Do Overconfident CEOs Ignore Toehold Strategies?

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ABSTRACT

In a toehold strategy, an acquirer buys a minority stake with the intention to gain control of a target later. Yet despite the claimed advantages toehold strategies offer, acquirers only rarely buy toeholds. This study presents a behavioural dynamic model and empirical evidence, showing that overconfidence of CEOs causes them to forgo the more prudent toehold strategy to make immediate controlling acquisitions instead. We find a negative relation between the likelihood of acquiring a minority stake and CEO overconfidence, revealed through measures based on the timing of their option portfolio and on external perception. Overconfident CEOs also purchase on average larger fractions of their targets. Furthermore, the acquirer returns on toehold announcements tend to be higher than majority stake acquisitions. We conclude that CEO overconfidence causes acquirers to forgo minority stake acquisitions, despite the advantages of minority stakes versus controlling acquisitions.

Keywords: Toeholds, Real Options, Dynamic Model, Overconfidence

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1 Introduction

The neglect of toehold strategies is puzzling in the context of widespread evidence that the majority of full acquisitions fail to deliver value for the acquirer on announcement[1]. While acquisitions create value overall, the sellers seem to get the better half, with acquirer's returns on average close to zero (Malmendier and Tate, 2008; Stulz, Walkling and Song, 1990; Leeth and Borg, 2000). Sequencing a transaction with a toehold helps to even the balance and improve the poor acquirer returns. This study presents a behavioral theory and empirical evidence explaining why toeholds are rarely adopted, despite their higher returns than full acquisitions on announcement.

The immediate plunge in the deep of a full-scale acquisition, contrasts with a toehold allowing for testing the waters and limits the need to hurry. In light of uncertainties, buying a toehold in a target company (i.e. acquiring a minority stake in a target before making a controlling bid) provides a more cautious investment strategy. In a two-stage acquisition process after a toehold, a controlling bid on the remaining shares can be made when macro-economic uncertainties are resolved or important proprietary deal or company information is revealed. A strand of literature shows that a toehold can grant its owner several advantages in acquiring full control of the target. It increases the probability of a successful offer, even if the toehold owner is competing with a stronger rival, because it may allow for profitable overbidding (Hirshleifer and Titman, 1990; Burkart, 1995; Singh, 1998). It can mitigate the free-rider problem (Shleifer and Vishny, 1986) and in common value auctions, it also enables its owner to win an auction inexpensively, using her information advantage and potential position as a seller (Bulow, Huang, and Klemperer, 1999).

The myriad of benefits however that minority stakes provide seems to be in conflict with their observed rare use in practice. Indeed this neglect of toeholds seems *puzzling* (Betton et al. (2009)). Acquirer-CEO's decision-making psychology can be affected by biases, in the sense that acquisition uncertainties can be perceived lower than they in reality are. This is particular relevant for toehold acquisitions, as toehold strategies prove their value in more complex and uncertain deals such as hostile takeovers and bidding contests. '*Hubris'* and overconfidence have been a popular explanation of acquirer's behaviour, but they have not been analysed in context of toeholds. Roll (1986), Malmendier and Tate (2008) and others formalized the notion that bounded rationality of acquisitive CEOs may cause excessive takeover premiums, in particular when facilitated by internal financing. The implications of overconfidence for mergers, however, are more than mere overbidding. In this study we attempt to explain the low use of toeholds. In particular we take up the following question[2]: "*Is the rare use of toehold acquisitions grounded in CEO overconfidence?"*

We develop a theoretical dynamic model of toehold strategies and we empirically test for a relation between the use of toehold strategies by CEOs and CEO-overconfidence.

[1] For instance, only 5% of the total acquisitions executed by listed US companies was a toehold in a target company in the period 2004-2013. Source: Thomson One Banker.

[2] We focus on the rare use, the time trend is examined in other studies (e.g. Betton et al., 2009; Dai, Gryglewicz and Smit, 2016 among others)

We present a model of minority stake investment under uncertainty. From the model we can hypothesize that overconfident CEOs frame their acquisition opportunities differently, underestimating uncertainty and overestimating growth, and consequently are likely to eagerly execute controlling acquisitions or exercise their minority stake immediately, avoiding more vigilant sequential toehold strategies. As a result, CEOs seem to be less perceptive to prudent strategies, undertaking investments rather sooner than later.

An important part of conducting the empirical research is to define and label CEOs as overconfident. For this purpose, we rely on the measures of overconfidence constructed by Malmendier and Tate (2005a, 2005b, 2008). These measures are based on the personal option portfolio behaviour of CEOs. Overconfidence affects the company's acquisition strategy but also their risk taking in their option portfolio. Malmendier and Tate (2005a) link CEO overconfidence, as measured by their option behaviour, to a variety of corporate investment decisions and investment-cash flow sensitivity[3]. For robustness purposes, we test our findings with a different dataset and a completely different measure of overconfidence, which is based on the external perception of CEOs by high-quality newspapers.

Using a dataset of nearly 10,000 acquisitions by S&P1500 companies in the period 2004-2013 and a dataset on CEO stock and option behaviour, we find a statistically and economically significant relationship between CEO overconfidence and the tendency of CEOs to forgo toeholds in corporate acquisitions. We find that biased, i.e. overconfident, CEOs are less likely to acquire a toehold and acquire on average larger controlling stakes instead. This negative relation remains pronounced when we only consider toeholds, which are sufficiently large to effectively acquire control in a toehold strategy, which is consistent with the explanation of the minority stake puzzle as in Betton et al. (2009).

To the best of our knowledge, this study is the first to link the limited use of toehold strategies to CEO overconfidence. Furthermore it extends existing dynamic models of investment under uncertainty for the use of toehold strategies and incorporates biased CEO behaviour in the model. This study relates therefore to several strands of literature.

First, we aim to contribute to the growing strand of behavioural corporate finance literature considering the consequences of biased managers in efficient markets (Barberis and Thaler, 2003; Baker, Ruback, and Wurgler, 2004; Camerer and Malmendier, 2007 and others). The model in our paper is most closely related to the strand of literature that considers decision making with regard to acquisitions as option games (Smit, 2001) and in particular to the seminal models of rational acquisition-decision making by Lambrecht (2003) and Morellec and Zhdanov (2005). The later describes the returns to both bidders and sellers in acquisitions and shows that the effect of competition causes the sellers to capture most of the value. To be able to test these models in our context, we complement and extend the framework of Morellec and Zhdanov (2005) and the work of Lambrecht (2003) in two

[3] Several studies question the validity of the CEO overconfidence option-exercise-based measures. Cao (2009) argues that industry and mispricing, offers alternative explanations to both late option exercising by the CEOs and distortions in corporate investment. Sen and Tumarkin (2014) argue that whether a CEO retains shares on option exercise offers a stronger relation with a CEO's optimism about the company's future cash flows than the timing of option exercise.

ways. First we adjust their models to a toehold strategy context, with which the toehold owner can gain some of the seller advantages. A toehold strategy can me be more clearly specified as an option than the standard restructuring option. Secondly, we incorporate the realistic context of bounded rationality in the model. By introducing overconfidence and overoptimism (as in Hackbarth 2009) in the model, we create a quantitative framework of *behavioural real options* (Smit and Moraitis, 2015). Thus, we find empirical evidence, which supports the implications of the real options models of Lambrecht (2003) and Morellec and Zhdanov (2005) under the realistic extension of bounded rationality.

Our paper is also closely related to the literature that links the beliefs that CEOs reveal in their personal portfolio choices to their corporate decisions. CEO overconfidence can account for corporate investment distortions (Malmendier and Tate, 2005a), frequent and unsuccessful merger decisions (Malmendier and Tate, 2008), explain dividend decisions (Deshmukh, Goel and Howe, 2009), corporate financing policies (Malmendier, Tate and Yan, 2011) and performance over the cycle (Mueller and Brettel (2012)). Overconfidence not only has implications for overbidding, overinvestment, financing and performance. We show that overconfident CEOs also avoid more prudent toehold strategies and this is likely at the expense of the acquirer shareholder wealth.

Of course our study also contributes to the toehold literature (Shleifer and Vishny, 1986; Hirshleifer and Titman, 1990; Burkart, 1995; Singh, 1998; Betton, et al., 2009, Dai, Gryglewicz and Smit, 2016). These toehold strategies' attractive merits, contradict sharply with their use in practice. Our behavioural explanation for the neglect of toehold strategies is another piece of the puzzle. However, more significant than our contribution to the literature itself, are the implications of our study for the use of toehold strategies in practice as a way to potentially improve poor acquirer performance. Therefore we propose more often adoption of toehold strategies rather than immediate full acquisitions.

2 A Theory of CEO Overconfidence and Toehold Neglect

2.1 Literature on the Benefits of Toeholds

A toehold can grant its owner several advantages. By initiating a small position, the acquisition is temporally staged, causing the acquirer to benefit of some of the seller advantages. For instance, it can mitigate the free-rider problem because its owner can gain on the shares she already owns (Grossman and Hart 1980; Shleifer and Vishny, 1986)[4]. The buyer can exert corporate control and thereby alter the target build-up in a favourable way even before the full bid has commenced and prepare the target for full future integration. The strongest value enhancements occur for those firms that have a product relation, especially in industries with high uncertainty and corresponding research costs (Allen and Phillips, 2000).

[4] In a widely held target firm, every shareholder wants to free-ride the synergy value created by a successful takeover. A tender offer will not be accepted if the price premium is less than the expected synergy value, thereby seriously limiting the acquirer's profit.

A toehold provides an acquirer with the much-needed edge in a takeover battle. In a bidding contest, a toehold allows for a higher bid and even overbidding, as the payoff for the holder of it will be higher, regardless of the outcome of the bidding war. As the price is driven up, the minority stake holder benefits from a slower pace of increment, as he pays this premium on a smaller part of the target if he wins. It increases the probability of a successful offer, even if the toehold owner is competing with a stronger rival, (Hirshleifer and Titman, 1990; Burkart, 1995; Singh, 1998). All these theoretical benefits have been verified empirically as well. Toehold owners win a bidding war far more often than not (Eckbo, 2009). But even when rival bidders also have a toehold, the probability of them winning a bidding war deteriorates in a co-moving fashion with the size of the rival's minority stake (Dasgupta and Tsui, 2003; Betton and Eckbo, 2000).

In common value auctions, it also enables its owner to win an auction inexpensively, using her information advantage and potential position as a seller (Bulow, Huang, and Klemperer, 1999)[5]. If the rival ends up with the target, the high premium will also be paid for the minority stake, leaving the holder with a nice return. A toehold owner can consequently bid more aggressively, which is empirically confirmed (Betton and Eckbo, 2000). Its an ownership position sends a clear signal of commitment to potential rivals and conveys a higher bidder valuation of the target. Potential rivals can be deterred by the prospect of a higher likelihood of ending up with the winner's curse (Bulow, Huang, and Klemperer, 1999). This leads to fewer bids by competitors, decreasing the premiums required to capture the target (Betton et al., 2008).

The toehold also provides more and higher quality information about future risks and benefits. Target company management, often realizing the forthcoming sale, use existing uncertainty to get as high a price as possible. Observed techniques include under-funding capital expenditures to inflate cash flows, treating recurring items as extraordinary ones and optimistically recognizing sales to distributors as market sales (Cullinan et al, 2004). This is in line with the empirical finding of higher dollar gains for acquisitions between companies in relating industries (Sing, 1987). Having a toehold in the company can reduce this form of *windowdressing*, reducing uncertainty and improving the valuation.

Given their benefits, it is remarkable to observe rare use of minority stakes in practice. Dai, Gryglewicz and Smit (2016) focus on the trend over time and show that there is process of learning over time to apply the toehold strategy more effectively in difficult transactions.[6] Another reason for not pursuing an initial minority stake is the element of surprise. As the purchase portrays a clear and outspoken commitment, this results in information for rivals, who can now anticipate their bidding strategy on the minority share

[5] When associated with a board position a toehold provides an insider position in the target firm and therefore reduces valuation uncertainty (Bulow, Huang, and Klemperer, 1999), which allows the acquirer to avoid low returns due to the winners' curse in common value auctions (Thaler, 1988).

[6] Many reasons presented in literature fail to properly explain the rare use. Legislative rulings such as disclosure rules and anti-trust regulations are not a big obstacle. In addition, increased liquidity makes it easier to dispose a stake. Entrenchment and a hostile reception by incumbent target management can form an obstacle. While minority stake acquisitions are often considered to be part of an aggressive bidding strategy, this cannot fully explain negativity from out of the target company.

purchase. For publicly listed companies, information of this kind can lead to run-ups in stock prices in particular when they are illiquid, as investors anticipate a future takeover premium. Betton et al (2008) find that purchases of target stock increases run-ups significantly. However, that same research shows that while this offers a theoretically compelling argument, it is not sufficient to exceed the advantages.

2.2 A Dynamic Model of Acquisitions with CEO Overconfidence

By taking a toehold position, the acquisition is temporarily staged, and the acquirer can benefit from some 'seller insights' before making a controlled bid. Essentially, 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 external uncertainty resolves. Thus when (environmental) uncertainties are high, a toehold strategy allows executives to review their intentions without 'betting the farm'. We assume that without taking a toehold, bidders cannot defer the merger and will pay a premium in the acquisition price close to the value of the synergies.

2.2.1 A Dynamic Model for Toeholds

In this section we describe a dynamic model for toehold acquisition strategies. We build on the reduced-form model for corporate takeovers, by Lambrecht (2003) and Morellec and Zhdanov (2005), and we extend their framework for the use of toehold acquisition strategies. We assume constant risk-free rate r, risk neutral agents and continuous time. Furthermore we consider a complete probability space $(\Omega, \mathcal{F}, \{\mathcal{F}\}_{t\geq 0}, \mathbb{P})$

Consider two firms, the bidder and the target, with respective cash flows $X(t)$ and $Y(t)$. The cash flows are stochastic processes with the following dynamics, with growth rate μ_A and volatility σ_A:

$$dA(t) = \mu_A A(t)dt + \sigma_A A(t)dW_A(t), \quad A = X, Y \tag{1}$$

with, $dW_X(t)dW_Y(t) = \rho dt$. Hence ρ represents the correlation between the Brownian motions W_X and W_Y. The firm values of the bidder $V^B(X)$ and of the target $V^T(Y)$ are given by:

$$V^B(X) = \frac{X}{r-\mu_X} \qquad V^T(Y) = \frac{Y}{r-\mu_Y} \tag{2}$$

We follow the reasoning of Shleifer and Vishny (2003) and Morellec and Zhdanov (2005) by assuming that, when the bidder executes a takeover deal (at any time $t > 0$), the value of the merged entity $V^C(X, Y)$ is a linear combination of pre-takeover values. Hence we describe the post-takeover value of the combined firm as:

$$V^C(X, Y) = \alpha V^B + \gamma V^T = \frac{\alpha X}{r-\mu_X} + \frac{\gamma Y}{r-\mu_Y}, \tag{3}$$

where $(\alpha, \gamma) \geq 1$ can be considered as 'synergy factors'.

