
Toehold Acquisition as a Staging Real Option

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Dissertation

Master in Finance

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2019

Biographical Note

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Acknowledgments

I want to take this opportunity to thank all those who, both directly and indirectly, contributed to this dissertation.

Directly, I would like to express my gratitude to professor Paulo J. Pereira for all the motivation and all the knowledge shared with me throughout this journey.

Indirectly, I must thank my family, closest friends, and my girlfriend for the support they gave me to conclude this project. I still apologize to these people, for the absence that the accomplishment of the dissertation caused.

Abstract

The increased popularity of M&A transactions across the worlds of corporate finance and corporate strategy, and the remarkable rare use of minority stakes (toeholds) as a preliminary step towards a full acquisition, despite all the benefits claimed by past literature, motivates this dissertation. Therefore, the main goal is to learn more about the dynamics of this strategy and, for this purpose, we develop a Real Options model for the choice of the optimal takeover strategy. By comparing a full acquisition when the bidder owns (two-step takeover) and does not own (single-step takeover) a pre-bid minority stake in the target firm, we found that (i) the toehold's information advantage confers an additional value to the bidder's takeover option; (ii) the first-mover advantage offsets the value of toehold's information and overbidding capacity advantages together; (iii) the bidder is more prone to follow a two-step takeover strategy when under a context of hidden competition given the lower takeover trigger and higher premium offered; (iv) the takeover timing is different depending on who is the first-mover since when the target is the first-mover, the takeover trigger increases with the toehold position and with the portion of transaction costs supported by the bidder.

Keywords: Real options; M&A; Hostile takeovers; Toeholds; Information asymmetry; Hidden competition.

JEL codes: C73; D81; D82; G34.

Sumário

A crescente popularidade das transações de fusões e aquisições no mundo das finanças empresariais e da estratégia empresarial, e o notável raro uso de participações minoritárias (*toeholds*) como um passo preliminar para uma aquisição completa, apesar de todos os benefícios reivindicados pela literatura passada, serve de motivação para a presente dissertação. Assim, o objetivo principal é perceber melhor a dinâmica dessa estratégia e, para esse fim, desenvolvemos um modelo de Opções Reais para a escolha da melhor estratégia de aquisição. Ao comparar uma aquisição total quando a empresa adquirente possui (aquisição em duas fases) e não possui (aquisição em uma fase) uma participação minoritária antes de uma oferta de aquisição formal, descobrimos que (i) dada a vantagem em termos de revelação de informação de uma posição minoritária, esta confere um valor adicional à opção de aquisição do possível adquirente; (ii) a vantagem de ser a empresa líder supera o valor conjunto das vantagens de uma posição minoritária, vantagem informativa e de capacidade superior de licitação; (iii) quando consideramos um contexto de competição oculta, o adquirente é mais propenso a seguir uma estratégia de aquisição faseada uma vez que, a aquisição tende ocorrer mais cedo e o prêmio oferecido é maior; (iv) o momento ótimo da aquisição é diferente dependendo de quem assume a liderança, uma vez que, quando a empresa alvo é a líder, a aquisição ocorre mais tarde quanto maior é a posição minoritária e custos de transação suportados pelo adquirente.

Palavras-chave: Opções Reais; M&A; Aquisição hostil; Posições minoritárias; Assimetria de informação; Competição oculta.

Classificação JEL: C73; D81; D82; G34.

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1 Introduction

Over the last few decades, corporate Merger and Acquisitions (M&A) activities have experienced a tremendous increase in popularity across the worlds of corporate finance and corporate strategy. With the periods between M&A waves shrinking over time, and given the significant impact, on both domestic and global economies, that the trillions of dollars involved in these activities¹ can have, this topic motivates both academics and business people. In fact, it gathers attention from academic researchers in such a way, that it seems to generate more research than other areas of finance. Nevertheless, there is much about M&A transactions that remains to be understood.

One of the puzzles that remains to be solved has to do with toehold acquisitions as a preliminary step towards a future a corporate takeover. In other words, a toehold acquisition strategy is a two-stage strategy where the potential acquirer often purchases a minority position in the target firm prior to initiating M&A discussions with the target firm. Despite most of the literature supporting the idea that acquiring a minority ownership brings many advantages and increases the probability of takeover success (Bessler, Schneck, & Zimmermann, 2015; Betton & Eckbo, 2000; Strickland, Martin, & Cotter, 2010), this strategy continues to be neglect, which seems puzzling (Betton, Eckbo, & Thorburn, 2009).

Not all acquisitions lead to value-enhancement for the acquirers, despite using sophisticated valuation techniques and making all kinds of risk assessment. The main threat to the success of M&A deals is the overpayment or overestimation of synergies (DePamphilis, 2009). Predicting the value of synergies, however, is far from trivial. Acquisitions are therefore high-risk decisions, and in fact, widespread evidence suggests that majority of full acquisitions fail to deliver value for the acquirer (Betton, Eckbo, & Thorburn, 2008; Martynova & Renneboog, 2008). Rather than going straight away with a full-scale commitment, the potential acquirer can opt for a wait-and-see strategy that helps to even the balance and improve the poor acquirer returns, i.e., buying a toehold in the target firm before starting M&A negotiations.

It is in this context of lower acquires's returns and remarkable low frequency of

¹According to Institute for Mergers, Acquisitions and Alliances, last year, worldwide M&A activities totalled approximately 4.091 trillion US dollars and ranked as the fourth year with higher M&A activity in value terms. Source: <https://imaa-institute.org/mergers-and-acquisitions-statistics/>

toeholds, given all the benefits attributed by past literature, that the dissertation is inserted. Therefore, the starting point was to apply Real Options framework to enhance the effectiveness of pre-bid minority stakes in improving acquirers' returns. We focused primarily on toeholds' ability to solve the problem of information asymmetries (Bulow, Huang, & Klemperer, 1999; Povel & Sertsios, 2014), one of the main reasons for excessive premiums in M&A deals, and we assume that the future synergies value reveal themselves in full after the toehold purchase. Borrowing insights from Lukas, Pereira, and Rodrigues (2019), Lukas and Welling (2012), we follow a non-cooperative game from which the single-step takeover and two-step takeover² solutions are derived to find out which is the best strategy to choose. On the assumption that when the bidder takes a minority stake in the target firm, the first firm may or may not lose the first-mover advantage depending on whether that target foresees or not the true intentions of that toehold purchase, the bidder must choose the takeover strategy based on its beliefs regarding target reactions.

Our model shows that the toehold confers an additional value to the takeover option, which is the result of two effects: first, the toehold's overbidding capacity, as already proved by Lukas et al. (2019); second, and with stronger effect, the information advantage of toeholds since it reduces informations asymmetries by facilitating information gathering about target characteristics. Even with the value increase in the takeover option that the toehold's benefits represent, they might not be enough to offset the value loss that the bidder suffers when the target anticipates its move, i.e., when the bidder loses the first-mover advantage for the target, since the two-step takeover is only the best strategy when the bidder maintains the leader position. Thus, the bidder only chooses the two-step strategy if he believes there is a strong likelihood of keeping its true intentions secret, which shows how determinant is to be the first-mover when weighting a takeover. Additionally, it should be stressed that, in contrast to Lukas and Welling (2012), by considering the toehold position or an unequal division of transactions costs, the option threshold is different depending on who is the first-mover. When the target foresees the final purpose of the minority ownership purchase the takeover trigger increases with the toehold position and with the portion of transaction costs supported by the bidder. The opposite occurs when the bidder maintains the first-mover position.

²From now on, two-step takeover and single-step takeover refer to hostile takeovers when the bidder holds a toehold in the target firm before making a formal bid and when the bidding firm holds no toehold before the takeover is made.

By taking a toehold, the bidder can also prevent competition and even winning takeover contests (Bulow et al., 1999). Taking the toehold competitive advantage in consideration, we extend the basic model to incorporate the concept of hidden competition of Pereira and Armada (2013), and observe how the optimal takeover strategy reacts. As in Pereira and Armada (2013) the takeover dynamics under hidden competition lead to a decrease in the option threshold and option value, consequent from the higher premium offered when the bidder assumes the possibility of hidden bidder preempt it. Therefore, the toehold strategy becomes more likely to happen as the required probability of the target anticipating the full acquisition is lower when the bidder assumes the possible existence of other hidden bidders.

The remainder of the dissertation proceeds as follows. Chapter 2 provides a brief overview of recent literature regarding M&A activity, the role of information asymmetries in takeover processes, the toeholds activity as well as its benefits and shortcomings, and lastly, the Real Options literature on toeholds. Chapter 3 presents the basic model derivation, where the single-step and two-step takeovers solutions are found, and then compared with each other to find the optimal takeover strategy. Chapter 4 makes a step further and includes hidden competition in the basic model. Chapter 5 showcases the optimal takeover strategy with a numerical example. Chapter 6 provides the final remarks and suggestions for future research.

2 Literature Review

2.1 M&A Overview

Firms use M&As as an alternative business tool to organic growth, representing an effective way (if properly used) to augment operations, to enter new markets and increase competitiveness in an increasingly globalised market. Whether managerial decisions create value or not is one of the most relevant questions in finance. Nonetheless, defining value creation of M&A is not an easy task. Value to whom? Bidders shareholders, target shareholders, or all the other stakeholders of the two companies? Besides that, how we measure the acquisition impact on shareholder wealth? Depends on the benchmark used and also when and for how long the impact was felt. Hence, the debate on whether mergers lead to short-term and long-term returns continues.

Martynova and Renneboog (2008) have shown through an extensive review of 65 event studies of successful nonfinancial (friendly and hostile) M&As in the United States, United Kingdom, and continental Europe, concluded that M&As increase, on average, the combined market value of the merged firms, with target shareholders earning significant positive returns and bidding firm shareholders on average showing little or no abnormal return. From a compilation of 16 recent and large samples (1,000 or more bidders firms) studies of abnormal stock returns to bidders and targets around takeover contests, Betton et al. (2008) also concluded that the stockholders of target firms are the clear winners in takeovers. The results show that the average target cumulative average abnormal stock return (CAR) is positive and significant in all samples, while 49% of the bidders have negative CAR.

From these overwhelming evidence, a question arises, are M&As a wasteful investment? It looks like, but there are some transactions that augment shareholders' value, like a combination of small bidder, private target and all-stock as payment, the best-case scenario in Betton et al. (2008), and also when is a hostile merger. Understanding the factors that contribute to the failure of many transactions to realize expected benefits is also critical to the goal of maximizing shareholder wealth. The three commonly cited reasons for such failure, ranked by the number of studies in which they are mentioned, are: overestimation of synergy or overpaying, the slow pace of postmerger integration, and a poor strategy (DePamphilis, 2009).

According to Cullinan, Le Roux, and Weddigen (2004), very often due diligence becomes an exercise of financial analysis rather than focus on a fair analysis of the

deal's strategic logic and the acquirer's ability to realize potential synergies. Thus, for a better estimation of the acquisition value creation, Cullinan et al. (2004) provided an intuitive way of looking to synergies that helps to understand the overestimation of synergy gain and the failure of synergy efforts. They categorized potential synergies as a series of concentric circles, where the farther out the synergy component (saving or revenue) lies, the more difficult achieving synergy becomes and the longer it takes to realize. Then, to arrive the final value of potential synergies, the authors suggest that the analysts can attribute to each circle a potential value with a probability associated and a timetable for implementation.

The overpayment factor can also be justified from a behavioural 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, thus, increasing the probability of failure. The CEO envy theory of Goel and Thakor (2010) also predicts overpayment from a behavioural perspective. The authors suggest that CEOs' envy of other CEOs' compensation increase after an acquisition leads them also to engage in takeovers and that the more envious CEOs are more likely to pay higher acquisition premiums than less envious CEOs. Overpayment becomes particularly important to manage because postmerger integration is often more difficult and costly to achieve than estimated before the deal is completed. "However, no matter what is paid for the target firm, success is elusive if the strategy justifying the acquisition is flawed" (DePamphilis, 2009, p.39). That is why acquiring a minority stake in the target firm before a takeover is made might reveal a good strategy to better predict future synergies and delineate better integration processes.

2.2 Information Asymmetry

Cullinan et al. (2004) also state that target firm management often uses uncertainty on its favour to get the highest price possible by recurring a wide range of accounting tricks to make their assets look more appealing than they really are. This brings us to another challenge of M&A deals, the information asymmetry between the target and bidder firms.

Information asymmetry, as in many other fields, plays an important role in M&A. Acquirers are often faced with asymmetric information about the quality or the value of the target's assets, which in turn leads to an economic problem known as "adverse selection". Making the bridge between the seminal paper of Akerlof (1970)

and M&A, the target's higher bargaining power consequent of its bigger knowledge about itself may result in the bidder paying for a high-quality firm (with high growth prospects and a supposedly high degree of integration between both firms) and getting a "lemon" instead. Given the incentives for the target to misrepresent its actual value, what we can conclude is that the higher the information asymmetry is, the difference between the price the bidder pays and actual value of the target, and the fewer changes the acquisition will succeed.

