time of the majority acquisition. The variable R&D/Assets shows the ratio of R&D expenses over total assets by industry-year for the industry of the target company in the year it was acquired. The industry-year R&D ratio was constructed by averaging the R&D to Assets ratio from all companies in Compustat. The industry definitions follow the 48 industry classifications in Fama and French (1997). The variable Cross-Border takes a value of 1 if the target and the acquirer are from different countries, and zero otherwise. The dummy Different Industry takes a value of 1 if the target and the acquirer operate in different industries, and zero otherwise. The variable Potential Bidders is a weighted average of the total number of public companies that operate in industries that are likely to acquire companies in the target's industry. Total Assets is the book value of targets' assets at the time of the acquisition in 2010 US\$ millions. The variable Toehold Size is the fraction of the target company owned by the acquirer before the majority acquisition for acquisitions preceded by toeholds. Final Ownership Stake is the fraction of the target company that the acquirer owns after a majority acquisition that was preceded by a toehold.

<b>Variable</b>	<b>Mean</b>	<b>sd</b>	<b>Min</b>	<b>Max</b>	<b>N</b>
Toehold	0.02	0.14	0.00	1.00	49,012
Private	0.87	0.34	0.00	1.00	49,012
Age	21	21	2	80	49,012
R&D/Assets (%)	0.04	0.05	0.00	0.29	49,012
Cross-Border	0.14	0.35	0.00	1.00	49,012
Different Industry	0.43	0.50	0.00	1.00	49,012
Potential Bidders	629.1	307.3	202.1	1,270.5	49,012
Total Assets (millions)	297.80	587.04	0.004	2,552.5	8,607
Toehold Size	27.23	14.68	0.01	50.00	858
Final Ownership Stake	93.58	14.13	50.10	100.00	921

the takeover account for 2% of the majority acquisitions. This number is smaller than what has been shown in other papers (e.g., Betton et al. (2009); Bates et al. (2006)). This difference is due to the fact that previous papers only study toeholds on publicly traded targets, where toeholds are more common. In our sample, 87% of the targets are private companies. In our data, the fraction of acquirers who had a toehold is 1.4% for privately held targets, while for publicly traded targets it is much higher, 5.4%. Thus, when considering publicly traded targets, our statistics are in line with those of previous papers in the literature.

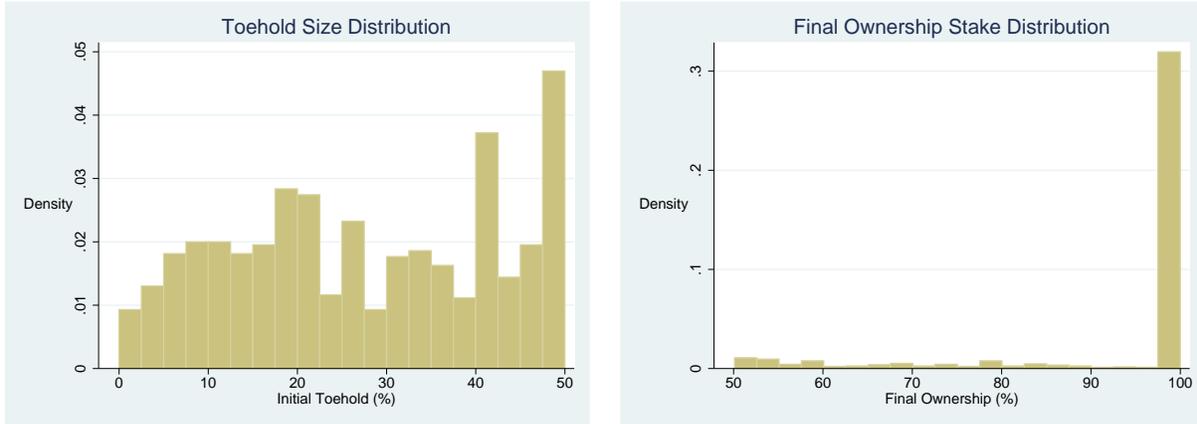
Our sample shows that the mean age of a target at the moment an acquirer takes it over is 21 years; that 14% of acquirers are from a different country than the target company; and that 43% of the acquirers operate in an industry classification different from that of the target. As mentioned above, only for 8,607 observations we have information regarding the targets' book value of assets at the time they were acquired. The mean size of the target's assets in the sample is close to 300 US\$ millions. Although it is not shown in the table, it is worth noticing that 3,197 of the 8,607 asset observations correspond to private companies. Thus, when we include assets as an explanatory variable in a regression setting, we are considering both private and public firms. Moreover, there is substantial variation in the dummy Toehold both for public and private companies within the subsample for which there is data on targets' assets. This implies that in a regression setting we can control for the target's ownership status and asset size simultaneously.