For the toehold owner, the acquisition can be considered as exercising an option to exchange the initial firm for a fraction ξ of the combined firm (Smit, 2001; Morellec and Zhdanov, 2005). The target firm receives $(1-\xi)V^C$, representing the price of the takeover. This bid, including the takeover premium, can be made in shares but we can likewise interpret the fraction of the combined firm $(1-\xi)V^C$ as a cash bid. The part of the total takeover gains or surplus to the bidding firm after restructuring therefore satisfies $\xi V^C - V^B$.

If the bidder possesses a toehold, it owns a fraction $\phi < \frac{1}{2}$ of the target firm: ϕV^T. The minority stake acts as an option as it allows for a wait-and-see strategy towards a full acquisition (which is the exercise of the option). We model the minority stake option analogous to a perpetual American option on a dividend paying stock (see e.g. Dixit and Pindyck, 1994). If the option is exercised, a pay-off is received consisting of the total value including synergies minus the exercise price. The costs of holding the minority stake option without exercising, are the lost 'dividends' in the form of synergies and the (missed) target's cash flows. These 'dividends' are equal to the difference between the amount of periodic cash flows the toehold owner receives with and without a controlling acquisition, i.e. $(\alpha X + \gamma Y) - (X + \phi Y)$. If we now define $q_x \equiv (\alpha - 1)$ and $q_y \equiv (\gamma - \phi)$, it is possible, using familiar standard arguments, to show that the value of the bidder's minority stake option solves the following partial differential equation:

$$(\mu_X - q_x)XO_X^M + (\mu_Y - q_Y)YO_Y^M + \frac{1}{2}\sigma_x^2 X^2 O_{XX}^M + \frac{1}{2}\sigma_Y^2 Y^2 O_{YY}^M + \rho\sigma_X\sigma_Y XYO_{XY}^M = rO^M, \quad (5)$$

where r denotes the risk-free rate and subscripts represent partial derivatives. The PDE is solved subject to the following boundary conditions.

$$O^M(X^*,Y^*) = \{(1-\phi)V^T(Y^*) + [V^C(X^*,Y^*) - V^B(X^*) - V^T(Y^*)] - (1-\xi)(1-\phi)V^C(X^*,Y^*)\} \quad (6)$$

Value of the minority stake option at moment of exercise

Standalone value of the remaining stake in the target

Total synergistic value

Takeover price of the remaining stake of the target

$$O_X^M(X^*,Y^*) = \xi V_X^C(X^*,Y^*) + \phi(1-\xi)V_X^C(X^*,Y^*) - V_X^B(X^*) \quad (7)$$

$$O_Y^M(X^*,Y^*) = \xi V_Y^C(X^*,Y^*) + \phi(1-\xi)V_Y^C(X^*,Y^*) - \phi V_Y^T(Y^*) \quad (8)$$

Equation (6), the value-matching condition, shows that the option value of the minority stake should be equal to the pay-off of the option at the moment of exercise, where (X^*, Y^*) represent the threshold levels of the cash flows at which the option is exercised. The pay-off of the minority stake option consists of the standalone value of the remaining part of the target firm, plus the synergies, which are only obtained after the full acquisition is completed, minus the acquisition price paid. Without a toehold, the negotiated price is expressed as a fraction $(1-\xi)$ of the combined firm value V^C. However, when the bidder owns a toehold the target cannot make demands over the part (ϕV^T) that the toehold owner

already possesses. The price is therefore expressed as a fraction equivalent to $(1-\xi)(1-\phi)V^C$ allowing the bidder to gain some of the seller advantages over its toehold.

The remaining equations (7) and (8) are the smooth-pasting conditions, which guarantee optimality by requiring continuity of the slopes at the threshold levels. The last boundary condition requires that the ratio of the option value to the present value of the bidder's cash flows approaches zero, as the ratio of the present value of the bidder's cash flows to the target's cash flows goes to zero, that is:

$$\lim_{(X/Y)\to 0} \frac{O^M(X,Y)}{X} = 0 \tag{9}$$

If we let $R(t)_{t\geq 0} = (X(t)/Y(t))_{t\geq 0}$ we can describe the bidder's exercise strategy via the threshold R_B^* at which (and above) it is optimal to exercise the minority stake option (that is, acquire a controlling stake). With use of the boundary conditions we derive the following for the option value of the toehold (for details, see the Appendix)

$$O^M(R) = \{\xi V^C(R_B^*,1) + \phi(1-\xi)V^C(R_B^*,1) - V^B(R_B^*) - \phi V^T(1)\} \left(\frac{R}{R_B^*}\right)^\beta$$

$$O^M(X,Y) = \{\underbrace{[\xi V^C(X^*,Y^*) - V^B(X^*)]}_{\text{Bidder surplus without toehold}} + \underbrace{\phi[(1-\xi)V^C(X^*,Y^*) - V^T(Y^*)]}_{\text{Additional value due to seller advantages for toehold holder: equal to fraction } \phi \text{ of target surplus}}\} \underbrace{\left(\frac{X/Y}{X^*/Y^*}\right)^\beta}_{\text{Stochastic discount factor}} \tag{10}$$

Equation (10) shows the option value of the toehold, which is the discounted value of the surplus that the acquirer obtains by exercising his option. From this expression we clearly see that with a toehold strategy, the bidder gains from some seller advantages. The surplus that the bidder obtains, now also includes components which otherwise would be completely received by the target in the case of an immediate full-scale acquisition strategy. This total surplus consists of the bidder surplus which would be received anyways – even without the toehold – however now the bidder also receives a fraction of the target surplus. Finally, the exercise threshold value is given by

$$R_B^* = \frac{\beta}{\beta-1}\frac{r-\mu_X}{r-\mu_Y}\frac{\phi-\xi\delta-\phi(1-\xi)\delta}{\xi\gamma+\phi(1-\xi)-1} \tag{11}$$

and β is the positive root of the following quadratic equation:

$$\frac{1}{2}(\sigma_X^2 - 2\rho\sigma_X\sigma_Y + \sigma_Y^2)\beta(\beta-1) + [(\mu_X - q_X) - (\mu_Y - q_Y)]\beta - [(r-(\mu_Y - q_Y)] = 0 \tag{12}$$

The total value of the toehold therefore equals the minority stake fraction of the standalone value of the target firm plus the option value of the acquisition.

$$Toehold\ Value = \phi V^T(Y) + O^M(X,Y). \tag{13}$$

2.3 Abnormal Returns: Minority Stake vs. Controlling Acquisition

In this section we describe the mechanism of abnormal returns in our framework that are associated with a direct controlling acquisition versus a staged minority stake acquisition. As described above, the total magnitude of the takeover surplus is determined by the synergy parameters (α, γ). It is commonly assumed that synergy parameters are known to the managers, but are unknown in the financial market (e.g. Morellec and Zhdanov, 2005), i.e. investors are not completely informed.

The abnormal returns stem from beliefs of the market about the synergy factors. We investigate the abnormal returns from the perspective of the bidding firm. The investors use public information and the executed acquisition type as signals to update their beliefs about the synergy parameters (α, γ). With the immediate controlling acquisition almost all relevant information is revealed, there is no real option left to value. Hence the expectation of the investors is updated in the following way:

$$\hat{\alpha} = \alpha + \varepsilon_\alpha, \quad \varepsilon_\alpha \sim N\left(0, \eta_{\varepsilon_\alpha}\right) \tag{14}$$

$$\hat{\gamma} = \gamma + \varepsilon_\gamma, \quad \varepsilon_\gamma \sim N\left(0, \eta_{\varepsilon_\gamma}\right) \tag{15}$$

The distributions for the error terms $(\varepsilon_\alpha, \varepsilon_\gamma)$ are assumed to be Gaussian with zero mean and variances $\left(\eta_{\varepsilon_\alpha}, \eta_{\varepsilon_\gamma}\right)$ respectively. Hence the investors' expectations about the synergy factors are unbiased and the difference $\xi V^C(\hat{\alpha}, \hat{\gamma}) - \xi V^C(\alpha, \gamma)$, which causes the abnormal returns is often small. This is in line with empirical findings that acquirer's abnormal returns are often nihil (see e.g. Jensen and Ruback, 1983).

In the case of a minority stake acquisition the investors recognize the real option, which is created with the purchase of a toehold. Less information is revealed since there is no controlling acquisition yet. Investors have an expectation of the minority stake option, where they also take in account the seller advantages and a possible discount on the premium which will follow from the exercise of the toehold option. Hence we assume that they update their beliefs as follow:

$$\check{\alpha} = \alpha + \zeta_\alpha, \quad \zeta_\alpha \sim F\left(\mu_{\zeta_\alpha}, \eta_{\zeta_\alpha}\right) \tag{16}$$

$$\check{\gamma} = \gamma + \zeta_\gamma, \quad \zeta_\gamma \sim F\left(\mu_{\zeta_\gamma}, \eta_{\zeta_\gamma}\right) \tag{17}$$

Similar to a real option, the error terms $(\zeta_\alpha, \zeta_\gamma)$ follow a non-symmetrical distribution F, most likely right skewed, with positive means $\left(\mu_{\zeta_\alpha}, \mu_{\zeta_\gamma}\right)$ and variances $\left(\eta_{\zeta_\alpha}, \eta_{\zeta_\gamma}\right)$. Thus the expectations of the investors about the synergy factors are positively biased (in statistical sense) like $\mathbb{E}(\check{\alpha}, \check{\gamma}) > \mathbb{E}(\alpha, \gamma)$ and therefore more positive than for the controlling acquisition. This causes the possible positive abnormal returns for minority stake acquisitions.

3 CEO Behaviour and Minority Stakes versus Full Acquisition

In this section we incorporate behavioural biasedness of the CEO in our framework. Therefore we first elaborate in general on overconfidence, which is known as one of the most important behavioural biases. Next we examine the effects of overconfidence on CEO decision-making. Subsequently we develop propositions and in line with these empirically testable hypotheses.

3.1 Overconfidence

The concept of overconfidence has concerned scholars for a long time:

> *"The overweening conceit which the greater part of men have of their own abilities, is an ancient evil remarked by the philosophers and moralists of all ages"*
>
> ~ Adam Smith, *The wealth of Nations (1776)*

More recently, Daniel Kahneman, one of the most influential pioneers on the intersection of psychology and economy, stated that if he would possess a magic wand with the power to eliminate one human bias, he would get rid of overconfidence (Shariatmedari, 2015).

The cognitive psychology literature, typically distinguishes between three distinct types of effects of overconfidence (Moore and Healy, 2008), i.e. 1) over-precision, 2) better-than-average effect, 3) and overestimation. An overconfidence bias resulting from over-precision can best be described as having a too narrow confidence interval when predicting highly uncertain events. The better-than-average effect is the belief that that one is above average in a particular category of skills. Fairly well-known is the research of Svenson (1981), who presents a striking illustration of the better-than-average effect by using a sample of American and Swedish drivers. He finds that 88% of the American and 77% of the Swedish objects considers themselves as a saver driver than the median driver. Furthermore In the US sample 93% believed themselves to be more skillful drivers than the median driver and 69% of the Swedish drivers shared this belief in relation to their comparison group. Finally, with overestimation, one overestimates the amount of personal control or influence on future chance based and non-controllable outcomes (Griffen and Tversky, 1992; Langer, 1975). In essence, individuals tend to underestimate how much of a particular outcome will be the result of chance and overestimate the extent to which their individual input was responsible for a particular outcome.

Within the finance literature, precise definitions of terms are extremely varied and are frequently dependent on the authors' decision. Various papers define over-optimism and miscalibration as two facets of overconfidence (see Ben-David, Graham, and Harvey, 2013; Hribar and Yang, 2016; Skala, 2008). In this paper we follow this thought by considering over-optimism and miscalibration as two sub-dimensions of overconfidence.

Over-optimism relates to an individual being irrationally optimistic about uncertain future events. This bias is in line with the previously discussed better-than-average effect and overestimation effects. A CEO in essence, by overestimating his own personal skill and the degree of control over future outcomes, overestimates the mean of possible outcomes. Over-optimism differs from miscalibration, which relates to the over-precision cognitive bias previously discussed. This is translated into an underestimation of the variance of possible outcomes or having a too narrow confidence interval for an uncertain event. Overconfident CEOs thus have the potential to suffer from a risk-bias (where they underestimate levels of risk) and a growth-bias (overestimating future growth rates) (Hackbarth, 2008; 2009).

3.1.1 The Impact of CEO Miscalibration on the Likelihood of a Toehold

Immediate full acquisitions can be based on executive overestimation and the 'better-than-average' effect (Svenson, 1981) when executives believe they possess superior capabilities compared to target management to run a company. Overconfident executives engage in acquisitions to release target firms from ineffective incumbent management (Malmendier and Tate, 2005a), believing they have the power to improve the firm's performance once they gain control of it (Malmendier and Tate, 2005a; Brown and Sarma, 2007). As a result, overconfident executives perceive lower endogenous uncertainty, and attribute the positive resolution of exogenous uncertainty to their own superior capabilities.

Positive recent performance or the successful completion of earlier deals can build executive confidence, leading them to underestimate their chances of failure in future acquisitions (Gervais and Odean, 2001). Executive overconfidence can be reinforced by a self-attribution bias (Billet and Qian, 2008), when successes are attributed to personal skills, but failures are seen as stemming from bad luck, a bias that is likely to be reinforced by the successful completion of the deal (Malmendier and Tate, 2005b). Executives whose overconfidence is caused by attribution bias tend to undertake multiple acquisitions within a short time, and are less likely to stage acquisitions - but these subsequent overconfidence driven acquisitions are likely to produce negative outcomes (Doukas and Petmazes, 2007).