Dionne, La Haye, and Bergerès (2015) also proved how prominent information asymmetry problem could be in determining the price paid in an acquisition and consequent success from that. From a sample of sample of 1,026 acquisitions in the United States between 1990 and 2007, showed that bidders holding between 5% and 50% of target's shares before the announcement of the offer pay around 70% lower premium than do other buyers. They suggest that, given the privileged information about the target that those bidders have access, they are better informed about the performance and the fair value of the target than other bidders.

In international business literature, such information asymmetry is an even more preponderant factor to take into consideration. When a company intends to penetrate in a foreign market, the acquisition of a firm in that market represent an effective and quick way to establish on this new market and to obtain a large portion of the foreign market share. The risk is that the acquiring firm may be "to a certain extent outguessing the local owners", since "the sellers of the company have a thorough knowledge of the business and the price at which they are selling is presumably higher than their estimate" (Madura & Fox, 2011, p.14). In other words, such transactions are not a level playing field, since the target is in possession of more information. According to Chen and Hennart (2004), the acquirer is subject to information asymmetries in both ex-ante screening of cross-border targets and ex-post enforcement of cross-border contracts. First, the buyer must incur in extra costs screen good targets from lemons avoiding "seller's ex-ante misrepresentations". Then, the acquirer also needs to guard themselves against "ex-post opportunism" since the target firm may not transfer the full value of the intangible assets and management expertise to the acquiring firm, resulting in an unsuccessful integration. Hence, Chen and Hennart (2004) propose partial acquisitions as a facilitator of ex-ante screening of targets and ex-post enforcement of contracts. In addition, the hostage theory of Chen and Hennart (2004) suggests that seller's willingness to accept partial offers signals ex-ante the quality of his firm, and given his remaining equity stake restrains him from engaging ex-post opportunism. From a sample of

114 Japanese firms acquiring U.S. firms, the authors of hostage hypothesis, concluded that target firms subject to higher information asymmetry are more likely to be partially taken over.

Chen and Hennart (2004) and Dionne et al. (2015) show that toeholds can have the crucial role of mitigating information asymmetry, reducing uncertainty and, improving the deal valuation. The following section presents more discussion about this toehold's advantage as well as other benefits and shortcomings of toeholds.

2.3 Toehold Acquisitions as a M&A Strategy

Toehold acquisition is corporate ownership transaction in which the acquiring firm only acquires a minority stake of the target firm. Bidders can use this type of transaction as a primary towards a full acquisition. In doing so, bidders seek to establish a toehold from which will launch a formal bid. This strategy can facilitate an acquisition when properly used, but it also carries risks of its own. The present section shows the strengths and weaknesses of a toehold strategy as well as empirical evidence of the general activity of this strategy.

Researchers use different criteria to define toeholds. Majority of studies (Bessler et al., 2015; Betton, Eckbo, Thompson, & Thorburn, 2014; Betton et al., 2009; Povel & Sertsios, 2014) consider the acquisitions of non-controlling equity stakes (i.e., usually less than 50 percent ownership in the target firm), while others only focus on less than 5 percent ownership, which is the threshold before being required file form 13-D where the acquirer must disclose the motivation behind that transaction. According to Betton et al. (2009), the average toehold investment size is large, about 20% of the target's shares. While the average short-term toehold (defined as target shares purchased within six months of the offer) size is 13% of the target equity, the average size of a long-term toehold is also 20%.

Several researchers have studied the effect of using toehold bidding on both the likelihood of deal success and on the bidder's performance. Most of them concluded that, theoretically, using toeholds in an acquisition process should improve the chances of success for acquirers as it offers the buyer several benefits (Bessler et al., 2015; Betton & Eckbo, 2000; Strickland et al., 2010). We can say that those benefits come from the dual advantage that a toehold offers to the acquirer. First, if the market is unaware of the real intentions, the acquirer may be able to form the toehold before share prices rise in reflection of the takeover premium and second, the bidder becomes a shareholder of the target firm which may provide some of the

same rights as the other target shareholders have.

Some researchers, such as Chowdhry and Jegadeesh (1994), Hirshleifer and Titman (1990), Shleifer and Vishny (1986) have been proposing toeholds as a possible solution to the “free-rider problem” of Grossman and Hart (1980), which states that firms with a very dispersed ownership might be a harder target to take over. Grossman and Hart (1980) suggest, that since these atomistic shareholders consider themselves as having a negligible impact on a takeover outcome, they would free-ride on their fellow shareholders, rejecting any tender offer unless the acquiring firm offers the full acquisition expected synergies as a premium. As a result, the probability of acquisition to succeed decreases significantly given that no one has the incentive to attempt any acquisition as they would not benefit from a successful takeover. With pre-bid minority ownership bought at a price before the run-up, the acquirer can still profit from a successful takeover, even if it has to pay the expected full value for any shares bought in a tender offer. Therefore, given premium savings it makes on the minority stake, we can say that the toehold confers it an overbidding capacity that otherwise would not have.

With this capacity, toehold acquirers have greater bargaining power in bidding wars than non-toehold bidders and ultimately, may discourage rival bids. Betton and Eckbo (2000) report that greater toeholds decrease the probability of rival bidder entry. Bessler et al. (2015), for a sample of 15,626 international acquisitions, analysed the success of three different takeover bidding strategies, toehold bidding, preemptive bidding and negotiating a termination fee, in preventing competition, and if a contest occurs, how to prevail. They found strong evidence for the deterrent role of toeholds as well as termination fees in deter competition and also to increase the probability of the toehold bidder winning bidder contests. Likewise, Bulow et al. (1999) showed that even small differences in toeholds could sharply improve the chances of the bidder with greater toehold winning a bidder contest. The authors suggested that a toehold make a bidder more aggressive, and such aggressiveness makes non-toeholders fear the winner’s curse and bid more conservative in an ascending auction. Therefore, toehold bidder will be less exposed to the possibility of suffering the winner’s curse and at the same time will allow it to be more aggressive still, “creating a powerful feedback loop”. “So owning a toehold can help a bidder win an auction, and win very cheaply” (Bulow et al., 1999, p.428). In fact, Betton and Eckbo (2000) state that toeholds and premiums are negatively correlated. This can be attributed to the fewer bids by competitors and consequent lower premiums required to capture the target.

Moreover, if the toehold bidder loses a takeover contest, the minority stake in the target company can still provide it with capital gains, given that the loser still receives a positive payoff from selling its toehold to the rival bidder (Bessler et al., 2015; Betton & Eckbo, 2000).

Last but not least, toeholds are an effective way of mitigating information asymmetry between the bidder and target, as mentioned in the earlier section when cited Chen and Hennart (2004) and Dionne et al. (2015). Many other studies analyse and state the toeholds' role as a source of information for a bidder (Aintablian, El Khoury, & M'Chirgui, 2017; Arnold & Shockley, 2001; Povel & Sertsios, 2014). Having a toehold may allow the acquirer to make a more informed decision since it may concede the possibility to interact with the target management and subsequently, gather better insight into the operations of the target and what synergies can emerge from an acquisition (Povel & Sertsios, 2014).

Empirical evidence suggests that less well-informed bidders, normally associated to situations where the target is more opaque and when is from another industry and/or country than the bidder, are prone to use toeholds as the first step of a future full acquisition (Aintablian et al., 2017; Povel & Sertsios, 2014). Povel and Sertsios (2014) argue that a potential acquirer that initially finds it harder than others to assess the value of potential synergies, because is in possession of less precise information than the others potential acquirers, benefit more from purchasing a minority stake in the target. They supported their view by presenting evidence that acquirers operating in different industries, or originating from other countries than the target, are more likely to have a toehold. In the same way, Aintablian et al. (2017) tested the hypothesis that information asymmetry is more observed when target and bidder operate in different countries and different industries and also proved that toeholds are more frequent in these situations. They also showed that the probability of acquirers using toeholds as acquisition strategy is higher as the ratio of target intangible assets to target total. Consistent with this prediction, and since that R&D-intensive firms are more difficult to evaluate given that the values of projects depend largely on intangibles, Povel and Sertsios (2014) results showed that takeovers are more likely to be preceded by toeholds if the target is younger and when it operates in an R&D-intensive industry. The authors attribute these results to the fact that these companies are characterised by a more opaque nature which in turn makes them harder to analyse for outsiders, and for that reason potential acquirers benefit more by purchasing a minority ownership before a full takeover offer. Still, in this context of information asymmetry, Povel and Sertsios (2014)

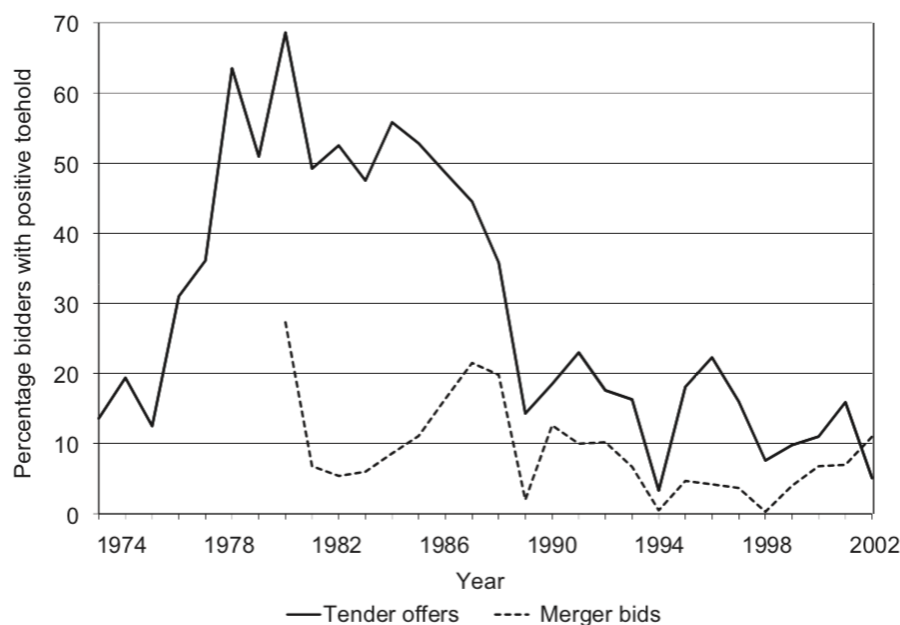
study presented another finding. Although a toehold is more beneficial if the bidder finds it harder to evaluate target than others bidders, the benefit is relatively less important if the target is opaque given that the target becomes harder to analyse by the others bidders too. Their prediction finds evidence on the results, that show the likelihood that an acquirer from another country and other industry than the target having a toehold decreases when the target is younger and operates in an R&D-intensive industry.

In contrast to all above-mentioned advantages of toeholds, using this strategy as a facilitator of subsequent full acquisition process may not sound as good as the theoretical literature make it seem. Some limitations in pursuing this tactic come from regulatory considerations. Security Exchange Commission (SEC) regulation 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 to disclose detailed information regarding their identity, the number of shares owned, acquirer's purpose, plans, 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), though, in practice, a bidder can continue to increase the size of their toehold anonymously after hitting the 5% threshold until the disclosure date.

As previously mentioned, in theory, 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 perceive the toehold bidder is not negotiating in good faith and become reluctant to enter in friendly negotiations. In fact, toehold bidding is four times more frequent in hostile acquisitions (50% of the initial bidders in hostile contests have toeholds) than in friendly acquisitions (11% of the initial bidders in friendly contests have toeholds) (Betton et al., 2009). Goldman and Qian (2005) propose an explanation to why raiders do not acquire the maximum possible toehold prior to announcing a takeover bid. Though a larger toehold increases profits if the takeover succeeds, it also conveys a higher level of management resistance, which may be motivated by the managers' intention to retain private benefits of control. In their model, outside investors might react negatively to news that the target management has rejected all bids. If so, the negative market reaction possibly causes the target share price to drop and in turn, leads to a loss on the initial bidder's minority stake investment. Betton et al. (2009) test and fail to find evidence supporting this toehold-cost argument. In their model, it is also assumed that some target managers resist to takeovers. But now the toehold costs come from the fact that, target managers by rejecting negotiations, the bidder forgoes the ben-

efit of the termination agreement and incurs resistance costs during the takeover process (e.g., forgoes the opportunity to examine the target books). The target management can also resist to a takeover by launching a poison pill (“shareholder rights plans”) that grants the incumbent target’s shareholders the exclusive right to purchase a company’s newly issued equity at a substantial discount. The right is conditional upon the acquisition of a certain percentage of shares (normally 15%) by an outside investor. Betton et al. (2009) found that average toehold size is smaller when the target has a poison pill, possibly reflecting the barrier that the threshold of the poison pill imposes to the toehold.