From SDC and Capital IQ we are able to obtain information regarding the toehold size for 858 out of the 946 acquisitions where the acquirer had a toehold. We also find the final ownership stake for 921 of these acquisitions. We show the summary statistics for these variables in the bottom two rows of Table 1. As can be observed, the average toehold size is quite substantial: 27%; and the average final stake is very close to full ownership: 94%. To better understand the distribution of these variables, we plot them in Figure 2. The main takeaway from these distributions is that acquirers' toeholds have substantial variation in their size, with large toeholds (near 50%) being slightly more frequent. The final ownership stake, on the other hand, is concentrated on the right of the distribution. Eighty percent of the deals have a final ownership of 100%.<sup>10</sup> That is, most of the deals in our sample end up in a complete acquisition of the target company.

To understand how toeholds came into place in our sample we look for information about the toehold transaction itself in Capital IQ for the deals in which the toeholder ends up acquiring the

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<sup>10</sup> In some takeovers, the target's management retain an equity stake. If we exclude deals where final ownership is not 100% all our results hold.



Panel A: *Toehold Ownership Distribution*

Panel B: *Final Ownership Distribution*

Figure 2: *Toehold and Final Ownership Distribution.*

company. We find descriptions for 155 such deals. Table 2, Panel A presents this information. The left column of this table shows the form in which the toehold was taken and column II shows the number of deals we observe for each toehold form. Ninety five deals are categorized as acquisitions of minority stakes, representing 61% of the 155 deals for which we have information. The rest of the toehold transactions take different forms: there are 26 deals in which the initial stake was bought in a PIPE transaction; 22 deals in which the initial stake was part of a VC transaction; 11 initial stakes were part of private equity deals; and for one deal the initial equity stake was obtained by a strategic buyer in a LBO of the target company. Also, the average initial stake in these deals varies with the toehold form. The mean toehold size in a minority stake acquisition is 31%, while toeholds acquired in PIPEs, VCs and Private Equity transactions are about 20% of the target company. These patterns highlight that there is important heterogeneity in the forms that acquirers obtain toeholds in targets. They also highlight that the sizes of the equity stakes are highly dependent of the context or form in which they were acquired.

For the toeholds for which we have information about their form we also have information about the length of time between the toehold was acquired and the final acquisition. We tabulate the number of months that passed between the toehold acquisition and the majority acquisition by percentiles in Panel B. As can be seen, only 10% of the toeholds in the sample occurred in the 3 months prior to the majority acquisition; while 50% of the final acquisitions occurred at least 15 months prior from the toehold acquisition. The fact that toeholds are not held for short periods of

Table 2: Toehold Form and Months to Final Acquisition

Panel A shows the manner in which the toehold was acquired for 155 of the majority acquisition deals that were preceded by toeholds (i.e., the deals for which data on the toehold transaction is available). Column I describes the type of toehold transaction; column II shows the number of deals per toehold form; column III shows the fraction of the 155 deals that each category represents, and column IV shows the mean toehold size observed in each category. Panel B shows the number of months that elapsed between the acquisition of the toehold and the majority acquisition, sorted by different percentiles of the distribution.

Panel A

<b>Toehold Form</b>	<b>N</b>	<b>% of Deals</b>	<b>Toehold Size</b>
Acquisition of Minor Equity Stake	95	61%	31%
PIPE	26	17%	18%
Venture Capital	22	14%	19%
Growth Capital/Private Equity	11	7%	20%
LBO	1	1%	33%
Total	155	100%	

Panel B

<b>Months to Majority Acquisition</b>	<b>Pctile</b>
3	10%
8	25%
15	50%
28	75%
49	90%

time is consistent with toeholds being useful to gather information about the target company.<sup>11</sup>

## 6 Results

### 6.1 Univariate Analysis

In Table 3, we compare the means of characteristics of majority acquisitions, where the acquirer had a toehold before a majority acquisition, or where the acquirer did not. Acquirers are more likely to have a toehold in the target when the target company is potentially more difficult to analyze for outsiders: when it is younger and when it operates in a R&D-intensive industry. We also observe that acquirers are more likely to have a toehold in the target when the acquirer is potentially less informed than other potential acquirers; namely, when the acquirer operates in a different country or in a different industry than the target. Additionally, we observe that the number of potential bidders is lower in deals where the acquirer had a toehold than in deals where the acquirer did not, while acquirers of larger targets — in terms of assets — are more likely to have a toehold in the target. All these results are consistent with toeholds playing an important role in providing information to acquirers when it is more valuable to them. All the differences are statistically significant at the 1% level, except for the differences in the variables Different Industry and in R&D/Assets, which are statistically significant at the 5% and 10% level, respectively.