To answer our question: "*Is the rare use of toehold acquisitions related to CEO overconfidence?*" we compare a sequential toehold exercise strategy as modelled above, with immediate controlling acquisitions. In our model we consider a controlling acquisition to be equivalent to the immediate exercise of the toehold, therewith foregoing on the wait-and-see strategy and its advantages. Decision-making under uncertainty relies on manager's judgment and their beliefs of uncertainty on how to optimally deal with it. *Miscalibration* leads managers to perceive uncertainty favourably, and estimate the distribution too narrowly (Ben-David et al, 2013). Thus, this will be reflected in the CEO's perception of the target's volatility ($\sigma_Y' < \sigma_Y$) (Hackbart, 2009).

Panel A of Figure 1 shows the impact of executive overconfidence on following a toehold strategy vs. making a controlling acquisition. The figures displays threshold values above which it becomes optimal to make a controlling acquisition under rational decision-making and the impact of low perceived volatility ($\sigma_Y' < \sigma_Y$) on this threshold. The underestimation of uncertainty results in a lower threshold value $R_B^*{}'$ and a premature

exercise region reducing the likelihood of pursuing a sequential toehold strategy. We can formally proof that the threshold decreases as volatility decreases, i.e. that we have $\frac{\partial R_B^*}{\partial \sigma_Y} > 0$ (see Appendix). Therefore we arrive at the following proposition

> **Proposition 1**: *Overconfident (risk-biased) CEOs have lower perceptions of uncertainty compared to actual uncertainty* $(\sigma_Y' < \sigma_Y)$. *As a consequence they are more likely, (i.e.* $(\mathbb{P}[R(0) \geq R_B^{*\prime}] \geq \mathbb{P}[R(0) \geq R_B^*] | R_B^{*\prime} \leq R_B^*)$*), to favour the full acquisitions (i.e., instantaneous exercise of the toehold option at* $t = 0$*) over a toehold.*

3.1.2 The Impact of CEO Overoptimism on the Likelihood of a Toehold

Executives also prefer full acquisitions when they have overoptimistic expectations (Kahneman and Lovallo, 1993; Hayward and Hambrick, 1997) of total synergistic gain. An optimistic CEO assesses the growth rate of the target firm high ($\mu_Y' > \mu_Y$), which also leads to an overestimation and biased perception of the synergetic value. Unbiased managers assess the synergetic value as $\hat{S} = S + \varepsilon$, with a symmetric distribution for the error term centred at zero. For (over)optimistic managers however, due to overoptimistic forecasts of environmental, industry and company variables growth, the error-distribution shifts to the right and becomes right-skewed.

Therefore the synergetic value is most likely to be overestimated. In particular, this bias is often used to strengthen the rationale of an acquisition decision when executives are highly committed (Heaton, 2002) and when they believe that the success of the deal is within their personal control (Langer, 1975)[7].

Panel B of Figure 1 shows the effect of alteration in distribution of acquisition outcomes as a result of executive overoptimism on the exercise threshold. Assumptions of higher mean growth rate of the target ($\mu_Y' > \mu$) and therewith overoptimistic forecasts result in a lower threshold value $R_B^{*\prime}$ and a premature/immediate exercise region, reducing the likelihood of pursuing a sequential toehold strategy. We can formally proof that the threshold decreases as the target growth rate increases, i.e. that we have $\frac{\partial R_B^*}{\partial \mu_Y} < 0$ (see Appendix). Therefore we arrive at the following proposition

> **Proposition 2**: *Overconfident (growth-biased) CEOs have higher perceptions of growth compared to actual growth* $(\mu_Y' > \mu_Y)$. *As a consequence they are more likely to overestimate synergetic value and are more likely, i.e.:* $(\mathbb{P}[R(0) \geq R_B^{*\prime}] \geq \mathbb{P}[R(0) \geq R_B^*] | R_B^{*\prime} \leq R_B^*)$ *to favour the full acquisitions (i.e., instantaneous exercise of the toehold option at* $t = 0$*) over a toehold.*

[Insert Figure 1 about here]

[7] While relative valuations using transaction multiples may serve as a reality check on fundamental valuations, these relative valuations are themselves sensitive to inconsistencies or over exuberance in financial markets, which behaviourists claim is caused by investors' bounded rationality.

3.2 Empirical Predictions on the Overconfidence Hypothesis of Toehold Neglect

In our model the most important subforms of overconfidence in the acquisition context are managerial overoptimism and miscalibration. Since decisions are made by the CEO and his management team[8], their perception of uncertainty is crucial, as it could largely determine the strategic approach that will be adopted. A key benefit of a toehold can be found in reducing uncertainty as it makes the acquisition approach more cautious. However, if behavioural biases distort the perception of this uncertainty or overestimate growth, the need to reduce uncertainty through toeholds diminishes accordingly. Therefore, uncertainty neglect and over optimism due to overconfidence could explain the limited use of toeholds. Hence, we formulate the following hypothesis:

H1 *Overconfident[9] CEOs are less likely to acquire a toehold in a target company compared to a full acquisition.*

If a CEO is overconfident and commits more than rational strategy can allow for, this should have a negative impact on the shares of the company. Indeed, the overconfident executive might perceive opportunities as fruitful: analysts, traders and other investors conduct their own research and should - at least on average - not share the same behavioural bias. Malmendier and Tate (2008) find that the market is able to recognize the irrational behaviour of CEOs. Companies conducting acquisitions trough majority stakes should on average experience lower announcement returns after their acquisitions; this is also in line with the predictions of our model. To distinguish between acquirer returns of the acquisition types and to confirm empirically the predictions of our model we formulate the following hypothesis:

H3 *Minority stake acquisitions result in higher announcement returns compared to immediate controlling acquisitions*

These two hypotheses allow us to distinguish a behavioural view from several alternative theoretical views. Using the CEO personal portfolio behaviour, Hypothesis 1 is well-suited to compare overconfidence, where managers are unaware of suboptimal acquisition decisions, to views that build on empire building and agency consideration. Agency considerations empire-building motives are not likely to lead to suboptimal execution of their personal portfolio and these predictions are thus different than those of overconfidence[10]. Our 3rd hypothesis is well-suited to distinguish the behavioural

[8] Decisions are usually made in teams and not by individuals. Ultimately however, the decision lies with the CEO and team dynamics actually have the potential to aggravate the potential for overconfidence. A decision bias, called *groupthink*, occurs when group members favour consensus over expressing their alternative opinion (Janis, 1982).}

[9] Overconfidence in empirical context (as in Malmendier and Tate, 2005a) is the broader definition, including several subforms.

[10] Learning-by-doing is a relevant explanation for the higher returns of hypothesis 3 as minority stake specific learning can lead acquirers to assess the threshold size more accurately. Similarly in serial deals learning from investor feedback can help them adjust their future bidding strategies (Aktas *et al.*, 2009). Acquirers can use an earlier deal to improve their target-screening and valuation skills (Capron and Shen, 2007), to mitigate hazards of adverse selection (Reuer and Ragozzino, 2008), and to enhance their acquisition capabilities (Laamanen and Keil, 2008). Dai, Gryglewicz and Smit (2016) show that toeholds are most likely to be utilized in difficult takeovers, those that offer low expected acquirer returns in the first place. If one corrects for the difficult context, toeholds provide a higher return on announcement, which even increases over time. This

perspective of CEO overconfidence from rational explanations to make full acquisitions, as rational explanations would be received more positive by financial markets overconfidence.

We analyse the impact of CEO overconfidence on the likelihood of the occurrence and returns of toeholds in a general setting that allows for market inefficiencies, such as information asymmetries, and managerial frictions, such as agency costs and private benefits. Similar to Malmendier and Tate (2008) we assume that these frictions and the quality of merger opportunities do not vary systematically between overconfident and rational CEOs, i.e., that overconfident and rational CEOs sort randomly across firms over time and we account for violations of this assumption using firm and level controls.

Betton et al. (2009) finds that a competitive stake size materializes around 9%, but it remains idiosyncratic for each deal. In addition to availability[11], this could be an explanation for the observation that bidders either acquire a relatively large stake, or no stake at all. We extend the overconfidence predictions by introducing a minimum threshold for the size of a minority stake acquired to deal with entrenchment explanation which is consistent with the explanation in Betton et al. (2009) of the minority stake puzzle. The negative relation between overconfidence and the probability of minority stake vs. controlling stake should be pronounced when minority stakes are sufficiently large to effectively acquire control[12]. Therefore comparison will take place by testing all hypotheses with a data sample including only stakes sizes of 9% or higher.

4 Data & Methodology

4.1 Data Collection

Starting point of the collection process consisted of selecting all companies that were part of the S&P Composite 1500 index for at least three years during the range of 2004-2013. This resulted in 1683 companies. Further 20 companies that engaged into three or more minority stake transactions in that same period were added. Missing figures for insider transactions led to the exclusion of 146 companies, while a lack of information on important control characteristics led to eliminate 352 additional firms. The resulting total number of companies in the data sample is 1201. Characteristics of these firms, such as cash flow and leverage, were collected using the Compustat database.

For every sample year, each company's CEO was selected with the use of the CGI Index, as was also the information on the number of directors. If information on this number of directors was absent, the number is assumed to be the average of all sample years. For

improvement can be attributed, to a certain extent, to learning. More specifically, acquirers in corporate takeovers "learn by doing"; this learning works when the acquisition experience is toehold specific.

[11] When target companies are owned by a few parties only, the stake size that can be acquired is dependent on the size of shares available for sale.

[12] They argue that a 9% stake is optimal given these trade-offs and forms the top of an inverse u-shaped function. However, overconfident managers might perceive this function differently, shifting both the place and spread of the distribution. Past toehold-owners make better decisions on when to buy a toehold and how large a toehold to buy, compared to acquirers without toehold experience.

companies and years with missing data, the CEO names are hand-collected. Information on the options awarded to the executives of all companies was gathered from the Thomson Reuters Insider Filing Table 2 database. This includes information on the exercise price and the expiry date. Only options were considered, leaving out the granting of ordinary shares, or the issue of restricted stock. Observations with no information on the type of derivative were removed. Further only type 4 forms were included and the following derivative types: OPTNS, ISO, CALL, NONQ, DIRO, DIREO, EMPO and SAR. Observations with no information on the exercise price or expiration date were removed.

This information was cross-referenced to the company and CEO statistics. Data on the exercise of the executive options was selected from the Compustat Executive compensation database. This includes CEO characteristics, salary, bonus, industry group and, most importantly, the value and number of the options that are simultaneously in the money and unvested, but not exercised[13].

The acquisitions by these firms and executives were collected from the ThomsonONE M&A database. This led to a total of 9646 announced acquisitions. These were identified as either majority or minority acquisition, depending on the fraction acquired. We collected geographical and sectorial information as well. Deal value information was included, but only available for a limited number of acquisitions (44%).

Table 1 shows the way in which all sample acquisitions are distributed over the years. Further it shows the average stake sizes, the fraction of toehold acquisitions and the average toehold size. The number of deals shows a drop after 2008 due to the financial crisis. The fraction of toeholds used is relatively low around the 4-6%, with an average toehold size around 20%.

[Insert Table 1 about here]

4.2 Measuring Overconfidence

In its capacity as behavioural trait, overconfidence is not easily observable. However, previous research has successfully found indirect ways to measure the extent to which behaviour can be deemed overconfident.

Overconfidence has, in a methodological context (Kahneman and Tversky, 1982), been linked to excess entry into competitive markets (Camerer and Lovallo, 1999), increased trading activity (Deaves et al, 2008), and a source of distinction between entrepreneurial and

[13] Malmendier, Tate and Yan (2011) explore whether their findings on the influence of overconfidence are robust to changes in datasets. They construct variations to their overconfidence measure (*longholder* variable) from data in the COMPUSTAT Execucomp database (1992-2007) and Thomson Reuters insider transition database (1996-2007) and replicate their test on financing decisions. Results show that both variations provide information on CEO beliefs, yet the Execucomp variable has a limited span of detailed information (from 2006 onwards) while the Thomson Reuters variable is noisier.

managerial roles within organizations (Busenitz et al, 1997). Among other methodology, questionnaires targeted on executives are often used to measure overconfidence.

Another way to measure overconfidence uses external perception as a proxy for actual overconfidence. Selecting newspaper articles and searching for the combination of the CEOs name and certain keywords[14], CEOs are labelled overconfident if they are portrayed in the business press as such. Malmendier et al. (2011) use this approach to confirm the relation between overconfidence and early-life experiences. Linking behavioural traits to outsider perception is a rather young methodology and can offer fresh insights or confirmation of existing insights .

The third method is based on option timing. Malmendier and Tate have provided multiple papers in this area, illustrating the use, and solidifying the power and robustness of this measure. This paper follows this methodology by making use of measures based on option behaviour of executives. Starting point is the level of exposure to risks that executives bear, while they could possibly be mitigated. Idiosyncratic risk-exposure offers an excellent insight into this risk-equation. Normally, CEOs are under diversified because of their human capital investments in the company they work for, as well as their often large holdings of company stock. If they are risk averse, they will want to diversify this risk, by selling these holdings. However, if they are overconfident/overoptimistic, they expect future returns on their companies to be high, specifically higher than rationally can be accounted for. As a consequence, they will want to keep their company stock, because they believe under their guidance, the company will flourish, and its stock price will continue to rise and outperform.

Overconfident managers think they are better than average and overestimate their ability to create value. Overconfident managers believe they possess superior capabilities to run a company compared to target management, make a better prediction and valuation of the target company than the market, or have the ability to integrate the two companies faster than expected, or beat (market) expectations by leading the target to better performance (Malmendier and Tate, 2008). As a result, they underestimate uncertainties and overestimate the returns they can generate both in their own company and by taking over other firms. Overconfident CEOs unambiguously perceive a too narrow distribution and higher expected value and therefore underestimate the option value of toehold strategies using minority stakes[15]. Keeping their risks centred on their company's performance therefore reveals overconfidence, at least on average. To ensure robustness and reliability, we employ two different option-timing-based measures of executive overconfidence, as proposed by Malmendier and Tate: *longholder* and *holder67*.

The *longholder* CEO holds his options although they are in the money. This variable thus looks at the temporal element of overconfident behaviour, rather than forming a quantitative measure of stochastic capital gains. An average option package granted to an

[14] Examples are 'confident' or 'optimistic' (positive) and 'conservative' or 'frugal' (negative).

[15] Systematically higher valuations of targets can be a result of optimism. The optimism bias, often seen as a complementary of overconfidence, can arise for individuals are highly committed or who believe the outcomes are under their personal control (Heaton, 2002; Kahneman and Lovallo, 1993; Hayward and Hambrick, 1997).

executive has a duration of 10 years, with a maximum vesting period of 5 years. According to this measure, a CEO is portrayed as overconfident, if he keeps the options until the final year. This means he has held on to the options long after the vesting period has ended. This portrays the neglect of the executive to diversify his holdings, even though he is now able to.

