Toehold Acquisitions as Staging Real Options*

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Abstract

This paper studies how a pre-bid minority ownership (toehold) in the target firm can improve the acquirer's position in the takeover process by reducing the information asymmetry. Using a dynamic real options approach to compare the takeover options (with and without a toehold), the bidder can optimally choose the acquisition mode and the toehold size. Toehold acquisitions are more likely to occur under low market uncertainty, low expected synergies and high synergies uncertainty. These results suggest that managers' overconfidence, market and synergies uncertainty, and asymmetry of information can help explaining the choice of the acquisition strategy.

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1 Introduction

Over the last decades, Merger and Acquisition (M&A) activities have experienced a tremendous increase, both in terms of number of deals and value. It is natural to see the attention that M&As gathers among academics, being one of the topics that generate more research in the area of finance. Nevertheless, there is much about M&A transactions that remains to be understood.

One of the puzzles regards toehold acquisitions as a preliminary step towards a future takeover. In a two-stage acquisition strategy the acquirer purchases a minority stake in the target firm, prior to initiating the takeover deal. Despite most of the literature supports the idea that a toehold enhances the bidder's position and increases the probability of the takeover success (Betton and Eckbo, 2000; Bessler et al., 2015; Dai et al., 2021), this strategy is being neglect by most of the acquiring firms (Betton et al., 2009).

One of the main threats to the success of M&A deals is the overestimation of synergies (DePamphilis, 2009). Predicting the value of synergies, however, is far from trivial, due to, for instance, problems of information asymmetry. Acquisitions are therefore risky decisions, and in fact, widespread evidence suggests that majority of full acquisitions fail to deliver value for the acquirer (Betton et al., 2008; Martynova and Renneboog, 2008). Rather than going straight with a full-scale commitment, the potential acquirer can opt for a two-steps strategy, buying a toehold in the target before starting M&A process, which may help him to better assess the target firm.

It is in this context of low acquires' returns and remarkable low frequency of toeholds, despite all the benefits attributed by the literature, that this paper inserts. We focus primarily on the potential of toeholds to solve the problem of information asymmetries (Povel and Sertsios, 2014; Bulow et al., 1999), one of the main reasons for excessive premiums in M&A deals, by allowing the bidder to extract relevant information from the target.

Borrowing insights from Lukas and Welling (2012) and Lukas et al. (2019), we follow a non-cooperative game approach, from which the single-step and the two-steps takeover solutions are derived. One of the key features of our model is that, when taking a minority stake in the target firm, the bidder may lose the first-mover advantage over the second stage, depending on whether the target foresees the true intentions of the bidder.

Our model shows that a toehold grants additional value to the takeover option, which is the result of two important effects: firstly, the overbidding capacity, as already shown by Lukas et al. (2019); and secondly, the information advantage of toeholds, since they may help to reduce information asymmetries through a better knowledge of target's characteristics (e.g., Singh, 1998; Arnold and Shockley, 2001; Chen and Hennart, 2004; Povel and Sertsios, 2014; Dionne et al., 2015; Aintablian et al., 2017).

Interestingly, however, we argue that this value increase may not be enough to offset

the loss that the toehold bidder suffers if the target anticipates his intents, capturing the first-mover advantage on the second stage of the deal. In fact, the two-steps takeover is only the best strategy if the bidder maintains the initiating position, i.e., if he remains the offering party. The bidder's decision upon which strategy to follow depends on his beliefs about what will be the reaction of the target to the toehold acquisition.

The mains findings of our paper are: i) the dominant strategy (single-step or two-steps acquisition) depends on the beliefs of the bidder about the reaction of the target to the toehold acquisition and the reduction of asymmetry of information it produces; ii) toehold acquisitions are more likely to occur under low market uncertainty conditions, indicating that in riskier industries or in high volatility market conditions, the single-step takeover is more likely to occur; iii) low expected synergies, and iv) high synergies uncertainty favor toehold acquisitions. These results suggest that managers' overconfidence, uncertainty and asymmetry of information can play a role in explaining the choice of the acquisition strategy.

The remainder of the paper unfolds as follows. Section 2 provides a brief overview of the related literature. Section 3 presents the derivation of the basic model, where the solutions for the single-step and for the two-steps takeover are presented. Section 4 show how the optimal strategy and toehold size can be chosen by the bidder. Section 5 showcases the optimal takeover strategy with a numerical example and a sensitivity analysis to main value drivers of the models. Section 6 concludes.

2 Related literature

It is well documented in the literature that M&A activities seem to fail in delivering value for the shareholders of bidder firms, being typically those of the target the winners of the deal (e.g., Jensen and Ruback, 1983; Andrade et al., 2001; Moeller et al., 2005; Martynova and Renneboog, 2008; Betton et al., 2008; Lin et al., 2011). In this context, understanding the factors that contribute to this outcome becomes critical for bidders' shareholders. The three commonly cited reasons for such failure are: overestimation of synergy or overpaying, the slow pace of post-merger integration, and a poor strategy (DePamphilis, 2009).

The overpayment factor can be justified from a behavioral perspective. The hubris hypothesis of Roll (1986) provides valuable insights on this matter, since managers' overconfidence may lead them to overpay for the target, as result of an overestimation of potential synergies. The CEO envy theory of Goel and Thakor (2010) also predicts bidders' overpayment. Cullinan et al. (2004) state that target firms often use information on their favor to get the highest price possible, by incurring in a wide range of accounting tricks for making their assets look more appealing than they really are.