We now turn to study the impact of targets' opacity, the acquirer's pre-toehold informational disadvantage, and the expected competitiveness of the takeover contest on the probability that an acquirer had a toehold in the target company prior to the takeover, in a multivariate setting.

### 6.2 Regression Analysis

Table 4 shows the estimation of a probit model that uses as dependent variable the dummy Toehold. Column I uses all explanatory variables, except the logarithm of total assets, as the number of observations for this variable is more limited. Column II includes the logarithm of total assets as an explanatory variable. In both regressions we use year fixed effects to control for macro shocks such as merger waves. Also, in both estimations, the standard errors are clustered at the target

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<sup>11</sup> The patterns in Table 2, Panel B, are likely to be underestimating the true time that passes between the acquisition of the toeholds and the majority acquisition, as Capital IQ did not register transactions prior to 1998. Thus, older majority acquisitions in our data are more likely to be missing toehold information if toeholds are old enough.

Table 3: Univariate Analysis

This table shows the variables Private, Age, R&D/Assets, Cross-Border, Different Industry, Potential Bidders and Total Assets, sorted by the dummy Toehold. The differences in the mean of the variables are presented in column III. Significant at: \*10%, \*\*5% and \*\*\*1%.

Variable	Toehold=1	Toehold=0	Difference (Toehold=1–Toehold=0)
Private	0.62 (N=946)	0.87 (N=48,066)	-0.25***
Age	17.1 (N=946)	21.1 (N=48,066)	-4***
R&D/Assets (%)	0.047 (N=946)	0.045 (N=48,066)	0.002*
Cross-Border	0.244 (N=946)	0.141 (N=48,066)	0.103***
Different Industry	0.456 (N=946)	0.429 (N=48,066)	0.275**
Potential Bidders	570.7 (N=946)	630.3 (N=48,066)	-59.6***
Total Assets (millions)	451.5 (N=369)	290.9 (N=8,488)	160.5***

industry level, as the potential number of bidders and R&D intensity are computed at the industry level. In these specifications we do not include interaction terms, so we can only test Hypotheses 1, 2 and 4. Standard errors are shown in parentheses, below the coefficients.

The results from Table 4 confirm those of Table 3. We find that younger targets and targets that operate in R&D-intensive industries are more likely to be purchased through sequential acquisitions, although only the result for Target Age is statistically significant. These results are consistent with Hypothesis 1, that toeholds are more beneficial for acquirers when it is harder to analyze a target and therefore the synergies that can be expected from a full takeover.

We also find that when the acquirer operates in a different country, or in a different industry, than the target company, it is more likely that the acquirer takes a minority stake in the target company before taking over the company. The result for the Cross-Border dummy is statistically significant at the 1% level. The result for the Different Industry dummy, however, is not statistically significant. Overall, these two results are in agreement with Hypothesis 2, that the acquirer is more likely to take a toehold in the potential target when he/she is potentially ex-ante less well informed than other potential bidders.

Consistent with a decreasing value of information when the takeover contest is expected to be more competitive (Hypothesis 4), we find that the potential number of bidders is negatively related to the likelihood of acquiring a toehold before a takeover. Also consistent with this argument, the likelihood of a toehold increases with the size of the target's assets. (Acquirers tend to be larger than

Table 4: Regression Analysis

This table shows 2 probit regressions where the dependent variable is the Toehold dummy. The base case specification uses information for 49,012 majority acquisitions. The explanatory variables are the dummy Private, Age, R&D/Assets, the dummies Cross-Border and Different Industry, the number of Potential Bidders and year fixed effects. The second column additionally includes the logarithm of the target's assets as explanatory variable, reducing the sample to 8,607 majority acquisitions. Significant at: \*10%, \*\*5% and \*\*\*1%. Standard errors are adjusted for heteroscedasticity and clustered at the industry level.

<b>Variable</b>	<b>Toehold</b>	<b>Toehold</b>
<b>Private</b>	-0.5895*** (0.0592)	-0.3861*** (0.0959)
<b>Age</b>	-0.0043*** (0.0013)	-0.0041** (0.0018)
<b>R&amp;D/Assets (%)</b>	0.3749 (0.7126)	0.7099 (0.7921)
<b>Cross-Border</b>	0.2334*** (0.0393)	0.1607* (0.0864)
<b>Different Industry</b>	0.0162 (0.0510)	0.0890 (0.0901)
<b>Potential Bidders</b>	-0.0003* (0.0002)	-0.0006** (0.0002)
<b>Log(Assets)</b>		0.1035*** (0.0183)
<b>Year-Fixed Effects</b>	Yes	Yes
<b>Industry Cluster</b>	Yes	Yes
<b>R-squared</b>	0.059	0.093
<b>N</b>	49,012	8,607

targets, so a larger target has less potential acquirers.) Thus, the takeover contest is potentially less competitive and this increases the value of obtaining more precise information about the synergies with the target through a toehold. Both the logarithm of assets and the potential number of bidders are statistically significant. Overall, the evidence on the takeover competitiveness favors the hypothesis that information gathering is a strong motivation for the acquisition of a toehold before acquiring a majority stake.