The *longholder* variable is constructed using the option packages data described in section 4.1. Comparing the option exercise behaviour of the executive to the expiration dates of the different packages leads to the identification of the period during which the options are held. *Longholder* CEOs keep their options until the very last year before expiration. In addition, these options should be at least 40% in the money (Malmendier and Tate, 2005). First, the estimated value of the *unexercised but exercisable* options is divided by the number of these options to obtain the estimated value per option. These values are then compared to the option market prices to calculate the percentage of in-the-moneyness. The moneyness is obtained by taking the ratio of the marketprice and strike-price of an option. The *longholder* variable is a dummy with a value of 1, if an option is at least 40% in the money *and* kept until the last year until expiration. A CEO is classified as *longholder* in every year of the sample if at some point the right criteria are met[16].

The *holder67* variable considers the value of options that are kept by the CEO, while both in the money and with an expired vesting period. A risk averse CEO would, under those circumstances, immediately take his gains and use the proceeds to diversify his asset allocation. If an executive nevertheless keeps his options, this means he is acting overconfident, either through underestimation of idiosyncratic risk or through overestimation of his company's prospects. The *holder67* variable looks at a different aspect of ownership consistence. Whereas the *longholder* variable is, in its essence, focused on a time-oriented bias effect, the *holder67* loosens that restriction.

The *holder67* is also a dummy and also uses the moneyness of the options held, but does not require the options to expire within a year. Instead, the *holder67* variable considers all options that are no longer within their vesting period (and can thus be exercised). The threshold of the extent to which they are in the money is however, considerably higher. Following Malmendier and Tate (2005a), the threshold is set at 67%. Calculations are similar to the approach adopted for the *longholder* variable. The *holder67* dummy is activated when an executive has met this criterion at least *twice* in the sample date range[17]. This is supposed to eliminate accidental or coincidental observations, focusing primarily on a consistent effect of a more habitual nature. The option moneyness thresholds (67% and 40%) are calculated using the Hall and Murphy (2002) framework for optimal option exercise prices given various measures of risk-aversion and portfolio diversification. The percentage 67% for instance corresponds to a risk-aversion of three in a constant relative risk-aversion specification. Now a CEO is *holder67*-overconfident in every year since the first time he is classified as *holder67.*

[16] We assume overconfidence to be a state of mind, i.e. a CEO is either overconfident or not, he does not become overconfident at a certain point in time.

[17] This approach neglects the vesting period as a barrier. We also considered the holder67 in an alternative form, where a CEO is labelled overconfident already after the first time the 67% threshold is crossed. No significant results were found.

A third variable, called *BIAS*, forms a combination of the *longholder* and *holder67* measures. Taking every form of overconfidence into account, this dummy is equal to one if the sum of the other dummy variables is equal to or greater than one. With this variable, it is possible to test the full range of overconfidence measures while preserving caution for the risk of double counting, i.e. preventing the overlap between the measures from spurring the relation.

4.3 Cumulative Abnormal Returns

To study the market's reaction in the second set of hypotheses in the form of announcement returns, a *CAR* variable is constructed that provides the cumulative abnormal returns, i.e. the extra return generated around the period of announcement when compared to the market return in that same period. First we obtain all returns for both the acquirer's stock and the S&P 500 from the CRSP database. Next we estimate the daily abnormal returns AR_{jk} for an event period by following the method of Betton et al. (2008):

$$r_{jt} = \alpha_j + \beta_j r_{mt} + \sum_{k=1}^{K} AR_{jk} d_{kt} + \varepsilon_{jt}\,, \quad t = day\{-293, end\},$$

where r_{jt} is the excess return to firm j at day t, r_{mt} is the value-weighted market returns adjusted by the risk-free rate and d_{kt} is a dummy variable that takes a value of one if day t falls in the k-th event window and zero otherwise. The estimation method applies ordinary least squares. The CAR for firm j over period k is obtained by $CAR_{jk} = \omega_k\, AR_{jk}$, where ω_k is the number of trading days in an event window. The number of trading days for the regressions ranges from 293 days before the announcement date (denoted by -293) to 126 days after the announcement date (end). We consider 4 distinct event windows [-20,10], [-20,1], [-10,10] and [-10,1]. These intervals all include the announcement period [-1,1] and also take into account a small run-up period (e.g. [-20, -2]) and a post-announcement period (e.g. [2,10]).

4.4 Control Variables

Most control variables used are similar to the ones used in Malmendier and Tate (2005a). Board size could have a material impact on acquisition behaviour, as too small (or too large) board sizes may lead to inefficient decision-making processes. The *CG (corporate governance)* variable is a dummy variable that is activated when the number of board members is between 4 and 12. The amount to which the CEO already owns shares in the company under his supervision could be a source of distorted behaviour as well (Malmendier and Tate 2005b, 2008, Brown and Sarma 2007). Variable *Owner* is a ratio defined as the CEO's shareholdings divided by the number of outstanding company shares. Variable *Size* controls for the acquirer's size and is obtained by taking the natural logarithm of the book value of the assets at year-end. The variable *Q*, representing Tobin's Q approximates the investment

opportunities of the acquirer. Tobin's Q is measured as the ratio of the market value of assets and book value of assets. Market value of assets is measured by adding the market value of equity to the book value of total liabilities and the value of preferred shares, subsequently subtracting the value of convertible debt and deferred tax assets. The market value of equity is calculated by multiplying the price at the end of the fiscal period with the number of outstanding shares at the end of the fiscal period (Malmendier and Tate 2005b, 2008, Brown and Sarma 2007, Billet and Qian 2005).

The variable *Cash flow* is constructed by adding depreciation and amortization to the earnings before extraordinary items and is normalized by the book value of assets at the end of the previous year (Malmendier and Tate 2005b, 2008). The investments variable *Inv* is constructed by normalizing the capital expenditures by the book value of assets at the end of the previous year (Malmendier and Tate 2005b, 2008). The control variable *Cash* indicates the amount of cash and equivalents relative to the book value of assets. It serves as an indicator of the available internal resources. Control variable *Leverage* denotes the acquirers leverage and is obtained by taking the outstanding debt as a fraction of the market value of equity, the latter being calculated as the product of market price at year-end and the total number of shares outstanding. The value of the acquisition is controlled for by variable *Value/MVA* and is scaled by the market value of assets, to normalize the impact for size distortions. In that context, variable *Value/stake* looks at deal value when scaled by the fraction of the target that was acquired.

Billet and Quan (2008) found lower returns for frequent acquirers, making it worthwhile to regard the impact of 'heavy' acquirers. This is done by control variable *Prev.acq.all* that looks at the total number of acquisitions engaged into in the last three years. Further, we use a control variable related to the learning effect *Prev.acq.min*, which is similar to *Prev.acq.all*, however now denotes the number of previous minority acquisitions. A geographical effect is controlled for by the dummy variable *cross-country*, while a sector specific effect is controlled for by the dummy variable *cross-sector.*

4.5 Descriptive Statistics

Panel A of Table 2 shows the distribution of acquisitions per type over the categories of overconfident CEOs. Further the average stake size along with its standard deviation for the types of acquisition are displayed. When looking at the different sub-groups, a difference in the size of the average stake acquired becomes apparent. This difference becomes larger when it is set off against the group of CEOs that are not biased, and is significant at the 1%-level[18]. Of all CEOs, 18% qualifies as *longholder* and 19% as *holder67.* These percentages are in line with the literature: Malmendier and Tate (2005a, 2008) find between 10% and 25% of studied CEOs to qualify as overconfident.

[18] P-values for two-sample t-tests to test for differences in means showed significant differences at the 1%-level.

Panel B of Table 1 shows the acquirer characteristics. Overconfident CEOs manage companies that are not particularly different in size. As industry leaders are believed to engage into many acquisitions, a small amount of overconfident CEOs in those places could alter the data spread significantly. Because both median and mean of the company size are in a close range when the two groups are compared, this effect does not dominate these tests. Overconfident managers have a slightly higher balance of investments and higher Tobin's Q. Although these differences are small, this further indicates the idea that overconfident managers seek for growth in a stronger manner, resulting in their companies obtaining characteristics of a growth company (as opposed to value companies that have generally lower market-to-book ratios).

[Insert Table 2 about here]

4.6 Methodology

The first hypothesis examines the relation between overconfident CEOs and toehold strategies. The primary effect tested is the effect of overconfidence, measured by one of the variables *longholder*, *holder67*, on the likelihood of acquiring a minority stake. This likelihood is denoted trough the dependent binary variable $minority_i$, which takes the value 1 if a minority stake was taken in deal i and 0 in case of a majority stake. A minority stake is defined as a sought stake-size smaller than 50%, while the total acquired fraction of the target firm is also less than 50%. This results in the following regression equation, with $measure_i$ denoting one of the overconfidence measures {*longholder*, *holder67*, *BIAS*} for all acquisitions i.

$$H1: \quad minority_i = \beta_0 + \beta_1 measure_i + \varepsilon_i.$$

This equation can be extended by the inclusion of the control variables, along with additional variables related to the acquisition value (deal variables). Including deal value variables leads to significant loss of observations. The second set of hypotheses looks at the way the market perceives minority acquisitions by overconfident CEOs to be more or less valuable than majority acquisitions. We examine this by considering the *CAR* variable, representing the cumulative abnormal returns:

$$H3: \quad CAR_{ik} = \beta_0 + \beta_1 minority_i + \beta_2 measure_i \times minority_i + \varepsilon_i.$$

That is, we regress the CAR of every acquiring company in acquisition i for every relevant window k on an overconfidence measure and the interaction effect between overconfidence and the use of a minority stake. Note that the constant term represents the reference state, i.e. a majority stake taken by a non-overconfident CEO.

5. Results

5.1 Overconfidence and Toeholds

Table 3 (Holder67) and Table 4 (Longholder) provide an overview of the regression results conducted on the full sample for testing the first hypothesis. Betton et al. (2009) however argue that 9% is an optimal stake size for the trade-off between conveying a commitment (which increases with size) and the ability to remain flexible in a competitive environment (which decreases with size). Hence we compare the results for the several hypotheses also to a data sample including only stakes sizes of 9% or higher, the regression results related to the first hypothesis from this subsample are presented in Table 5 (Holder67) and Table 6 (Longholder).

Starting with the first hypothesis, relating overconfidence and the use of a toehold strategy, it turns out that both measures of overconfidence have a significant effect on the likelihood of a minority stake transaction. This effect is strong for both the *longholder* and *holder67* variable. From the baseline regressions we observe that in general the probability at a minority stake is around 5%, overconfidence decreases this probability on average with 1.3% Longholder) - 1.9% (Holder67), which is a relative reduction in probability of 26% and 38% respectively.

[Insert Table 3 about here]

[Insert Table 4 about here]

These results confirm the basic existence of a relation, paving the way for an extension by including the formulated control variables, deal variables and industry, year and year-industry fixed effects. The estimated coefficients of the overconfidence measures remain in general negative and statistically significant among several regressions. Thus, the effect persists with the inclusion of control variables, illustrating the strength and robustness of the effect. Including deal value variables results in a significant loss of observations, cutting the sample size roughly in half. Similar to the other control measures, this action reduces neither direction nor significance of the main relation, i.e. the contribution of bias measurements on the minority stake acquisition probability. Hence, in general we observe a negative effect of overconfidence on the likelihood of a toehold acquisition.

The contributions of the different control variables to the results are diverse. The *size* and market-to-book ratio (described through *Tobin's Q*) both have a positive and significant influence on the minority stake probability among most regressions. This could be explained by the fact that buy-and-build strategies (in which optionality and the use of minority stakes is dominantly present), are more often exploited by large companies, such as market leaders. The higher Tobin's Q could be a sign for the recognition of the option value embedded in minority stakes: the possible future payoffs allow for a higher valuation of these companies, relative to their book values. *Cash flow* is significant and negative across most regressions, which is to be expected. If a firm is able to generate larger quantities of cash, it is also able to acquire other companies more easily, and is likely to have fewer capital budgeting

restrictions. This reduces the need for a step-by-step approach, as full acquisitions can be financed easier. The *Investment* variable contributes positively and significantly, in the way that increased investments cause an increased minority stake use. *Cash* holdings are positively linked to minority stake use, which relates to the cautionary nature of both phenomena. Also, buying minority stakes costs a lot less, giving room for the accumulation of cash on the balance sheet. *Leverage* is a significant positive contributor. This could be explained as follow: the high leverage might give rise to corporate financial restrictions, preventing the expenditures necessary for a full acquisition from being available. The variable *owner* shows no significant contributions. The *CG* variable shows a small negative effect. Apparently the board size can have a negative influence on the likelihood of a minority stake if very small stakes are also taken into account. The *cross-sector* variable has a small positive effect indicating that cross-sector acquisition can have a positive influence on acquiring minority stakes, this is in line with a learning explanation. The *cross-country* variable has a significant and relatively large positive coefficient. This is again a confirmation for the value of minority stakes when diversifying geographically, which comes with increased levels of uncertainty. Finally the 'experience' variables *Prev.acq.all* and *Prev.acq.min* show both strong significant effects. The number of all previous acquisitions shows a negative coefficient across all regressions, which indicates that a large number of conducted acquisitions in general decreases the likelihood of a minority stake acquisition, that is, if a CEO is very experienced in doing acquisitions, it is less likely for him to appeal to a toehold acquisition. However the number of previous minority acquisitions, displays a positive coefficient, pointing out a possible learning effect: if a CEO has done a lot of minority stake acquisitions in the past, he is more likely to do so again (Dai, Gryglewicz and Smit, 2016).

Including the deal value variables does not alter the general outcome direction with respect to the measures of overconfidence, or their significance. However, they do contribute significantly and in line with theoretical expectations. The *value/MVA* variable measures the deal value standardized by the size (market value) of the acquisition, and portrays a strongly negative and significant effect. That is, if the impact of the transaction on the company will be relatively high, the likelihood of a minority stake acquisition is lower. This is also consistent with the control premium phenomenon: obtaining full control over a company requires a larger premium. As a result of the scaling with respect to size, the coefficient of the initial size variable is lower. The *value/stake* has a small positive effect, which means that the likelihood for a toehold is larger if the value per cent of the target is higher.