S. Betton et al. / Journal of Financial Economics 91 (2009) 158–178



Total sample of 3,056 tender offers over the period 1973–2002, and in 7,750 merger bids over the period 1980–2002. Targets are U.S. domiciled and publicly traded. Source: Betton, Eckbo, and Thorburn (2009)

Figure 2.1: Annual percentage of initial control bidders with positive toehold over the period of 1973–2002

Although, in theory, the literature suggests that the advantages of using toeholds outweigh its drawbacks, the toehold bidding has in fact been declining dramatically since its peaks in 1980s and is now rare³ (from a sample of 10,806 initial bidders only 13% have toeholds and only 2% for short-term toeholds), which seems puzzling

³Other studies have confirmed the low frequency use of toeholds as part of an active bidding strategy., such as Povel and Sertsios (2014) and Aintablian et al. (2017). The early study, from a sample of 49,010 majority acquisitions of US and Canadian targets collected over the years 1998–2010 reported an extremely low frequency of

(Betton et al., 2009). This decline is evident in Figure 2.1, which plots toehold data from the authors' study.

The toehold literature has been suggesting some potential costs of toeholds, such as mandatory information disclosure, target management entrenchment to takeovers, and market liquidity. According to Betton et al. (2009), the last cost does not seem to be a reason behind the toehold puzzle since the market liquidity increase during the entire sample period. Though the mandatory disclosure rule could represent a cost to pre-acquisition minority ownerships since it reveals the bidder's real intentions and consequently discouraging the use of this strategy as a precedent for a full acquisition, in fact, this argument does not seem valid. Theoretically, because in some countries like the UK, the bidder can declare that has no interest in taking over the firm in which bought the toehold but still make an offer after the six months of being prevented it from making an offer. The empirical reason is that toeholds were still reasonably common during the 1980s, as the Figure 2.1 shows, while the mandatory disclosure rules were implemented a long time ago, 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). Finally, considering the argument of target managers resistance, as mentioned above, in the model of Betton et al. (2009) the rejection of target management to enter in negotiations is costly because it forces bidders to launch unsolicited tender offers without the benefit of a termination agreement in case of the rival win the contest or the target to withdraw negotiations. The model predicts that toehold frequency is higher in hostile bids, which is consistent with the decline of toehold bidding in the 80s since it was also a period of general decrease of hostile takeovers as result of widespread adoption of structural takeover defences such as poison pills.

This empirical evidence regarding the rarely used of pre-bid minority stakes, present a misleading picture of the effectiveness of this strategy, as the past literature have been showing, and also as we will try to prove later on this dissertation.

toeholds, around 1,93%, which the authors justified by the fact that 87% of its sample is composed of private targets, while the most of the previous papers only studied toeholds on publicly traded companies, where toeholds are more common. Aintablian et al. (2017), in turn, reported a much higher frequency, around 25,81%. Nevertheless, its sample consists of 9,169 acquisitions from 72 countries worldwide for the period of 2001–2014.

2.4 Toehold Acquisitions and Real Options

Using a minority stake as a preliminary step towards a future takeover can be seen through the lens of Real Options Theory. Acquiring a toehold provides an option to acquire the target firm, allowing the acquirer to position himself advantageously against any rival bidders while he can wait until target's internal and external uncertainty unfolds. In other words, the acquirer need only commit to further actions if the target turns out to be valuable investment limiting the downside risk to the toehold costs. Some research has also been applying Real Options perspective (Dapena & Fidalgo, 2003; Folta & Miller, 2002; Smit & Kil, 2017; Xu, Zhou, & Phan, 2010) but typically more in the context of international joint ventures.

One practical example of toehold's advantages, interpreted from the real options point of view, is Arnold and Shockley (2001) work that showed how Anheuser-Busch effectively exploited this strategy in overseas acquisitions. They proved that growth options can represent a large portion of firms' total value. Arnold and Shockley estimated the value of the company's "assets in place" (the capitalized present value of its current economic added value) and the value of its "growth options" between 1996 and 1998, and presented evidence that from the \$11.5 billion in market value added for investors during this period, only a small amount was due to increases in the value of their assets in place. The real value creation came from the firm's growth options, that worth nearly 10 billion dollars. Anheuser-Busch strategy in the 1990s was to make a series of minority stakes acquisitions in breweries located in emerging markets and with a growing demand for beer. By injecting a few million in the local company, Anheuser-Busch would have its products brew and distributed, while the joint venture, under the direction of Anheuser-Busch, would market the product. The main idea that this study tries to communicate is that investing in small joint ventures is actually investing in information that later on, can be used to make better investment decisions. "Investments in information are investments that create options" (Arnold & Shockley, 2001, p.61).

Smit and Kil (2017) analysed toeholds acquisitions from the perspective of two strands of finance, Real Options Theory and Behavioural Finance. The authors argue that dealmakers' 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. Smit and Kil (2017) first explored the four of the most common and widely acknowledged pitfalls in rational human decision making, and all the types of acquisition specific uncertainty (exogenous, bidding and industry-

specific and company-specific), and then showed how effective toehold strategies can be to manage all these difficulties. To conclude, Smit and Kil (2017) highlighted that the major difference between an immediately full acquisition versus a staged acquisition process is that in the latter case, the CEO can limit downside losses of significant write-offs by not acquiring the all target shares at once while preserving the upward potential. Like a call option, the toehold uses uncertainty in its favour and changes the distribution of acquisition outcome skewed to the positive outcome.

Smit and Matawlie (2017) gives a behavioural explanation based on a real options framework to the toehold puzzle (Betton et al., 2009). Based on real options framework, presents a behavioural dynamic model and empirical evidence that shows that CEOs' overconfidence causes them to forgo toehold strategy to follow immediate controlling takeover instead. The authors divided overconfidence into two sub-dimensions, overoptimism and miscalibration. Overoptimism has to due with better-than-average and overestimation effects, that translate to overestimates of the mean of possible outcomes. On its turn, miscalibration means to have over-precision, that results in an underestimation of the variance of possible outcomes. The study, based on external perception of CEOs by quality newspapers and on the timing of their option portfolio as measures of overconfidence, showed economically and statistically strongly significant evidence for a negative relation between the probability of acquiring a minority ownership and CEO overconfidence.

The paper the most resembles this dissertation is Lukas et al. (2019), as they also value a hostile takeover option when the bidder already holds a minority position in the target firm. By considering hostile takeovers and friendly mergers as possible and alternative M&A strategies, the authors change the dynamics of the bargaining game through the incorporation of toeholds. They concluded that toehold increases bidder's bargaining power, making the target more prone to accept a hostile bid.

Despite all previous contributions, the literature tends to focus on the overbidding capacity that toeholds bring to the potential acquirers, and is not extensive as it could (or should) be, specially from Real Options perspective, as the toehold puzzle remains to be fully solved and many particular issues regarding this acquisition strategy are not deeply understood. Something that should be addressed with a bit more seriousness, given what we already mentioned about overpayment as one of the leading causes for M&A failure, is the toehold importance in reducing information asymmetries between the bidder and target firms and consequently improved deal valuation. That is the purpose of this dissertation, show how toeholds information role can improve acquirers' M&A performance.

3 Base Model

Consider two firms, B and T, which are respectively the bidding firm and the target firm. We assume that the value of the target is not constant over time but rather a stochastic variable that follows a geometric Brownian motion:

$$dx(t) = \alpha x(t)dt + \sigma x(t)dW(t) \quad (3.1)$$

where $\alpha \in R$ is the instantaneous risk-neutral drift, $\sigma \in R^+$ is the instantaneous standard deviation and $dW(t)$ is the standard Brownian motion. Under risk-neutrality we set $\alpha = r - \delta$, where r denotes the risk-free rate and δ represents the cost of holding the option to buy the target firm without exercising, in other words, the lost ‘dividends’ in the form of the target’s cash flows.

Our acquisition process will be modeled as non-cooperative bargaining game, based on Lukas and Welling (2012), where a certain premium $\psi^* > 0$ over the target’s market value is defined by one of the agents in play (bidder or target) on the first stage and then, in stage two, conditional on this offered premium, the other firm (the reacting party) will decide when to accept it, i.e. it will choose the trigger value $V^*(\psi^*)$ which corresponds to the optimal timing decision ($t^* = \min[t \geq t_0 | V(t) > V^*]$). Both bidder and target firms, to exercise the takeover option, incur in irreversible transaction costs (fees to investment banks, legal fees, etc.) denoted, respectively, as ϵY and $(1 - \epsilon)Y$, where $\epsilon \in (0, 1)$.

Firms merge with or acquire other firms motivated for a myriad of reasons, such as market power, strategic realignment, diversification, tax and legal considerations, managers hubris, operating and financial synergies (DePamphilis, 2017). The former motive, here represented as a fraction of the target value (ωV), is one of the most used to justify M&A deals (Ferreira, Santos, de Almeida, & Reis, 2014) and can be defined as the value created through the combination of the two business activities from which it may result in economies of scope and scale, a lower capital cost, among others synergies. However, given the uncertain nature of synergies, bidder’s evaluation of its hostile takeover option is based on its synergy expectations. As already mentioned in Chapter 2, these synergies expectations have been pointed out as one of the main reasons for M&A failures, given its tendency to overestimate the actual value creation from acquisitions.

In turn, having a minority stake in the target company may help to resolve target-specific uncertainties before a full acquisition is made when target-acquirer

information sharing is facilitated, for instance, through board representation or a close operating alliance. This information advantage may concede a better perspective of what are the target's strengths and weaknesses, and how they can be combined with bidder's characteristics to get the most out of both firms, and consequently, out of the acquisition deal. Additionally, a board seat can provide as well a voting power and the ability to influence the strategic agenda which could help to prepare the target, as well as its own company, for a future full integration. Bearing this in mind, we assumed that the toehold bidder is in a favourable position to delineate a better integration process, that by itself increases the likelihood that the expected synergy gains materialize, and consequently, knowing precisely the synergy value that emerges from the acquisition.

To understand if the having pre-bid minority stake confers an additional value to the bidder when compared to a hostile takeover without any minority ownership, as literature tends to suggest, we will first derive the single-step takeover solution and then the two-step takeover solution. These solutions will further ahead serve as the basis for gauging whether the two-step takeover strategy is or not a more valuable strategy when engaging in a takeover process.

3.1 Single-step Takeover

Although Lukas and Welling (2012) paper assume the possibility that both firms can act as the Stackelberg leader, in this section, for the hostile takeover without toehold, we considered the setting where is the firm B that makes the offer, catching everyone by surprise, the firm T and also all the market. For this reason, the target market value does not incorporate any takeover expectation, allowing the bidder to receive the first-mover advantage. That being said, at the time of selling, which is determined by T conditional on the premium received from B, the target gets $(1 + \psi)V(t)$ in exchange for its asset worth $V(t)$ and pays the transaction costs of $(1 - \epsilon)Y$. Therefore, for any given premium level, ψ_s , target's timing decision to sell the company solves the following maximization problem:

$$F(V) = \max_{\tau} [E[(\psi_s V(t) - (1 - \epsilon)Y)e^{-r\tau}]], \quad (3.2)$$

where $E(.)$ is an expectation operator.

Using standard real options arguments⁴ allow us to present the optimization

⁴For more details see Dixit and Pindyck (1994)

problem in Equation (3.2) as follows:

$$= \max_{V_s^*(\psi_s)} \left[\left(\psi_s V_s^*(\psi_s) - (1 - \epsilon)Y \right) \left(\frac{V(t)}{V_s^*(\psi_s)} \right)^{\beta_1} \right] \quad (3.3)$$

where $\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{(-\frac{1}{2} + \frac{\alpha}{\sigma^2})^2 + \frac{2r}{\sigma^2}}$ is the positive root of the standard fundamental quadratic equation, and $V_s^*(\psi_s)$ is the takeover threshold for any given ψ_s , in other words the target reaction to the bidder offering premium.

The bidder firm, in turn, knows the target reaction function and proposes an optimal premium (ψ_s^*) that optimizes its objective function given the target's optimal response ($V_s^*(\psi_s)$), that is:

$$\max_{\psi_s} \left[\left(\bar{\omega} - \psi_s \right) V_s^*(\psi_s) - \epsilon Y \right] \left(\frac{V(t)}{V_s^*(\psi_s)} \right)^{\beta_1} \quad (3.4)$$

Since takeover synergies are always uncertain, the bidder firm evaluates its takeover option based on its own synergy expectations that, for the sake of tractability, we assumed as a simple expected value between two possible outcomes, a higher (ω_h) and lower (ω_l) synergy values, where $p \in [0, 1]$ denotes the probability of synergies being high, that is:

$$\bar{\omega}(\omega_h, \omega_l, p) \equiv \bar{\omega} = p\omega_h + (1 - p)\omega_l \quad (3.5)$$

Solving both objective functions recursively leads to the following proposition:

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:*

$$V_s^* = \frac{\beta_1(\beta_1 - \epsilon)Y}{(\beta_1 - 1)^2 \bar{\omega}} \quad (3.6)$$

$$\psi_s^* = \frac{(\beta_1 - 1)(1 - \epsilon)\bar{\omega}}{\beta_1 - \epsilon} \quad (3.7)$$

Consequently, the takeover option value for firm B results in the following expression:

$$B_s(V, \bar{\omega}, p, Y, \epsilon) = \frac{(\beta_1 - \epsilon)Y}{(\beta_1 - 1)^2} \left(\frac{V}{V_s^*(\bar{\omega}, p, Y, \epsilon)} \right)^{\beta_1} \quad (3.8)$$

3.2 Two-step Takeover

Now we extend the previous section framework to include the particularity of firm B holding a minority ownership on the firm T before a full acquisition is made.