Although we interpret asset size as a proxy for the inverse number of potential bidders, it can also be interpreted as a proxy for uncertainty about the target's value (Martin (1996)). If that is the case, our model suggests the same empirical implication: the larger the target, the more likely that the acquirer gets a toehold prior to the majority acquisition, according to Hypothesis 1. Thus, regardless of the interpretation given to the targets' asset size, the finding that it is positively related to the likelihood that a majority acquisition is preceded by a toehold is consistent with toeholds being more beneficial when the value of information is higher.

Finally, the control variable *Private* is negative and statistically significant at the 1% level, implying that acquisitions of private targets are less likely to be preceded by a toehold. This implies that practical reasons (i.e., purchasing a toehold in a private company is not as simple as in a public company given that their stakes are less liquid) are empirically more important than informational issues in the estimation of the parameter of the dummy *Private*. The result that majority acquisitions are less likely to be preceded by toeholds when the target is private is consistent with the findings presented by Ouimet (2011). She finds that minority acquisitions are less likely to occur in private companies.

In Table 5, we include the interactions between the variables that capture targets' opacity and the variables that capture the acquirers' ex-ante informational disadvantage to test the prediction from Hypothesis 3. As in Table 4, column I does not include *Assets* as an explanatory variable, but column II does. Column I shows that all 4 parameters of the interaction terms are in agreement with Hypothesis 3: *Cross-Border* has less of a positive impact in the likelihood that an acquirer has a toehold prior to the majority acquisition when the target firm is younger and when it operates in an R&D-intensive industry. This is also the case for acquirers belonging to a different industry than the target. Although all the parameters are signed as expected, only the interaction between *Cross-Border* and *Age* is statistically significant. Column II shows similar results. Overall, Hypothesis 3 seems to find some support in the data.

Table 5: Regression Analysis with Interaction Terms

This table shows 3 probit regressions where the dependent variable is the Toehold dummy. The base case specification uses information for 49,012 majority acquisitions. The explanatory variables are the dummy Private, Age, R&D/Assets, the dummies Cross-Border and Different Industry, the number of Potential Bidders, the interaction between Age and Cross-Border, Different Industry and Age, Cross-Border and R&D/Assets, Different Industry and RD/Assets, and year fixed effects. The second column additionally includes the logarithm of the target's assets as an explanatory variable, reducing the sample to 8,607 majority acquisitions. The right column additionally includes the interaction of the dummy Private and the variables Cross-Border and R&D/Assets. Significant at: \*10%, \*\*5% and \*\*\*1%. Standard errors are adjusted for heteroscedasticity and clustered at the industry level.

Variable	Toehold	Toehold	Toehold
<b>Private</b>	-0.5887*** (0.0599)	-0.3787*** (0.0995)	-0.2342** (0.1048)
<b>Age</b>	-0.0060*** (0.0013)	-0.0046** (0.0020)	-0.0046** (0.0019)
<b>R&amp;D/Assets (%)</b>	0.5312 (0.9326)	1.3767* (0.7458)	1.3398* (0.7580)
<b>Cross-Border</b>	0.1673** (0.0664)	0.0503 (0.1366)	0.0487 (0.1361)
<b>Different Industry</b>	0.0079 (0.0746)	0.2510** (0.1175)	0.3357*** (0.1248)
<b>Potential Bidders</b>	-0.0003* (0.0002)	-0.0006*** (0.0002)	-0.0006*** (0.0002)
<b>Log(Assets)</b>		0.1086*** (0.0180)	0.1105*** (0.0176)
<b>Cross-Border*Age</b>	0.0035** (0.0014)	0.0019 (0.0029)	0.0020 (0.0029)
<b>Different Industry*Age</b>	0.0017 (0.0016)	0.0001 (0.0020)	-0.0002 (0.0020)
<b>Cross-Border*R&amp;D/Assets (%)</b>	-0.0017 (0.6387)	1.0313 (0.8003)	1.1438 (0.7980)
<b>Different Industry*R&amp;D/Assets(%)</b>	-0.4682 (0.8007)	-3.5264*** (1.0149)	-3.4681*** (0.9921)
<b>Cross-Border*Private</b>			-0.0772 (0.1867)
<b>Different Industry*Private</b>			-0.3432** (0.1338)
<b>Year-Fixed Effects</b>	Yes	Yes	Yes
<b>Industry Cluster</b>	Yes	Yes	Yes
<b>R-squared</b>	0.06	0.101	0.104
<b>N</b>	49,012	8,607	8,607