[Insert Table 5 about here]

[Insert Table 6 about here]

Considering the results for the reduced sample (stake sizes > 9%) changes little to the direction or significance of the different variables. The coefficients are overall slightly less pronounced, which indicates that sample executives do not directly recognize the limited

strategic value of a small minority stake. However, even small stakes convey a certain commitment, and can in that fashion offer strategic possibilities.

5.1.1 Robustness of the Overconfidence-Toehold Hypothesis

In order to examine the robustness of the relationship between overconfidence and the use of minority stakes in an acquisition, we test our hypothesis 1 in a completely different setting. We construct an additional dataset consisting of a sample of 360 acquisitions in the period 2003 – 2013. However now, (i) we require all acquiring companies to be firms from the UK and (ii) use a different measure for overconfidence.

This country restriction is set to make sure that there are no country specific factors that could drive the relationship between overconfidence and the neglect of minority stakes. The UK is chosen because it is known for having a well-developed financial market (Porta, Lopez-de-Silane, Schleiffer and Vishny (1996)), is known for an active M&A market and there is sufficient data available for deals in this country. Furthermore, it enables us to compare the results to our main dataset and previous research that mainly focuses on deals in the United States. Finally, a minimum market capitalization of the acquirer of 500 million pound is set as a condition, to make sure there is sufficient media coverage available about the CEO. This dataset only covers acquisitions that are made by listed, public firms.

The media coverage is needed to construct a different overconfidence measure. Following the measure of Malmendier et al. (2005, 2011) we use outsider's perception as a proxy to approach the conceptualization of overconfidence. We therefore collect articles from the British newspapers *The Guardian, Daily Telegraph* and *The Financial Times*. These newspapers are selected because they have a reputation of being 'quality press', and all three newspapers are described as having different political allegiance (BBC, 2009), which creates a more balanced view on outsiders perspective. Similar to Malmendier and Tate (2005), a CEO is classified as *overconfident* if he or she is mentioned more often as 'confident' or 'optimistic' than as ' reliable', 'cautious', 'frugal', 'steady', 'conservative' or 'practical'. All references in articles are manually checked, to make sure the articles refer to the CEO.

The final adjustment we make in our setting for testing the hypotheses, is the use of a different smaller set of control variables. The control variables we employ are *Size*, *Leverage*, *Cash*, *cross-country* and *cross-sector*. Moreover it is also expected that minority acquisitions are more likely to be paid with cash, based on the empirical findings of Betton et al. (2009), hence we include *Cash Payment* (a dummy variable that indicates the payment method). Furthermore we control for year and industry specific effects. The logistic regression results of the minority stake dummy on the external perception measure and additional control variables are displayed in Table 7.

[Insert Table 7 about here]

From Table 7 we observe that the tested hypothesis of the relation between the use of a minority stake and overconfidence of a CEO is again confirmed. For all regressions we find

negative significant coefficients for the overconfidence measure, indicating the negative relation between the use of toeholds and overconfidence of a CEO. That is, the likelihood of pursuing a toehold strategy is smaller for overconfident CEOs. This link remains consistent when we add control variables and control for industry and year effects. Furthermore we also observe a negative significant coefficient for the variable *Cash Payment,* across the several regressions. This indicates a negative relation between the payment method and the likelihood of employing a minority stake strategy, which is in line with the findings of Betton, et al. (2009). The remaining variables do not show significant coefficients.

The results indicate that our hypothesis of a negative relation between CEO overconfidence and the use of minority stakes is robust when tested in a different setting. That is, it is robust with respect to a different measure of overconfidence, to a dataset from a different country, to less data and a different set of control variables.

4.2 Overconfidence and Announcement Returns

The second set of hypotheses revolves around the overconfidence dimension, the announcement return and the acquisition type. The results of the regressions for the several event windows [-20,1], [-20,10], [-10,1] and [-10,10] are outlined in Table 10.

[Insert Table 10 about here]

Notice that the constant represents the reference state, which in this setting is the case of a majority stake combined with a non-overconfident CEO. The additional effects of overconfidence, a toehold acquisition and the interaction effect are given by the corresponding coefficients. We observe in general positive cumulative abnormal returns (CAR) for the acquisitions through the several event windows. The coefficients for the minority stake variable are overall positive and significant, indicating on average higher cumulative abnormal returns for toehold acquisitions, which is in line with our theory. There are no pronounced effects for the overconfidence measures, indicating that being a biased CEO does not necessarily affects the returns, whereas the signal of conducting a minority acquisition does. Furthermore we do not find significant interaction effects. The interaction effect however is not persistent for the other measures or event windows. Overall we only find a clear relationship between higher cumulative abnormal returns and the use of minority stakes.

6. Conclusion

Do overconfident CEOs ignore minority stakes? This study shows that the answer is yes. This is a very important research question as acquisitions tend to provide poor bidder returns while the sellers receives the better half. Minority stakes may transfer some of these seller advantages to the bidder. A new behavioural explanation is based on the *perception* of CEOs towards the risks of their acquisitions rather than the actual risk itself.

We extend a dynamic model for the analysis of toeholds strategies, where decision makers can be overconfident or overoptimistic. We show that these behavioural biases cause CEOs to have a lower likelihood of making minority stake investments. We test our claims of the impact of overconfidence on the use of minority stakes in acquisition strategies. A sample of nearly 10.000 acquisitions, conducted between 2004 and 2013, was linked to the degree to which the CEOs are prone to biased behaviour, specifically overconfidence. Absent other market frictions, overconfident CEOs are unambiguously more likely to ignore minority stake acquisitions and execute controlling acquisitions instead. A key contribution of our analysis is to directly measure which CEOs are prone to overconfidence (or hubris) and to show that those CEOs, in particular, may destroy value for their shareholders by ignoring minority stakes and favouring controlling acquisitions.

We use CEOs' private investment decisions to capture their revealed beliefs. Overconfidence is conceptualized in different measures. The *longholder* and *holder67* measures use the timing and value of options in possession of the executive. Because the CEO is relatively overexposed to the risks of the company, it would be rational to dispose options as soon as possible. *Longholders* ignore this axiom by holding on to their options until the final year. *Holder67* CEOs keep highly in-the-money options while they are exercisable. To show that suboptimal decision-making in the personal portfolio is not a result of errors but of biasedness, we use an alternative measure of overconfidence, which is based on the external perception of CEOs by quality newspapers.

The main empirical results show economically and statistically strongly significant evidence for lower likelihood of minority stake use among biased CEOs, even when a different dataset and a different measure of overconfidence are used. This supports the existence of a relation between behavioural biases and acquisition decisions. An acquisition by a company that has a biased CEO in charge is, on average, less likely to be a minority stake acquisition. Put differently, biased CEOs are more likely to approach the acquisition decision as a full go/no go type of choice. Considering the market returns, cumulative abnormal returns are on average higher for toehold acquisitions than for full-scale acquisitions. Due to the large sample size and careful composition of the performed analysis, the results of this paper are very persistent and robust across multiple dimensions.

The practical implication of this article is that it focuses attention on toehold acquisition strategies to improve acquisition performance. Our results have implications for contracting and deal execution practices. Evidence that minority stakes perform better than full acquisitions is inconsistent with the neglect of toehold strategies. Unlike CEOs with empire-building preferences, who consciously disregard shareholders' interests, overconfident CEOs believe they are maximizing value. Acknowledging the existence of overconfidence in acquisition strategies can offer executives the insights and new organisational processes that could be helpful in efforts to *debias* acquisition strategies.

Appendix A Derivation of Option Value and Exercise Threshold

Following Morellec and Zhdanov (2005), we represent the option value of acquiring the remainder of the company while having a minority stake as $O^M(X,Y)$. With the use of Itō's Lemma we can write for the dynamics:

$$\mathrm{d}O^M = O_X^M \mathrm{d}X + O_Y^M \mathrm{d}Y + \left[\frac{1}{2}\sigma_X^2 X^2 O_{XX}^M + \frac{1}{2}\sigma_Y^2 Y^2 O_{YY}^M + \rho\sigma_X\sigma_Y XY O_{XY}^M\right]\mathrm{d}t$$

In equilibrium should hold that the expected return on the option is equal to the risk-free rate r. Hence, if combined with above dynamics we arrive at the following PDE.

$$(\mu_X - q_x)XO_X^M + (\mu_Y - q_Y)YO_Y^M + \frac{1}{2}\sigma_x^2 X^2 O_{XX}^M + \frac{1}{2}\sigma_Y^2 Y^2 O_{YY}^M + \rho\sigma_X\sigma_Y XY O_{XY}^M = rO^M$$

subject to the following boundary conditions:

$$O^M(X^*,Y^*) = \{(1-\phi)V^T(Y^*) + [V^C(X^*,Y^*) - V^B(X^*) - V^T(Y^*)] - (1-\xi)(1-\phi)V^C(X^*,Y^*)\}$$

$$O_X^M(X^*,Y^*) = \xi V_X^C(X^*,Y^*) + \phi(1-\xi)V_X^C(X^*,Y^*) - V_X^B(X^*)$$

$$O_Y^M(X^*,Y^*) = \xi V_Y^C(X^*,Y^*) + \phi(1-\xi)V_Y^C(X^*,Y^*) - \phi V_Y^T(Y^*)$$

$$\lim_{(X/Y)\to 0}\frac{O^M(X,Y)}{X} = 0$$

It is fairly straightforward to see that the value function $O^M(X,Y)$ is linearly homogenous in (X,Y). Hence if we let $R(t)_{t\geq 0} = (X(t)/Y(t))_{t\geq 0}$, we can describe the option with this ratio instead of with two distinct variables. The value of the option can now be described as

$$O^M(X,Y) = YO^M\left(\frac{X}{Y},1\right) = YO^M(R)$$

Morellec and Zhdanov (2005) show that the following hold:

$$O_X^M(X,Y) = O_R^M(R)$$

$$O_Y^M(X,Y) = O^M(R) - RO_R^M(R)$$

$$O_{XX}^M(X,Y) = O_{RR}^M(R)/Y$$

$$O_{YY}^M(X,Y) = R^2 O_{RR}^M(R)/Y$$

$$O_{XY}^M(X,Y) = -RO_{RR}^M(R)/Y$$

Substituting these in the boundary and equilibrium conditions gives the ODE

$$\frac{1}{2}\sigma_R^2 R^2 O_{RR}^M + \mu_R RO_R^M = (r - (\mu_Y - q_Y))O^M$$

With boundary conditions

$$O^M(R_B^*) = \xi V^C(R_B^*,1) + \phi(1-\xi)V^C(R_B^*,1) - V^B(R_B^*) - \phi V^T(1)$$

$$O_R^M(R_B^*) = \xi V_R^C(R_B^*,1) + \phi(1-\xi)V_R^C(R_B^*,1) - \frac{1}{r-\mu_X}$$

$$\lim_{R\to 0}\frac{O_R^M(R)}{R} = 0$$

The general solution of such a problem is well-known:

$O^M(R) = AR^\beta + BR^\gamma$

With A and B positive constants and with β and γ, respectively the positive and negative roots of the quadratic equation

$\frac{1}{2}(\sigma_X^2 - 2\rho\sigma_X\sigma_Y + \sigma_Y^2)\beta(\beta-1) + [(\mu_X - q_X) - (\mu_Y - q_Y)]\beta - (r - (\mu_Y - q_Y)) = 0$

From the last boundary condition, it follows that $B = 0$. Then we can write

$AR_B^{*\beta} = \xi V^C(R_B^*, 1) + \phi(1-\xi)V^C(R_B^*, 1) - V^B(R_B^*) - \phi V^T(1)$

$$\beta A R_B^{*\beta-1} = \xi V_R^C(R_B^*, 1) + \phi(1-\xi)V_R^C(R_B^*, 1) - \frac{1}{r-\mu_X}$$

$A = \{\xi V^C(R_B^*, 1) + \phi(1-\xi)V^C(R_B^*, 1) - V^B(R_B^*) - V^T(1)\}(R_B^*)^{-\beta}$

From which we obtain

$O^M(R) = \{\xi V^C(R_B^*, 1) + \phi(1-\xi)V^C(R_B^*, 1) - V^B(R_B^*) - V^T(1)\} \left(\frac{R}{R_B^*}\right)^\beta$

$R_B^* = \frac{\beta}{\beta-1}\frac{r-\mu_X}{r-\mu_Y}\frac{\phi-\xi\delta-\phi(1-\xi)\delta}{\xi\gamma+\phi(1-\xi)-1}$

Appendix B Direction of Slopes of the Exercise Threshold

To derive the slopes and their corresponding sign of the exercise threshold we look at its derivative with respect to the parameters of interest. That is

$\frac{\partial R_B^*}{\partial \mu_Y} = \left[\frac{\partial R_B^*}{\partial \beta}\right]\left[\frac{\partial \beta}{\partial \mu_R}\right]\left[\frac{\partial \mu_R}{\partial \mu_Y}\right]\left[\frac{r-\mu_X}{r-\mu_Y}\right] + \left[\frac{\beta}{\beta-1}\right]\left[\frac{-(r-\mu_X)}{(r-\mu_Y)^2}\right]$

$\frac{\partial R_B^*}{\partial \sigma_Y} = \left[\frac{\partial R_B^*}{\partial \beta}\right]\left[\frac{\partial \beta}{\partial \sigma_R}\right]\left[\frac{\partial \sigma_R}{\partial \sigma_Y}\right]$

$\frac{\partial R_B^*}{\partial \sigma_X} = \left[\frac{\partial R_B^*}{\partial \beta}\right]\left[\frac{\partial \beta}{\partial \sigma_R}\right]\left[\frac{\partial \sigma_R}{\partial \sigma_X}\right]$

Where $\mu_R = (\mu_X - q_X) - (\mu_Y - q_Y)$ and $\sigma_R = (\sigma_X^2 - 2\rho\sigma_X\sigma_Y + \sigma_Y^2)$. Then, for the first component we have

$\left[\frac{\partial R_B^*}{\partial \beta}\right] = \left[-\frac{1}{(\beta-1)^2}\right] < 0$

Next, for the second components we apply

$Q(\beta, \sigma_R) = \frac{1}{2}\sigma_R^2\beta(\beta-1) + \mu_R\beta - (r-\mu_Y) = 0$

$\frac{\partial \beta}{\partial \sigma_R} = -\frac{\frac{\partial Q}{\partial \sigma_R}}{\frac{\partial Q}{\partial \beta}} = -\frac{\sigma_R\beta(\beta-1)}{\sigma_R^2\beta - \frac{1}{2}\sigma_R^2 + \mu_R} = -\frac{>0}{>0} \Leftrightarrow \frac{\partial \beta}{\partial \sigma_R} < 0$

and also

$$Q(\beta, \mu_R) = \frac{1}{2}\sigma_R^2\beta(\beta - 1) + \mu_R\beta - (r - \mu_Y) = 0$$

$$\frac{\partial\beta}{\partial\mu_R} = -\frac{\frac{\partial Q}{\partial\mu_R}}{\frac{\partial Q}{\partial\beta}} = -\frac{\beta}{\sigma_R^2\beta - \frac{1}{2}\sigma_R^2 + \mu_R} = -\frac{>0}{>0} \iff \frac{\partial\beta}{\partial\mu_R} < 0$$

Finally for the third components we have

$$\left[\frac{\partial\mu_R}{\partial\mu_Y}\right] = -1 < 0$$

$$\left[\frac{\partial\sigma_R}{\partial\sigma_Y}\right] = \frac{\sigma_Y - \rho\sigma_X}{\sqrt{-2\rho\sigma_X\sigma_Y + \sigma_X^2 + \sigma_Y^2}} = \begin{cases} > 0 & if \quad \sigma_Y > \rho\sigma_X \\ < 0 & if \quad else \end{cases}$$

$$\left[\frac{\partial\sigma_R}{\partial\sigma_X}\right] = \frac{\sigma_X - \rho\sigma_Y}{\sqrt{-2\rho\sigma_X\sigma_Y + \sigma_X^2 + \sigma_Y^2}} = \begin{cases} > 0 & if \quad \sigma_X > \rho\sigma_Y \\ < 0 & if \quad else \end{cases}$$

Combining all the above, we have $\frac{\partial R_B^*}{\partial\mu_Y} < 0$ which always holds. Furthermore we have $\frac{\partial R_B^*}{\partial\sigma_Y} > 0$ and $\frac{\partial R_B^*}{\partial\sigma_X} > 0$, which holds if the correlation is negative $\rho < 0$, or if the volatilities σ_X and σ_Y do not differ to much from each other.