The literature identifies several benefits of holding a toehold (e.g., Bessler et al., 2015; Betton and Eckbo, 2000). Firstly, if the market is unaware of the true intentions, the

acquirer may be able to form the toehold before share prices rise reflecting the takeover premium, and secondly, the bidder becomes a shareholder of the target firm, which may allow him to access to relevant information, or, even more important, may give him power to influence relevant decisions. Additionally, toehold acquirers have greater bargaining power in bidding wars which may discourage rival bids. Betton and Eckbo (2000); Bessler et al. (2015) report a deterrence effect of toeholds on competition, decreasing the probability of rival biddings. Likewise, Bulow et al. (1999) show that even small differences in toeholds can sharply improve the chances of a bidder to win the contest. The authors suggests that a toehold makes the bidder more aggressive which makes non-toeholders fear from the winner's curse and bid more conservative in an ascending auction. Moreover, if the toehold bidder loses a takeover contest, the minority stake in the target company can still provide him some capital gains, as he receives the proceeds from selling the toehold to the rival bidder.

Furthermore, toeholds are an effective way of mitigating information asymmetry between the bidder and target (e.g., Singh, 1998; Arnold and Shockley, 2001; Chen and Hennart, 2004; Povel and Sertsios, 2014; Dionne et al., 2015; Aintablian et al., 2017). Having a toehold may allow the acquirer to make a more informed decision, since it can give him the possibility to interact with the target management and access to relevant information, otherwise impossible to gather. Empirical evidence suggests that less informed bidders (normally associated to situations where the target is more opaque or when it operates in a different industry/country than that of the bidder) are more prone to use toeholds as a first step of a future full acquisition (Aintablian et al., 2017; Povel and Sertsios, 2014). Consistent with this result, Povel and Sertsios (2014) find that takeovers are more likely to be preceded by a toehold acquisition when the target is a young firm and when it operates in an R&D-intensive industry. In a recent study, Dai et al. (2021) show that toehold strategies are preferred for performing difficult takeovers, and also that they increase the returns of acquirers.

Additionally, the pre-acquisition minority stake conveys substantial strategic advantages to the bidder. Since many of these advantages come at the expense of the target firm, some targets may argue the bidder is not negotiating in good faith, becoming reluctant to enter in friendly negotiations. In fact, toehold biddings are four times more frequent in hostile acquisitions (50% of the initial bidders in hostile contests have toeholds) than in friendly mergers (11% of the initial bidders in friendly contests have toeholds)(Betton et al., 2009).

Despite the advantages, toehold biddings have been declining dramatically since the peaks in 1980s and are now much less frequent (Betton et al., 2009). One reason could be related to regulatory considerations. In the US, the Security Exchange Commission (SEC) specifies that anyone who acquires 5% or more of a target's outstanding shares will be required to file a Schedule 13D within ten days after the acquisition to disclose

detailed information regarding their identity, the number of shares owned, the purpose, and proposals concerning the purchase. Mandatory disclosure rules make toeholds too costly because they reveal the bidder's intentions early in the takeover process (Eckbo, 2009).

Although the mandatory disclosure rule could represent a cost to pre-acquisition minority ownerships, as it may reveal the bidder's real intentions, this argument does not seem valid. In some countries like the UK, the bidder can declare that has no interest in taking over the firm in which bought the toehold and still make an offer after six months have been passed. Additionally, toeholds were reasonably common during the 1980s, while the mandatory disclosure rules where implemented much before that, with the 1968 Williams Act (filling form 13D of SEC) and 1976 Hart–Scott–Rodino Antitrust Improvements Act (share acquisitions exceeding a certain threshold trigger notification to the antitrust agencies).

The strategic decision to acquire a minority stake as a preliminary step towards a future takeover can be seen as a dynamic real options game. Acquiring a toehold gives the bidder the option to acquire the remaining stake of the target firm in an advantageous position, overcoming the problem of information asymmetry.

Smit and Kil (2017) analyze toeholds acquisitions from the perspective of two strands of literature in finance, real options theory and behavioral finance. The authors argue that managers' biases lead them to be careless about the many uncertainties that often surround acquisitions and rush to deals that eventually fail to deliver the anticipated synergies. Also Smit and Matawlie (2017), following the same perspective, offer an explanation to the toehold puzzle. The authors present a behavioral dynamic model, as well as empirical evidence, which shows that CEOs' overconfidence causes them to forgo the toehold strategy, following an immediate controlling takeover instead.

Despite all previous contributions, many relevant issues regarding the toehold acquisition strategy remain to be understood, particularly about its importance in reducing information asymmetry, along with the impact of target's reaction when becoming aware of the toehold acquisition. As we will see, these aspects are quite important for governing the strategy to be chosen by a bidder firm.

3 Takeover strategies

Consider two firms B and T, which are, respectively, the bidder and the target. We assume that the value of the target is not constant over time but rather behaves stochastically following a geometric Brownian motion:

$$dV(t) = \alpha V(t)dt + \sigma V(t)dW(t) \tag{1}$$

where $\alpha \in \mathbb{R}$ is the instantaneous risk-neutral drift, $\sigma \in \mathbb{R}^+$ is the instantaneous standard deviation and $dW(t)$ is an increment of the Wiener process. Under risk-neutrality we set $\alpha = r - \delta$, where r denotes the risk-free rate and δ represents the rate of return shortfall, i.e. the cost of holding the option to buy the target firm un-exercised.

The acquisition process is modeled as non-cooperative bargaining game, based on Lukas and Welling (2012), where a given premium $\psi^* > 0$ over the target's market value is optimally defined by one of the agents in play (bidder or target) and then, conditional on this offered premium, the other firm (the reacting party) decides when to accept the deal, i.e. it will choose the trigger value $V^*(\psi^*)$, which corresponds to the optimal timing decision ($t^* = min[t \geq t_0 | V(t) \geqslant V^*(\psi^*)]$). Both bidder and target, for exercising the takeover, incur in irreversible transaction costs denoted, respectively, as ϵY and $(1-\epsilon)Y$, where $\epsilon \in (0, 1)$.

The takeover is expected to produce synergies, here represented as a fraction of the target value (ωV), which can be defined as the value created through the combination of the two firms. However, the bidder's evaluation of the takeover option is based on his expectations about the synergies. As already mentioned, a toehold strategy can be used to stage the acquisition process, contributing to overcome the problem of asymmetry of information.