Finally, in column III of Table 5 we include the interactions between the dummy Private and the variables Cross-Border and Different Industry. We include these interactions to test whether some portion of the parameter for the dummy private accounts for targets' opaqueness. What we have in mind is that  $\beta^{\text{Private}} = \beta^{\text{Practical}} + \beta^{\text{Opacity}}$ , where  $\beta^{\text{Practical}} < 0$  and  $\beta^{\text{Opacity}} > 0$  and the first effect is empirically more relevant than the second. According to Hypothesis 3,  $\beta^{\text{Practical}}$  can be further decomposed into a stand-alone effect, and two interaction effects:  $\beta^{\text{Opacity}} = \beta_0^{\text{Opacity}} + \beta_1^{\text{Opacity}} \times \text{Cross-Border} + \beta_2^{\text{Opacity}} \times \text{Different Industry}$ , where  $\beta_0^{\text{Opacity}} < \beta_1^{\text{Opacity}}$  and  $\beta_1, \beta_2 < 0$ . Thus, if the dummy Private is also capturing some degree of the targets' opaqueness, we expect the interaction terms of the dummy Private with Cross-Border and Different Industry to be negative. We also expect the coefficient of the dummy Private to be less negative when the interaction terms are included. This is exactly what we find: Comparing the specifications from column III and column II, the parameter of the dummy Private significantly increases from -0.38 to -0.23; while both interaction terms are negative, although only the interaction between Private and Different Industry is statistically significant. This result provides additional support for Hypothesis 3.

### 6.3 Alternative Hypotheses

Our paper studies under what conditions the benefits of acquiring a toehold prior to a majority acquisition are larger. So far, we have found evidence consistent with the use of toeholds prior to majority acquisitions when better information about the target is particularly valuable. In this subsection, we address the possibility that our results could be driven by alternative explanations; specifically, agency considerations.

The literature on toeholds in the presence of agency problems focuses on disciplinary takeovers. Grossman and Hart (1980) argue that a toehold is the main source of profit for a "raider," which implies that targets suffering from agency problems are more likely to be acquired by a toeholder. In other words, the presence of agency problems in a target makes it more likely that toeholds are used to acquire it. We therefore ask what variables describing the target might be related to agency problems. An agency view might argue that a target's opaqueness increases the likelihood of finding agency problems. However, the type of targets that we classify as more opaque — younger and more R&D-intensive firms — are less likely to suffer from certain agency problems than older and more mature firms. An agency view might also focus on the size of a target, arguing that larger

firms are more likely to have weak corporate governance. Thus, agency considerations, in principle, could explain the positive coefficient on the targets' assets that we find in our regressions. As can be inferred from these examples, agency problems can generate predictions that can either go in the opposite direction of our findings or they can potentially explain them. Therefore, to test whether agency considerations can indeed explain our results, we take a simple approach which does not rely on any particular agency theory: we study the differential effect of the targets' characteristics on the likelihood of acquiring a toehold according to the targets' ownership status.

Arguably, agency problems are a smaller concern for privately held firms. Publicly traded firms have a more dispersed share ownership and are therefore missing an important channel for corporate governance. Thus, if agency problems were driving the decision to take a toehold, the estimated coefficients should be larger and more significant for publicly traded targets than for privately held targets, regardless of the underlying agency-based explanation. To test whether this is the case, we analyze the differential impact of Age, R&D/Assets, Potential Bidders and Assets for publicly traded and privately held targets. If the coefficient of Age and Potential Bidders is more negative for publicly traded targets, and the coefficients of R&D/Assets and Assets are more positive, then we cannot reject the alternative hypothesis, that our results are driven by agency considerations. However, if that is not the case, we can be more confident that our results are not explained by agency problems. We present the results in Table 6.

We find that the coefficient of Age is more negative for privately held firms than for publicly traded firms. Also, the coefficients of the variables R&D/Assets and Assets are more positive for privately held targets. This suggests that agency problems are unlikely to explain our results. In fact, the signs of the coefficients on the interaction terms are consistent with an informational story: For privately held (and therefore more opaque) firms, the coefficients of Age, R&D/Assets and Assets are actually more pronounced.