With a toehold position in the target firm, the bidder puts himself in an advantageous position for two reasons. First, the bidder forms the toehold before the price run-up, and for this reason, it does not have to pay a premium on the minority stake position. Second, the bidder becomes a shareholder of the target firm. From these two toehold advantages, as mentioned in Section 2.3, many benefits may accrue for the acquirer, in particular, reducing information asymmetries. By taking a toehold position the acquisition is staged which, as mentioned at the beginning of Chapter 3, might give such a significant advantage in terms of unveiling information that we assume that, at the exact moment of toehold purchase, the firm B has access to enough information so that the future synergy values are fully revealed for it.

Regarding the costs of the minority stake purchase, we assumed that are negligible, and for that reason, there is no timing for the toehold purchase.

For the two-step takeover strategy, we considered that two possible scenarios might happen, just as Lukas and Welling (2012). Thus, either firm B or T can be the first-mover, depending on whether the target foresees or not, the bidder's intentions to make a full acquisition.

3.2.1 The bidder as first-mover

The possibility of firm B keeping the surprise factor when buying the toehold might seem somewhat unrealistic. Nevertheless, it is still plausible to assume that, firm T does not have enough time to conduct its due diligence and define the terms that maximize its welfare (the demanded premium) before firm B making the bid, or that the target simply does not interpret the toehold purchase as a preliminary step towards a future full acquisition. Thus, similarly to Section 3.1, in this section, the toehold bidder also catches the target off guard and gets the first-mover position.

Following the same procedures as before, for any given premium, the target decides on the timing of the takeover that maximizes its objective function:

$$G_B(V) = \max_{V_{tB}^*(\psi_{tB})} \left[\left(\psi_{tB}(1 - \theta)V_{tB}^*(\psi_{tB}) - (1 - \theta)(1 - \epsilon)Y \right) \left(\frac{V(t)}{V_{tB}^*(\psi_{tB})} \right)^{\beta_1} \right] \quad (3.9)$$

Compared to the hostile acquisition without toehold, the target receives a lower premium amount since now the firm B owns a fraction $\theta \in (0, 0.5)$ of T, but at the same time, it also pays less $\theta(1 - \epsilon)$ of transaction costs (Y). On the contrary, firm B supports the transaction cost savings of firm T as a counterpart for the lower amount of premium paid. Thus, the value of the option to acquire the target held

by firm B is the solution of the following maximization problem:

$$\max_{\psi_{tB}} \left[\left((\omega_{h,l} - \psi_{tB}(1 - \theta)) V_{tB}^*(\psi_{tB}) - (\theta(1 - \epsilon) + \epsilon) Y \right) \left(\frac{V(t)}{V_{tB}^*(\psi_{tB})} \right)^{\beta_1} \right] \quad (3.10)$$

As before in Section 3.1, B anticipates T's reaction and includes it on its objective function to offer the optimal premium, ψ_{tB}^* . The synergy variable $\omega_{h,l}$ here could be a higher or a lower value, dependent on how those synergies reveal themselves to the bidder at the time of toehold purchase.

Proposition 2. *The two-step takeover, when the target foresees the real purpose of the bidder's toehold purchase, occurs at the optimal timing $V(t) = V_{tB}^*$, determined by the target after receiving the optimal premium ψ_{tB}^* from the bidder, where V_{tB}^* and ψ_{tB}^* are given by:*

$$V_{tB}^* = \frac{\beta_1(\beta_1 - (\theta(1 - \epsilon) + \epsilon))}{(\beta_1 - 1)^2} \frac{Y}{\omega_{h,l}} \quad (3.11)$$

$$\psi_{tB}^* = \frac{(\beta_1 - 1)(1 - \epsilon)\omega_{h,l}}{\beta_1 - (\theta(1 - \epsilon) + \epsilon)} \quad (3.12)$$

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

$$B_{tB}(V, \omega_{h,l}, Y, \epsilon) = \frac{(\beta_1 - (\theta(1 - \epsilon) + \epsilon))Y}{(\beta_1 - 1)^2} \left(\frac{V}{V_{tB}^*(\omega_{h,l}, Y, \epsilon)} \right)^{\beta_1} \quad (3.13)$$

Under the setting where B chooses the toehold strategy, and T does not foresee its real motivation, and considering the assumption that after the bidder buying the toehold the synergies reveal themselves in full, the takeover option value for the toehold bidder, before and at the exact moment it buys the toehold, is:

$$\bar{B}_{tB}(V, \omega_h, \omega_l, Y, \epsilon, p) = pB_{tB}(V, \omega_h, Y, \epsilon) + (1 - p)B_{tB}(V, \omega_l, Y, \epsilon) \quad (3.14)$$

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

Given that the uncertainties about the future synergies vanishes at immediate moment the minority stake is formed, at that time the bidder either receives an option to buy the target with high synergy value or an option to buy the target with low synergy value and that is why the probabilities (p and $(1 - p)$) are outside the functions and not on the synergies itself.

3.2.2 The target as first-mover

Contrary to what we said earlier in Section 3.2.1, there are also good reasons for the toehold bidder to lose the first-mover advantage for the target. In fact, one of the mentioned reasons for not pursuing a toehold is that it eliminates the element of surprise, given some countries' information disclosure rules⁵ and because it is practically impossible, if not at all, to hide the minority ownership from target managers and shareholders, who can now anticipate the bidding strategy of firm B and prepare defences or defining its required terms for a possible bid.

A recent example occur in May of last year, after the Norwegian oil and gas company DNO building up a 27.68% stake in Faroe Petroleum.⁶ Although, DNO declared it had no intentions to launch a takeover bid still, Faroe Petroleum hired investment bank Rothschild to prepare for a potential takeover bid. Despite all that, early this year the takeover eventually was finished.⁷

Therefore, assuming that those are reasons enough for strongly supporting the scenario where firm T gets to be the first-mover, let us now start to describe the setting. The framework is the same, but now we have the procedure following the inverse sequence because now is the target who anticipates the bidder reaction and dictates the minimum premium for which it is willing relinquishing control.

The target firm anticipates bidder's reaction for any given premium, which is the solution for the next optimization problem:

$$G_T(V) = \max_{V_{tT}^*(\psi_{tT})} \left[\left((\omega_{h,l} - \psi_{tT}(1 - \theta)) V_{tT}^*(\psi_{tT}) - (\theta(1 - \epsilon) + \epsilon)Y \right) \left(\frac{V(t)}{V_{tT}^*(\psi_{tT})} \right)^{\beta_1} \right] \quad (3.15)$$

By incorporating the previous solution on its objective function, the target firm can now choose the optimal premium such that it maximizes:

$$\max_{\psi_{tT}} \left[\left(\psi_{tT}(1 - \theta) V_{tT}^*(\psi_{tT}) - (1 - \theta)(1 - \epsilon)Y \right) \left(\frac{V(t)}{V_{tT}^*(\psi_{tT})} \right)^{\beta_1} \right] \quad (3.16)$$

Once more, solving firms B and T objective functions (Equations (3.15) and (3.16)) recursively leads to the following results for the threshold, premium and firms' option

⁵Varies between 3-5% for different countries. In the US, SEC regulation requires that anyone who acquires more than 5% of a voting class of a company's equity securities must file Schedule 13(D) within ten days to disclose their identity, the number of shares owned, and more importantly, their purpose in acquiring the shares

⁶<https://www.londonstockexchange.com/exchange/news/market-news/market-news-detail/0MHP/13592726.html>

⁷<https://www.reuters.com/article/faroe-petroleum-ma/faroe-petroleum-raises-defences-for-possible-dno-bid-idUSL8N1SA797>.

values:

Proposition 3. *The two-step takeover, when the target does not foresee the real purpose of the bidder's toehold purchase, occurs at the optimal timing $V(t) = V_{tT}^*$, determined by the bidder after the optimal premium ψ_{tT}^* is demanded by the target, where V_{tT}^* and ψ_{tT}^* are given by:*

$$V_{tT}^* = \frac{\beta_1(\beta_1 - (1 - \theta)(1 - \epsilon))}{(\beta_1 - 1)^2} \frac{Y}{\omega_{h,l}} \quad (3.17)$$

$$\psi_{tT}^* = \frac{(\beta_1 - 1)(1 - \theta)(1 - \epsilon) + \theta(1 - \epsilon) + \epsilon}{(\beta_1 - (1 - \theta)(1 - \epsilon))} \frac{\omega_{h,l}}{(1 - \theta)} \quad (3.18)$$

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

$$B_{tT}(V, \omega_{h,l}, Y, \epsilon) = \frac{(\theta(1 - \epsilon) + \epsilon)Y}{\beta_1 - 1} \left(\frac{V}{V_{tT}^*(\omega_{h,l}, Y, \epsilon)} \right)^{\beta_1} \quad (3.19)$$

Under the setting where B chooses the toehold strategy, and T anticipates its real motivation, and considering the assumption that after the bidder buying the toehold the synergies reveal themselves in full, the takeover option value for the toehold bidder, before and the exact moment it buys the toehold, is:

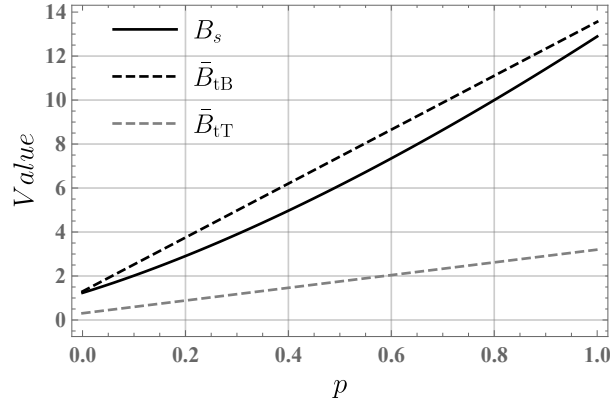
$$\bar{B}_{tT}(V, \omega_h, \omega_l, Y, \epsilon, p) = pB_{tT}(V, \omega_h, Y, \epsilon) + (1 - p)B_{tT}(V, \omega_l, Y, \epsilon) \quad (3.20)$$

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

3.3 Single-step vs Two-Step Takeovers

Since our primary goal is to study which strategy a bidder should pursue given each strategy characteristics, would make sense to, similarly to Lukas et al. (2019), not only study the options values but also which strategy is more likely to occur, i.e., which strategy reaches the trigger in the first place. However, because choosing the two-step takeover automatically eliminates the possibility of a single-step takeover, studying the probability of reaching the thresholds becomes irrelevant. Therefore, with this section, we intend to determine in which situations, if when it is the bidder or the target the first-mover or even both scenarios, one strategy is preferable over the other, i.e., the best strategy to pursue.

Let us then start by individually comparing the option values of the two scenarios of takeover strategies with toehold (bidder maintains or not the first-mover advantage) with the option value of a plain takeover strategy.



$$V_0 = 100, Y = 7, \epsilon = 0.5, \theta = 0.2, \omega_l = 0.05, \omega_h = 0.25, r = 0.05, \delta = 0.03, \sigma = 0.25, p = 0.5$$

Figure 3.1: Comparison between single-step takeover (B_s) and two-step takeover, with the bidder as first-mover ($\bar{B}_{tB}$) and with the target as first-mover ($\bar{B}_{tT}$)

Figure 3.1 shows the impact of the probability of high synergy on the options values B_s , $\bar{B}_{tB}$ and $\bar{B}_{tT}$ and from it, we see that for any given p that the single-step strategy (B_s) is always superior to the two-step strategy with the target as first-mover ($\bar{B}_{tT}$), but has an inferior value when bidder holds the first-mover positions ($\bar{B}_{tB}$). The higher value the toehold strategy with B as first-mover has in comparison to an immediate takeover is attributed to the toehold itself and to the fact that the synergies reveal themselves to the bidder when it acquires the minority ownership on the target. Although the toehold induces the firm B to offer higher premium because of its overbidding capacity (B does not have to pay the total premium amount, ψ^*V , because it owns θV), with B as first-mover the takeover threshold also decreases (as shown in Corollary 4), and the overall effect is that a pre-bid minority ownership increases the takeover option value. Analytically, the toehold's additional value can be proved by $\partial B_{tB}/\partial\theta > 0$ and graphically (Figure 3.1), is possible to see that the toehold strategy with B as first-mover becomes steeper which otherwise would be if only were considered the information advantage since the two options would touch when the probability is equal to one (see proof of Corollary 1).⁸

On the contrary, when the target foresees the bidder's plan, it ends up being the one who dictates the terms of the transaction, getting a first-mover advantage and, for that reason, the toehold strategy becomes worthless when compared to a hostile takeover without any toehold (Figure 3.1). This result proves that the toehold's advantages (information advantage and the advantage of forming the toehold before

⁸Although not visible on Figure 3.1, the takeover option function also moves upwards with the toehold and for this reason when $p = 0$ the two-step takeover with B as first mover is still more valuable than the single-step takeover.

the stock price run-up) are not enough to offset the loss of value by becoming the second-mover, as a consequence of the higher additional value granted by the Stackelberg leader position.