To understand if the toehold strategy creates additional value to the bidder, when compared to a full takeover without a toehold, we derive the models both for the single-step takeover, as well as for the two-steps alternative. These models will be useful to analyze and compare the two takeover strategies, identifying the best strategy to follow.

3.1 Single-step takeover

In the single-step takeover strategy, no toehold is held by the bidder firm (B). We follow Lukas and Welling (2012) and assume that the bidder acts as a Stackelberg leader. We set firm B as the initiating party, catching by surprise both firm T and the market. For this reason, the target's market value does not incorporate any takeover expectations. At the time of deal, which is determined by T conditional on the premium offered by B, the target receives $(1+\psi_s)V(t)$, in exchange for his assets worth $V(t)$, and pays the transaction costs of $(1-\epsilon)Y$. Therefore, for a given premium, ψ_s, the target's timing decision to sell the company solves the following maximization problem:

$$\max_{\tau} \left[\mathrm{E}_t[(\psi_s V(t) - (1-\epsilon)Y)e^{-r\tau}] \right], \tag{2}$$

where $\mathrm{E}_t(.)$ is an expectation operator.

Standard real options arguments[1] allow us to present the optimization problem defined

[1]For more details see Dixit and Pindyck (1994).

in (2) as follows:

$$\max_{V_s^*(\psi_s)} \left[(\psi_s V_s^*(\psi_s) - (1-\epsilon)Y) \left(\frac{V(t)}{V_s^*(\psi_s)} \right)^{\beta_1} \right] \tag{3}$$

where $\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{\left(-\frac{1}{2} + \frac{\alpha}{\sigma^2} \right)^2 + \frac{2r}{\sigma^2}} > 1$ is the positive root of the standard fundamental quadratic equation, and $V_s^*(\psi_s)$ is the takeover trigger for a given premium ψ_s.

The bidder firm, in turn, offers the premium (ψ_s^*) that maximizes his objective function, given the target's optimal response ($V_s^*(\psi_s)$), i.e.:

$$\max_{\psi_s} \left[(\bar{\omega} - \psi_s) V_s^*(\psi_s) - \epsilon Y) \left(\frac{V(t)}{V_s^*(\psi_s)} \right)^{\beta_1} \right] \tag{4}$$

Since takeover synergies are assumed to be uncertain, the bidder firm evaluates the takeover option based on his synergy expectations. To keep it simple we assume two possible outcomes for the synergy, a high synergy (ω_h) and low synergy (ω_l), occurring with probabilities $p \in [0,1]$ and $(1-p)$, respectively. Accordingly, the expected synergy is:

$$\bar{\omega}(\omega_h, \omega_l, p) = p\omega_h + (1-p)\omega_l \tag{5}$$

which means that the expected amount of takeover synergy is $\bar{\omega}V$.

Solving both objective functions recursively leads to the following Proposition[2]:

Proposition 1. *The single-step takeover occurs at the optimal timing $V(t) = V_s^*$, determined by the target after receiving the optimal premium ψ_s^* from the bidder, where V_s^* and ψ_s^* are given by:*

$$V_s^*(\omega_h, \omega_l, p) = \frac{\beta_1(\beta_1 - \epsilon)}{(\beta_1 - 1)^2} \frac{Y}{\bar{\omega}(\omega_h, \omega_l, p)} \tag{6}$$

$$\psi_s^*(\omega_h, \omega_l, p) = \frac{(\beta_1 - 1)(1-\epsilon)\bar{\omega}(\omega_h, \omega_l, p)}{\beta_1 - \epsilon} \tag{7}$$

Consequently, the takeover option value for firm B is as follows:

$$B_s(V, \omega_h, \omega_l, p) = \frac{(\beta_1 - \epsilon)Y}{(\beta_1 - 1)^2} \left(\frac{V}{V_s^*(\omega_h, \omega_l, p)} \right)^{\beta_1}, \text{ for } V < V_s^*(\omega_h, \omega_l, p) \tag{8}$$

3.2 Two-steps takeover

Let us now extend the previous framework to include the case of firm B holding a minority ownership on firm T (first stage) before moving to the full acquisition (second stage). With

[2]The proofs of non self-explanatory propositions and corollaries appear in the Appendix.

a toehold position in the target firm, the bidder puts himself in an advantageous position for two reasons. First, it does not need to pay a premium on the minority stake position. Second, the toehold gives the acquirer information that may fully reveal the value of synergies.

For the two-steps takeover strategy (as in Lukas and Welling (2012)), we consider that two possible scenarios might happen: either firm B or firm T will take the first-mover position (i.e., they both have the chance to be the initiating party in the second stage), depending on whether the target foresees or not the bidder's final goal (the full acquisition of the target).

The bidder as first-mover

Let us start by the case where the bidder acquires a toehold, corresponding to a fraction $\theta \in (0, 0.5)$ of T's equity, while keeping the initiating party role in the second stage of the deal. Under this setting, the target is assumed not to respond to the toehold acquisition, either because he does not interpret it as a preliminary step towards a future full acquisition, or simply because he does not have enough time to conduct all the necessary diligences to react and lead the terms of the subsequent deal.

Following the same procedure as before, for a given premium offered by the bidder, the target decides on the timing of the takeover:[3]

$$\max_{V^*_{tB}(\psi_{tB})} \left[(\psi_{tB}(1-\theta)V^*_{tB}(\psi_{tB}) - (1-\theta)(1-\epsilon)Y) \left(\frac{V(t)}{V^*_{tB}(\psi_{tB})} \right)^{\beta_1} \right] \tag{9}$$

Compared to the single-step acquisition, the target receives a lower premium amount since now firm B owns a fraction θ of T, and, at the same time, he also pays a lower fraction of the transaction costs. On the other hand, firm B supports the transaction cost saved by firm T as a counterpart for the lower amount of premium to be paid. Thus, the optimal premium to be offered by B is the solution to the following maximization problem:

$$\max_{\psi_{tB}} \left[\left((\omega_{h,l} - \psi_{tB}(1-\theta)) \, V^*_{tB}(\psi_{tB}) - (\theta(1-\epsilon) + \epsilon) \, Y \right) \left(\frac{V(t)}{V^*_{tB}(\psi_{tB})} \right)^{\beta_1} \right] \tag{10}$$

The synergy factor $\omega_{h,l}$ can either be high or low, depending on how the synergies are revealed to the bidder, as a result of the toehold position.