For the variable Potential Bidders, however, we find that the coefficient is more pronounced for public firms than for private firms. In particular, we find that the negative effect of the potential number of bidders is statistically significant only for public firms. For private firms the positive coefficient on the interaction term almost completely offsets the negative effect of potential bidders on the likelihood of taking a toehold. Although it is possible to come up with agency explanations for this finding, we believe the most reasonable explanation derives from the form in which the variable potential bidders is constructed. This variable is a weighted average of the number of

Table 6: Private vs. Public Targets

This table shows a probit regression where the dependent variable is the Toehold dummy. The explanatory variables are the dummy Private, Age, R&D/Assets, the dummies Cross-Border and Different Industry, the number of Potential Bidders, the logarithm of the targets' book value of assets, and the interactions between the dummy Private and Age, R&D/Asset, Number of Potential bidders and the logarithm of the targets' assets. Significant at: \*10%, \*\*5% and \*\*\*1%. Standard errors are adjusted for heteroscedasticity and clustered at the industry level.

<b>Variable</b>	<b>Toehold</b>
<b>Private</b>	-0.8972*** (0.2067)
<b>Age</b>	-0.0033* (0.0018)
<b>R&amp;D/Assets (%)</b>	-0.1219 (0.8316)
<b>Cross Border</b>	0.1522* (0.0875)
<b>Different Industry</b>	0.1038 (0.0908)
<b>Potential Bidders</b>	-0.0008*** (0.0003)
<b>Log(Assets)</b>	0.1071*** (0.0198)
<b>Age*Private</b>	-0.0047 (0.0045)
<b>R&amp;D/Assets*Private</b>	3.5784*** (0.6738)
<b>Potential Bidders*Private</b>	0.0007*** (0.0002)
<b>Log(Assets)*Private</b>	0.0073 (0.0328)
<b>Year-Fixed Effects</b>	Yes
<b>Industry Cluster</b>	Yes
<b>R-squared</b>	0.106
<b>N</b>	8,607

public companies that operate in the target’s industry and related industries. Given that 2/3 of acquirers of publicly traded targets are publicly traded, while only 1/3 of the acquirers of privately owned targets are publicly traded, our measure of potential number of bidders better reflects the expected competitiveness of the takeover environment for publicly traded targets than for privately owned targets. Therefore, it is natural for our measure of potential bidders to have a stronger impact on publicly traded targets.

In sum, although agency-based explanations can play a role in the decision of an acquirer to take a toehold in the target company prior to a majority acquisition, we do not find evidence that our results are driven by such explanations. Our results support the hypotheses from our model, which relate to the informational benefits that toeholds provide to their holders.

## 7 Conclusion

Acquisitions can fail for many reasons. Well-designed plans may be executed poorly, or bad luck may play a role. An important reason, though, is that acquirers often overestimate the synergies they can expect from a takeover, so even the best “execution” cannot deliver the promised value.

Quaker Oats’ acquisition of Snapple in 1994 is a well-known example: The assessment of the possible synergies seems to have been over-optimistic. In fact, the post-takeover performance was so poor that Quaker Oats sold Snapple (at a much lower price) after only two years. Walmart’s expansion into Germany is another example. Walmart seems to have overestimated its ability to apply business practices that work well in its U.S. market to its newly acquired subsidiaries abroad. Again, the expectations seem to have been over-optimistic, and Walmart recently sold its stores to a local competitor and withdrew from the German market.

With the benefit of hindsight, it looks like the motivation for these acquisitions was flawed, being based on a very limited understanding of the synergies that a takeover could produce. Neither acquirer seemed to have understood what the value drivers in the target companies and their markets were, and how an acquisition could unleash additional value.

These examples support the key message in this paper, that information about possible synergies from a takeover is important for firms considering an acquisition. Potential acquirers need to use any source of information available. As we argue, one way to improve this information is to take a toehold in the target firm, before making a full takeover offer. Taking a toehold allows the potential acquirer to interact with the target and its management. It gives the acquirer better insight into

the operations of the target, and how an acquisition could improve them. A toehold does not represent a commitment to eventually take over the target. It opens the doors to a takeover, and it allows for a more informed decision. If the better information is negative, the toehold can easily be undone.

Taking a toehold is costly, of course. Our focus in this paper is on the circumstances under which a toehold is particularly beneficial, compared with a direct takeover offer (likely to lead to a bidding contest). We find that toeholds are particularly beneficial if information about the target is generally hard to obtain; if a bidder considering a takeover is initially less well-informed than other potential bidders (Walmart's lack of experience with the German retail market is a case in point); and if there are less potential rival bidders for a target.

The empirical evidence is consistent with these predictions: Our data set on acquisitions of both privately held and publicly traded North-American targets includes information on non-controlling equity stakes held by the eventual acquirer before the acquisition. We find that acquirers are more likely to have owned a toehold if the target is opaque (hard to analyze); if the acquirer found it harder than other bidder to analyze the target (cross-border and cross-industry acquisitions); and if the number of potential bidders was smaller.