All that being said, is possible to state that:

Corollary 1. *Staging the takeover process is always the optimal takeover strategy for the bidder if, and only if, he can hide his real intentions (making a full acquisition) from the target. Otherwise, the single-step takeover is always the optimal takeover strategy ($\bar{B}_{tB} > B_s > \bar{B}_{tT}$).*

Proof. See Appendix. □

3.4 Takeover Strategy Choice

Taking into consideration the Corollary 1, the bidder always prefers to secretly buy a toehold in the target firm and later acquiring the whole firm. But the possibility of such trading is somewhat limited because as we said earlier, in some countries is required by law to disclose his trades. Nevertheless, the target can still interpret as simple equity investment or a possible corporate alliance and do not realise what B's real intentions are.

That said, considering the coexistence of both scenarios realistic, the 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 its takeover decision on its beliefs about target interpretation to the toehold purchase, as the proposition below states:

Proposition 4. *The toehold takeover strategy, before and at the exact moment of toehold purchase, has the following value:*

$$B_t(V, \omega_h, \omega_l, Y, \epsilon, p, q) = q\bar{B}_{tB}(V, \omega_h, \omega_l, Y, \epsilon, p) + (1 - q)\bar{B}_{tT}(V, \omega_h, \omega_l, Y, \epsilon, p) \quad (3.21)$$

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

As with the synergy uncertainty, the bidder only knows if the target will interpret its minority ownership acquisition as the first step towards a full acquisition after having the toehold, and this is why the bidder has to weight each of both possible scenarios ($\bar{B}_{tB}(V, \omega_h, \omega_l, Y, \epsilon, p)$ and $\bar{B}_{tT}(V, \omega_h, \omega_l, Y, \epsilon, p)$) by its own beliefs regarding the target's reaction.

Since there is always a dominant strategy depending on whether the target firm anticipates or not the toehold bidder intentions, the bidder's beliefs about probability q play a fundamental role to determine the optimal strategy to follow. That being said:

Proposition 5. *The bidder will choose a toehold takeover strategy instead of a single-step takeover if, and only if, firm B has a level of certainty about the possibility of T does not uncover its real intentions above:*

$$q > q^* = \frac{B_s(V, \bar{\omega}, Y, \epsilon, p) - \bar{B}_{tT}(V, \omega_h, \omega_l, Y, \epsilon, p)}{\bar{B}_{tB}(V, \omega_h, \omega_l, Y, \epsilon, p) - \bar{B}_{tT}(V, \omega_h, \omega_l, Y, \epsilon, p)} \quad (3.22)$$

Given Corollary 1, the result in the proposition above is intuitive. The lower the difference between the options values of single-step takeover and the two-step takeover with the target as first-mover, or the higher difference between the toehold strategy with the bidder as first-mover and with the target as first-mover, the lower probability q is required to the bidder to engage in a toehold acquisition strategy, i.e., more likely is to choose two-step strategy.

Besides its information disclosure advantage, a toehold can even be a way of preempting the other possible rivals but without the full commitment of an immediately full acquisition, as the next chapter shows.

4 Takeover Strategy under Hidden Competition

As Eckbo (2009, p.151) points out that "in a very real sense, merger negotiations occur in the shadow of an auction, so the expected auction outcome affects the bargaining power of the negotiating parties", this section introduces another nuance to the basic model presented earlier, which is the acquisition decision-making under hidden competition. In a similar manner to Pereira and Armada (2013), the firm B must make the takeover decision under total asymmetric information about other rival bidders given that firm B does not know who their competitors are until the moment they decide to move forward with the acquisition. While Pereira and Armada (2013) assumes the entrance in the market up to two firms until the investment opportunity vanishes completely, in our model when a firm exercises its option to acquire the target, the takeover opportunity obviously disappears for the remaining firms interested.

Based on the literature (Bessler et al., 2015; Betton & Eckbo, 2000; Betton et al., 2009) it is also reasonable to assume that when bidder firm acquires a toehold in the target, all the other potential bidders will lose its interest in the target, given the overbidding capacity of toehold bidder that makes the others fear of suffering from winner's curse. That said, not only when a firm makes the takeover, but also when the firm acquires a minority stake in the target, the takeover option expires for all the other rival bidders.

4.1 Hostile Takeover under Hidden Competition

The derivation process is the same applied in the basic model version. Now, we just add the dynamics of hidden competition from Pereira and Armada (2013) to the takeover option. In this competitive context, the likelihood of a particular hidden rival revealing itself by acquiring the target firm is an exogenous event with some probability of occurrence. The takeover value-function of firm B is then dependent on the likelihood that is preempted by another hidden bidder, during the next infinitesimal period of time dt . This event occurs randomly according to a Poisson distribution with a mean arrival rate λ .

Based on the standard arguments, the value-function of B must now satisfy a

ODE similar to Pereira and Armada (2013), that is:

$$\frac{1}{2}\sigma^2 V^2 H''(V) + (r - \delta)VH'(V) - rH(V) + \lambda[F_\lambda(V) - H(V)] = 0 \quad (4.1)$$

where the last term captures the real option's expected loss of value due to the preemption of a hidden bidder, during the next infinitesimal period of time dt . Since when a rival anticipates and takes over the target or acquires a toehold first, the firm B loses its takeover opportunity, the real option must be worthless,

$$F_\lambda(V) = 0 \quad (4.2)$$

Rearranging the ODE (Equation (4.1)):

$$\frac{1}{2}\sigma^2 V^2 H''(V) + (r - \delta)VH'(V) - (r + \lambda)H(V) = 0 \quad (4.3)$$

From the well known general solution for Equation (4.3) results the fundamental quadratic $Q = 0.5\sigma^2\eta(\eta - 1) + (r - \delta)\eta - (r + \lambda)$ that has the following roots:

$$\eta_1 = \frac{1}{2} - \frac{r - \delta}{\sigma^2} + \sqrt{\left(-\frac{1}{2} + \frac{r - \delta}{\sigma^2}\right)^2 + \frac{2(r + \lambda)}{\sigma^2}} > 1 \quad (4.4)$$

$$\eta_2 = \frac{1}{2} - \frac{r - \delta}{\sigma^2} - \sqrt{\left(-\frac{1}{2} + \frac{r - \delta}{\sigma^2}\right)^2 + \frac{2(r + \lambda)}{\sigma^2}} < 0 \quad (4.5)$$

Given the boundary condition $\lim_{V \rightarrow 0} H(V) = 0$, we are left with η_1 .

Since for the target shareholders it is indifferent to sell the company to any of the bidders, only the value function of firm B directly incorporates the hidden competition dynamics. That said, the target reaction for any offered premium stays the same, $V_s^*(\psi_\lambda)$, while the premium offered by the bidder (ψ_λ) changes as a result of the new expression that the value-function assumes:

$$H(V) = \max_{\psi_\lambda} \left[\left(\bar{\omega} - \psi_\lambda V_H^*(\psi_\lambda) - \epsilon Y \right) \left(\frac{V(t)}{V_H^*(\psi_\lambda)} \right)^{\eta_1} \right] \quad (4.6)$$

Following the same procedures as in Section 3.1, where the bidder chooses the optimal premium and the target the optimal timing, we state that:

Proposition 6. *Under a context of hidden competition, the hostile takeover of firm T by firm B occurs at the optimal timing $V(t) = V_\lambda^*$, determined by T after receiving the optimal premium ψ_λ^* from B, where V_λ^* and ψ_λ^* are given by:*

$$V_\lambda^* = \frac{\eta_1(\beta_1 - \epsilon)}{(\beta_1 - 1)(\eta_1 - 1)} \frac{Y}{\bar{\omega}} \quad (4.7)$$

$$\psi_\lambda^* = \frac{\beta_1 (\eta_1 - 1)(1 - \epsilon)\bar{\omega}}{\eta_1 (\beta_1 - \epsilon)} \quad (4.8)$$

Consequently, the takeover option value for firm B results in the following expression:

$$B_\lambda(V, \bar{\omega}, p, Y, \epsilon) = \frac{(\beta_1 - \epsilon)Y}{(\beta_1 - 1)(\eta_1 - 1)} \left(\frac{V}{V_\lambda^*(\bar{\omega}, p, Y, \epsilon)} \right)^{\eta_1} \quad (4.9)$$

When a bidder weighting a hostile takeover admits the possibility of hidden rival preempt it and buys the target firm, the takeover timing, the offered premium and the option value, are all affected when compared to the situation where this probability is assumed as null:

Corollary 2. *Under a context of total incomplete information about other rival bidders (and taking in consideration that $\frac{\partial H(\lambda)}{\partial \lambda} = \frac{\partial H(\lambda)}{\partial \eta_1} \frac{\partial \eta_1}{\partial \lambda}$) a higher likelihood of rival preemption induces the bidder to offer a higher premium:*

$$\frac{\partial \psi_\lambda^*}{\partial \eta_1} = \frac{\omega \beta_1 (1 - \epsilon)}{\eta_1^2 (\beta_1 - \epsilon)} > 0 \quad (4.10)$$

and the transaction to occur earlier.

$$\frac{\partial V_\lambda^*}{\partial \eta_1} = \frac{Y(\epsilon - \beta_1)}{\omega(\beta_1 - 1)(\eta_1 - 1)^2} < 0 \quad (4.11)$$

Notwithstanding this, the bidder's option value is non-monotonic for λ , i.e.:

$$\frac{\partial B_\lambda}{\partial \eta_1} = \frac{V\bar{\omega}}{\eta_1} \left(\frac{(\beta_1 - 1)(\eta_1 - 1)V\bar{\omega}}{\eta_1 Y(\beta_1 - \epsilon)} \right)^{\eta_1 - 1} \log \left(\frac{(\beta_1 - 1)(\eta_1 - 1)V\bar{\omega}}{\eta_1 Y(\beta_1 - \epsilon)} \right) \leq 0 \quad (4.12)$$

which for levels of likelihood of new entrant above (below):

$$\frac{\sigma^2}{2} \left(\left(\frac{r - \delta}{\sigma^2} + \frac{(\beta_1 - 1)V\bar{\omega}}{(\beta_1 - 1)V\bar{\omega} + Y(\epsilon - \beta_1)} - \frac{1}{2} \right)^2 - \left(\frac{r - \delta}{\sigma^2} - \frac{1}{2} \right)^2 \right) - r \quad (4.13)$$

the option value increases (decreases) as λ increases.

Proof. See Appendix. □

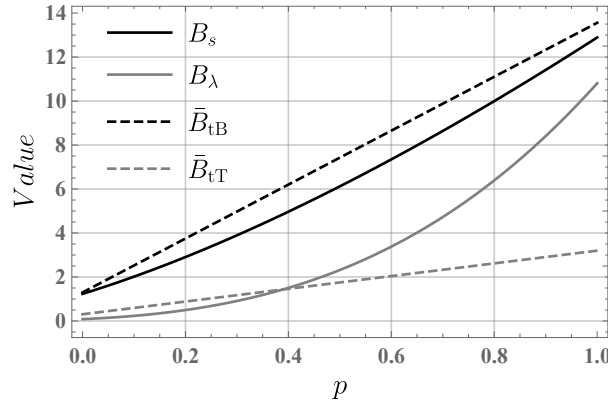
The corollary above proves that the bidder, when perceives the possibility to be preempted by other hidden rivals, it is willing to offer a higher premium. As a consequence of that, and because is the target who defines timing, the higher probability of hidden rival preemption the earlier the takeover occurs. Like in Pereira and Armada (2013), in hostile takeovers there is also a tendency to a preemptive move against hidden rivals. This result is in accordance with the intuition that, in

an effort to secure the deal from other possible rivals, the bidder is more willing to offer higher premiums to persuade the target to accept the offer as soon as possible, and this way preempts any other possible hidden bidders, which is consistent with the Theory of Preemptive Takeover Bidding of Fishman (1988) and the empirical results of Betton et al. (2009).⁹ However, changes in the mean arrival rate have an ambiguous impact on the takeover option value.