Proposition 2. *The second-stage of a two-steps takeover, in which the bidder remains as the initiating party, occurs at the optimal timing $V(t) = V^*_{tB}$, determined by the target after incorporating the optimal premium ψ^*_{tB} offered by the bidder, where V^*_{tB} and ψ^*_{tB} are*

[3]The subscript tB stands for "toehold strategy with B as the initiating party".

given by:

$$V^*_{tB}(\theta, \omega_{h,l}) = \frac{\beta_1 \left(\beta_1 - (\theta(1-\epsilon)+\epsilon)\right)}{(\beta_1 - 1)^2} \frac{Y}{\omega_{h,l}} \tag{11}$$

$$\psi^*_{tB}(\theta, \omega_{h,l}) = \frac{(\beta_1 - 1)(1-\epsilon)}{\beta_1 - (\theta(1-\epsilon)+\epsilon)} \omega_{h,l} \tag{12}$$

Consequently, the takeover value for the toehold bidder, for either high or low synergies, results in the following equation:

$$B_{tB}(V, \theta, \omega_{h,l}) = \frac{\left(\beta_1 - (\theta(1-\epsilon)+\epsilon)\right) Y}{(\beta_1 - 1)^2} \left(\frac{V}{V^*_{tB}(\theta, \omega_{h,l})}\right)^{\beta_1}, \text{ for } V < V^*_{tB}(\theta, \omega_{h,l}) \tag{13}$$

Under this setting, and assuming the toehold informs the bidder about the correct level of synergies with a probability $s \in (0, 1]$, the takeover option value for the toehold bidder is:

$$\bar{B}_{tB}(V, \theta, \omega_h, \omega_l, p, s) = s(pB_{tB}(V, \theta, \omega_h) + (1-p)B_{tB}(V, \theta, \omega_l)) + (1-s)B_{tB}(V, \theta, \bar{\omega}(\omega_h, \omega_l, p)) \tag{14}$$

where $p \in [0, 1]$, denotes the probability of synergies being high.

Given that the uncertainty about the future synergies may vanish (with probability s) by holding the minority stake, the bidder either holds an option to buy the target with a high synergy value ($B_{tB}(V, \theta, \omega_h)$) or with low synergy value ($B_{tB}(V, \theta, \omega_l)$) and the probabilities for that to occur are, respectively, p and $(1-p)$. Additionally, if synergies are not revealed (with probability $1-s$), firm B bids based on its expected value.

The target as first-mover

Consider now the case where the target firm anticipates the true intentions of the toehold bidder, and decides to assume the role of initiating party. In this case, the toehold bidder looses the first-mover advantage to the target firm, that defines the terms of a possible takeover bid, enhancing his bargaining power.[4]

The setting is similar to the one previously presented, but now we have to proceed following the inverse sequence, as the target is now the initiating party, who anticipates the bidder's reaction and dictates the premium for which he is willing to sell the company.

Accordingly, the bidder firm defines the timing, incorporating the premium required

[4] A recent interesting example occurred in 2018, after the Norwegian oil and gas company DNO building up a 27.68% stake in Faroe Petroleum. Although, DNO declared no intentions to launch a takeover bid, Faroe Petroleum hired Rothschild & Co to advise and to prepare a potential takeover bid. Despite all that, early 2019 the takeover was eventually finished. For details: https://www.reuters.com/article/faroe-petroleum-ma/faroe-petroleum-raises-defenses-for-possible-dno-bid-idUSL8N1SA797.

by the target, solving the following maximization problem:[5]

$$\max_{V^*_{tT}(\psi_{tT})} \left[\left((\omega_{h,l} - \psi_{tT}(1-\theta)) \, V^*_{tT}(\psi_{tT}) - (\theta(1-\epsilon)+\epsilon)Y \right) \left(\frac{V(t)}{V^*_{tT}(\psi_{tT})} \right)^{\beta_1} \right] \tag{15}$$

while the target anticipates the bidder's reaction and sets the optimal premium:

$$\max_{\psi_{tT}} \left[\left(\psi_{tT}(1-\theta) V^*_{tT}(\psi_{tT}) - (1-\theta)(1-\epsilon)Y \right) \left(\frac{V(t)}{V^*_{tT}(\psi_{tT})} \right)^{\beta_1} \right] \tag{16}$$

As before, solving objective functions (15) and (16) recursively leads to the following results for the threshold, premium and bidder's option value:

Proposition 3. *The second-stage of a two-steps takeover, in which the target is the initiating party, occurs at the optimal timing $V(t) = V^*_{tT}$, determined by the bidder after incorporating the optimal premium ψ^*_{tT} required by the target, where V^*_{tT} and ψ^*_{tT} are given by:*

$$V^*_{tT}(\theta, \omega_{h,l}) = \frac{\beta_1 \left(\beta_1 - (1-\theta)(1-\epsilon) \right)}{(\beta_1 - 1)^2} \frac{Y}{\omega_{h,l}} \tag{17}$$

$$\psi^*_{tT}(\theta, \omega_{h,l}) = \frac{(\beta_1 - 1)(1-\theta)(1-\epsilon) + \theta(1-\epsilon) + \epsilon}{\left(\beta_1 - (1-\theta)(1-\epsilon) \right)(1-\theta)} \omega_{h,l} \tag{18}$$

Consequently, the takeover option value for the toehold bidder, for either high or low synergies, comes as follows:

$$B_{tT}(V, \theta, \omega_{h,l}) = \frac{(\theta(1-\epsilon)+\epsilon)\, Y}{\beta_1 - 1} \left(\frac{V}{V^*_{tT}(\theta, \omega_{h,l})} \right)^{\beta_1} \tag{19}$$

Under this setting, and assuming full information about the synergies, the takeover option value for the toehold bidder is:

$$\bar{B}_{tT}(V, \theta, \omega_h, \omega_l, p) = pB_{tT}(V, \theta, \omega_h) + (1-p)B_{tT}(V, \theta, \omega_l) \tag{20}$$

where $p \in [0, 1]$, denotes the probability of synergies being high.