References

Aktas, N., De Bodt, E., & Roll, R. (2009). Learning, hubris and corporate serial acquisitions. *Journal of Corporate Finance*, *15*(5), 543-561.

Allen, J. & Phillips, G., 2000. Corporate equity ownership, strategic alliances, and product market relationships. *Journal of Finance,* pp. 2791-2815.

Anon., 2014. Stocking Up: Executive Optimism, Option Exercise, and Share Retention. *Working paper, AFA 2010 Atlanta Meetings Paper .*

Baker, M., Ruback, R. S., & Wurgler, J. (2004). *Behavioral corporate finance: A survey* (No. w10863). National Bureau of Economic Research.

Barberis, N., & Thaler, R. (2003). A survey of behavioral finance. *Handbook of the Economics of Finance*, *1*, 1053-1128.

Bazerman, M., & Moore, D. A. (2012). Judgment in managerial decision making.

Ben-David, I., Graham, J. & Harvey, C., 2007. Managerial overconfidence and corporate. *Working Paper, National Bureau of Economic Research..*

Ben-David, I., Graham, J. R., & Harvey, C. R. (2013). Managerial miscalibration. *The Quarterly Journal of Economics*, qjt023.

Betton, S. & Eckbo, B., 2000. Toeholds, bid jumps, and expected payoff in takeovers.. *Review,* p. 841–882.

Betton, S., Eckbo, B. E., & Thorburn, K. S. (2008). Corporate takeovers. *Elsevier/North-Holland Handbook of Finance Series*.

Betton, S., Eckbo, B. & Thorburn, K., 2009. Merger negotiations and the toehold puzzle.. *Journal of Financial Economics,* pp. 158-178.

Billett, M. & Qian, Y., 2008. Are overconfident CEOs born or made? Evidence of selfattribution. *Management Science,* pp. 1037-1051.

Brown, R. & Sarma, N., 2007. CEO overconfidence, CEO dominance and corporate acquisitions. *Journal of Economics and Business,* pp. 358-379.

Bulow, J., Huang, M. & Klemperer, P., 1999. Toeholds and takeovers. *Journal of Political Economy,* pp. 427-454.

Burkart, M. (1995). Initial shareholdings and overbidding in takeover contests. *The Journal of Finance*, *50*(5), 1491-1515.

Busenitz, L. W., & Barney, J. B. (1997). Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of business venturing*, *12*(1), 9-30.

Camerer, C., & Lovallo, D. (1999). Overconfidence and excess entry: An experimental approach. *The American Economic Review*, *89*(1), 306-318.

Camerer, C. F., & Malmendier, U. (2007). Behavioral organizational economics. *Behavioral Economics and Its Applications, Princeton University Press, Princeton and Oxford*.

Cao, J., 2009. CEO Overconfidence or Stock Mispricing and Growth? Reexamining the Effect of CEO Option Exercise Behavior on Corporate Investment. *Working paper, Chinese University of Hong Kong.*

Capron, L., & Shen, J. C. (2007). Acquisitions of private vs. public firms: Private information, target selection, and acquirer returns. *Strategic Management Journal*, *28*(9), 891-911.

Carpenter, J., 1998. The exercise and valuation of executive stock options. *Journal of Financial Economics,* pp. 127-158.

Cullinan, G., Le Roux, J. M., & Weddigen, R. M. (2004). When to walk away from a deal. *Harvard Business Review*, *82*(4), 96-105.

Deaves, R., Lüders, E., & Luo, G. Y. (2008). An experimental test of the impact of overconfidence and gender on trading activity. *Review of finance*, rfn023.

Dasgupta, S., & Tsui, K. (2003). A "matching auction" for targets with heterogeneous bidders. *Journal of Financial Intermediation*, *12*(4), 331-364.

Dai, Y., S. Gryglewicz, and J.T.J. Smit. "Learning in Toehold Acquisitions." *Working Paper* (2016).

Deshmukh, S., Goel, A. M., & Howe, K. M. (2009). *CEO overconfidence and dividend policy* (No. 2009-06). Working Paper, Federal Reserve Bank of Chicago.

Dixit, A. K., & Pindyck, R. S. (1994). *Investment under uncertainty*. Princeton university press.

Doukas, J. A., & Petmezas, D. (2007). Acquisitions, Overconfident Managers and Self-attribution Bias. *European Financial Management*, *13*(3), 531-577.

Eckbo, B., 2009. Bidding strategies and takeover premiums: a review. *Journal of Corporate Finance,* pp. 149-178.

Fama, E., 1976. *Foundations of Finance.* New York: Basic Books.

Folta, T. & Miller, K., 2002. Real options in equity partnerships. *Strategic Management*, pp. 77-88.

Gervais, S., & Odean, T. (2001). Learning to be overconfident. *Review of Financial studies*, *14*(1), 1-27.

Goldman, E. & Qian, J., 2005. Optimal toeholds in takeover contests.. *Journal of Financial Economics,* pp. 321-346.

Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of financial economics*, *60*(2), 187-243.

Grossman, S. J., & Hart, O. D. (1980). Takeover bids, the free-rider problem, and the theory of the corporation. *The Bell Journal of Economics*, 42-64.

Hackbarth, D. (2009). Determinants of corporate borrowing: A behavioral perspective. *Journal of Corporate Finance*, *15*(4), 389-411.

Hall, B. & Murphy, K., 2002. Stock options for undiversified executives.. *Journal of Accounting and Economics,* pp. 3-42.

Hayward, M. & Hambrick, D., 1997. Explaining the premiums paid for large acquisitions:. *Administrative Science Quarterly,* pp. 103-127.

Heaton, J., 2002. Managerial optimism and corporate finance. *Financial Management,* pp. 33-45.

Hirshleifer, D. & Titman, S., 1990. Share tendering strategies and the success of hostile takeover bids. *Journal of Political Economy,* pp. 295-324.

Janis, I. L. (1982). *Groupthink: Psychological studies of policy decisions and fiascoes* (Vol. 349). Boston: Houghton Mifflin.

Jensen, M. C. (1986). Agency cost of free cash flow, corporate finance, and takeovers. *Corporate Finance, and Takeovers. American Economic Review*, *76*(2).

Kahneman, D., & Tversky, A. (1982). Variants of uncertainty. *Cognition*, *11*(2), 143-157.

Kahneman, D. & Lovallo, D., Management Science. Timid choices and bold forecasts: a cognitive perspective. *Management Science,* Volume 17-31, p. 1993.

Kil, J. & Smit, J.T.J., Behavioral real options: uncertainty neglect in acquisition. *Working paper, Erasmus University Rotterdam, 2015.*

Krueger, A., 1999. Experimenta estimates of Education Production Functions. *Quaterly Journal of Economics,* pp. 497-532.

Laamanen, T., & Keil, T. (2008). Performance of serial acquirers: Toward an acquisition program perspective. *Strategic Management Journal*, *29*(6), 663-672.

Lambrecht, B. M. (2004). The timing and terms of mergers motivated by economies of scale. *Journal of Financial Economics*, *72*(1), 41-62.

Langer, Ellen J. "The illusion of control." *Journal of personality and social psychology* 32, no. 2 (1975): 311.

Leeth, J. D., & Borg, J. R. (2000). The impact of takeovers on shareholder wealth during the 1920s merger wave. *Journal of Financial and Quantitative Analysis*, *35*(02), 217-238.

Malmendier , U. & Tate, G., 2005a. CEO overconfidence and corporate investment. *Journal of Finance,* pp. 2661-2700.

Malmendier, U. & Tate, G., 2005b. Does overconfidence affect corporate investment? CEO overconfidence measures revisited.. *European Financial Management,* pp. 649-659.

Malmendier, U. & Tate, G., 2008. Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics,* pp. 20-43.

Malmendier, U., Tate, G. & Yan, J., 2011. Overconfidence and Early-Life Experiences: The Effect of Managerial Traits on Corporate Financial Policies. *Journal of Finance.*

Miller , K., 1992. framework for integrated risk management in international business. *Journal of International Business Studies,* Issue 311-331.

Moore, D. & Kim, T., 2003. Myopic social prediction and the solo comparison effect. *Journal of personality and social psychology,* pp. 1121-1135.

Moore, D., & Healy, P. J. (2008). The trouble with overconfidence. *Psychological Review, 115*(2), 502-517.

Morellec, E., & Zhdanov, A. (2005). The dynamics of mergers and acquisitions.*Journal of Financial Economics*, *77*(3), 649-672.

Mueller, A. & Brettel, M., 2012. Impact of Biased Pecking Order Preferences on Firm Success in Real Business Cycles. *Journal of Behavioral Finance,* pp. 199-213.

Porta, R. L., Lopez-de-Silane, F., Shleifer, A., & Vishny, R. W. (1996). *Law and Finance* (No. w5661). National Bureau of Economic Research.

Reuer, J. J., & Ragozzino, R. (2008). Adverse selection and M&A design: The roles of alliances and IPOs. *Journal of Economic Behavior & Organization*,*66*(2), 195-212.

Rochowicz Jr, J., 2010. Bootstrapping Analysis, Inferential Statistics and EXCEL. *Spreadsheets in Education (eJSiE).*

Roll, R., 1986. The hubris hypothesis of corporate takeovers. *Journal of Business.*

Singh, H., & Montgomery, C. A. (1987). Corporate acquisition strategies and economic performance. *Strategic Management Journal*, *8*(4), 377-386.

Singh, R. (1998). Takeover bidding with toeholds: The case of the owner's curse. *Review of Financial Studies*, *11*(4), 679-704.

Shariatmadari, David. (2015). "Daniel Kahneman: 'What Would I Eliminate If I Had a Magic Wand? Overconfidence.'" *The Guardian*. July 18. http://www.theguardian.com/books/2015/jul/18/ daniel-kahneman-books-interview.

Shleifer, A. & Vishny, R., 1986. Large shareholders and corporate control. *Journal of Political Economy*, pp. 461-488.

Shleifer, A., & Vishny, R. W. (2003). Stock market driven acquisitions. *Journal of financial Economics*, *70*(3), 295-311.

Smit, H. T., & Ankum, L. A. (1993). A real options and game-theoretic approach to corporate investment strategy under competition. *Financial Management*, 241-250.

Smit, H. (2001). Acquisition strategies as option games. *Journal of Applied Corporate Finance*

Smit, H., & Moraitis, T. (2015). *Playing at acquisitions: Behavioral option games*. Princeton University Press.

Svenson, O., 1981. Are we all less risky and more skillful than our fellow drivers?. *Acta Psychologica*, pp. 143-148.

Stulz, R. M., Walkling, R. A., & Song, M. H. (1990). The distribution of target ownership and the division of gains in successful takeovers. *The Journal of Finance*, *45*(3), 817-833.

Thaler, R. H. (1988). Anomalies: The winner's curse. *The Journal of Economic Perspectives*, *2*(1), 191-202.

Varaiya, N. & Ferris, K., 1987. Overpaying in Corporate Takeovers: The Winner's Curse. *Financial Analysts Journal*, pp. 64-70.

Walkling, R., 1985. Predicting tender offer success: a logistic analysis. *Journal of Financial and Quantitative Analysis*, pp. 461-478.

Figures

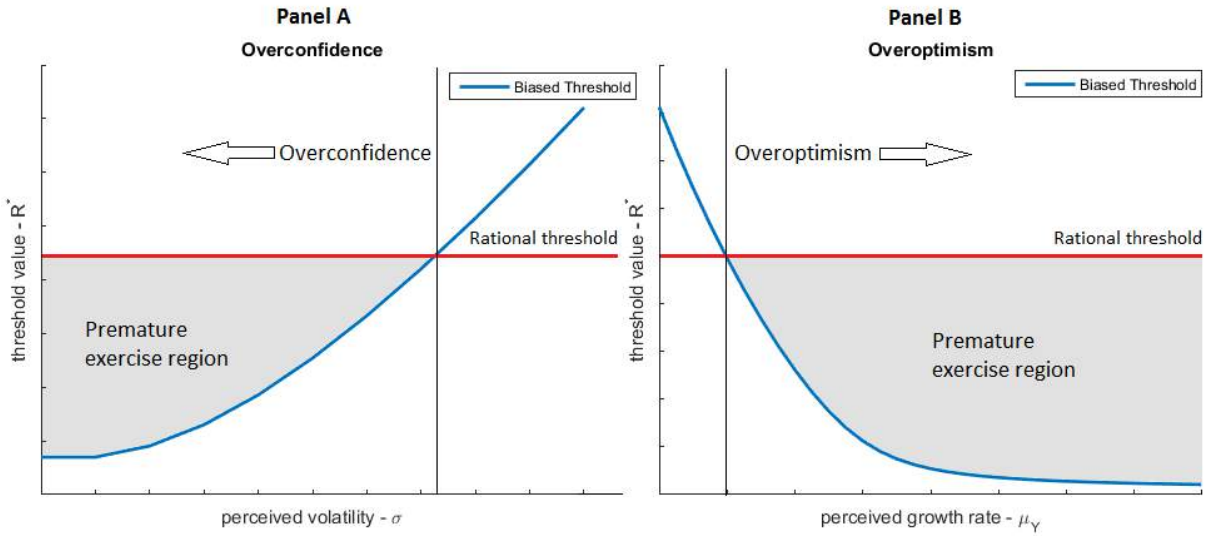

Figure 1 - This figure shows the toehold option exercise threshold (blue line) as function of perceived volatility (Panel A) and growth (Panel B). The red line represents the rational unbiased threshold. The grey area marks the region where the option is early exercised and therewith where the likelihood of a full-scale acquisition (immediate exercise) is bigger.