4.2 Single-step vs Two-Step Takeovers under Hidden Competition

Similarly to Section 3.3, let us now see what is the bidder's optimal strategy when it faces total incomplete information about other rivals.

For the same numerical example as in Figure 3.1 and with a mean arrival rate (λ) of 0.2, Figure 4.1 adds the hostile takeover under a context of hidden competition to compare the effect of the probability of takeover synergies to be high (p) on the options values with the other possible scenarios.



$$V_0 = 100, Y = 7, \epsilon = 0.5, \theta = 0.2, \omega_l = 0.05, \omega_h = 0.25, r = 0.05, \delta = 0.03, \sigma = 0.25, p = 0.5, \lambda = 0.2$$

Figure 4.1: Comparison between single-step takeover, with and without hidden competition (B_s and B_λ , respectively), and two-step takeover, with the bidder as first-mover ($\bar{B}_{tB}$) and with the target as first-mover ($\bar{B}_{tT}$)

This time, under hidden competition, the dominance of single-step strategy (B_λ) over the two-step strategy with the target as first-mover ($\bar{B}_{tT}$) does not hold and

⁹According to Betton et al. (2009) the average initial offer premium in tender offers is higher when the initial bidder succeeds with the first bid than when occur takeover contests. For the single-bidder contests, the initial premium averages 44.8% and for the multiple-bidder contests, the average initial premium is 41.1%.

thus, only when above a specific probability of synergies being high is that going straight away to the full acquisition becomes a more valuable strategy. On the other hand, the toehold strategy with the bidder as first-mover still dominates the single-step strategy, but now with a more significant difference.

Since the possible preemption of hidden rivals induces the bidder to offer a higher premium, and in turn, the target anticipates the takeover timing, the single-step takeover has now a lower value than in Section 3.1, as the Figure 4.1 illustrates and corollary below proves that.

Corollary 3. *Given that by considering the existence of other potential hidden bidders the value of single-step takeover option decreases, staging the takeover process is always the optimal takeover strategy for the bidder if, and only if, he can hide his real intentions (making a full acquisition) from the target ($\bar{B}_{tB} > B_s > B_\lambda$). Otherwise, the single-step takeover is the optimal takeover strategy for higher levels of p , and the inverse for lower levels of p .*

Proof. See Appendix. □

4.3 Takeover Strategy Choice under Hidden Competition

The firm B has now to make a decision taking in consideration that if it opts for the single-step strategy there is probability of a hidden bidder preempt him, and for this reason, the condition to ensure that staging the takeover process is the best strategy (proposition 5) has changed, as the proposition below shows:

Proposition 7. *Under a context of hidden competition, the bidder will choose a toehold takeover strategy instead of a single-step takeover if, and only if, firm B has a level of certainty about the possibility of T does not uncover its real intentions above:*

$$q > q_\lambda^* = \frac{B_\lambda(V, \bar{\omega}, Y, \epsilon, p) - \bar{B}_{tT}(V, \omega_h, \omega_l, Y, \epsilon, p)}{\bar{B}_{tB}(V, \omega_h, \omega_l, Y, \epsilon, p) - \bar{B}_{tT}(V, \omega_h, \omega_l, Y, \epsilon, p)} \quad (4.14)$$

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

Once more, the lower the difference between the options values of single-step takeover and the two-step takeover with the target as first-mover, or the higher difference between the toehold strategy with the bidder as first-mover and with the target as first-mover, the lower probability q is required to the bidder to engage in a toehold acquisition strategy, i.e., more likely is to stage the takeover process.

Given Corollary 3, the point of indifference between the single-step takeover strategy and two-step takeover strategy is always lower when hidden competition is considered ($q^* > q_\lambda^*$). Therefore, under hidden competition context there is a higher probability of the bidder following the toehold strategy, which confirms the literature evidence on toehold bidding as competitive advantage over rival bidders.

5 Optimal Takeover Strategy Analysis

Let us now showcase the model, with and without hidden competition, by using the numerical example in Table 5.1, for a better understanding of the main drivers of the optimal takeover strategy decision.

Description	Parameter	Value
Target market value	V	100
Total transaction costs	Y	7
Share of Y supported by the bidder	ϵ	0.5
High synergy value	ω_h	0.25
Low synergy value	ω_l	0.05
Toehold position	θ	0.2
Risk free rate	r	0.05
Dividend yield of the target	δ	0.03
Volatility of V	σ	0.25
Probability for a rival bidder preemption	λ	0.2
Probability of synergies being high (ω_h)	p	0.5

Table 5.1: Base-case parameters

Parameter	Value	Parameter	Value
V_s^*	311	ψ_s^*	0.036
V_λ^*	146	ψ_λ^*	0.076
$V_{tB}^*(\omega_h)$	167	$\psi_{tB}^*(\omega_h)$	0.067
$V_{tB}^*(\omega_l)$	836	$\psi_{tB}^*(\omega_l)$	0.013
$V_{tT}^*(\omega_h)$	206	$\psi_{tT}^*(\omega_h)$	0.231
$V_{tT}^*(\omega_l)$	1036	$\psi_{tT}^*(\omega_l)$	0.046

(a) Optimal timing of the takeover strategies (approximated values)

(b) Optimal premium of the takeover strategies (approximated values)

Table 5.2: Solutions for the base-case parameters in Table 5.1.

For the base-case parameters in Table 5.1, Table 5.2 presents the optimal takeover timing and premium for all possible scenarios. Important to notice the dramatical impact of the first-mover on the takeover trigger since, as a result of the higher

bargaining power of the first-mover and negative impact of a premium on B's pay-off, the takeover occurs more than five times later and the premium demanded by T is more than five times higher when the target realises the bidder final purpose of the toehold purchase. Moreover, Table 5.2 also shows the serious impact of a possible preemption by other hidden bidder given the takeover threshold decrease of 53% and the premium increase of more than double when hidden competition is considered.

5.1 The effect of toeholds

As explained in the literature review, one of the main advantages of a toehold bidder is its overbidding capacity when compared to other bidders without toehold. Following Lukas et al. (2019), this toehold advantage can be demonstrated through the total amount of premium paid by B ($\Psi_{tB,tT}^* = (1 - \theta)\psi_{tB,tT}^*V$), which decreases with the toehold ($\partial\Psi_{tB,tT}^*/\partial\theta < 0$). As a result of the premium savings, the toehold bidder is willing, or at least less averse, to offer higher premium ($\partial\psi_{tB,tT}^*/\partial\theta > 0$) than otherwise would be if had no pre-takeover minority stake. Notwithstanding all this, the takeover timing reacts differently to toehold changes dependent on who is the Stackelberg leader:

Corollary 4. *The higher the toehold the bidder holds, the earlier the takeover occurs when the bidder holds the first-mover position:*

$$\frac{\partial V_{tB}^*}{\partial\theta} = -\frac{\beta(1-\epsilon)}{(\beta-1)^2} \frac{Y}{\omega_{h,l}} < 0 \quad , \quad (5.1)$$

and the later the takeover happens when the target anticipates the bid and gets to be the Stackelberg leader:

$$\frac{\partial V_{tT}^*}{\partial\theta} = \frac{\beta(1-\epsilon)}{(\beta-1)^2} \frac{Y}{\omega_{h,l}} > 0 \quad (5.2)$$

As a consequence of B's overbidding capacity ($\partial\psi_{tB,tT}^*/\partial\theta > 0$) and, because the premium has an opposite effect on firms' pay-off, is also a result of who defines the takeover timing:

$$\frac{\partial V_{tB}^*(\psi_{tB})}{\partial\psi_{tB}} = -\frac{\beta(1-\epsilon)}{(\beta-1)} \frac{Y}{(\psi_{tB})^2} < 0 \quad , \quad (5.3)$$

$$\frac{\partial V_{tT}^*(\psi_{tT})}{\partial\psi_{tT}} = \frac{Y\beta(1-\theta)(\theta + (1-\theta)\epsilon)}{(\beta-1)((\theta-1)\psi_{tT} + \omega)^2} > 0 \quad (5.4)$$

Proof. See Appendix. □

The intuition of the previous corollary is straightforward: given that higher toehold means higher premium and since the bidder is better-off the lower is the premium it has to pay when the target anticipates takeover, the bidder delays the exercise of the takeover option. The contrary happens when is the target who decides the timing of the takeover.

While in Lukas and Welling (2012) the optimal trigger is independent of whether the bidder or target is the first-mover, here, because B holds a minority stake on T, the same does not happen. Despite the fact of the premium having a contrary impact on each firm pay-off, the impact is of different magnitude for each firm when the bidder holds a minority stake in the target, as opposed to Lukas and Welling (2012), where the magnitude is the same. Therefore, in our model, given the asymmetric

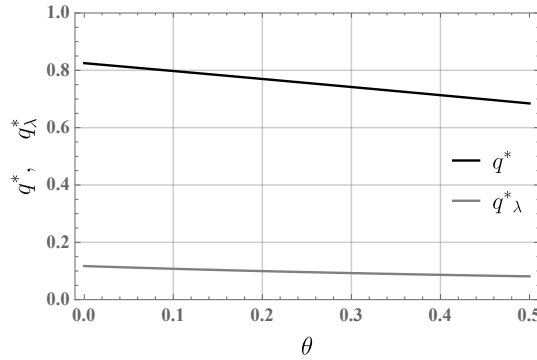


Figure 5.1: Optimal takeover strategy: sensitivity to toehold. Computation based on the parameters shown in Table 5.1.

affect the premium has on firms B and T, and the toehold's positive impact on the premium, the timing of the acquisition is conditional on whether the target foresees the bid or not.

With regard to the effect of toehold changes on the takeover strategy decision, we can see from Figure 5.1, that, independently of assuming or not the possibility existing hidden competition, the probability of toehold strategy is the best decision to acquire T increases as the B's toehold increases. This happens for two reasons. First, the value of toehold strategy with T as first-mover approximates to the plain takeover (the numerator of Equations (3.22) and (4.14) decreases), given that the last strategy is not affected by the toehold size. Secondly, for the base-case parameters in Table 5.1, B's takeover option increases with θ at a much slower pace when T anticipates the bid (see Figure 5.2a). Thus, each denominator of Equations (3.22) and (4.14) ends up increasing with the toehold, which contributes to q^* and q^*_λ decrease even more. This last effect is a reflection of the higher bargaining power

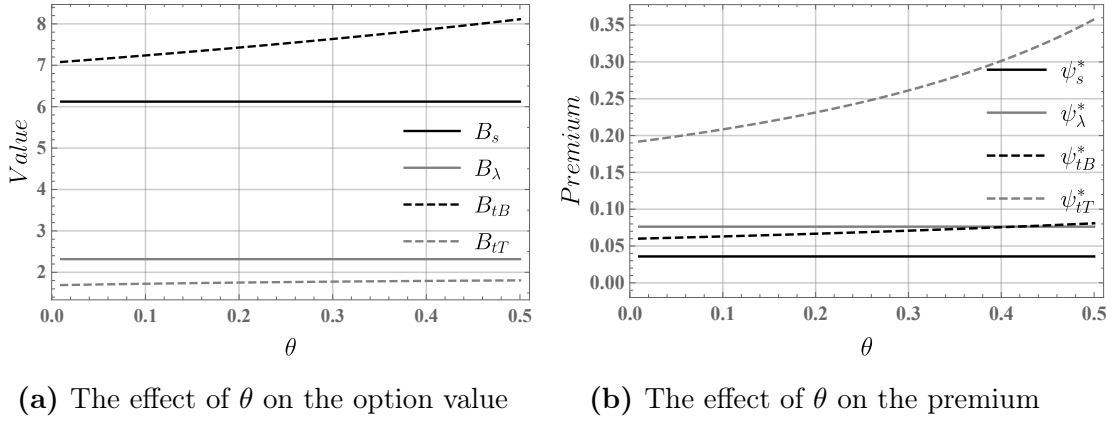


Figure 5.2: The effect of toehold on the option value and optimal takeover premium. Computation based on the parameters shown in Table 5.1.

that the first-mover holds, that when is the target to assume this position, it is able to extract a much higher premium from the bidder, i.e. $\psi_{tT}^* > \psi_{tB}^*$ (Equations (3.11) and (3.18), respectively), and also to exploit the toehold bidder advantage on its favour by extracting out an even higher premium as θ increases (see Figure 5.2b).¹⁰ In turn, to counteract this pay-off loss, B delays takeover timing, but at the same time, the stochastic discount factor decreases. The overall effect for the base-case parameters is that increases in the toehold results in a lower positive impact on the takeover option value with T as first-mover if compared to the opposite scenario.