The effect of toeholds

One of the main advantages of holding a toehold is the overbidding capacity of the bidder, when compared to that of a potential bidder without a toehold. The premium offered monotonically increases with the toehold ($\partial \psi^*_{tB,tT} / \partial \theta > 0$). Interestingly, however, the takeover timing is affected differently to toehold changes, depending on who is the initiating party. In fact:

[5] The subscript tT stands for "toehold strategy with T as the initiating party".

Corollary 1. *The higher the toehold the bidder holds, the earlier the takeover occurs when the bidder holds the first-mover position:*

$$\frac{\partial V_{tB}^{*}}{\partial \theta} = -\frac{\beta_1(1-\epsilon)}{(\beta_1-1)^2}\frac{Y}{\omega_{h,l}} < 0, \tag{21}$$

while it occurs later when the target becomes the initiating party:

$$\frac{\partial V_{tT}^{*}}{\partial \theta} = \frac{\beta_1(1-\epsilon)}{(\beta_1-1)^2}\frac{Y}{\omega_{h,l}} > 0. \tag{22}$$

The intuition of the previous corollary is straightforward: given that a higher toehold promotes a higher premium, and since the bidder is worse-off under higher premiums when the target is the initiating party in the second-stage, the bidder delays the exercise of the deal as he is who decides about the timing. The contrary occurs when the bidder is the initiating party, where it is the target who decides the timing of the takeover.

While in Lukas and Welling (2012) the optimal trigger is the same independently of who is the initiating party, here, because B holds a minority stake on T, that does not happen. In fact, given the asymmetric effect of the premium on firms B and T, and given the positive impact of the toehold on the premium, the timing of the acquisition is conditional on whether the target becomes, or not, the leading party in the second stage of the deal.

More importantly, for choosing the acquisition strategy, the relevant effect is on the option values.

Corollary 2. *The higher the toehold the bidder holds, independently of who is the initiating party, the more valuable is the option to acquire the target:*

$$\frac{\partial B_{tB}}{\partial \theta} = \frac{(1-\epsilon)Y}{\beta_1 - 1}\left(\frac{V}{V_{tB}^{*}(\theta,\omega_{h,l})}\right)^{\beta_1} > 0, \tag{23}$$

$$\frac{\partial B_{tT}}{\partial \theta} = \frac{(1-\theta)(1-\epsilon)^2 Y}{\beta_1 - (1-\theta)(1-\epsilon)}\left(\frac{V}{V_{tT}^{*}(\theta,\omega_{h,l})}\right)^{\beta_1} > 0, \tag{24}$$

and the higher the value of the two-steps strategy under asymmetry of information about the synergies:

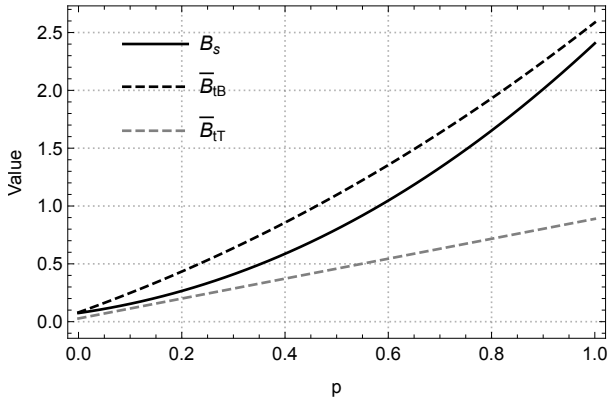
$$\frac{\partial \bar{B}_{tB}}{\partial \theta} = s\left(p\frac{\partial B_{tB}(.,\omega_h)}{\partial \theta} + (1-p)\frac{\partial B_{tB}(.,\omega_l)}{\partial \theta}\right) + (1-s)\frac{\partial B_{tB}(.,\bar{\omega})}{\partial \theta} > 0, \tag{25}$$

$$\frac{\partial \bar{B}_{tT}}{\partial \theta} = p\frac{\partial B_{tT}(.,\omega_h)}{\partial \theta} + (1-p)\frac{\partial B_{tT}(.,\omega_l)}{\partial \theta} > 0, \tag{26}$$

4 Optimal strategy and toehold size

After deriving the all the relevant value functions, let us compare the option values of the two scenarios where toehold is in place with that of the single-step takeover strategy.

Figure 1 shows the impact of the probability of a high synergy on the option values B_s, $\bar{B}_{tB}$ and $\bar{B}_{tT}$. We see that, for every p, the single-step strategy (B_s) dominates the two-steps strategy in which the target is the first-mover ($\bar{B}_{tT}$), but it is dominated by a two-steps strategy where the toehold bidder remains the initiating party. The higher value of the toehold strategy with B as first-mover, in comparison to a single-step takeover, is attributed to the toehold effect and to the fact that the synergies are revealed to the bidder by acquiring the minority stake on the target.