A Tables

Table 1: **Corporate takeovers in the period 2004-2013**

Our sample consists of 9646 deals in the period 2004-2013. All the deals are by US acquirers from the S&P1500 composite index. Data on each deal must be available from CRSP and Compustat. This table gives the yearly distribution of deals, the average stake size, the number and percentage of deals with a toehold strategy and the average toehold size. %

Year	No. Of Deals	Average stake size (%)	No. of Toeholds	Fraction of Toeholds (%)	Average Toehold size (%)
2004	970	96.32	39	4.02	20.61
2005	1073	95.50	53	4.94	19.98
2006	1215	95.83	52	4.28	19.23
2007	1080	95.70	47	4.35	14.62
2008	1094	93.83	73	6.67	18.90
2009	690	93.85	47	6.81	17.75
2010	885	96.14	38	4.29	22.19
2011	930	96.63	36	3.87	21.02
2012	961	96.77	32	3.33	22.29
2013	748	96.77	27	3.61	21.24
Total	9646	95.73	444	4.60	19.48

Table 2: **Acquisition and CEO descriptive statistics**

This table shows acquisition and acquirer statistics for the full sample and also specified per category CEO. Panel A shows the acquisition descriptive statistics with the number of acquisitions (obs.), together with the average stake size (mean) and the standard deviation (SD). Panel B shows company characteristics of the acquirer again for the full sample and the CEO categeories. For every characteristic, the mean, median and standard deviation (SD) are displayed. An asterisk (*) denotes that a characteristic is denoted in million dollars.

Panel A: acquisition descriptive statistics

	Full Sample			*longholder CEO*		
Acquisition type	Obs.	Mean	SD	Obs.	Mean	SD
Minority - % acquired	444	19.5	14.0	40	21.7	14.6
Majority - % acquired	9202	99.4	4.5	1681	99.4	4.4
Total	9646	95.7	17.6	1721	96.5	15.9

	holder67 CEO		
Acquisition type	Obs.	Mean	SD
Minority - % acquired	108	21.8	14.6
Majority - % acquired	1696	99.4	4.1
Total	1804	96.0	16.7

Panel B: Acquirer Characteristics

	Full Sample (n=9646)			*longholder (n =1721)*		
**In million $*	Mean	Median	SD	Mean	Median	SD
Size*	8.5	8.2	1.8	8.43	8.0	1.8
Cash flow*	0.07	0.07	0.08	0.07	0.07	0.06
Investments*	0.04	0.03	0.08	0.04	0.03	0.05
Cash position*	0.16	0.10	0.18	0.13	0.09	0.14
Tobin's Q	1.8	1.6	1.3	1.9	1.7	0.85
Leverage	0.12	0.14	0.09	0.11	0.09	0.11

	holder67 (n=1804)		
**In million $*	Mean	Median	SD
Size*	8.0	7.9	1.7
Cash flow*	0.07	0.06	0.06
Investments*	0.05	0.03	0.08
Cash position*	0.15	0.10	0.2
Tobin's Q	1.9	1.6	1.0
Leverage	0.13	0.1	0.15

Table 3: **Overview of Holder67 regressions**

This table shows an overview of relevant coefficients resulting from several regressions. The dependent variable in the regressions is *Minority*, a binary variable taking the value of 1 if a toehold strategy is used and 0 otherwise. The independent variables is the *Holder67* measure of overconfidence. Furthermore control variables, deal variables and fixed effects are included.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Baseline	Control Variables	Deal Variables	Controls FE	Controls FE	Controls FE	Dealvars FE	Dealvars FE	Dealvars FE
Holder67	**-0.0189*** **	**-0.0179*** **	**-0.0150** **	**-0.0172*** **	**-0.0156*** **	**-0.0153*** **	**-0.0145** **	**-0.0162** **	**-0.0157** **
	(0.00418)	(0.00400)	(0.00666)	(0.00400)	(0.00401)	(0.00402)	(0.00669)	(0.00674)	(0.00676)
Size		0.00432***	0.00410	0.00470***	0.00343**	0.00384**	0.00439	0.00189	0.00186
		(0.00162)	(0.00295)	(0.00165)	(0.00163)	(0.00166)	(0.00300)	(0.00309)	(0.00314)
Tobins Q		0.00477	0.00931*	0.00455	0.00820**	0.00821**	0.00945*	0.0121**	0.0126**
		(0.00341)	(0.00504)	(0.00346)	(0.00343)	(0.00350)	(0.00511)	(0.00513)	(0.00527)
Cash Flow		-0.0996**	-0.129**	-0.0962**	-0.0797*	-0.0747*	-0.125**	-0.121**	-0.125**
		(0.0451)	(0.0539)	(0.0452)	(0.0446)	(0.0448)	(0.0542)	(0.0535)	(0.0548)
Investments		0.229***	0.260***	0.224***	0.203***	0.199***	0.254***	0.200***	0.201***
		(0.0433)	(0.0460)	(0.0434)	(0.0503)	(0.0502)	(0.0454)	(0.0657)	(0.0626)
Cash		0.0482***	0.0801***	0.0492***	0.0477***	0.0492***	0.0789***	0.0928***	0.0910***
		(0.0158)	(0.0256)	(0.0160)	(0.0158)	(0.0162)	(0.0259)	(0.0255)	(0.0260)
Leverage		0.105***	0.181***	0.101***	0.0979***	0.0979***	0.175***	0.165***	0.163***
		(0.0245)	(0.0418)	(0.0246)	(0.0242)	(0.0242)	(0.0420)	(0.0414)	(0.0412)
Prev.acq.all		-0.00128***	-0.00261***	-0.00130***	-0.00169***	-0.00179***	-0.00268***	-0.00220***	-0.00218***
		(0.000178)	(0.000617)	(0.000178)	(0.000196)	(0.000200)	(0.000618)	(0.000620)	(0.000626)
Prev.acq.min		0.0499***	0.0575***	0.0497***	0.0459***	0.0448***	0.0576***	0.0540***	0.0524***
		(0.00532)	(0.00840)	(0.00530)	(0.00529)	(0.00522)	(0.00836)	(0.00840)	(0.00805)
CG		-0.0608***	-0.0637**	-0.0591***	-0.0417**	-0.0384**	-0.0645**	-0.0539**	-0.0544*
		(0.0177)	(0.0266)	(0.0177)	(0.0179)	(0.0179)	(0.0267)	(0.0271)	(0.0278)
Cross-Sector		0.0179***	0.0373***	0.0178***	0.0181***	0.0181***	0.0372***	0.0355***	0.0347***
		(0.00501)	(0.00908)	(0.00501)	(0.00513)	(0.00513)	(0.00910)	(0.00919)	(0.00914)
Cross-Country		0.0662***	0.0809***	0.0662***	0.0701***	0.0696***	0.0801***	0.0845***	0.0830***
		(0.00555)	(0.00942)	(0.00556)	(0.00565)	(0.00567)	(0.00940)	(0.00955)	(0.00950)
Owner		0.0479	0.160	0.0439	0.0458	0.0334	0.160	0.185*	0.182*
		(0.0380)	(0.100)	(0.0378)	(0.0381)	(0.0382)	(0.0999)	(0.101)	(0.0997)
Value/MVA			-0.0438**				-0.0435**	-0.0446**	-0.0432**
			(0.0199)				(0.0197)	(0.0197)	(0.0198)
Value/Stake			0.000835***				0.000822***	0.000828***	0.000818***
			(0.000170)				(0.000172)	(0.000166)	(0.000171)
Constant	0.0535***	0.0129	-0.00350	0.0105	0.0309	-0.0197	-0.0226	0.0461	-0.0434
	(0.00292)	(0.0239)	(0.0383)	(0.0239)	(0.0288)	(0.0463)	(0.0381)	(0.0481)	(0.0602)
Observations	9,657	9,657	4,292	9,657	9,657	9,657	4,292	4,292	4,292
R-squared	0.002	0.125	0.169	0.127	0.135	0.146	0.171	0.174	0.194
Industry FE					YES	YES		YES	YES
Year FE				YES		YES	YES		YES
Year-Industry FE						YES			YES
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

Table 4: **Overview of Longholder regressions**

This table shows an overview of relevant coefficients resulting from several regressions. The dependent variable in the regressions is *Minority*, a binary variable taking the value of 1 if a toehold strategy is used and 0 otherwise. The independent variables is the *Longholder* measure of overconfidence. Furthermore control variables, deal variables and fixed effects are included.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Baseline	Control Variables	Deal Variables	Controls FE	Controls FE	Controls FE	Dealvars FE	Dealvars FE	Dealvars FE
Longholder	**-0.0127*** **	-0.00628	**-0.0177** **	**-0.00697***	**-0.00764***	**-0.00875** **	**-0.0174** **	**-0.0188*** **	**-0.0190*** **
	(0.00451)	(0.00416)	(0.00702)	(0.00417)	(0.00420)	(0.00426)	(0.00701)	(0.00705)	(0.00712)
Size		0.00404**	0.00388	0.00446***	0.00317*	0.00360**	0.00421	0.00170	0.00170
		(0.00163)	(0.00296)	(0.00165)	(0.00163)	(0.00166)	(0.00301)	(0.00311)	(0.00315)
Tobins Q		0.00482	0.00937*	0.00457	0.00837**	0.00835**	0.00946*	0.0122**	0.0127**
		(0.00341)	(0.00504)	(0.00346)	(0.00344)	(0.00350)	(0.00510)	(0.00512)	(0.00526)
Cash Flow		-0.106**	-0.130**	-0.102**	-0.0836*	-0.0781*	-0.126**	-0.121**	-0.125**
		(0.0452)	(0.0540)	(0.0452)	(0.0446)	(0.0448)	(0.0543)	(0.0535)	(0.0548)
Investments		0.227***	0.263***	0.222***	0.203***	0.198***	0.258***	0.201***	0.202***
		(0.0444)	(0.0464)	(0.0445)	(0.0513)	(0.0511)	(0.0459)	(0.0667)	(0.0636)
Cash		0.0493***	0.0790***	0.0503***	0.0477***	0.0490***	0.0778***	0.0915***	0.0897***
		(0.0158)	(0.0256)	(0.0160)	(0.0158)	(0.0162)	(0.0259)	(0.0255)	(0.0260)
Leverage		0.106***	0.184***	0.102***	0.0986***	0.0985***	0.177***	0.169***	0.167***
		(0.0246)	(0.0417)	(0.0246)	(0.0242)	(0.0242)	(0.0419)	(0.0412)	(0.0411)
Prev.acq.all		-0.00121***	-0.00264***	-0.00123***	-0.00165***	-0.00175***	-0.00271***	-0.00224***	-0.00221***
		(0.000177)	(0.000617)	(0.000178)	(0.000195)	(0.000200)	(0.000618)	(0.000619)	(0.000625)
Prev.acq.min		0.0497***	0.0571***	0.0496***	0.0456***	0.0444***	0.0572***	0.0535***	0.0519***
		(0.00534)	(0.00840)	(0.00532)	(0.00530)	(0.00523)	(0.00836)	(0.00840)	(0.00806)
CG		-0.0645***	-0.0674**	-0.0626***	-0.0445**	-0.0411**	-0.0678**	-0.0579**	-0.0580**
		(0.0177)	(0.0266)	(0.0177)	(0.0179)	(0.0179)	(0.0267)	(0.0271)	(0.0278)
Cross-Sector		0.0174***	0.0372***	0.0173***	0.0178***	0.0177***	0.0371***	0.0355***	0.0347***
		(0.00501)	(0.00911)	(0.00501)	(0.00513)	(0.00513)	(0.00913)	(0.00922)	(0.00918)
Cross-Country		0.0662***	0.0810***	0.0663***	0.0701***	0.0697***	0.0803***	0.0845***	0.0831***
		(0.00555)	(0.00943)	(0.00556)	(0.00565)	(0.00567)	(0.00940)	(0.00955)	(0.00951)
Owner		0.0435	0.168*	0.0406	0.0440	0.0330	0.168*	0.194*	0.192*
		(0.0379)	(0.100)	(0.0378)	(0.0381)	(0.0383)	(0.0999)	(0.101)	(0.0999)
Value/MVA			-0.0443**				-0.0439**	-0.0451**	-0.0438**
			(0.0201)				(0.0199)	(0.0199)	(0.0200)
Value/Stake			0.000847***				0.000834***	0.000841***	0.000831***
			(0.000170)				(0.000171)	(0.000166)	(0.000171)
Constant	0.0496***	0.0134	0.000273	0.0119	0.0321	-0.0177	-0.0182	0.0520	-0.0381
	(0.00258)	(0.0239)	(0.0384)	(0.0239)	(0.0290)	(0.0463)	(0.0383)	(0.0484)	(0.0602)
Observations	9,657	9,657	4,292	9,657	9,657	9,657	4,292	4,292	4,292
R-squared	0.001	0.124	0.169	0.125	0.134	0.145	0.171	0.174	0.194
Industry FE					YES	YES		YES	YES
Year FE				YES		YES	YES		YES
Year-Industry FE						YES			YES
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