The literature has so far focused on distortions to a toeholder's bidding in takeover contests. We show that there is more to it. Information seems to play an important role in the decision to take a toehold, and also in subsequent takeover contests.

## A Appendix: The Probability of Winning

This appendix shows how a toehold affects a bidder's probability of winning. Our empirical tests ask how likely an acquirer is to have had a toehold before an acquisition. The theoretical results focus on circumstances that make it more attractive for a potential acquirer to first take a toehold and thereby gain access to more reliable information about possible synergies. We show that while a toehold may affect a bidder's probability of winning, and thus her probability of being present in our data set (consisting of successful acquirers), such an effect is not present for some of our results, and for the other results, it goes *against* our theoretical results. In other words, the possible bias from sample selection makes it less likely that we find empirical results consistent with our theoretical predictions. Specifically, if our theory predicts that a certain change in the parameters makes it more beneficial to take a toehold, the ratio of probabilities of winning — with and without a toehold — decreases or is unchanged; and vice versa.

Our first hypothesis focuses on the informativeness of a non-toeholder's signal: the less informative (the lower  $\varphi_2$ ), the more beneficial a toehold becomes. In contrast, a less informative non-toeholder signal (a lower  $\varphi_2$ ) reduces the probability that a toeholder wins, compared with the probability of winning in a setup without any toeholds.

**Proposition A1** *The probability of winning is larger with a toehold, and the difference increases with  $\varphi_2$ .*

**Proof.** Without a toehold, the bidders are symmetric, so the probability of winning is

$$\mathcal{P}_1^{\text{noTH}} = \int_{\ell}^h \int_{\ell}^{s_1} \frac{1}{h-\ell} ds_2 \frac{1}{h-\ell} ds_1 = \frac{1}{2}.$$

If  $\varphi_2 > \frac{1}{1+2\alpha}\varphi_1$  (so  $b_1^*(s_1) > v_2(\ell)$  for all  $s_1$ ), the toeholder's probability of winning is

$$\mathcal{P}_{1+}^{\text{TH}} = \int_{\ell}^{\sigma_1(h)} \int_{\ell}^{\beta_2(b_1^*(s_1))} \frac{1}{h-\ell} ds_2 \frac{1}{h-\ell} ds_1 + \int_{\sigma_1(h)}^h \frac{1}{h-\ell} ds_1 = \frac{-\varphi_1^2 - \varphi_2^2 + 6\varphi_1\varphi_2 + 8\alpha\varphi_1\varphi_2}{8\varphi_1\varphi_2(\alpha+1)}.$$

It increases with  $\varphi_2$ :

$$\frac{\partial}{\partial \varphi_2} \mathcal{P}_{1+}^{\text{TH}} = \frac{\varphi_1^2 - \varphi_2^2}{8\varphi_1\varphi_2^2(\alpha+1)} > 0.$$

Evaluated at  $\varphi_2 = \frac{1}{1+2\alpha}\varphi_1$ ,

$$\mathcal{P}_{1+}^{\text{TH}}|_{\varphi_2=\frac{1}{1+2\alpha}\varphi_1} = \frac{1}{2} + \frac{\alpha}{2(1+2\alpha)} > \frac{1}{2},$$

so  $\mathcal{P}_{1+}^{\text{TH}} > \frac{1}{2}$  for all  $\varphi_2 \geq \frac{1}{1+2\alpha}\varphi_1$ . If  $\varphi_2 \leq \frac{1}{1+2\alpha}\varphi_1$  (so  $b_1^*(s_1) = v_2(\ell) \forall s_1 \leq \widehat{s}_1$ ),

$$\mathcal{P}_{1-}^{\text{TH}} = \int_{\widehat{s}_1}^{\sigma_1(h)} \int_{\ell}^{\beta_2(b_1^*(s_1))} \frac{1}{h-\ell} ds_2 \frac{1}{h-\ell} ds_1 + \int_{\sigma_1(h)}^h \frac{1}{h-\ell} ds_1 = \frac{\varphi_1 + \alpha\varphi_2}{2\varphi_1}$$

$$\frac{\partial}{\partial\varphi_2} \mathcal{P}_{1-}^{\text{TH}} = \frac{\alpha}{2\varphi_1} > 0.$$

Also,  $\mathcal{P}_{1-}^{\text{TH}} = \frac{1}{2} + \frac{\alpha\varphi_2}{2\varphi_1} > \frac{1}{2}$ , so the probability of winning is larger than in the symmetric case. ■

This result implies that  $\frac{\partial}{\partial\varphi_2} \frac{\mathcal{P}_{1+}^{\text{TH}}}{\mathcal{P}_{1+}^{\text{noTH}}} > 0$  and  $\frac{\partial}{\partial\varphi_2} \frac{\mathcal{P}_{1-}^{\text{TH}}}{\mathcal{P}_{1-}^{\text{noTH}}} > 0$ . In other words, the relative probability of winning (compared with the no-toeholds setup) is increasing in  $\varphi_2$ . This implies that observations in which a target is classified as more opaque, a toeholder's probability of winning is *lower* than with less opaque targets. So if we observe a *higher* incidence of toeholds held by acquirers of more opaque targets, that must be due to significant informational benefits, since the increase in the chances of winning is actually not as high as in the case of less opaque targets.