$V_0 = 50$, $Y = 10$, $\epsilon = 0.5$, $\theta = 0.2$, $\omega_l = 0.05$, $\omega_h = 0.25$, $r = 0.05$, $\delta = 0.05$, $\sigma = 0.2$, $s = 0.5$

Figure 1: Comparison between single-step takeover (B_s) and two-steps takeover, with the bidder as first-mover ($\bar{B}_{tB}$) and with the target as first-mover ($\bar{B}_{tT}$)

On the contrary, when the target foresees the bidder's plans and acts by dictating the terms of the transaction, the toehold strategy becomes less valuable when compared to a single-step takeover (see Figure 1). This result shows that the toehold benefits (eliminating information asymmetries and forming the toehold without premium) are not enough to offset the loss in value of becoming the second-mover in the takeover deal.

It possible to state that:

Corollary 3. *Staging the takeover process is the optimal strategy for the bidder if, and only if, he is able keep the first-mover advantage in the second stage of the acquisition process, i.e., if he remains as initiating party. In the cases where the target is expected to become the initiating party, the single-step takeover is the optimal strategy from the bidder's point of view ($\bar{B}_{tB} > B_s > \bar{B}_{tT}$).*

Taking into consideration Corollary 3, the strategy to be followed at the outset (to acquire the toehold or move to a single-step acquisition) depends on the bidder's expec-

tations about how the target firm will interpret the toehold acquisition (either a simple equity investment or a first-step of a subsequent full takeover).

Considering both scenarios, firm B has to assess, beyond all the common sources of uncertainty, the likelihood of each scenario to occur, and only then choose the optimal strategy. Consequently, the bidder bases the takeover decision on his beliefs about target's interpretation of the toehold acquisition:

Proposition 4. *The toehold takeover strategy has the following expected value for the bidder:*

$$B_t(V, \theta, \omega_h, \omega_l, p, q, s) = q\bar{B}_{tB}(V, \theta, \omega_h, \omega_l, p, s) + (1-q)\bar{B}_{tT}(V, \theta, \omega_h, \omega_l, p) \tag{27}$$

where $q \in [0, 1]$ denotes the probability assigned by the bidder to the scenario in which he maintains a first-mover advantage even after acquiring the toehold.

As the bidder does not know how the target will interpret the minority ownership acquisition, he weights each scenario ($\bar{B}_{tB}$ and $\bar{B}_{tT}$) based on his beliefs regarding the target's reaction.

Since there is always a dominant strategy depending on whether the target firm anticipates or not the bidder's final goal, the beliefs about probability q play a fundamental role in determining the optimal strategy to be followed by B. Accordingly,

Proposition 5. *The bidder will choose a toehold takeover strategy, instead of a single-step takeover if, and only if, his beliefs about the probability of keeping the first mover advantage in the second-stage takeover, q, are above the indifference threshold q^*, i.e.:*

$$q > q^*(\theta, \omega_h, \omega_l, p, s) = \frac{B_s(V, \omega_h, \omega_l, p) - \bar{B}_{tT}(V, \theta, \omega_h, \omega_l, p)}{\bar{B}_{tB}(V, \theta, \omega_h, \omega_l, p, s) - \bar{B}_{tT}(V, \theta, \omega_h, \omega_l, p)} \tag{28}$$

The result presented in the Proposition 5 is intuitive. The lower the difference between the option values of a single-step takeover and the two-steps takeover with the target as first-mover, or the larger the difference in value between the toehold strategy with the bidder as first-mover and with the target as first-mover, the lower probability q^* is required by the bidder to engage in a toehold acquisition strategy, i.e., more likely he chooses a two-steps strategy.

It is worth noting that q^* does not depend on the value of target (V), but only on the bidder's expectations about synergies and the likelihood of obtaining full information by acquiring a toehold.[6] Therefore, it is possible for the bidder to define the toehold size based on his expectations, independently from the value of the target.

[6]The multiplicative factor V^{β_1} is common to all option values in Equation (28).

It is reasonable to consider that the acquisition of a larger toehold may reduce the likelihood of keeping the first-mover advantage, since the target can discover the intentions of the acquirer, i.e. $q'(\theta) < 0$, for example:

$$q(\theta) = \max\left[1 - \frac{\theta}{\theta^{disc}}, 0\right] \tag{29}$$

where for a toehold of size θ^{disc} the bidder looses its full advantage almost surely.

Additionally, it is also reasonable to argue that the likelihood of obtaining full information by acquiring a toehold depends on its size, i.e. $s'(\theta) > 0$. It can be assumed that it varies from being null to becoming almost sure for a sufficient large toehold (θ^{full}), according, for example, to the following function:[7]

$$s(\theta) = \min\left[\frac{\theta}{\theta^{full}}, 1\right] \tag{30}$$

Proposition 6. *Based on his exceptions about synergies (ω_h, ω_l, and p), and about obtaining full information ($s(\theta)$) and keeping the first mover advantage by staging the acquisition ($q(\theta)$), the bidder will choose a toehold of size θ^* that maximizes its option value:*

$$\theta^* = \underset{\theta}{\operatorname{argmax}}\, B_t(V, \theta, \omega_h, \omega_l, p(\theta), q(\theta)) \tag{31}$$

and will choose the toehold strategy if it is more valuable:

$$B_t(V, \theta^*, \omega_h, \omega_l, p, q(\theta^*), s(\theta^*)) > B_s(V, \omega_h, \omega_l, p) \tag{32}$$

If the optimal toehold size makes the two-steps acquisition method more valuable than the single-step strategy, the bidder acquires the toehold before the trigger for the second stage is reached. To determine the optimal toehold size, it weights the advantages of reducing the asymmetry of information ($\partial B_t/\partial s > 0$) and the likelihood of losing the first-mover advantage ($\partial B_t/\partial q < 0$).

5 Comparative Statics

In this section we perform a numerical comparative statics of the effects of the parameter values on the optimal strategy and toehold size. For that purpose, Table 1 shows the base-case values.

Table 2 shows the optimal takeover trigger, premium and value for all cases. The optimal toehold is 6.54% (Equation (31)) and the two-steps takeover strategy is more

[7] It can be argued that a minimum toehold is needed to get some information. Adding this feature to the model does not change the results.