For this particular example, we can see in Figure 5.1 that probability q^* drops more with the toehold than the q_λ^* does. This result is consistent with Povel and Sertsios (2014) findings since when the competition is higher, in our model, when we consider hidden competition, the bidder benefits less from the toehold.

5.2 The effect of transaction costs

Similarly to the previous section, by considering the possibility of firms supporting uneven shares of the total amount of transaction costs, the optimal takeover timing will differ and react in opposite ways to changes in ϵ , depending on who has the first-mover advantage. While in Lukas and Welling (2012), by considering equal

¹⁰Given that from the toehold strategy, whoever is the first-mover, results in only one premium depending on whether synergies reveal themselves to be high or low, and that we know about the positive impact of synergies on the optimal premium, for a better legibility of the Figures 5.2b and 5.4b, we only used the premiums for the two scenarios of the two-step strategy (ψ_{tB}^* and ψ_{tT}^*) for the case of high synergies.

transaction costs to each firm, the optimal threshold to exercise the takeover option is the same no matter who is the Stackelberg leader, if we consider an asymmetric division of these costs we have a different trigger, as the corollary below proves that:

Corollary 5. *The higher the transaction costs supported by B are, the sooner the takeovers occur when the bidder holds the first-mover position:*

$$\frac{\partial V_{tB}^*}{\partial \epsilon} = -\frac{\beta(1-\theta)}{(\beta-1)^2} \frac{Y}{\omega_{h,l}} < 0 \quad , \quad (5.5)$$

and the later the takeovers occur when the target anticipates the bid and gets to be the Stackelberg leader:

$$\frac{\partial V_{tT}^*}{\partial \epsilon} = \frac{\beta(1-\theta)}{(\beta-1)^2} \frac{Y}{\omega_{h,l}} > 0 \quad (5.6)$$

As a consequence of B's overbidding capacity ($\partial \psi_{tB,tT}^*/\partial \epsilon < 0$) and, because the premium has an opposite effect on firms' pay-off, is also a result of who defines the takeover timing (Equations (5.3) and (5.4)).

Proof. See Appendix. □

The sensitivity of the optimal strategy to transaction cost is illustrated in Figure 5.3, both in terms of the total amount and also how they are shared between the two firms. Regarding the distribution of transaction costs, we can conclude from

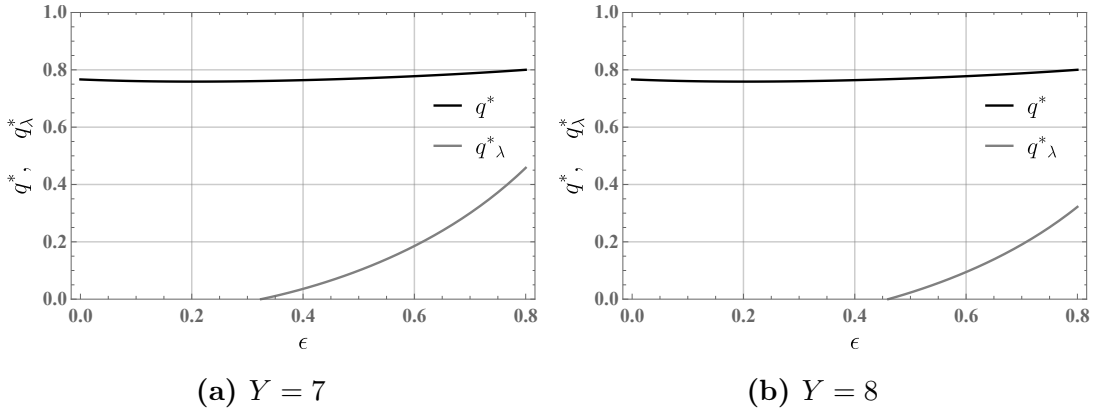


Figure 5.3: Optimal takeover strategy: sensitivity to transaction costs. Computation based on the parameters shown in Table 5.1.

Figure 5.3, that regardless of hidden competition is assumed or not, a higher portion supported by firm B leads to a higher probability of the single-step strategy being the best choice. This result is, once more, attributed to the higher bargaining power of the first-mover. For this reason, when T assumes the first-mover position it is

able to extort a higher premium from B, as we mentioned in the previous section, and also, given the parameters in Table 5.1, increases in ϵ have lower marginal effect on the reduction of the premium when B is the second-mover (see Figure 5.4b). Although the denominator of q^* and q_λ^* (Equations (3.21) and (4.14)) is increasing with ϵ , B_s and B_λ increase more than $\bar{B}_{tB}$, especially under hidden competition (see Figure 5.4a). Which for this reason, increases in ϵ have a much smaller effect under a context of no hidden competition (see Figure 5.3).

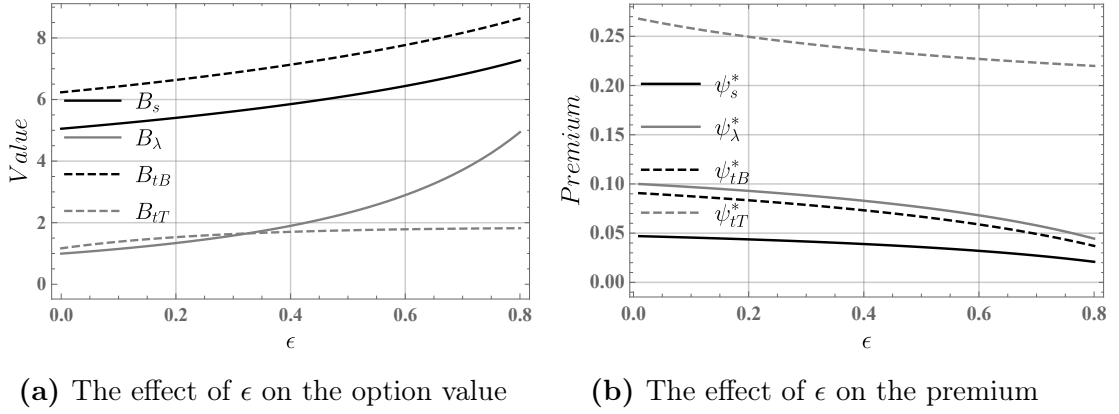


Figure 5.4: The effect of toehold on the option value and optimal takeover premium. Computation based on the parameters shown in Table 5.1.

Despite the fact that higher transaction costs (the sunk costs of the takeover option) always means later takeovers ($\partial V_i^*/\partial Y$, $\forall i = H, \lambda, tB, tT$) and the premiums remain unchangeable for any level of Y , for changes on this variable only the strategy decision under a context of hidden competition (i.e. q_λ^*) is affected. As Figure 5.3 shows, when Y decreases from 6 to 5, q_λ^* shifts to the left and up while q^* remains same. The justification for this phenomena as to due with the stochastic process involved in each situation. Since, when the possibility of hidden rivals is discard, we are comparing two strategies (single-step takeover and two-step takeover strategies) affected by the same variable and with the same stochastic process, meaning that the best strategy is always the same independently how much Y changes. Under hidden competition conditions, however, the stochastic processes of the toehold strategy with the target as first mover is different as the bidder has to account for a possible preemption of hidden competitors and lose the takeover opportunity. Whence, the probability q_λ^* decreases as the total transaction costs (Y) increase.

To summarise, high costly transactions and a higher portion of transaction costs supported by the bidder tend to favour less toehold strategy, and this is specially true if B admits the possible existence of hidden competitors.

5.3 The effect of uncertainty

On this section, we analyse the effect of two sources of uncertainty a bidder faces when weights the decision of acquiring another firm. While σ is the uncertainty associated with the market value of the target (V), the probability of the takeover leading to a high synergy value (p) can be viewed as the uncertainty about the future value-added from this transaction.

Figure 5.5b illustrates the behaviour of the takeover strategy decision (q^*) for changes in the uncertainty of the target market value, σ . The results for no hidden competition setting are in line with Lukas and Welling (2012) conclusions, which state that as the uncertainty increases the first-mover advantage also increases until the point that the first-mover receives the total value generated from the deal. While changes on uncertainty have a positive effect on both B_s and $\bar{B}_{tB}$ because the bidder is the Stackelberg leader, when B loses the leader position ($\bar{B}_{tT}$), has the opposite impact which results in q^* increasing with uncertainty. That said, under a context of no hidden competition, higher σ tends to favour the choice of an immediate full takeover strategy.

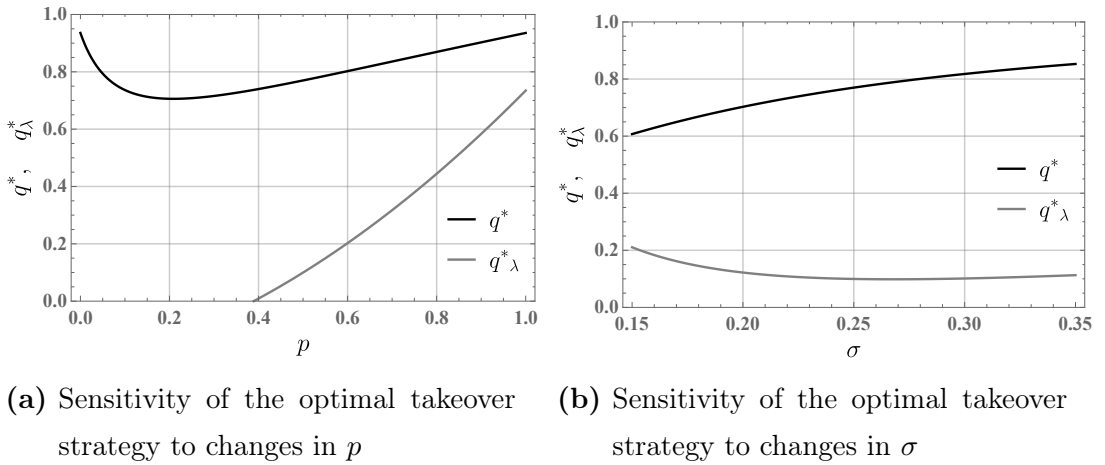


Figure 5.5: Optimal takeover strategy: sensitivity to uncertainty. Computation based on the parameters shown in Table 5.1.

However when hidden competition is considered the effect of uncertainty on the choice of the takeover strategy is ambiguous because first the q^*_λ decreases when σ increases, and after a certain level of uncertainty the effect reverts and q^*_λ slightly increases.

Regarding the impact of changes in the other source of uncertainty (p) on the takeover strategy decision, we can observe in Figure 5.5a that p has an ambiguous

effect on q^* . This is the consequence of the Jensen's Inequality since, for lower levels of p , changes in this probability results in lower increases of B_s compared to $\bar{B}_{tB}$ and the opposite occurs for high levels of p , while $\bar{B}_{tT}$ increases even less than the other settings, as Figure 3.1 proves that. Given the positive impact of toeholds on the bidder's takeover option, q^* is slightly lower than otherwise would be if B had no toehold.

Still on Figure 5.5a, when hidden competition is admitted, the point of indifference between both strategies increase since, for the present numerical example, the value single-step strategy increases at a faster pace with the increase of p , the strategy decision will tend to an immediate full takeover as p increases. This result is in accordance with Smit and Matawlie (2017) conclusions. As overconfident CEOs tend to be overoptimistic about future events, they believe that have the personal skill and the degree of control over future outcomes to improve the firms' performance once they gain control of the target. Therefore, they overestimate the possible outcomes, which in our model translates to higher p , and jump right away to a full acquisition rather than acquire a toehold and wait to see uncertainties resolve.

Important to notice that our results illustrated in Figure 5.5a only support Smit and Matawlie (2017) conclusions under a context of hidden competition. Perhaps the intuition behind that is that overconfident bidder's CEOs, that tend believe so much on its capabilities, when perceiving the possible preemption of hidden rivals, its overoptimism and miscalibration might equivocally become more pronounced as an irrational response to the apparent threat of losing the target for another firm.

5.4 The effect of synergies

Finally, we have the impact of takeover synergies on the strategic decision. Higher synergies, of course, means higher option value for the bidder as its takeover payoff increases. Nonetheless, the magnitude of the impact differs from strategy and consequently, the optimal strategy changes with different levels of synergies.

For hidden competition setting, the higher the synergies (low or high synergy), the higher the probability of B being the first-mover (q) is required for the toehold strategy become the right decision.