Table 5: **Overview of Holder67 regressions for stakesizes > 9%**

This table shows an overview of relevant coefficients resulting from several regressions for the subsample of stakesizes larger than 9% . The dependent variable in the regressions is *Minority*, a binary variable taking the value of 1 if a toehold strategy is used and 0 otherwise. The independent variables is the *Holder67* measure of overconfidence. Furthermore control variables, deal variables and fixed effects are included.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Baseline	Control Variables	Deal Variables	Controls FE	Controls FE	Controls FE	Dealvars FE	Dealvars FE	Dealvars FE
Holder67	**-0.0121*** **	**-0.0124*** **	-0.00954	**-0.0119*** **	**-0.0113*** **	**-0.0112*** **	-0.00910	**-0.0106***	**-0.0104***
	(0.00362)	(0.00356)	(0.00606)	(0.00357)	(0.00358)	(0.00358)	(0.00608)	(0.00614)	(0.00612)
Size		0.00344**	0.00415	0.00368**	0.00291**	0.00325**	0.00440	0.00264	0.00264
		(0.00147)	(0.00280)	(0.00150)	(0.00147)	(0.00149)	(0.00285)	(0.00294)	(0.00298)
Tobins Q		0.00411	0.00307	0.00401	0.00613**	0.00617**	0.00298	0.00494	0.00514
		(0.00304)	(0.00376)	(0.00307)	(0.00307)	(0.00312)	(0.00384)	(0.00389)	(0.00400)
Cash Flow		-0.0621	-0.0696	-0.0586	-0.0484	-0.0460	-0.0671	-0.0659	-0.0696
		(0.0439)	(0.0487)	(0.0439)	(0.0437)	(0.0436)	(0.0488)	(0.0489)	(0.0493)
Investments		0.170***	0.181***	0.167***	0.141**	0.129*	0.181***	0.105	0.105
		(0.0525)	(0.0616)	(0.0526)	(0.0643)	(0.0671)	(0.0613)	(0.0907)	(0.0962)
Cash		0.0199	0.0503**	0.0205	0.0209	0.0223*	0.0496**	0.0623***	0.0632***
		(0.0130)	(0.0227)	(0.0132)	(0.0129)	(0.0133)	(0.0229)	(0.0228)	(0.0233)
Leverage		0.104***	0.163***	0.101***	0.0972***	0.0983***	0.159***	0.146***	0.146***
		(0.0223)	(0.0383)	(0.0224)	(0.0221)	(0.0221)	(0.0385)	(0.0378)	(0.0375)
Prev.acq.all		-0.000914***	-0.00184***	-0.000932***	-0.00117***	-0.00124***	-0.00188***	-0.00152***	-0.00147**
		(0.000152)	(0.000582)	(0.000153)	(0.000166)	(0.000171)	(0.000583)	(0.000587)	(0.000589)
Prev.acq.min		0.0356***	0.0443***	0.0356***	0.0332***	0.0325***	0.0444***	0.0422***	0.0410***
		(0.00510)	(0.00816)	(0.00508)	(0.00508)	(0.00500)	(0.00811)	(0.00819)	(0.00785)
CG		-0.0326**	-0.0468*	-0.0316**	-0.0218	-0.0214	-0.0479*	-0.0422*	-0.0458*
		(0.0158)	(0.0250)	(0.0158)	(0.0161)	(0.0162)	(0.0252)	(0.0256)	(0.0262)
Cross-Sector		0.00949**	0.0247***	0.00939**	0.0100**	0.0102**	0.0244***	0.0237***	0.0227***
		(0.00442)	(0.00821)	(0.00442)	(0.00454)	(0.00453)	(0.00822)	(0.00836)	(0.00828)
Cross-Country		0.0509***	0.0641***	0.0508***	0.0541***	0.0531***	0.0637***	0.0671***	0.0653***
		(0.00500)	(0.00869)	(0.00500)	(0.00511)	(0.00509)	(0.00868)	(0.00884)	(0.00878)
Owner		0.0380	0.143	0.0345	0.0350	0.0244	0.143	0.155*	0.153*
		(0.0328)	(0.0906)	(0.0327)	(0.0333)	(0.0338)	(0.0902)	(0.0911)	(0.0910)
Value/MVA			-0.0267*				-0.0260*	-0.0271*	-0.0240
			(0.0152)				(0.0150)	(0.0151)	(0.0151)
Value/Stake			0.000384*				0.000361	0.000381*	0.000329
			(0.000225)				(0.000226)	(0.000223)	(0.000224)
Constant	0.0381***	-0.00634	-0.00721	-0.00824	0.0110	-0.00788	-0.0232	0.0373	-0.0125
	(0.00251)	(0.0211)	(0.0351)	(0.0211)	(0.0265)	(0.0466)	(0.0349)	(0.0464)	(0.0640)
Observations	9,529	9,529	4,215	9,529	9,529	9,529	4,215	4,215	4,215
R-squared	0.001	0.084	0.110	0.085	0.091	0.103	0.112	0.115	0.135
Industry FE					YES	YES		YES	YES
Year FE				YES		YES	YES		YES
Year-Industry FE						YES			YES
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

Table 6: **Overview of Longholder regressions for stakesizes > 9%**

This table shows an overview of relevant coefficients resulting from several regressions. The dependent variable in the regressions is *Minority*, a binary variable taking the value of 1 if a toehold strategy is used and 0 otherwise. The independent variables is the *Longholder* measure of overconfidence. Furthermore control variables, deal variables and fixed effects are included.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Baseline	Control Variables	Deal Variables	Controls FE	Controls FE	Controls FE	Dealvars FE	Dealvars FE	Dealvars FE
Longholder	**-0.0116*** **	**-0.00690***	**-0.0138*** **	**-0.00725*** **	**-0.00770*** **	**-0.00842*** **	**-0.0135*** **	**-0.0146*** **	**-0.0149*** **
	(0.00381)	(0.00362)	(0.00627)	(0.00362)	(0.00364)	(0.00371)	(0.00625)	(0.00627)	(0.00631)
Size		0.00321**	0.00397	0.00349**	0.00269*	0.00305**	0.00425	0.00247	0.00249
		(0.00147)	(0.00281)	(0.00150)	(0.00147)	(0.00149)	(0.00286)	(0.00295)	(0.00299)
Tobins Q		0.00417	0.00313	0.00404	0.00630**	0.00630**	0.00300	0.00503	0.00520
		(0.00304)	(0.00376)	(0.00308)	(0.00308)	(0.00313)	(0.00384)	(0.00389)	(0.00400)
Cash Flow		-0.0653	-0.0691	-0.0616	-0.0504	-0.0478	-0.0667	-0.0652	-0.0694
		(0.0439)	(0.0487)	(0.0440)	(0.0437)	(0.0436)	(0.0488)	(0.0490)	(0.0494)
Investments		0.167***	0.183***	0.164***	0.139**	0.127*	0.183***	0.104	0.103
		(0.0531)	(0.0613)	(0.0532)	(0.0651)	(0.0680)	(0.0611)	(0.0908)	(0.0963)
Cash		0.0203	0.0492**	0.0210	0.0206	0.0219	0.0486**	0.0611***	0.0620***
		(0.0130)	(0.0227)	(0.0132)	(0.0130)	(0.0133)	(0.0229)	(0.0228)	(0.0233)
Leverage		0.105***	0.165***	0.102***	0.0979***	0.0989***	0.161***	0.149***	0.149***
		(0.0223)	(0.0382)	(0.0224)	(0.0221)	(0.0221)	(0.0384)	(0.0377)	(0.0373)
Prev.acq.all		-0.000864***	-0.00185***	-0.000883***	-0.00114***	-0.00121***	-0.00189***	-0.00154***	-0.00149**
		(0.000151)	(0.000581)	(0.000152)	(0.000165)	(0.000170)	(0.000582)	(0.000585)	(0.000587)
Prev.acq.min		0.0355***	0.0440***	0.0355***	0.0330***	0.0322***	0.0441***	0.0419***	0.0407***
		(0.00510)	(0.00815)	(0.00509)	(0.00508)	(0.00500)	(0.00811)	(0.00818)	(0.00784)
CG		-0.0353**	-0.0492**	-0.0342**	-0.0239	-0.0234	-0.0501**	-0.0449*	-0.0483*
		(0.0157)	(0.0251)	(0.0158)	(0.0161)	(0.0162)	(0.0252)	(0.0256)	(0.0262)
Cross-Sector		0.00904**	0.0245***	0.00893**	0.00970**	0.00979**	0.0242***	0.0236***	0.0225***
		(0.00442)	(0.00824)	(0.00442)	(0.00455)	(0.00453)	(0.00825)	(0.00838)	(0.00831)
Cross-Country		0.0509***	0.0642***	0.0508***	0.0541***	0.0532***	0.0639***	0.0671***	0.0654***
		(0.00500)	(0.00869)	(0.00500)	(0.00512)	(0.00509)	(0.00868)	(0.00884)	(0.00878)
Owner		0.0381	0.150*	0.0352	0.0366	0.0267	0.150*	0.163*	0.161*
		(0.0327)	(0.0905)	(0.0326)	(0.0333)	(0.0338)	(0.0901)	(0.0910)	(0.0910)
Value/MVA			-0.0271*				-0.0264*	-0.0275*	-0.0244
			(0.0154)				(0.0151)	(0.0152)	(0.0152)
Value/Stake			0.000394*				0.000370	0.000392*	0.000341
			(0.000224)				(0.000225)	(0.000222)	(0.000224)
Constant	0.0365***	-0.00493	-0.00369	-0.00630	0.0130	-0.00519	-0.0193	0.0429	-0.00676
	(0.00225)	(0.0212)	(0.0352)	(0.0212)	(0.0267)	(0.0467)	(0.0350)	(0.0467)	(0.0640)
Observations	9,529	9,529	4,215	9,529	9,529	9,529	4,215	4,215	4,215
R-squared	0.001	0.083	0.110	0.085	0.090	0.102	0.113	0.116	0.135
Industry FE					YES	YES		YES	YES
Year FE				YES		YES	YES		YES
Year-Industry FE						YES			YES
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

Table 7: **Logistic regressions with the external perception measure**

This table shows the regression results of *Minority* on the external perception overconfidence measure with additional control variables and year and industry effects. The dependent variable in the regressions is *Minority*, a binary variable taking the value of 1 if a toehold strategy is used and 0 otherwise. The dummy variable $Overconfident$ takes value 1 if a CEO is classified as overconfident, based on outsiders perception measured by media coverage. Articles that classify a CEO as cautious consist on or more of the following keywords: 'reliable', 'cautious', 'frugal', 'steady', 'conservative' and 'practical', referring to the CEO of interest. Articles that classify a CEO as overconfident consist one or more of the following keyword: 'confident' and 'optimistic', referring to the CEO of interest. Articles are obtained from The Guardian, Financial Times and The Daily Telegraph, and are manually checked to make sure the article is referring to the CEO. If a CEO is more often described as confident than cautious, the CEO is classified as overconfident

	Dependent variable: Minority				
	Full sample				
	(1)	(2)	(3)	(4)	(5)
Overconfident	-0.567**	-0.638**	-0.687**	-0.677**	-0.772**
	(0.260)	(0.314)	(0.339)	(0.330)	(0.362)
Size		0.058	0.067	-0.017	-0.011
		(0.082)	(0.088)	(0.089)	(0.096)
Leverage		-0.489	-0.516	-0.050	0.081
		(0.671)	(0.704)	(0.746)	(0.787)
Cash		-0.597	-0.075	-0.834	-0.248
		(1.615)	(1.603)	(1.661)	(1.660)
Cash Payment		0.651**	0.676**	0.800**	0.810**
		(0.303)	(0.312)	(0.320)	(0.330)
Cross Country		0.184	0.282	0.342	0.385
		(0.358)	(0.378)	(0.377)	(0.393)
Cross Sector		0.564	0.546	0.551	0.546
		(0.355)	(0.374)	(0.364)	(0.387)
Constant	-0.899***	-1.740**	-1.576*	-1.050	-0.716
	(0.200)	(0.813)	(0.970)	(0.905)	(1.083)
Observations	361	297	297	297	297
Year effects	no	no	yes	no	yes
Industry effects	no	no	no	yes	yes
Log Likelihood	-188.598	-146.247	-140.721	-141.091	-135.76
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 8: **CAR regressions**

This table shows the results of several linear regressions with CAR (cumulative abnormal returns) as dependent variable. The regressions are executed on several CAR intervals: [t-20,t+1], [t-20,t+10], [t-10,t+1] and [t-10,t+10], where t denotes the announcement date of the acquisition. The explanatory variables are the type of acquisition (majority/minority), a measure of overconfidence (Longholder, Holder67 or a combination of these denoted by BIAS) and interaction effects between the acquisition type and overconfidence. The constant represents the reference class, that is a majority acquisition without overconfident CEO.

	Dependent variable:							
	CAR [-20,1]				CAR [-20,10]			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.003***	0.002	0.002	0.001	0.003***	0.004**	0.003*	0.002*
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Minority	0.012**	0.018***	0.011*	0.018***	0.010*	0.014*	0.007	0.017***
	(0.005)	(0.007)	(0.006)	(0.005)	(0.005)	(0.008)	(0.007)	(0.006)
BIAS		0.001				−0.002		
		(0.002)				(0.002)		
Longholder			0.002				0.001	
			(0.002)				(0.002)	
Holder67				0.004**				0.002
				(0.002)				(0.002)
BIAS × Minority		−0.013				−0.008		
		(0.009)				(0.011)		
Longholder × Minority			0.003				0.008	
			(0.010)				(0.011)	
Holder67 × Minority				−0.020**				−0.023**
				(0.010)				(0.012)
Observations	9,497	9,497	9,497	9,497	9,497	9,497	9,497	9,497
R^2	0.001	0.001	0.001	0.001	0.0004	0.001	0.0005	0.001

	Dependent variable:							
	CAR [-10,1]				CAR [-10,10]			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.004***	0.005***	0.004***	0.004***	0.005***	0.007***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Minority	0.007*	0.010*	0.006	0.011**	0.005	0.006	0.002	0.010*
	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.007)	(0.006)	(0.005)
BIAS		−0.001				−0.004*		
		(0.002)				(0.002)		
Longholder			−0.0003				−0.001	
			(0.002)				(0.002)	
Holder67				0.001				−0.001
				(0.002)				(0.002)
BIAS × Minority		−0.006				−0.001		
		(0.007)				(0.009)		
Longholder × Minority			0.003				0.008	
			(0.008)				(0.010)	
Holder67 × Minority				−0.012				−0.015
				(0.008)				(0.010)
Observations	9,497	9,497	9,497	9,497	9,497	9,497	9,497	9,497
R^2	0.0004	0.0005	0.0004	0.001	0.0001	0.001	0.0002	0.0004

Note: *p<0.1; **p<0.05; ***p<0.01