Table 1: Base-case parameter values.

Description	**Parameter**	**Value**
Target market value	V	50
Total transaction costs	Y	10
Share of Y supported by the bidder	ϵ	0.5
High synergy factor	ω_h	0.25
Low synergy factor	ω_l	0.05
Risk free rate	r	0.05
Rate of return shortfall	δ	0.05
Volatility	σ	0.25
Toehold size for loosing the first-mover advantage	θ^{disc}	0.2
Toehold size for full information	θ^{full}	0.1

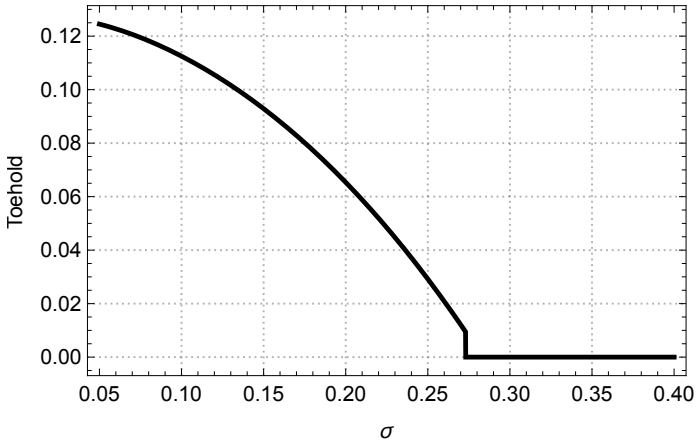
valuable. For that toehold the probability of the bidder being first-mover is 67% and the probability of acquiring full information about synergies is 65%.

It is important to notice the significant impact of being the first-mover on the takeover trigger, as well as on the premium offered. In fact, when the bidder is the initiating party, and in comparison to the case where the target is the first-mover, a lower premium is paid and the deal takes place sooner ($\psi^*_{tB}(\omega_{h,l}) < \psi^*_{tT}(\omega_{h,l})$ and $V^*_{tB}(\omega_{h,l}) < V^*_{tB}(\omega_{h,l})$). As expected, higher expected synergies lead to higher premiums and lower triggers, when compared to those premiums and triggers of a low synergistic merger ($\psi^*_{tB,tT}(\omega_h) > \psi^*_{tB,tT}(\omega_l)$ and $V^*_{tB,tT}(\omega_h) < V^*_{tB,tT}(\omega_l)$).

Table 2: Takeover strategies for the base-case parameter values.

Strategy	**First-mover**	**Information**	**Syn.**	**Trigger**	**Prem.**	**Value**	**Prop.**
Single step				177.843	0.0524	0.799	1
Two steps						**0.894**	4
	Bidder (67%)					1.113	2 - Eq.(14)
		Asym. (35%)		174.339	0.0534	0.818	2 - Eq.(14)
		Full (65%)				1.270	2 - Eq.(14)
			High	104.603	0.0891	2.463	2
			Low	523.017	0.0178	0.076	2
	Target (33%)					0.443	3 - Eq.(20)
			High	108.809	0.1699	0.859	3
			Low	544.044	0.0340	0.027	3

Figure 2 shows that for a high market uncertainty the single-step strategy is the best strategy, and that as uncertainty decreases, the two-steps strategy with an increasing toehold size becomes more valuable. Toeholds are more likely to occur under low volatility



Base-case parameter values as in Table 1.

Figure 2: Impact of market uncertainty on the optimal toehold.

markets and in industries with less uncertainty. Single-step acquisitions are favored by high uncertainty conditions.

Synergies that drive mergers and acquisitions have important effects on the acquisition mode. Higher expected synergies tend to promote single-step acquisitions and small synergies induce the bidder to acquire a larger toehold (Figure 3). This result is in accordance with Smit and Matawlie (2017). As overconfident CEOs tend to be overoptimistic about future events and about their skills to extract larger synergies, they tend to jump straight to a full acquisition rather than acquiring a toehold and wait to see uncertainties resolve.

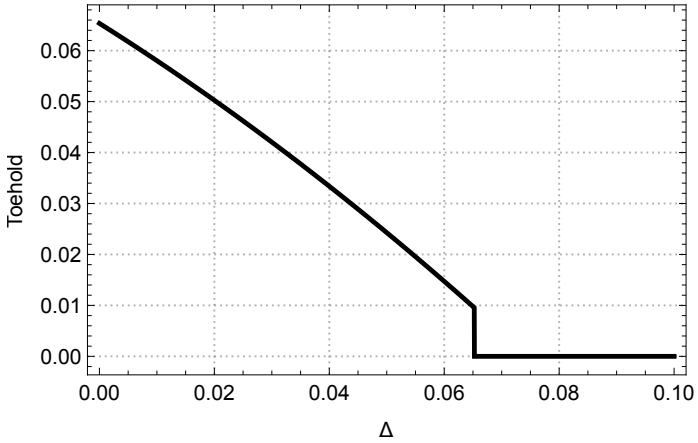
A higher uncertainty about the expected synergies increases the likelihood to proceed with a toehold strategy (Figure 4). The benefit of using the toehold to reduce the asymmetry of information becomes more attractive when synergies uncertainty is large.

6 Conclusion

This paper studies how a pre-bid minority ownership in the target firm may impact the takeover strategy. We follow a dynamic real options approach to compare the takeover option with and without a pre-bid minority stake, in order to determine the optimal strategy to follow. Additionally, we incorporate the possible strategic responses of the target to the minority stake acquisition.