If B does not consider the possible existence of hidden competitors, when low synergy value increases from 5% to 10% (from Figure 5.6a to Figure 5.6b) q^* increases, while for increases in high synergy value the opposite occurs. This is the result of Jensen's Inequality, since the larger the range that synergy value can as-

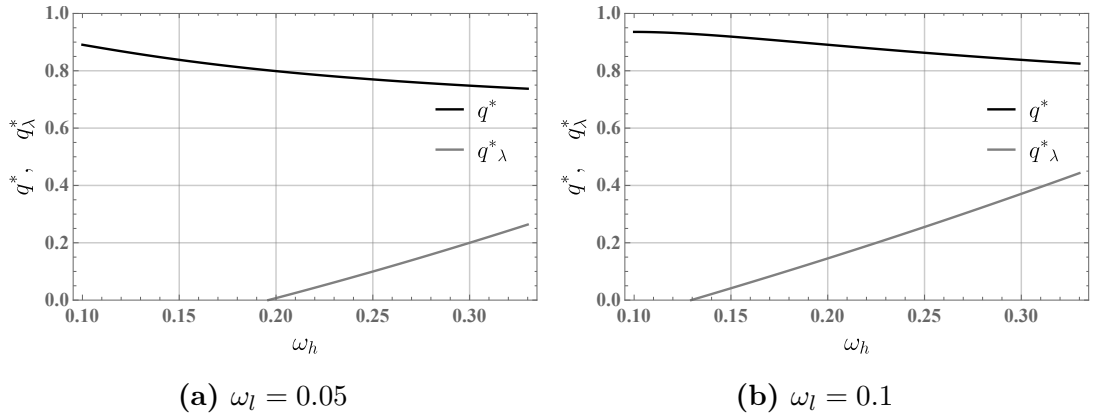


Figure 5.6: Optimal takeover strategy: sensitivity to synergies. Computation based on the parameters shown in Table 5.1.

sume the more valuable becomes the toehold strategy. In other words, the narrower confidence interval the bidder attributes to the future synergies the more likely it is to choose the single-step takeover. Once more, the results are consistent with Smit and Matawlie (2017), that state that overconfident CEO are overprecise with its estimations about future uncertain events, and for this reason, they have no need to reduce uncertainty trough a minority ownership in the target, consequently, going straight away to a full acquisition.

6 Conclusion

This dissertation studies how pre-bid minority ownership in the target firm can improve the acquirer chances of having success after the takeover, specifically analysing two of the various benefits attributed by the literature to this strategy, which are reducing the information asymmetries between the target and bidder firms, and the deterrent role it has over other potential bidders. For this purpose, instead of simple go or no-go trade-off between value and target price in a traditional discounted cash flow analysis, we used the Real Options framework to compare a takeover option with and without any pre-bid minority stake to determine the optimal strategy to follow. Additionally, to understand the impact of competition on the takeover strategy choice, we incorporate the dynamics of hidden competition from Pereira and Armada (2013) into our base model.

With all the toehold's claimed benefits and simultaneous rare use, there is much to be discussed regarding this strategy, particularly in what concerns to information asymmetries. With this dissertation, we show in which situations this strategy is most valuable and when it should be chosen given its information advantage, and also competitive advantage. Given the former toehold advantage and the overbidding capacity that the toehold confers, we proved that staging the takeover process, through the acquisition of minority stake in the target before making a formal bid, is always the best strategy to pursue if, and only if, the target does not realise what are the bidder's true intentions.

Regarding the competitive advantage that a toehold may yield over rival bidders, we showed that by introducing the possible existence of other hidden bidders, the hostile takeover occurs earlier and optimal premium is higher, which in turn favours the choice of the two-step strategy, as the required probability of the target being the first-mover becomes lower.

As in any other study, this dissertation has its limitations. For example, the transaction costs involving the toehold's purchase and also economic costs of that purchase (e.g., liquidity cost of failed bid and activation of poison pills by the target firm), were all neglected and thus, the timing of the toehold takeover was not considered. Besides all the future research that this limitation might motivate, several others research avenues can be suggested, such as, derive the optimal toehold size, studying the toehold competitive advantage in a takeover contest, extending this model to allow for multiple minority stakes purchases before a formal bid is made.

Appendix

Proof of Propositions

Proof of Proposition 1.

Solving the maximization problem in Equation (3.3) we get the T's trigger for any given ψ_s :

$$V_s^*(\psi_s) = \frac{\beta_1(1 - \epsilon)}{(\beta_1 - 1)} \frac{Y}{\psi_s} \quad (\text{A.1})$$

Firm B anticipates this trigger and incorporates it into its maximization problem. Therefore, substituting Equation (A.1) into Equation (3.4) and solving it, we arrive to Equation (3.7). Then, substituting this result into Equation (A.1) and rearranging, the optimal timing presented in Equation (3.6) is founded. The option value in Equation (3.8) is the simplification of bidder's pay-off function after incorporation of Equations (3.6) and (3.7) into it, times the discount factor.

Proof of Proposition 2.

This proof is similar to the previous one since the only difference is that the pay-off structure changed for both firms. Thus, following the same procedures we first get the 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 Equations (3.11) to (3.13).

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 Equation (3.14).

Proof of Proposition 3.

Similarly to the previous propositions proofs, results from Proposition 3 are derived by recursively solving firms objective functions, but now is the firm T that gets to be the first-mover and the firm B the reactive party. Thus, firm B times the takeover by solving Equation (3.15) and the trigger assumes the expression below:

$$V_{tT}^*(\psi_{tT}) = \frac{Y\beta_1(\theta + (1 - \theta)\epsilon)}{(\beta_1 - 1)((\theta - 1)\psi_{tT} + \omega)} \quad (\text{A.2})$$

which this time, is anticipated by firm T who, in turn, finds the optimal premium (Equation (3.18)) through the incorporation of Equation (A.2) into Equation (3.16) and solving it in order to ψ_{tT}^* . Substituting ψ_{tT}^* into Equation (A.2) and rearranging we get Equation (3.17). The simplification of the option value in Equation (3.19) can be found by incorporating Equations (3.17) and (3.18) into the pay-off function of firm B, times the discount factor.

The takeover option the toehold bidder receives instantly after the minority ownership acquisition is made is obtained in the same way as the proof of Proposition 2.

Proof of Proposition 4.

Taking in consideration that any of the firms have the opportunity to be the first-mover after the toehold purchase, the value of the two-step strategy must incorporate the probabilities of each scenario, as presented in Equation (3.21).

Proof of Proposition 5.

Two-step takeovers become the optimal strategy when the condition in Equation (3.22) ($q > q^*$) is satisfied, which was derived by equalizing Equations (3.8) and (3.21) and putting it in order to q .

Proof of Proposition 6. This proof is identical to the proof of Proposition 1 with the only difference that the B's objective function changed (instead β_1 is η_1) as result of now admitting the possibility preemption of a rival bidder. Thus, if we follow the same steps we first obtain the T's optimal response for any given premium offered, which is the same as Proposition 1, and then the Equations (4.7) to (4.9).

Proof of Proposition 7.

Under a context of hidden competition, two-step takeovers become the best strategy when the condition in Equation (4.11) ($q > q_\lambda^*$) is met, which was derived by equalizing Equations (3.8) and (4.9) and putting it in order to q .

Proof of Corollaries

Proof of Corollary 1.

The inequality $B_s \leq \bar{B}_{tB}$ can be prove by recurring to the famous 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 $E[g(X)] \geq g(E[X])$. That said, since B_{tB} is a convex

function, and $\bar{B}_{tB}$, the expected value of $B_{tB}(\omega_h)$ and $B_{tB}(\omega_l)$, and $B_s(\bar{\omega})$, where $\bar{\omega}$ is the expected value of future synergies (ω_h and ω_l), are finite, then we can conclude that $B_s \leq \bar{B}_{tB}$. Since the toehold itself confers an additional value to the takeover option, in Figure 3.1, the option $\bar{B}_{tB}$ does not touch on B_s when the p is equal to one and zero as it would touch, given becomes steeper for changes in p than otherwise would be since the options B_s and $\bar{B}_{tB}$ would touch when the probability is equal to one (see Figure 3.1).

According to Lukas and Welling (2012), due to the higher bargaining power of the first-mover when compared to the second one, the option value of the first one is always higher than the latter, and for that reason $\bar{B}_{tT} < B_s$.

Proof of Corollary 2.

Taking in consideration that $\frac{\partial f(\lambda)}{\partial \lambda} = \frac{\partial f(\lambda)}{\partial \eta_1} \frac{\partial \eta_1}{\partial \lambda}$ and given that $\beta_1 > 1, \eta_1 > 1, \epsilon \in (0, 1), Y > 0, \omega_h > 0, \omega_l > 0, p \in [0, 1], \bar{\omega} = p\omega_h + (1-p)\omega_l$ and:

$$\frac{\partial \eta_1}{\partial \lambda} = \frac{1}{\sigma^2} \left(\left(\frac{r - \delta}{\sigma^2} - \frac{1}{2} \right)^2 + \frac{2(\lambda + r)}{\sigma^2} \right)^{-\frac{1}{2}} > 0 \quad (\text{A.3})$$

differentiating $V_\lambda^*, \psi_\lambda^*$ and B_λ in order to λ , we have:

$$\frac{\partial V_\lambda^*}{\partial \eta_1} = \frac{Y(\epsilon - \beta_1)}{\omega(\beta_1 - 1)(\eta_1 - 1)^2} < 0 \quad (\text{A.4})$$

$$\frac{\partial \psi_\lambda^*}{\partial \lambda} = \frac{\omega\beta_1(1 - \epsilon)}{\eta_1^2(\beta_1 - \epsilon)} > 0 \quad (\text{A.5})$$

$$\frac{\partial B_\lambda}{\partial \eta_1} = \frac{V\omega}{\eta_1} \left(\frac{(\beta_1 - 1)(\eta_1 - 1)V\omega}{\eta_1 Y(\beta_1 - \epsilon)} \right)^{\eta_1 - 1} \log \left(\frac{(\beta_1 - 1)(\eta_1 - 1)V\omega}{\eta_1 Y(\beta_1 - \epsilon)} \right) \leq 0 \quad (\text{A.6})$$

Equation A.6 proves that $B_\lambda(V, \bar{\omega}, p, Y, \epsilon)$ is a non-monotonic function in relation to η_1 (consequently, to λ also) and its strict minimum can be found by equalizing Equation (A.6) to zero and solve in order to η_1 which leads to:

$$\eta_1 = \frac{(\beta_1 - 1)V\omega}{(\beta_1 - 1)V\omega + Y(\epsilon - \beta_1)} \quad (\text{A.7})$$

and then we equalize this equation to Equation (4.4) to discover the λ for which the sign of the first derivative inverts, i.e, Equation (4.13).

Proof of Corollary 3.

By incorporating hidden competition in the base model, the single-step takeover pay-off on the waiting region of the value function suffers a twofold decrease, as the possibility of being preempt by a hidden rival induces the bidder to offer a higher

premium, and consequently, identical to Pereira and Armada (2013), anticipates the takeover timing (as Corollary 2 proves that).

Moreover, the takeover pay-off on the exercise region of the value function stays the same since the target reaction for any given premium stays the same as if the dynamics of hidden competition were not considered (Equation (A.1)). Therefore, as in Pereira and Armada (2013), the option value decreases with the introduction of hidden competition, which confirms $\bar{B}_{tB} > B_\lambda$.

Proof of Corollary 4.

Contrarily to Lukas and Welling (2012), when the bidder has a toehold in the target the takeover timing is dependent on who is the first mover, Equations (5.1) and (5.2). This is a consequence of the trigger sensitivity to changes in the premium in each scenario, given by Equations (5.3) and (5.4) (the derivatives of Equations (A.1) and (A.2) in relation to the premium, respectively), and also due to the toehold bidder's overbidding capacity which can be proved by the following equations:

$$\frac{\partial \psi_{tB}^*}{\partial \theta} = \frac{\omega_{h,l}(\beta_1 - 1)(\epsilon - 1)^2}{(\beta_1 - \theta + \epsilon(\theta - 1))^2} > 0 \quad (\text{A.8})$$

$$\frac{\partial \psi_{tT}^*}{\partial \theta} = \frac{\omega_{h,l}(\epsilon(1 - \theta) + \theta)(\beta_1 + (\beta_1 - 2)(1 - \epsilon)(1 - \theta))}{(\theta - 1)^2(\beta_1 + (1 - \epsilon)(\theta - 1))^2} > 0 \quad (\text{A.9})$$

Proof of Corollary 5.

Identical to the previous proof, if we consider that transaction costs are asymmetrically distributed between B and T, the option trigger will not be the same regardless who determines the takeover timing, as Equations (5.5) and (5.6) prove that. This comes from the fact that, once more, the trigger sensitivity to changes in the premium in each scenario (Equations (5.3) and (5.4)), and also because independently from who decides the timing, higher transaction costs supported by B will result in lower premium paid:

$$\frac{\partial \psi_{tB}^*}{\partial \epsilon} = -\frac{\omega_{h,l}(\beta_1 - 1)^2}{(\beta_1 - \theta + (\theta - 1)\epsilon)^2} < 0 \quad (\text{A.10})$$

$$\frac{\partial \psi_{tT}^*}{\partial \epsilon} = -\frac{\omega_{h,l}(\beta_1 - 1)^2}{(\beta_1 + (1 - \epsilon)(\theta - 1))^2} < 0 \quad (\text{A.11})$$

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