Our second hypothesis focuses on bidders whose information is initially (without a toehold) less reliable than that of other bidders. Such bidders benefit more from having a toehold, but, as we show now, a toehold does not improve their probability of winning by more than it does for other bidders.

**Proposition A2** *The no-toehold informativeness of a bidder's signal does not affect her probability of winning.*

**Proof.** We first show that without a toehold, the probability of winning is  $\frac{1}{2}$ , irrespective of the informativeness of a bidder's signal. Assume that bidder  $i$ 's informativeness is  $\varphi_i$  and bidder  $j$ 's is  $\varphi_j$ . W.l.o.g., let  $\varphi_i > \varphi_j$ . Neither bidder has a toehold, so the dominant strategy is to bid the expected valuation, given the realized signal. Bidder  $i$ 's probability of winning is

$$\mathcal{P}_{i,\varphi_i>\varphi_j}^{\text{noTH}} = \int_{\ell}^h \int_{\sigma_i(s_j)}^h \frac{1}{h-\ell} ds_i \frac{1}{h-\ell} ds_j = \frac{1}{2}.$$

So Bidder  $j$ 's probability equals  $1 - \mathcal{P}_{i,\varphi_i>\varphi_j}^{\text{noTH}} = \frac{1}{2}$ . Thus, if Bidder 2's signal is of informativeness

$\varphi_2$ , then whether the informativeness of Bidder 1's signal is either  $\varphi_2$  or  $\varphi_0 < \varphi_2$  does not affect her probability of winning — it is always  $\frac{1}{2}$ .

Next, if a bidder takes a toehold, the initial informativeness of her signal is replaced by  $\varphi_1$ , so the probability of winning does not depend on the initial informativeness. ■

This implies that the relative increase in the probability of winning due to taking a toehold is identical for all bidders, irrespective of the initial informativeness of their signal. Hence, the likelihood of observing a certain bidder in our data set (successful acquirers) does not depend on how reliable their information about the value of synergies is in the absence of a toehold.

Our third hypothesis compares the benefits of a toehold for initially disadvantaged or not disadvantaged bidders, and how that benefit depends on the target's opaqueness. Since the effects on the relative probabilities of winning are identical for both types of bidders, there cannot be a difference caused by changes in opaqueness (variations in  $\varphi_2$ ), either.

Finally, our fourth hypothesis is that the benefit from a toehold decreases with the number of rival bidders. In contrast, the relative increase in the probability of winning with a toehold, compared with the no-toeholds setup, *increases* with the number of bidders. This is easiest to see when comparing the limit case as  $n \rightarrow \infty$ .

**Proposition A3** *The relative increase in the probability of winning with a toehold is unbounded in the limit as  $n \rightarrow \infty$ .*

**Proof.** In the limit as  $n \uparrow \infty$ , the toeholder's probability of winning is

$$\lim_{n \rightarrow \infty} \mathcal{P}_{1,n}^{\text{TH}} = \lim_{n \rightarrow \infty} \int_{\max\{\widehat{s}_1, \ell\}}^{\sigma_1(h)} G_n(\beta_2(b_1^*(s_1))) \frac{1}{h-\ell} ds_1 + \int_{\sigma_1(h)}^h \frac{1}{h-\ell} ds_1 = \int_{\sigma_1(h)}^h \frac{1}{h-\ell} ds_1$$

Without a toehold, the probability of winning,

$$\mathcal{P}_{1,n}^{\text{noTH}} = \int_{\ell}^h G_n(s_1) \frac{1}{h-\ell} ds_1,$$

decreases with  $n$ , and in the limit as  $n \rightarrow \infty$  it converges to zero. So  $\lim_{n \rightarrow \infty} \frac{\mathcal{P}_{1,n}^{\text{TH}}}{\mathcal{P}_{1,n}^{\text{noTH}}} = \infty$ . ■

The same result holds for finite  $n$ : Adding one more rival increases the ratio  $\frac{\mathcal{P}_{1,n}^{\text{TH}}}{\mathcal{P}_{1,n}^{\text{noTH}}}$ . Deriving these results is a little more involved, since it requires a comparison of the relative probabilities of winning with  $n$  and  $n+1$  bidders, for each value of  $n$  separately; so these results are not reproduced here.

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