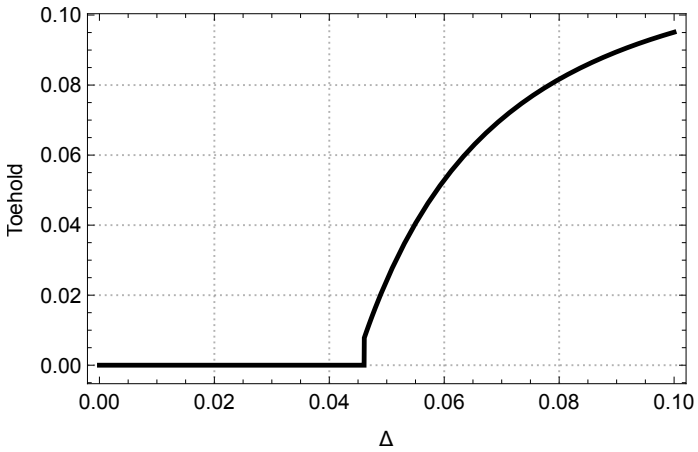
The dominant strategy (single-step or two-steps acquisition) depends on the beliefs of the bidder about the reaction of the target to the initial step (i.e., on whether the target foresees or not the final goal of the bidder). In fact, we show that staging the takeover is the best strategy to pursue if, and only if, the target does not respond assuming the role of initiating party in the second stage of the deal.

Considering the trade-off of toehold acquisitions, that reduce the probability of retain-



Base-case parameter values as in Table 1.The figure shows the impact of adding Δ to ω_h and ω_l.

Figure 3: Impact of synergies on the optimal toehold.



Base-case parameter values as in Table 1, except that $\omega_l = \omega_h = 0.15$. Synergies uncertainty is defined as Δ that increases the range of possible synergies, i.e. $\omega_h + \Delta$ and $\omega_l - \Delta$.

Figure 4: Impact of synergies uncertainty on the optimal toehold.

ing the first-mover advantage and also reduce the asymmetry of information about the expected synergies, the bidder can optimally choose the strategy and the toehold size. The choice of a two-steps strategy tends to be less likely as market volatility increases, which seems to indicate that in high-risk industries or in high volatility market conditions single-step takeovers are more likely to occur. Finally, we find that high expected synergies and low synergies uncertainty favor single-step acquisitions. These results suggest that managers' overconfidence and asymmetry of information play central roles on the choice of the acquisition strategy.

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Appendix

Proof of Proposition 1. Solving the maximization problem in Equation (3) we get T's trigger for any given ψ_s:

$$V_s^*(\psi_s) = \frac{\beta_1(1-\epsilon)}{(\beta_1-1)}\frac{Y}{\psi_s} \tag{33}$$

Firm B anticipates this trigger and incorporates it into his maximization problem. Therefore, substituting Equation (33) into (4) and solving it, we arrive to (7). Then, substituting this result into (33) and rearranging, the optimal timing presented in (6) is obtained. The option value in (8) is the simplification of bidder's pay-off after incorporating (7) and (6) and multiplying by the discount factor. □

Proof of Proposition 2. This proof is similar to the previous since the only difference is that the pay-off structure changes for both firms. Thus, following the same procedures we first get T's trigger for any given ψ_{tB}, which is the same as before given that the toehold has symmetric effects on the firms, and then, moving on to the next steps we arrive at (12), (11) and (13). Given the assumption that immediately after firm B acquires the minority stake the takeover synergies reveals themselves in full, the toehold bidder receives an takeover option either with high synergies or low synergies values. Thus, before and at the exact moment of the purchase, the takeover option value for the toehold bidder is the sum of the two options values weighted by the probability of synergies being high or low, respectively, as presented in (14). □

Proof of Proposition 3. Similarly to the previous proofs, results in Proposition 3 are derived by recursively solving firms' objective functions, but now is firm T that is the first-mover and firm B becomes the reactive party. Thus, firm B times the takeover by solving (15) and the trigger becomes:

$$V_{tT}^*(\psi_{tT}) = \frac{Y\beta_1(\theta+(1-\theta)\epsilon)}{(\beta_1-1)((\theta-1)\psi_{tT}+\omega)} \tag{34}$$

which is anticipated by firm T who, in turn, sets the optimal premium (18) through the incorporation of Equation (34) into (16) and solving it in order to ψ_{tT}^*. Substituting ψ_{tT}^* into Equation (34) and rearranging we get (17). The simplification of the option value in

(19) can be found by incorporating (17) and (18) into the pay-off function of firm B, times the discount factor. The takeover option the toehold bidder receives after the minority ownership acquisition is obtained in the same way as in the proof of Proposition 2. □

Proof of Proposition 5. The indifference threshold presented in Equation (28) is derived by equating (8) and (27) and solving for q. □

Proof of Corollary 2. From (13), and noting that

$$\frac{\partial}{\partial\theta}\left(\frac{V}{V^*_{tB}(\theta,.)}\right)^{\beta_1} = -\beta_1 \frac{1}{V^*_{tB}(\theta,.)} \frac{\partial V^*_{tB}(\theta,.)}{\partial\theta}\left(\frac{V}{V^*_{tB}(\theta,.)}\right)^{\beta_1},$$

using (21), we get (23). Since $1-\epsilon > 0$ and $\beta_1 > 1$, the partial derivative is positive. Following similar steps for the target case, we get (24). Since, additionally, $1-\theta > 0$, the partial derivative is positive. The remaining proofs are trivial. □

Proof of Corollary 3. The inequality $\bar{B}_{tB} \geq B_s$ can be prove by recurring to the Jensen's inequality, which states that, if $g(x)$ is a convex function on R_x, and $E[g(X)]$ and $g(E[X])$ are finite, then $E[g(X)] \geq g(E[X])$. Given that B_{tB} is a convex function, we can conclude that $\bar{B}_{tB} \geqslant B_s$. Since the toehold confers additional value to the takeover option, we have $\bar{B}_{tB} > B_s$ even for $p = 0$ or $p = 1$ (Figure (1) shows no apparent difference for $p = 0$ due to the scale in the y-axis). Furthermore, $\bar{B}_{tT} < B_s$ is due to the loss of bargaining power of the second-mover, as shown, for instance, by Lukas and Welling (2012). □